2008, Volume 8, Issue 2, July

- Physicians, Climate Change and Human Health (Message from the Editor-in-Chief)
- Genetic Services in the Sultanate of Oman and other Gulf Countries - Progress is needed now!
- Major Advances in the Treatment of Cancer - What does a Non-Oncologist need to know?
- Medical Education Units - History, Functions, and Organisation
- Regional Variation in the Prevalence of Asthma Symptoms among Omani School children - Comparisons from Two Nationwide Cross-sectional Surveys Six Years Apart
- Familial Mineralocorticoid Induced Hypertension in the Sultanate of Oman
- Extended-spectrum β-lactamase (ESBL) in Omani Children – Study of prevalence, risk factors and clinical outcomes
- Control and Management of Hypertension at a University Health Centre in Oman
- Assessment of the Relationship of Hepatic Enzymes with Obesity and Insulin Resistance in Adults in Saudi Arabia
- Varied Presentations of Acute Glomerulonephritis in Children - Single centre experience from a developing country
- Hydrogen Peroxide 3%: Is it Beneficial in Tonsillectomy?
- Intravenous Lidocaine for Refractory Chronic Orofacial Pain - Two case reports and a literature review
- Cushing’s Disease - Pituitary Surgery versus Adrenalectomy
- Occlusion of Upper Genital Tract Following Lower Segment Caesarean Section for Placenta Praevia
- Traumatic Rupture Right Hemidiaphragm Diagnosis aided by Computerized Tomography and Image Reformation - A Case Report
- Fracture of Supracondylar Process of the Humerus
- Traumatic Rupture Right Hemidiaphragm Diagnosis aided by Computerized Tomography and Image Reformation - A Case Report
- Fracture of Supracondylar Process of the Humerus
- Intraorbital Foreign Body: Clinical presentation, radiological appearance and management
- Insulinoma: A rare cause of a common metabolic disorder - Hypoglycaemia
- Efficacy and Safety of Selective Laser Trabeculoplasty as a Primary Procedure for Controlling Intraocular Pressure in Primary Open Angle Glaucoma and Ocular Hypertensive Patients
- Some Risk Factors for Coronary Heart Disease Among Omani Males - A matched case-control study
- Prevalence and Determinants of Waterpipe Tobacco Use among Adolescents in Oman
- Screening of Patients with Snoring and Obstructive Sleep Apnoea using Heart Rate Variability Indices
- Outcome as a Measure of Quality of Care in Oncology - Experience at Sultan Qaboos University Hospital, Oman
- Qualitative Research and its Uses in Health Care
- Care of Diabetic Retinopathy Patients with in Oman
- Molecular Imaging - Bridging Imaging and Biology
- Forthcoming Medical Conferences, Courses and Workshops
Physicians, Climate Change and Human Health

The theme of the World Health Organisation (WHO) initiated 2008 World Health Day, held on 7 April 2008, was Protecting Health from Climate Change. Communities and organisations around the world hosted activities to establish greater public awareness of the health consequences of the climate changes that we are experiencing. WHO has specifically put a great effort into increasing awareness of the effects of global warming and other climate related factors that impact on human health. We, as physicians, also have an important and potentially major role to play in this exercise.

In her World Health Day 2008 address, “The impact of climate change on human health”, WHO Director-General, Dr. Margaret Chan, said, “The core concern is succinctly stated: climate change endangers health in fundamental ways. The warming of the planet will be gradual, but the effects of extreme weather events – more storms, floods, droughts and heatwaves - will be abrupt and acutely felt....... affecting some of the most fundamental determinants of health: air, water, food, shelter, and freedom from disease”. She also pointed out that while climate change is a global phenomenon, its consequences will not be evenly distributed. Certain populations are more susceptible than others e.g. children, the elderly and the infirm, and more so in developing countries. She drew attention to the fact that, “last year marked the turning point in the debate of climate change. The scientific evidence continues to mount that the climate is changing and human activities are the principal cause”.

The Secretary-General of the United Nations, Ban Ki-moon, in his World Health Day 2008 address, stated that “We need to give voice to this often overlooked reality, ensuring that protecting human health is anchored at the heart of the global climate change agenda.” He also pointed out that the impact will be most severe in poor countries e.g. by the year 2020, up to a quarter of a billion Africans will experience increased water stress and up to 50% drop in crop yields. Climate-related infectious diseases take their heaviest tolls on the most vulnerable, the children, the elderly and the infirm. We must do more to prepare for these challenges because climate change is real. It is accelerating and threatens all of us. Climate change will erode the foundations of health.

WHO has identified five major health consequences of climate changes: (i) The agricultural sector is extremely sensitive to climate variability. Rising temperatures and more frequent droughts and floods can compromise food security. (ii) More frequent extreme weather events mean more potential deaths and injuries caused by storms and floods. The most recent Cyclone Nargis in Myanmar, with over a hundred thousand deaths, is a typical example for this. Our own experience in Oman with Cyclone Gonu last year was evidence enough with scores of deaths from flooding wadis and thousands of citizens suffering from a lack of clean fresh water, albeit only temporarily because of prompt government action. (iii) Water is essential for hygiene, but in excess it will increase the burden of diarrhoeal diseases which are spread through contaminated water and food. These diseases are responsible for 1.8 million deaths each year and are the second leading infectious cause of childhood mortality. (iv) Heatwaves increase morbidity and mortality mainly in the elderly with cardiovascular or respiratory disease. (v) Changing temperatures and patterns of rainfall are expected to alter the geographic distribution of insect vectors that spread infectious diseases such as malaria and dengue fever. In short, climate change can exacerbate problems that are already huge, largely concentrated in the developing world and already difficult to combat.

What can we, as physicians, do and what role can we play? As clinicians, we owe it to our patients to explain to them the dangers of extremes of temperatures and exposure. Estimates suggest that in 2003, during the European summer heat wave, approximately 70,000 more people died than would have been otherwise expected. It has been demonstrated that weather is associated with changes in birth rates and sperm counts, and with outbreaks
of pneumonia, influenza and bronchitis. Decreased humidity in some countries in winter leads to drying of nasal mucosa and respiratory passages with increased respiratory infections. As family and community physicians, we owe it to the community and the public, to explain the dangers of climate change and to explain that most of the climate change is the result of human activities. Global warming is not only made worse by greenhouse gases from industry, but all of us contribute to it by our daily habits. We also contribute to the change in climate by indiscriminate industrial logging and by cutting trees for fuel as in some communities. As educator physicians, we owe it to our students to explain the impact of changing climate on human health. Climate change brings new challenges to the control of infectious diseases. Seasonal changes in the availability of fresh water, regional drops in food production, and rising sea levels have the potential to force population displacement and increase the risks of civil conflict. As physician administrators, we owe to our community to ensure proper disposal of all wastes that may impact on the environment. We have to point out the need for clean air and unpolluted water. We also have to point out dangers of epidemics related to climate change such as the cholera outbreak in Bangladesh closely linked to flooding and unsafe water. Changing air and water temperatures and precipitation can also lead to increased infectious diseases among plants and animals through vector-borne and rodents, as well as to outbreaks of disease in coral reefs and trees overgrown with fungus. As physician researchers, the possibilities of contributing are only limited by our imagination. Physician researchers can contribute effectively to understanding the root causes as well as the effects of global warming and changing climate on individual patients and on the community.

As travellers in this space ship called Earth, we need to be very prudent as to how we use the resources vital to our health such as air, clean water and our atmosphere. We as physicians can play a relatively major role in reducing the negative impact of climate on human health and also have an impact on root causes.

Physicians and researchers in Oman and beyond need to review their resources and evaluate the possible ways that we can contribute. Let us all join in the spirit of this year’s World Health Day and make a difference in human health. SQUMJ will help by publishing news of the efforts and results.

Lamk Al-Lamki MD, FRCPC, FACR, FACNM
Editor-in-Chief
Email: mjournal@squ.edu.om
Tel. number: (+968) 2414 3457

REFERENCES
4. “Climate Change and Health: Preparing for Unprecedented Challenges” by Dr. Margaret Chan, Director-General of World Health Organisation. The 2007 David E. Barmes Global Health Lecture, Bethesda, Maryland, USA, 10 December


Genetic Services in the Sultanate of Oman and other Gulf Countries
Progress is needed now!

Sandy Raeburn

A GLOBAL VIEW

During the past decade there has been an explosion of new genetic information, with a greater understanding of gene functions and more powerful DNA-based technologies. The challenge is to apply such knowledge to the greatest benefit of patients and their families. In Oman and neighbouring countries, genetic services have been developed, both within the health care system and in universities. Such genetic services have been prompted by local needs as well as by prevention agendas, often initiated internationally. Given the different origins of these services, they may have been established piecemeal, without a unifying vision of the community objectives. Dependent on whether a service originates from a research laboratory setting or from clinical needs, there may be a laboratory or clinical focus.

This editorial emphasises that, in Oman and in neighbouring Gulf States, high quality integrated genetic services are needed now. Genetic consultations and tests must be professionally designed, as well as made accessible, cost-effective and equitable. Simple low-cost strategies, applied in the community health services could improve access to genetic resources, facilitating the effective use of laboratory services. Patient and family needs are the priority.

In most developed countries, genetic counselling services have been in place for many years. Clinical services were usually established first, often within departments of paediatrics, but some cytogenetic services date from the early 1960s. The organisation of such services, in each country, reflects the common genetic diseases, the type of health care provision and the culture. Thus European Community genetic services address disorders such as cystic fibrosis, Duchenne muscular dystrophy, Huntington’s disease and the fragile X syndrome. Countries with citizens of Mediterranean, Bedouin, African or Asian origins will focus first on haemoglobinopathies such as thalassaemias or sickle cell disease.

Rare genetic disorders are seen in all countries and are always difficult to diagnose and to manage. Investigation of such disorders often involves international cooperation and sharing of clinical information, of blood and DNA samples and of specialised technology, to the benefit of the patient, the family and the global community. But differences must be acknowledged; they will influence the design of any nationally planned genetic service.

In Europe and North America, rare disorders usually occur in small families with a single affected person. There may be doubts about the mode of in-
heritance; therefore, investigations (to clarify both the diagnosis and the mode of inheritance) will focus more on affected persons and less on the family tree.12 The emphasis is on the rare disorders of that community.

In contrast, affected Arab families in the Middle East region often have disorders causing several people to be affected, either in a sibship or in the wider family,3,14 usually the mode of inheritance is Mendelian and is not in doubt. Informative family trees here can confirm the single gene inheritance and focus investigation using tests which should have high predictive values. For example, whole genome genetic marker studies (e.g. using single nucleotide polymorphisms (SNPs) or microsatellite markers) in affected and unaffected people in the family may now be more logical as a first step in a multiplex Omani family than the protocols used in the West. Even if a country like Oman can call on much collaboration from international genetic centres (and will frequently need this for specialised techniques in some families), their primary and secondary genetic services must reflect what is common in the Omani community. Strategies in ‘Old World’ countries are necessarily different and should not be applied ‘off the shelf’.

**GENETIC DISORDERS IN THE GULF COOPERATION COUNCIL COUNTRIES**

Lihadh Al Gazali has pointed out the high proportion of unique disorders in the UAE;7 similar data come from other Arab countries3,5,14-16 including Oman. In summary, there are regions with a high prevalence of sickle cell disease and β thalassaemia, as well as moderate numbers of worldwide disorders. Rajab and her colleagues have reported the approximate birth incidences of some key conditions in Oman.5 Some approximate incidence figures from that report are summarized in Table 1.5

In most of these countries there are also many families with other progressive single gene disorders which lead to early death in affected people. Here, in addition to the health effects, severe social and financial difficulties can occur in sibships with several affected people. Also, discrimination against healthy members of the family can happen, for example when they consider marriage. Individually, such disorders may be uncommon but their cumulative effect in the population can be major.

**SERVICES AVAILABLE NOW IN GCC COUNTRIES**

Most Gulf countries have established genetic services, but there are urgent calls for greater integrated service provision.5,4 Genetic departments comprising clinical, molecular and cytogenetic sections (and often biochemical genetics, immunogenetics and/or HLA and tissue typing too), work best as an integrated team. 3,17 Health services in Kuwait, the United Arab Emirates (UAE), the Kingdom of Saudi Arabia, Qatar, Oman and Kingdom of Bahrain all have genetic centres and departments that meet some of the needs of families with genetic disorders. In addition, there have been excellent pan-Arab initiatives to pool important genetic information, backed up by international conferences (e.g. the Centre for Arabic Genomic Studies based in the UAE).

These existing services can delineate the clinical features of a disease in affected individuals, exclude or confirm chromosomal abnormalities and initiate molecular investigation towards identifying causative gene mutations. Sometimes they also access centres abroad for specialised molecular studies, but access to fully integrated services may be patchy; other affected people in an identified family may not receive the support they need and genetic counselling facilities for the ‘cascade’ of genetic information to relevant family members may be limited. We note that simple feedback to a family after successful gene mapping may empower the family,17 by clarifying future genetic risks. For example, even if the causative mutation is unknown, carrier testing in an undiagnosed autosomal recessive disorder could be based on linkage if the gene has been mapped. The predictive value in such families would be less than 100%, but is better than no information at all. Genetic centres need to establish family counselling urgently, with follow-up to record the natural history of the disorder and to offer further counselling as the family extends and ages. These elements would be essential in future genetic services. Beyond the genetic investigation and counselling needs, there may also be requirements for financial support or for aids towards normalisation of the affected people. Genetic centres should therefore interact with the support services of the Ministries of Social Affairs as well as with charitable organisations.
Healthcare Services in Oman are administered centrally in Muscat by the Ministry of Health (MoH) which coordinates healthcare provision in semi-autonomous regions. Each region has resources to provide healthcare through purpose-built family clinics and regional hospitals. Nationally, there are also tertiary referral centres for specialised services, mostly located in or near to the capital. The main MoH genetic centre is in the Royal Hospital, backed up by a cytogenetics laboratory and a molecular laboratory in another part of the city. Plans are well advanced for there to be a national Genetic Centre, funded by the MoH, which would draw together these elements of the genetic service. However, there may not yet be provision for university input, which would coordinate the teaching of the new generation of medical undergraduates as well as assimilating new research findings into future services of the MoH Centre.

The College of Medicine and Health Sciences of Sultan Qaboos University (SQU) has a Genetics Department with 4 sections: clinical genetics, cytogenetics, immunogenetics and molecular genetics. The mission of this team is: ‘to seek greater understanding of serious genetic disorders in the Sultanate of Oman, to apply new knowledge to the investigation, diagnosis and genetic counselling of affected families and to teach present and future doctors and scientists how to use genetic principles in their work’.

This means that the traditional academic roles of a university department, teaching and research, are intended to be augmented by some service provision.

Currently, five doctors are training to be consultant clinical geneticists, there are three holders of PhDs leading cytogenetic, immunogenetic and molecular genetic sections respectively, a scientist is abroad for PhD training and several others are planning to study, or already taking part in, relevant master’s programmes. All sections of the Department perform service work for patients attending the Sultan Qaboos University Hospital (SQUH), usually as tertiary referrals. Space both for genetic clinics and laboratories is very limited.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Total affected</th>
<th>Birth incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bardet-Biedl syndrome</td>
<td>14</td>
<td>1/30,000</td>
</tr>
<tr>
<td>Congenital adrenal hyperplasia</td>
<td>55</td>
<td>1/10,000</td>
</tr>
<tr>
<td>Cystic fibrosis</td>
<td>32</td>
<td>1/10,000</td>
</tr>
<tr>
<td>Ellis van Creveld syndrome</td>
<td>18</td>
<td>1/25,000</td>
</tr>
<tr>
<td>Meckel-Gruber syndrome</td>
<td>9</td>
<td>1/50,000</td>
</tr>
<tr>
<td>Metachromatic leukodystrophy</td>
<td>18</td>
<td>1/25,000</td>
</tr>
<tr>
<td>Microcephaly (primary)</td>
<td>31</td>
<td>1/15,000</td>
</tr>
<tr>
<td>Spinal muscular atrophy</td>
<td>56</td>
<td>1/10,000</td>
</tr>
</tbody>
</table>

Taken from Rajab et al

Table 1: Incidence of some autosomal recessive genetic disorders in Oman (based on a total of 420,000 live births in the period 1993-2002)
Facilitation of this pro-active approach needs three simple elements: (i) Strong collaboration between the MOH and the Universities; (ii) Access points in the community for the primary recognition of genetic disease in families and (iii) A positive role for disease-centred parent and patient organisations.

Patient organisations could play a part in the identification of needs and also in the coordination with agencies outside health which are required. The model of the Genetic Interest Group (GIG) in the UK could be applied in the GCC countries, but with a special focus on autosomal recessive disorders.

A VISION FOR GENETIC SERVICES IN THE ARABIAN PENINSULA

In all GCC countries, collaboration between the Ministries of Health and the universities could now be strengthened and built into robust partnerships. Coordinating committees and conferences are valuable, but must be seen as steps towards improving genetic health, not the final outcome.

Some pilot initiatives from the Genetics Department of Sultan Qaboos University are relevant here. These have shown the acceptability of university-led outreach genetic clinics in regional MoH hospitals (Sultan Qaboos Hospital in Salalah and Nizwa and Sohar Hospitals). The enthusiasm and support from families, who have much shorter distances to travel with their affected offspring could have been expected. But there has been support too from the specialists and medical directors in those regional hospitals. The paradigm is to work together to provide holistic genetic health care for the many, not to make research forays into the community to gain publications for the few.

A spin-off of the specialised genetic outreach clinics has been experiences gained when visiting Omani families at their home, usually when there are several affected people. A glance at one family tree shows why it is better for the genetic team to visit the home [Figure 1]. After a home visit the team was able to confirm that the proband in generation 5 (arrow) had the same disorder as the 3 living affected people in generation 4, who were siblings of the proband’s mother.

A valuable outcome of home visiting in village communities has been the opportunity to meet non-medical professionals in the health centres. These professionals take great pride in their work but often feel isolated; they are willing to contribute to genetic health care if they are taught how to do so. This raises the issue of the degree of genetic competence.
GENETIC SERVICES IN THE SULTANATE OF OMAN AND OTHER GULF COUNTRIES

133

needed in such health centres. A provocative answer might be that the genetic package may be extremely simple, involving just the ability to answer 3 questions [Table 2].

GENETIC KNOWLEDGE IN THE OMANI COMMUNITIES

A substantial proportion of Omani families touched by a genetic disease are aware that the disorder in their family is inherited and can lead to increased risk of the disease in relatives. As in any country, they may deny the diagnosis, or shop around for second opinions. Also unrelated families may be (excessively) concerned about future risks if they marry into an affected family. They may choose to avoid such marriages, often based on inaccurate information.

Omani families also know that marriages between close relatives may increase the risk of having affected children. They face the dilemma of choosing whether to abandon traditional practices or to consider procedures which are ethically sensitive (such as prenatal diagnosis) or expensive and less likely to result in much-wanted pregnancies (such as pre-implantation genetic diagnosis). These families may wish to consider other ways to utilise genetic tests. For example, carrier tests might assist family decisions if several cousins were tested before engagement or marriage; genetic counselling approaches might then be used to identify the low and high risk partnerships.

Omani families at the SQU genetic clinics have welcomed simple biological information about the mode of inheritance of the disease in their family. As in the UK, this information-giving element of counselling can ease psychological traumas, probably by reducing uncertainty. In any case, such information is required by families before they decide to embark on carrier testing, prenatal diagnosis, pre-implantation genetic diagnosis or presymptomatic detection. They also need to understand why genetic testing is only required or helpful in certain family members.

This preparatory work has shown us that a greater attention to the family tree and less emphasis initially on laboratory tests is more appropriate for genetic counselling in the Gulf setting [Table 3].

WHAT ARE THE CONSTRAINTS IN OMAN?

INADEQUATE FUNDING

Oman, the United Arab Emirates and the Kingdom of Saudi Arabia face greater numbers of autosomal recessive conditions than Europe and double the European prevalence of genetic malformations and handicaps. Logically, they should need higher staffing levels than recommended in, for example, the UK; however, this wish is unrealistic in Oman, both at present and in the near future. We recommend measures to tackle the major needs of families with genetic disadvantages which are realistic, in terms of resources.

WIDE GEOGRAPHICAL DISTRIBUTION OF FAMILIES WITH SPECIALISED GENETIC SERVICE NEEDS

The distance travelled to attend specialist genetic centres creates problems for many families, especially for those with limited resources.

INADEQUATE GENETIC UNDERSTANDING BY CLINICAL STAFF AND FAMILIES

This may be exacerbated by an excessive enthusiasm of doctors to initiate DNA-based genetic investigations without first assessing the family tree and the prior risks of the family or their psychosocial, informational or financial needs.

ARE STUDIES OF OTHER GENETIC SERVICES RELEVANT?

There are extensive publications on genetic counselling and other genetic services published from well-established genetic institutes in the West. Caution should be exercised before planning genetic services

<table>
<thead>
<tr>
<th>Table 2: Three questions which non-medical health centre staff could answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do all ‘affected’ people have the same condition?</td>
</tr>
<tr>
<td>2. Are ‘unaffected’ people in the family definitely free from the disorder?</td>
</tr>
<tr>
<td>3. Does the family tree suggest a need for specialist referral?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3: Elements of an integrated genetic service</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Accessible clinics with trained staff, nationally and in the regions</td>
</tr>
<tr>
<td>- Genetic Service laboratories with trained staff:</td>
</tr>
<tr>
<td>* Cytogenetics covering both constitutional chromosome disorders and cancer cytogenetics</td>
</tr>
<tr>
<td>* Molecular genetic staff trained in service provision in preference to research training</td>
</tr>
<tr>
<td>* Immunogenetic staff experienced in general tissue typing and in transplant donor matching</td>
</tr>
</tbody>
</table>
in Oman, based on such models. The options available might not be acceptable in Omani communities; more importantly, the spectrum of genetic diseases differs considerably from the West. Health care providers and practitioners in Oman may need to adopt a more pragmatic and family-focused approach.

**Evolving Solutions**

There must be universal support for the MoH initiatives towards offering genetic counselling for all families with people affected by genetic disorders. However, families with multiply affected members need to be ascertained too and prioritised. In such families, with several affected people already, there should be opportunities for pre-marital counselling and relevant carrier testing. An accurate family tree, as well as considerable practical molecular genetic expertise is crucial to success here.

Simple genetic counselling needs to be provided regionally and should be organised in consultations separate from clinical management of affected patients. This is because either the impact of the genetic risks or concerns about progression disease will limit understanding. The patient needs time to absorb information on genetic risks and separate allocations of time. The progress and treatment of disease is a clinical issue which needs to be distinct from genetic counselling.

In the long term, each region requires a consultant, trained in clinical genetics, to lead and coordinate the local programme. The consultant fulfilling this role regionally may have joint accreditation, e.g. as a clinical geneticist and a paediatrician (or physician). Each regional team requires a genetic nurse specialist, who can prepare family trees, collect blood samples and give counselling support. This nurse will see high risk couples with the geneticist and provide follow-up. Each team also requires a part-time coordinator, who will organise genetic clinics. Later, regional teams will include trained genetic counsellors. Regional genetic teams do not need laboratory facilities locally except those for DNA separation; specialist genetic laboratory services will be provided by laboratories in the new MoH Genetic Centre, complemented by the genetic laboratories at SQU.

The model for genetic service development described here may be of interest to neighbouring Arab nations; services designed for the Middle East region could be piloted jointly by Oman and by neighbours with larger populations. The ‘action list’ (Table 4) summarises what could be completed with some speed.

<table>
<thead>
<tr>
<th>Table 4: Action points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. More integrated departments of genetics are needed, so that clinical needs set the agenda in the laboratories as well as for management.</td>
</tr>
<tr>
<td>2. Closer collaboration between the MOH and University Departments dealing with genetic disorders is essential.</td>
</tr>
<tr>
<td>3. Outreach clinics are needed in main regional hospitals:</td>
</tr>
<tr>
<td>- Consultants with a genetic interest in each region, backed by a genetic counsellor or specialist nurse and a part-time coordinator.</td>
</tr>
<tr>
<td>- Resources to facilitate the interaction between staff in the Genetic Centre in Muscat and in regions. Travel expenses and short-term accommodation costs for staff from the National Genetic Centre and the reverse for Regional teams.</td>
</tr>
<tr>
<td>4. Facilitation of home visits to families in which multiple affected individuals are identified. Transport availability, occasional overnight accommodation etc.</td>
</tr>
<tr>
<td>5. Genetic database resources in the genetic centre, compatible with local computing facilities and laptops for outreach work and home visiting.</td>
</tr>
<tr>
<td>6. Adequate resources for other specialties that see genetic disorders frequently, e.g. electoretinogram equipment may be needed for the tertiary referral departments of Ophthalmology.</td>
</tr>
<tr>
<td>7. Development of a simple community teaching package for health centre staff. The aim will be to have one or two staff members in each health centre with skills in family tree preparation and simple interpretation.</td>
</tr>
</tbody>
</table>
CONCLUSION

This editorial is based on real experience and figures from Oman, backed up with data from neighbouring countries. The action points are therefore not hypothetical, nor are they based on a blind willingness to copy genetic services of the Western developed countries. It is hoped that the issues raised will stimulate actions as well as discussions, along with the confidence to go in a different direction from established (Western) genetic services. Solutions for genetic services in the Middle East need to be designed for their purpose, not translocated from other less relevant structures in the 'First World'!

ACKNOWLEDGEMENTS

It is a pleasure to acknowledge the many discussions with my colleagues in the Genetics Department of the College of Medicine and Health Sciences at the Sultan Qaboos University, particularly Dr. Aisha Al Shehi, Rayhanah Al-Mjeni, Dr Almundher Al-Maawali and my wife, Arlene Raeburn. Rahma Al-Jashmi kindly prepared the family tree.

REFERENCES

ABSTRACT The last few years have seen major advances in the management of cancers. Since it is not possible for the non-oncologist to keep abreast with the latest developments in the field of oncology, this review summarises the most significant advances in the area of treatment of various cancers over the past four years. In some areas, a paradigm shift has occurred setting new standards of care, for example, the use of targeted therapy (trastuzumab) in adjuvant treatment of breast cancer; the use of monoclonal antibodies (rituximab), with or without chemotherapy, in the treatment and maintenance of indolent lymphoma; the use of the tyrosine kinase inhibitor, imatinib, in the adjuvant setting in resected gastrointestinal stromal tumours. In other areas, new treatments have emerged, such as, the use of targeted therapies in hepatocellular carcinoma (sorafenib) and renal cell carcinoma (sunitinib, sorafenib, temsirolimus, bevacizumab). In some other cancers, the addition of targeted therapies has improved survival rates, for example, in colon cancer (bevacizumab, cetuximab, panitumumab), head and neck cancers (cetuximab), and pancreatic adenocarcinoma (erlotinib). In yet another group, new targeted therapies have emerged where resistance was previously observed with the existing targeted therapies, for example, breast cancer (lapatinib), chronic myeloid leukemia (dasatinib). Finally, the addition of chemotherapeutic agents has improved survival in some forms of cancer, for example, oxaliplatin in adjuvant treatment of colon cancer, temozolamide in glioblastoma multiforme, and adjuvant chemotherapy in non-small cell lung cancer. The information summarized here may provide useful for the busy physician needing an update in the field of oncology.

Keywords: Medical Oncology; Trastuzumab; Rituximab; Imatinib; Sorafenib; Sunitinib; Bevacizumab.
cremental gains. The management of cancers includes prevention, surveillance and early detection, treatment of early and advanced disease, and the issues related to long-term survival after the cure. For the purposes of this review, only advances related to treatment of the disease, both in adjuvant and palliative settings are described. Besides obtaining information from a review of the literature over the past four years, information was obtained from the series ‘Clinical Cancer Advances’ published in the Journal of Clinical Oncology for the past three years.1-3 The cancer sites/organs are arranged in alphabetical order and the setting of treatment (adjuvant or palliative) are described where appropriate, as follows:

1. Breast cancer
2. Chronic myeloid leukemia (CML)
3. Colon cancer
4. Gastric cancer
5. Gastrointestinal stromal tumour (GIST)
6. Glioblastoma multiforme (GBM)
7. Head and neck cancer
8. Hepatocellular carcinoma (HCC)
9. Lung cancer
10. Multiple myeloma
11. Non-Hodgkin’s lymphoma (NHL)
12. Ovarian cancer
13. Pancreatic cancer
14. Prostate cancer
15. Renal cell carcinoma (RCC)

**BREAST CANCER**

**ADJUVANT TREATMENT**

*Adjuvant Trastuzumab improves survival when added to standard adjuvant chemotherapy*

Since the publication of the meta-analysis establishing the role of adjuvant chemotherapy and hormone-therapy in early stage breast cancer, several important strides have been made. The addition of either anthracyclines (doxorubicin or epirubicin), and/or taxanes (paclitaxel or docetaxel) to cyclophosphamide with or without 5-fluouracil has been shown to improve disease free survival (DFS) and the overall survival (OS). The improvement in survival rates were of the order of 4-7% (absolute difference) at the end of 5 years.4 More recently, the addition of trastuzumab to the chemotherapy has been shown to improve further the survival in patients with breast cancer expressing the HER-2/neu oncogene (also called c-erbB2). Around 25-30% women with breast cancer have the oncogene, causing expression of the protein on the cell surface, which is detected by either immunohistochemistry (IHC) or fluorescent in-situ hybridization (FISH). The protein is associated with an increased risk of cancer recurrence and a decreased sensitivity to some forms of chemotherapy.

Trastuzumab is a monoclonal antibody that blocks the protein HER-2/neu and had been in clinical use since at least 1998 for metastatic breast cancer, where together with palliative chemotherapy, the survival was shown to be prolonged in women treated with trastuzumab. Four randomised trials involving more than 13,000 women have been reported within the past 3 years, all leading to the same conclusion.5-8 The analysis showed for the first time that adding trastuzumab to standard chemotherapy for early-stage breast cancer that expresses HER-2 reduced the risk of recurrence in women by almost half after three years compared with chemotherapy alone. The four trials varied in design to some extent, and the details are shown in Table 1.5-8 The National Surgical Adjuvant Breast and Bowel Project (NSABP) trial compared 4 cycles of doxorubicin and cyclophosphamide followed by 4 cycles of paclitaxel followed by observation or one calendar year of trastuzumab therapy. The Intergroup trial compared, in a three arm study, 4 cycles of doxorubicin and cyclophosphamide followed by weekly paclitaxel for 12 weeks with either observation, concomitant trastuzumab with paclitaxel or sequential trastuzumab for one year. The Breast Cancer International Research Group (BCIRG), also in a three arm study, compared 4 cycles of doxorubicin and cyclophosphamide followed by 4 cycles of docetaxel with either observation or trastuzumab for a year. The third arm consisted of 6 cycles of docetaxel and carboplatin followed by one year of trastuzumab. The fourth and the largest trial, the European Herceptin Adjuvant Trial (HERA), in addition to randomising patients between the observation and the trastuzumab arm after completion of the chemotherapy according to the institutional guidelines, also studied the relationship between duration of trastuzumab use (one year versus two years) and breast cancer recurrence in more than 5,000 women in 39 countries. Taken together, the four trials demonstrated that addition of adjuvant trastuzumab for one calendar year improves the DFS from 67% to 85% at 4 years. This degree of improvement
M A J O R A D V A N C E S I N T H E T R E AT M E N T O F C A N C E R

represents the most significant gain in survival in the history of adjuvant treatment of breast cancer.

However, the addition of trastuzumab was not free of side effects. All trials showed an increased risk of congestive heart failure associated with the drug.8 The incidence of severe congestive heart failure or death from heart problems ranged from 2.9% and 4.1% in the women taking trastuzumab, versus up to 0.8% in the observation group group. In an attempt to reduce the cardiotoxicity, without compromising the survival gain, yet another trial called the FinHer trial, studied the possibility of using attenuated trastuzumab therapy for 9 weeks compared to the observation group.9 The trial was small including only 232 women. Women in the trastuzumab group were significantly less likely to experience a recurrence with fewer cardiac side effects. With a longer follow-up, this trial might suggest that patients would be able to safely take a shorter course of the therapy, limiting the cost of the drug and the risk of serious side effects, without reducing efficacy.

However, currently, the individual and the pooled results of the four large clinical trials, represent a very significant advance in breast cancer treatment, and have already changed the standard of care for the women who express HER-2 protein.

Aromatase inhibitors improve the overall survival compared to tamoxifen in an adjuvant setting

Over the past 30 years, tamoxifen has been the standard of care for the adjuvant hormone treatment in hormone receptor positive early breast cancer.4 In the last few years alone, three third-generation aromatase inhibitors (letrozole, anastrazole, and exemestane) have been shown to improve the DFS and the OS in the adjuvant setting. Previously these agents had been shown to be effective in metastatic breast cancer. More recently, the three agents have been investigated as adjuvant therapy of early breast cancer employing various treatment strategies: replacement of tamoxifen as adjuvant therapy for 5 years, sequencing of tamoxifen before or after an aromatase inhibitor during the first 5 years, or following 5 years of tamoxifen. In the first adjuvant trial (arimidex, tamoxifen alone or in combination [ATAC]), anastrozole was significantly superior to tamoxifen in reducing risk of disease recurrence.10 The Breast International Group (BIG) trial BIG 1-98 demonstrated the significant superiority of letrozole over tamoxifen in improving disease-free survival.11 A large trial (International Collaborative Cancer Group [ICCG] trial 96) investigated the sequencing of 2 to 3 years of exemestane after 2 to 3 years of tamoxifen and found that switching to exemestane was significantly superior in disease-free survival compared with continuing on tamoxifen.12 Trial MA17 evaluated extended adjuvant therapy with letrozole versus a placebo following 5 years of tamoxifen. DFS was significantly improved with letrozole versus a placebo, irrespective of whether patients had lymph node-positive or node-negative tumours.13 All three aromatase inhibitors are generally well tolerated. However, the long-term side effects remain to be studied. Results of these trials indicate that aromatase inhibitors provide important benefits relative to tamoxifen in each of these adjuvant treatment settings.

### Table 1: Different treatment strategies employing trastuzumab in an adjuvant setting for breast cancer

<table>
<thead>
<tr>
<th>Trial</th>
<th>No of patients</th>
<th>Treatment Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSABP-31</td>
<td>1960</td>
<td>AC x 4 &gt; Pac 3 weekly x 12 wks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AC x 4 &gt; Pac 3 weekly x 12 wks + Tras weekly x 52 wks</td>
</tr>
<tr>
<td>Intergroup N-9831</td>
<td>3046</td>
<td>AC x 4 &gt; Pac weekly x 12 wks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AC x 4 &gt; Pac weekly x 12 wks + Tras weekly x 52 wks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AC x 4 &gt; Pac weekly x 12 wks &gt; Tras weekly x 52 wks</td>
</tr>
<tr>
<td>BCIRG 006</td>
<td>3222</td>
<td>AC x 4 &gt; Doc 3 weekly x 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AC x 4 &gt; Doc 3 weekly x 4 + Tras weekly &gt; 3 weekly x 52 wks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>carboplatin + Doc 3 weekly x 6 + Tras 3 weekly x 52 wks</td>
</tr>
<tr>
<td>HERA</td>
<td>5090</td>
<td>Any CT ± RT &gt; Observation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Any CT ± RT &gt; Tras 3 weekly for 12 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Any CT ± RT &gt; Tras 3 weekly for 24 months</td>
</tr>
</tbody>
</table>

NSABP = National Surgical Adjuvant Breast and Bowel Project; BCIRG = Breast Cancer International Research Group; HERA = Health, Empowerment, Research, and Awareness Foundation; AC = Doxorubicin + Cyclophosphamide; Pac = Paclitaxel; Doc = Docetaxel; Tras = Trastuzumab; CT = Chemotherapy; RT = Radiotherapy;
TREATMENT OF METASTATIC DISEASE

Patients with HER-2/neu positive disease, who fail first line treatment with anthracycline, taxane and trastuzumab are usually treated with the prodrug of 5-fluorouracil, capecitabine. Recently two trials have been reported, in which a combination of either a tyrosine kinase inhibitor, or a chemotherapeutic agent of a novel class, epothilone, were found to be superior than capecitabine alone in terms of DFS. Lapatinib, a tyrosine kinase inhibitor of HER2/neu and epidermal growth factor receptor (EGFR), was used in combination with capecitabine in a Phase III international multicentre trial in patients expressing HER-2/neu protein. Time to progression was almost twice as long in the lapatinib/capecitabine group: (36.9 weeks) compared with the capecitabine only group (19.7 weeks). The combination was well tolerated. In another Phase III trial, ixabepilone and capecitabine prolonged progression-free survival (PFS) (5.8 months) relative to capecitabine (4.2 months). For the first time the PFS has been shown to be prolonged in this difficult-to-treat group of patients.

CHRONIC MYELOID LEUKEMIA

Since the approval of imatinib by the US Food and Drug Administration (FDA), the treatment of chronic myeloid leukaemia (CML) has been revolutionised so that very few patients now receive the toxic treatment of allogeneic bone marrow transplant. Imatinib is an inhibitor of the tyrosine kinase produced by a mutation in the BCR-ABL gene. However, some patients develop additional mutations in this gene, causing their cancers to become resistant to the drug. Dasatinib targets these secondary mutations. In a Phase I clinical trial to determine the optimal dose of dasatinib for those who could not tolerate or had become resistant to imatinib, 92.5% of the patients had no evidence of disease after receiving dasatinib. Additionally, 70% of patients in the accelerated phase experienced a significant decrease in the number of blast cells after receiving dasatinib. The duration of benefit was dependent on the phase of the disease when the patient was treated. Dasatinib represents a significant improvement in the overall treatment of CML in general, and imatinib resistant cases in particular.

COLON CANCER

ADJUVANT TREATMENT

Over the years, modulated 5-FU has remained the standard of care for fully resected Stage II and III colon cancer in the adjuvant setting. Several different regimens incorporating leucovorin with 5-FU given for 6 months, had been shown to reduce the recurrence rates by 40% in Stage III colon cancer, and a lesser degree in Stage II disease. More recently, one large study (the MOSAIC trial) found that adding oxaliplatin to standard chemotherapy after surgery for early-stage colorectal cancer reduced the risk of recurrence by 24%.

A separate study from the National Surgical Adjuvant Breast and Bowel Project (NSABP) showed that adding oxaliplatin to standard chemotherapy reduced the risk of recurrence by 21% in early-stage colorectal cancer patients. Coupled with similar data from other smaller studies, these findings have changed the treatment approach for patients with early-stage colorectal cancer who need chemotherapy after surgery.

TREATMENT OF METASTATIC DISEASE

Three signal transduction inhibitors, bevacizumab, cetuximab, and panitumumab have been approved in the past three years for treatment of metastatic colorectal cancers in the first and the second line. Bevacizumab is a recombinant, humanised monoclonal antibody against vascular endothelial growth factor (VEGF) that is used to inhibit VEGF function in vascular endothelial cells and thereby inhibit tumour angiogenesis. The addition of bevacizumab to 5-FU, with or without irinotecan or oxaliplatin, in both the first- and second-line treatment of metastatic colorectal cancer, has been shown to significantly increase PFS in several randomised trials. The overall survival advantage attributable to bevacizumab is 4.7 months with first-line therapy and 2.1 months with second-line therapy. Bevacizumab has acceptable tolerability, with the majority of adverse events being generally mild and clinically manageable; however, cost effectiveness remains a concern in this setting.

Another monoclonal antibody cetuximab, an inhibitor of the epidermal growth factor receptor (EGFR) has been shown, together with chemotherapy, to improve survival in metastatic colon cancer. A Phase III clinical trial involving patients with advanced colorectal cancer showed that the addition of cetuximab to a standard first-line chemotherapy combination called FOLFIRI (folinic acid, 5-FU, and irinotecan) reduced
Major Advances in the Treatment of Cancer

the risk of progression by 15%. Significantly more patients were able to undergo surgery for the complete removal of their tumours. In addition, more than twice as many patients with liver metastases were able to have their tumours completely removed in the cetuximab plus FOLFIRI group. The study was the first to evaluate this combination, providing a new treatment option and enabling more patients to have their tumours surgically removed.

GASTRIC CANCER

NEO-ADJUVANT AND ADJUVANT TREATMENT
Stomach cancer is conventionally regarded as a difficult tumour to treat and most of the patients diagnosed with it die of the cancer despite adequate surgery. Over the past 7 years, two significant advances have occurred, which have set new standards in the management of completely resected gastric cancer. A large U.S. Intergroup study (INT-0116) demonstrated that combined chemoradiation following complete gastric resection improves median time to relapse (30 versus 19 months, \( p < .0001 \)) and overall survival (35 months versus 28 months, \( p = .01 \)). Subsequently, the results of the Medical Research Council Adjuvant Gastric Infusional Chemotherapy (MAGIC) Trial, conducted in the UK, provided another significant advance. Neo-adjuvant chemotherapy, employing three cycles of a combination of epirubicin, cisplatin and 5-FU (ECF), was not only able to downsize several tumours, rendering them resectable, but was also associated with improvement in OS. Three further cycles of the same regimen were administered after the resection in an adjuvant setting. The updated results of the MAGIC Trial showed that 36% of patients who received chemotherapy were still alive five years after diagnosis, compared with 23% of those who received surgery alone. Taken together, the results of the two trials have changed the standard of care of gastric cancer.

GASTROINTESTINAL STROMAL TUMOUR
Gastrointestinal stromal tumours (GIST) are characterised by the presence of c-kit receptor, which in turn can be blocked by imatinib. Imatinib has been in clinical use for the treatment of metastatic GIST for several years, and has response rates of up to 70%. Imatinib has also been used to downsize the large tumours, and make them amenable to surgery. More, recently, imatinib has been found to have improved the recurrence free survival (RFS) in patient with resected GIST when used in the adjuvant setting. A National Cancer Institute sponsored study randomised patients to receive either 1 year of imatinib, or a placebo after completely resecting the GIST. At the end of the first year of treatment, 97% of patients in the imatinib group had not experienced a recurrence, compared with 83% in the placebo group. The differences were most notable in patients with tumours larger than 10 cm. No differences in the overall survival rates were noted with this short follow-up. Based on the findings, the study was stopped early and the patients on the placebo arm were allowed to cross over to use imatinib. This study would have major implications in the management of this rather rare tumour.

GLIOBLASTOMA MULTIFORME
Glioblastoma multiforme (GBM) is one of the commonest brain tumours in adults and is associated with poor survival rates. The conventional treatment has been resection followed by radiotherapy. Recently, two studies have shown for the first time that additional use of temozolamide, an alkylating agent, together with radiotherapy and subsequently for another 6 months after resection of GBM, can prolong the OS. The first study showed that patients with previously untreated GBM who received temozolamide with radiotherapy had a median survival of 14.6 months compared to 12.1 months for patients who received radiotherapy alone. The difference was more apparent after two years, when more than twice as many patients in the temozolamide group were still alive. A separate study of these patients found that those who benefited from temozolamide were more likely to have a particular genetic marker in their tumour cells. Patients with this marker (an alteration of the MGMT gene) who received temozolamide plus radiation lived 21.7 months, compared with 15.3 months among those who received radiation alone.

HEAD AND NECK CANCER
Until recently, the standard of care for the squamous cell cancers of the head and neck region has been either curative resection, or radiotherapy, or resection followed by adjuvant radiotherapy; however, most of the patients still relapse loco-regionally. The addition of chemotherapy has little or no benefit. More recently, the addition of cetuximab to radiotherapy
was shown to improve OS for patients with head and neck cancers. Cetuximab, a monoclonal antibody that targets the EGFR in cancer cells, had previously been approved for use in colorectal cancers. The PFS was significantly longer in the cetuximab group: 24.4 versus 14.9 months. The OS in the cetuximab group was also significantly longer: 49 versus 29.3 months. Also, patients with locally advanced hypopharyngeal or laryngeal cancer who received cetuximab with radiation therapy were more likely to have their larynxes preserved compared with patients who received radiation therapy alone. The addition of cetuximab produced relatively mild side effects, including an acne-like rash and local reactions to the drug infusion.

Also recently, data demonstrated that adding cetuximab to standard chemotherapy for head and neck cancers increases survival. Data from four clinical trials confirmed that cetuximab also may prolong OS in patients with recurrent head and neck cancers; the difference was statistically significant: the OS was 5.9 months for those who received cetuximab compared with 3.4 months for patients who did not. Following publication of these studies, the FDA this year approved the drug for use in combination with radiation therapy to treat squamous cell cancer of the head and neck, making it the first drug to be approved for this disease in 45 years.

HEPATOCELLULAR CARCINOMA

Hepatocellular Carcinoma (HCC) is the third leading cause of cancer death globally, often resulting in death within a year of diagnosis, and is one of the most difficult cancers to treat. More than 90% of the patients present at a stage where curative treatment with either resection or transplantation is not feasible. For the past 30 years and more, several agents, including chemotherapeutic agents, have been tried, tested, and found to be ineffective. At the American Society of Clinical Oncology (ASCO) meeting in 2008, results of a Phase III trial were presented. Patients who were treated with a multi-kinase inhibitor, sorafenib, had a median survival of 10.7 months, compared to 7.9 months for those who received a placebo. Time to cancer progression was also significantly longer in the treatment group: 5.5 versus 2.8 months. Sorafenib is also approved for treating advanced kidney cancer. The study was terminated early due to the positive results, and represents a one of a kind study where a survival benefit led to rapid approval by the FDA.

LUNG CANCER

Chemotherapy has been shown to improve survival in a select group of patients with non-small cell lung cancer (NSCLC), and is currently considered the standard of care for patients with Stage IIIIB and IV disease with a good performance status; however, until now, questions persisted about the benefit of adjuvant chemotherapy. The National Cancer Institute of Canada Clini-
Major Advances in the Treatment of Cancer

Multiple trials Group and the U.S. National Cancer Institute Intergroup Trial found that OS among those patients with early-stage NSCLC who received adjuvant chemotherapy with vinorelbine and cisplatin after surgery was 94 months, compared to 73 months for patients who did not.30 Five-year survival was also higher in the chemotherapy group (69% versus 54%), and the risk of recurrence was 40% lower in the chemotherapy group. These findings, together with those reported recently by the Adjuvant Navelbine International Trialist Association (ANITA) and the Cancer and Leukemia Group B (CALGB), confirm that adjuvant chemotherapy has a significant role in the treatment of patients with operable NSCLC.31, 32 These studies resolve a long-standing debate about the benefit of adjuvant chemotherapy, definitively demonstrating that such treatment has a beneficial role in the care of patients with operable NSCLC.

Multiple Myeloma

Multiple myeloma (MM) was considered to be an incurable B-cell neoplasm. For the first time in several years, use of two new classes of drugs, immunomodulatory (thalidomide and lenalidomide) and proteosome inhibitors (bortezomib) have been considered as major therapeutic advances in the treatment of MM. Previously, thalidomide had been shown to improve the response rate and survival when used in combination with melphalan and prednisolone, and had become an integral part in the management of MM; however, the drug is not free of side-effects. More recently, the effectiveness of lenalidomide has been demonstrated in Phase III clinical trials.33, 34 Patients with relapsed/refractory MM were randomised to lenalidomide plus dexamethasone or dexamethasone alone. Patients in the lenalidomide group had superior response rates and duration of response. Lenalidomide is an analogue of thalidomide, and works by inhibiting angiogenesis and immune modulation, and increasing apoptosis. Lenalidomide is generally better tolerated than thalidomide. The proteosome inhibitor bortezomib is another recent addition to the MM treatment armamentarium. The target of bortezomib is the 26S proteasome. The benefit of bortezomib was shown in the Phase III APEX trial. Patients with relapsed/refractory MM were randomised to receive bortezomib or dexamethasone.35 The response rate, median time to progression, and 1-year survival were significantly increased in the bortezomib group. In addition, clinical trials have further established the role of stem cell transplantation and the benefits of post-transplant maintenance therapy. These advances have resulted not only in expanded treatment options, but seem to have changed the natural history of MM which was once considered to be an incurable neoplasm.

Non-Hodgkin’s Lymphoma

Follicular lymphoma (FL) is an indolent form of non-Hodgkin’s lymphoma (NHL), the outcomes of which had not improved over the past 3 decades.36 In the last 3 years, four large scale randomized trials have shown that adding the anti-CD20 monoclonal antibody, rituximab, to conventional combination chemotherapies improves the PFS and the OS.37-40 Rituximab added to a combination of cyclophosphamide, vincristine, prednisolone (CVP); cyclophosphamide, doxorubicin, vincristine, prednisolone (CHOP); mitoxantrone, cyclophosphamide, prednisolone (MCP) or chlorambucil, vincristine, prednisolone with interferon maintenance (CHVP-IFN-α), brought clear survival advantage (see Table 2 for details). A combination of rituximab and chemotherapy has now become the standard of care in the treatment of the commonest form of indolent lymphoma, the FL.41, 42

Furthermore, another series of studies have established the successful role of rituximab for maintenance after completion of chemotherapy.43-45 Used in this way, PFS and OS rates are prolonged. For example, in one study, 56% of patients who received maintenance rituximab showed no progression, compared with 33% of patients who were observed following chemotherapy. Moreover, 88% of the rituximab group was still alive after 4 years, compared with 72% of the observation group.

In a different setting, radioactivity conjugated with the anti-CD antibody has shown to induce higher remission rate, prolong the PFS and the OS. Two agents, 90Y and 131I have been extensively studied and the results have been reported. Increasingly, the radioimmuno-labelled antibodies are being incorporated in the management of indolent lymphomas not only after relapsed FL, but also in first line therapy.46, 47

As a result of recent developments, not only rituximab and radiolabelled antibodies have become the standard of care in the management of FL, but also, for the first time in the last three decades, the natural history of the disease seems to be changing, with the hope of a cure.
OVARIAN CANCER

The vast majority of patients with epithelial ovarian cancer present with advanced stage disease, and the standard of care is debulking surgery followed by adjuvant systemic chemotherapy. Despite the treatment, more than 80-90% of the patients relapse and die of their disease within few years of diagnosis. Continued attempts to improve the survival rates have been unsuccessful in the past 10 years, since adjuvant chemotherapy with a combination of platinum and paclitaxel emerged as the standard of care. However, recently, the results of a Phase III trial including 415 patients with advanced ovarian cancer revealed that intra-peritoneal administration of chemotherapy extended the median survival by more than 1 year (49.7 months versus 65.6 months) compared with intravenous chemotherapy. Patients who received intra-peritoneal therapy experienced more toxic side effects, and were more likely to report poorer quality of life, compared with women who received intravenous therapy. Only 42% of women in the intra-peritoneal chemotherapy group were able to complete all six cycles of therapy, compared with 83% of those who received intravenous chemotherapy. Such toxicity has limited the widespread use of intra-peritoneal therapy.

Table: Randomised trials comparing standard chemotherapy with standard chemotherapy and rituximab for non-Hodgkins lymphoma

<table>
<thead>
<tr>
<th>Study</th>
<th>No. of patients</th>
<th>Treatment</th>
<th>TTP</th>
<th>p-value OS</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solal-Ceingy</td>
<td>159</td>
<td>CVP</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>162</td>
<td>R-CVP</td>
<td>34</td>
<td>&lt;0.0001</td>
<td>89%</td>
</tr>
<tr>
<td>Hiddeman</td>
<td>205</td>
<td>CHOP</td>
<td>29</td>
<td></td>
<td>90%**</td>
</tr>
<tr>
<td></td>
<td>223</td>
<td>R-CHOP</td>
<td>NR</td>
<td>&lt;0.001</td>
<td>95%</td>
</tr>
<tr>
<td>Herold</td>
<td>96</td>
<td>MCP</td>
<td>25</td>
<td></td>
<td>74%</td>
</tr>
<tr>
<td></td>
<td>105</td>
<td>R-MCP</td>
<td>54</td>
<td>&lt;0.0001</td>
<td>88%</td>
</tr>
<tr>
<td>Salles</td>
<td>175</td>
<td>CHVP-IFN</td>
<td>62%***</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>184</td>
<td>R-CHVP-IFN</td>
<td>78%</td>
<td>&lt;0.03</td>
<td>n/a</td>
</tr>
</tbody>
</table>

TTP = Time to progression; OS = Overall survival; CVP = cyclophosphamide, vincristine, prednisolone; R-CVP = rituximab, cyclophosphamide, vincristine, prednisolone; CHOP = cyclophosphamide, doxorubicin, vincristine, prednisolone; R-CHOP = rituximab, cyclophosphamide, doxorubicin, vincristine, prednisolone; MCP = mitoxantrone, cyclophosphamide, prednisolone; R-MCP = rituximab, mitoxantrone, cyclophosphamide, prednisolone; CHVP-IFN = chlorambucil, vincristine, prednisolone, interferon α; R-CHVP-IFN = rituximab, chlorambucil, vincristine, prednisolone, interferon α; *3 year survival; **2 year survival; ***Event-free survival

PANCREATIC CANCER

Patients with advanced pancreatic cancer have a poor prognosis and the standard of care for the past 12 years has been the use of single agent gemcitabine. Several attempts to use combinations, such as with cisplatin, oxaliplatin, capecitabine and 5-FU have not yielded encouraging results. Pancreatic cancers are known to over-express EGFR and recently a tyrosine kinase inhibitor of the EGFR, erlotinib, was used in combination with gemcitabine in patients with unresectable, locally advanced, or metastatic pancreatic cancer. A total of 569 patients were randomly assigned to receive either gemcitabine plus erlotinib (100 or 150 mg/d orally) or gemcitabine plus a placebo in a double-blind, international Phase III trial. One-year survival was also greater with erlotinib plus gemcitabine (23% versus 17%). PFS was significantly longer with erlotinib plus gemcitabine. For the first time, a combination has been found to be superior than the single agent chemotherapy; however, given the modest gain in survival, pending complementary studies, the addition of erlotinib can not still be considered the standard of care. Nonetheless, this study paves the way for further trials employing signal transduction inhibitors in the management of unresectable pancreatic cancer.

PROSTATE CANCER

Prostate cancer is one of the most common cancers in men in the western world. Effective screening using digital rectal examination (DRE), and serum estima-
tion of the prostate specific antigen (PSA) means that more patients are being diagnosed at an early stage. However, since the majority of patients is diagnosed at an old age and has a higher chance of dying because of the cancer-unrelated causes, an expectant approach or ‘watchful waiting’ has been employed as a method of early treatment. As yet there is no clear understanding as to which patients require aggressive treatment. A total of 695 men with early prostate cancer were randomly assigned to radical prostatectomy (347 men) or ‘watchful waiting’ (348 men). During a median of 8.2 years of follow-up, 83 men in the surgery group and 106 men in the watchful-waiting group died. Radical prostatectomy was found to have reduced the disease-specific mortality, overall mortality, and the risks of metastasis and local progression. The absolute reduction in the risk of death after 10 years was small, but the reductions in the risks of metastasis and local tumour progression were substantial. When analysed by age, the benefits of surgery were greatest among younger men: among men under age 65, 19.2% in the ‘watchful waiting’ group had died after 10 years compared with 8.5% of those who had surgery, while among men age 65 and older, 11.5% in the ‘watchful waiting’ group died versus 8.5% of those in the surgery group. Based on these data, men under age 65 who have early-stage prostate cancer should undergo surgery to remove the prostate, while older men may choose ‘watchful waiting’.

RENAL CELL CARCINOMA

Nearly one-half of patients with renal cell carcinoma (RCC) have metastatic disease at the time of initial presentation. The tumour is not sensitive to chemotherapy, and the options included treatment with interferon-α (IFN-α) or interleukin-2 (IL-2) or surgical resection of metastases. However, response rates to the cytokine treatment do not exceed 10-20%, and the long-term prognosis remains dismal. High-dose IL-2, approved for treatment of advanced RCC, has significant limitations. The treatment must usually be administered in an intensive care unit, is associated with significant toxicity, and has not demonstrated a survival benefit. Over the past two years, four different agents have been proved to be effective in inducing responses, with the possibility of some longer remissions. Sunitinib, sorafenib, temsirolimus, and bevacizumab have demonstrated significant efficacy in clinical trials and have been approved by the FDA for the treatment of advanced RCC [Table 3].

![Table 3: Randomised trials in metastatic renal cell carcinoma](image)

Table 3: Randomised trials in metastatic renal cell carcinoma

<table>
<thead>
<tr>
<th>Study</th>
<th>No of patients</th>
<th>Treatment</th>
<th>ORR</th>
<th>PFS</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motzer</td>
<td>375</td>
<td>IFN-α</td>
<td>6%</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>375</td>
<td>Sunitinib</td>
<td>31%</td>
<td>11</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Escudier*</td>
<td>451</td>
<td>Placebo</td>
<td>37%</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>452</td>
<td>Sorafenib</td>
<td>62%**</td>
<td>5.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hudes</td>
<td>207</td>
<td>IFN-α</td>
<td>4.8%</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>209</td>
<td>Temsiroimus</td>
<td>8.6%</td>
<td>5.5</td>
<td>&lt;0.008</td>
</tr>
<tr>
<td></td>
<td>210</td>
<td>IFN+Temsiroimus</td>
<td>8.1%</td>
<td>4.7</td>
<td></td>
</tr>
<tr>
<td>Escudier</td>
<td>324</td>
<td>IFN-α</td>
<td>12.4%</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>325</td>
<td>Bevacizumab+IFN-α</td>
<td>10.2</td>
<td>10.2</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

ORR = Overall response rates; TTP = Time to progression; IFN-α = Interferon –α.

* Second line treatment, ** Disease control rate (complete response + partial response + stable disease)
the sunitinib arm and 5 months for the IFN α arm ($p < 0.000001$). In another study, 905 patients who had failed one prior systemic therapy in the last 8 months and had measurable disease, clear cell histology, a good or intermediate prognosis, and an Eastern Cooperative Oncology Group (ECOG) performance status of 0 to 1 were randomised to receive either sorafenib or placebo. Sorafenib significantly prolonged median PFS compared with placebo (24 vs 12 weeks, $p < 0.000001$). In a different study, 626 patients with several poor-risk features were randomised to receive either IFN α, temsirolimus or a combination of temsirolimus plus IFN α. The median survival of patients was superior in the temsirolimus-alone arm compared with IFN α (10.9 versus 7.3 months, $p < 0.007$), while the combination arm was not superior to IFN α (8.4 months, $p = 0.69$). The median PFS was statistically superior for both temsirolimus arms (3.7 months) compared with IFN α (1.9 months). In the fourth study, patients with metastatic kidney cancer who had undergone nephrectomy were randomly assigned to receive either bevacizumab or a placebo in addition to interferon. Adding bevacizumab nearly doubled PFS, from 5.4 months to 10.2 months. The tumour response rate was 31% for the bevacizumab group versus 13% for the placebo group.

Over the past 2 years, the use of these agents has essentially replaced the standard cytokine treatment, which had been the standard of care for more than two decades.

**CONCLUSION**

Oncology treatment has begun to progress by quantum leaps. A glance at this review would suggest that whereas, in some areas, a paradigm of management has shifted, for example, the use of targeted therapy in the adjuvant treatment of breast cancer, and the use of monoclonal antibody together with chemotherapy in indolent lymphoma, resulting in the cure of many more patients than were seen in the very recent past, in other areas, new treatments have emerged, in hard-to-treat cancers, such as, HCC and RCC, offering hope of a meaningful prolongation of life to thousands of patients annually. The improved survival seen with the addition of targeted therapies as well as chemotherapeutic agents in cancers of the colon, head and neck, NSCLC, and the pancreas represents the continual improvement seen using the Phase III randomised trials.

**REFERENCES**


146


Medical Education Units History, Functions, and Organisation

Nadia M Al-Wardy

ABSTRACT
Most medical schools have established a medical education unit (MEU) or similar bodies in response to various reforms in medical education. Such units have a variety of titles and operate either independently or under the office of the dean. Their activities include conducting educational research, teaching and providing service and career development of academic staff. The scope of their activities ranges from serving medical faculty only to all other health professionals at either the undergraduate or postgraduate levels. Several factors contribute to the success of MEUs and their establishment is seen to have a positive effect on their medical school.

Keywords: Education, Medical. Organisation and administration; Oman.

Most medical schools have well-established independent medical education units or similar bodies. Such units have various titles, but the ones in common use are: office, division, department, centre, and unit. In this paper, the term 'medical education unit' (MEU) will be used to refer to such titles.

The development of MEUs has been triggered by several factors such as curriculum reforms, need for faculty training, new methods for student selection, advances in medical informatics, the requirements from quality assurance and accreditation bodies, and education becoming a viable faculty career track. In the UK, in response to the recommendations of Tomorrow’s Doctors, many such units were established and charged with the responsibility for overseeing staff development. These units took on additional roles that were crucial to introducing changes in the curriculum.

The functions of MEUs include research, teaching, service and career development of staff and the scope of their activities ranges from undergraduate to postgraduate programmes and from uni-professional to multi-professional audiences. The balance of these activities varies according to the mission and scope of the units; however, the right balance is important for their continuity and stability.

Many MEUs started as administrative units in the medical school’s dean’s office, but then slowly evolved into independent academic units or departments. The
staff of the unit includes a range of expertise and comes from different professional backgrounds including medical and educational with part-time or full-time commitments. Several sections can exist in the unit to fulfill its mission.

Backup and support is important to sustain MEUs. This support can come from the dean and higher administration. Financial support can come from the medical school, university, government, or external sources.

The establishment of MEUs has several positive effects on medical schools. It enhances the quality of medical education, increases the publication of scholarly articles as well as the productivity of educational research, leading to the commitment of universities to their continuation. The units continue to provide important benefits to the educational mission of their institution and, by supporting the professional identity of medical education scholars, they are essential to the continued development of medical education as a discipline.

This review attempts to document the development of such units, the need for their establishment, their functions and organisational structure, thus providing useful information for those intending to establish one.

**Worldwide Development of Medical Education Units**

Many medical schools around the world have well established MEUs. However, the process of their establishment has been slow. From 1958, when the first medical education unit was started, until the 1970s, there were only 72 MEUs worldwide. From then on, the number of MEUs steadily increased.

In the USA, as of 2001, there were 61 formal MEU. Some of these units started as offices of research in medical education, while others have started as audiovisual units. In Canada, the trigger for the establishment of MEUs was the innovative initiative of problem-based learning and in Latin America, MEUs began to be established around 1968 as a result of lack of coordination in activities related to teaching and learning.

In the UK, several MEUs were set up during the 1970s to support the undergraduate curriculum and to act as a national resource in medical education. Several more were established as a result of financial support that was provided for medical schools to apply point facilitators to help faculty respond to the recommendations of Tomorrow’s Doctors. These facilitators, and the offices that supported them, were the precursors of many MEUs in Britain. Now, all new medical schools in the UK have MEUs to help underpin teaching with a strong research base. In other countries in Europe, MEUs were established in the universities of Geneva, Bern, the University of Maastricht and the Università Campus Bio-Medico, Rome, Italy.

The WHO played a leading role in creating a system of Regional Teacher Training Centres (RTTCs) to provide training to future national leaders to establish national centres in their countries. The creation of such a centre in Iran in the early 1970s had a remarkable impact on the region. In South East Asia, RTTCs were established at the Chulalongkorn University in Thailand and the University of Sri Lanka. These played a critical role in the establishment of the first National Teacher Training Centres (NTTCs) in Philippines, Republic of South Korea, India, Bangladesh, Myanmar and other countries in the South East region of the World Health Organisation (WHO). In India, however, the withdrawal of funding to these NTTCs led to their withering, but not before fostering the development of MEUs in other medical colleges.

In China, the first medical education unit was established as a medical education research unit in China’s Shanghai First Medical University in October 1978. Its purpose was to evaluate and promote the quality of medical education. Later, more research units were established in China’s other medical schools. In South East Asia, many medical schools have a medical education unit or a similar structure in place. The majority of these MEUs were established during or since 1990. In Japan, only 8 MEUs were founded in 1995, but by the year 2000, the number of MEUs reached 20.

In the African continent, MEUs were established in several medical schools in response to issues such as deteriorating student performance in medical exams, and the growing demands of the countries and the region for qualified medical teachers.

In Australia, the RTTC established by the WHO in Sydney (which is also the Centre for Medical Education at the University of New South Wales) in the early 1970s, played an important role in creating a critical mass of concerned and informed individuals and in matching training programmes with the identified needs of a regional constituency. Later, curriculum reforms, with the introduction of gradu-
ate-entry programmes and new admission criteria, led to the establishment of several MEUs in the 1990s. Now, almost all medical schools in Australia have set up similar bodies to lead and support this curriculum reform.

A survey that was conducted to look at the establishment and role of MEUs in the Gulf Cooperation Council (GCC) medical schools showed that 10 out of 13 medical schools had such units (unpublished data). MEUs exist in several medical colleges in Saudi Arabia, Kuwait, Bahrain, the United Arab Emirates and, recently, a medical education unit has been established in the College of Medicine and Health Sciences at Sultan Qaboos University, Oman.

THE NEED FOR MEDICAL EDUCATION UNITS

CURRICULUM CHANGE
Medical curricula around the world are undergoing reform. The introduction of new student selection criteria, integration of basic and clinical sciences, emphasis on relevance, increased attention to personal and professional development, problem-based and self-directed learning, the emphasis on information technology to support learning, community-based initiatives and the introduction of graduate-entry programmes are all major innovations to which medical schools have to respond. As a result, many medical schools have set up these units to lead, support and evaluate curriculum reform, with many being the driving force behind curriculum change.

ACCREDITATION REQUIREMENTS
Accreditation and quality assurance bodies are demanding greater scrutiny of the education process, the number and qualifications of teachers and teaching/learning and assessment methods. This has resulted in the design of outcome-based curricula, audits of teaching, and appraisal activities that are now normal processes in many medical schools around the world. A medical education unit can provide major support for these initiatives and a home base for staff involved in this process. In fact, certain accrediting bodies list the existence of a medical education unit in their criteria for accrediting new medical schools.

TEACHER TRAINING
The increasing complexity of the curriculum with its new educational strategies, new assessment tools and the increased use of learning technologies, has led to the recognition that all those who teach require some background and training in education. The General Medical Council of the UK requires that training in teaching is provided even at undergraduate level. Many universities conduct faculty development programmes for their teachers and make use of in-house, regional and international medical centre programmes, for this purpose. In fact, teaching constitutes a component, if not a major one, of promotion criteria in many medical school. Teacher training has proved pivotal in stimulating curricular changes and is becoming compulsory for all new staff members in some medical schools. In addition, many schools have encouraged their established staff, who have major teaching responsibilities, to undertake training leading to a recognised teaching certificate or diploma. In one medical school, consultants apply to become clinical teachers and are encouraged to undertake a postgraduate qualification in medical education. Their teaching practice is reviewed as part of their regular appraisal and consistently poor performance would result in their teaching duties being withdrawn.

MEUs can assist in this requirement of teacher training, a function that is provided by many such units around the world. In fact, some of the larger units organise award-bearing medical education programmes up to and including doctoral-level. It has been reported that this teacher training had “very much” improved medical education at their schools.

ADMINISTRATIVE NEED
Due recognition is needed for faculty who undertake the responsibility of training staff and who conduct faculty development workshops in their ‘borrowed’ time. MEUs should create a proper administrative structure with appropriate job descriptions and reward structures leading to the recognition of the efforts of staff undertaking these activities on a part-time basis.

FUNCTIONS OF MEDICAL EDUCATION UNITS
The functions of MEUs vary from institution to institution; their scope of activities can include undergraduate and postgraduate education and continuing professional education. These activities could extend not only to medical professionals but also to other healthcare professions such as dentistry, pharmacy, medical technology and nursing. In general, the functions of MEUs span the areas of research, teaching, service,
workshops, evaluation, consultancies, and the career
development of staff.\textsuperscript{1,36}

\textbf{Research}

An essential mission of MEUs across institutions is
to conduct research and provide scientifically sound
information that advances and promotes medical
education.\textsuperscript{6} The extent and priority of research in dif-
ferent MEUs depends on many identified factors
such as access to research expertise, protected time
for scholarship, funding (whether internal or exter-
nal), the institutional culture of scholarship, educa-
tional leadership, the history of medical education
innovation, the quality of faculty and the complemen-
tary areas of expertise they possess, critical mass of
educational scholars, status of the medical education
unit, response to accreditation bodies, mentorship,
faculty development, access to learners, and growth
of opportunities for advanced training in educational
scholarship.\textsuperscript{9,37-42} The areas of research also vary ac-
cording to the mission of the unit and the need of the
institutions. In the Faculty of Medicine at the University
of Maastricht, for example, the initial focus of research
was on the evaluation of problem-based learning, but
this focus widened to include the areas of student and
teacher learning, learning environments, and assess-
ment and evaluation of learning and teaching.\textsuperscript{39} A
wide variety of research is undertaken in other places,
covering topics considered important to their govern-
ments, health system administration, communities
and funding bodies.\textsuperscript{43} The areas include health serv-
ices research, public health, workforce and career out-
comes of medical courses and their relations to student
characteristics, admission and selection procedures,
curriculum development, and clinical reasoning and
problem solving.\textsuperscript{34} Based on a survey of 25 mem-
bers of the Society for Directors of Research in Medical
Education (SDRME – an international organisation
with primarily North American membership),\textsuperscript{39} the
research areas of focus were (in rank order): assess-
ment of competencies, curriculum, student assess-
ment approaches, standardised patients, instructional
design, computer-based education applications, pa-
tient simulations, institutional research, student selec-
tion, clinical decision making, medical informatics,
faculty careers, patient education, continuing educa-
tion, chronic diseases, health economics and disease
prevention.

MEUs play an important part in creating a culture
of research by innovating, developing new approaches
to medical education and publishing their findings.
Fellows of MEUs are authors of a substantial number of
peer reviewed manuscripts.\textsuperscript{6,37,38} Communication
concerning research such as running journal clubs,
circulating medical education newsletters, and con-
ducting medical education rounds\textsuperscript{49} are also ways used
by the units for promoting this culture.

\textbf{Teaching}

The major role of the MEU in the teaching aspect of
their function is to help equip the teaching staff with
the necessary abilities to undertake effectively their
roles as medical teachers. Teaching areas vary accord-
ing to need. They can range from teaching and learning,
medical student assessment and selection, curriculum
development and evaluation, course design, research
in medical education,\textsuperscript{1,15} instructional material design,
and e-learning.\textsuperscript{1} Again, based on a survey of 25 mem-
bers of the SDRME\textsuperscript{39} the teaching areas of MEUs were
(in rank order): research skills, educational methods,
statistics, academic skills, test taking/preparation,
computer applications, clinical education, medical
humanities, clinical decision making, international
medical education, enrichment programmes, basic
sciences, patient education, health economics/policy,
and disease prevention. Some MEUs in GCC medical
schools also took responsibility for running continu-
ing medical education (CME) activities, conferences,
workshops on evidence-based medicine and running
the clinical skills laboratory.

Types of educational activities were workshops,
seminar series, short courses, individual or augment-
ed feedback and site visits. Longitudinal programmes
(e.g. fellowships, Masters and PhDs) were also offered
by some units. Target audiences were both practising
clinicians and basic scientists from either one or more
disciplines\textsuperscript{34} or a mixture of health professionals. A
wide range of instructional methods were used such
as lectures, small-group discussions, interactive exer-
cises, role plays and simulations, films and videotape
reviews of performance.\textsuperscript{34}

\textbf{Service Provision}

Many MEUs are service providers within an institution.
For some, a service responsibility was the main ration-
ale for their establishment.\textsuperscript{13} The service areas include:
service on committees and task forces; consultancies
to educational providers; curriculum development,
planning and administration, for example, assistance
in defining objectives and curriculum organisation; assessment and evaluation, for example, curriculum and programme evaluation, test administration and scoring, developing and maintaining examination databanks; educational support services, for example, computer classroom/laboratory administration, computer support, standardised patient programme administration, clinical skills laboratory administration and preparation of teaching material; data analysis and statistical support; undergraduate and graduate student selection and admission to the medical programme; coordination of clinical elective placements; mentoring and student counselling and other services such as media production, printing, copying, medical illustrations and graphics production. 1, 15, 39, 46

ACADEMIC DEVELOPMENT AND SUPPORT
An important role of MEUs is to provide an academic home for and nurture the careers of faculty members wanting to focus on educational scholarship and develop as future medical educationists. By ensuring that these faculty members are given the necessary exposure to the field, and are allowed to develop their studies and publish research in medical education, MEUs help them to gain academic rewards and recognition for their expertise.

ORGANISATIONAL STRUCTURE
ADMINISTRATIVE STRUCTURE
The structure and organisation of an MEU depends on its position within the university’s structure i.e. whether it is within the medical school, within an institute of health sciences, or within the university. The units are usually administrative structures within the medical school dean's office, but a few are free-standing departments. They are headed by persons who hold titles such as head,45 coordinator,47 director, chair, assistant or associate deans.2, 39 These lead persons report to individuals with 7 different administrative titles, again, depending on the position of the unit within the university. If within the medical school, then the lead person reports to the dean or associate dean; if outside the medical school, then he/she reports to vice-chancellor, vice-president, or vice-provost.19

SIZE AND STAFF PROFILE
The size of the MEU varies from very small to very large depending on its role in the wider institution. In North America, on average, MEUs employ 5 professional or faculty staff and 3 clerical staff or support staff.6 The degrees held by faculty/professional staff were mostly PhD or EdD while few were MD. Around 68% of heads has a PhD while only 16% has an MD.39 The technical support staff has varied titles: Systems Analyst, Standardized Patient Coordinator, Research Scientist/Statistician, Instructional Technology Manager, Information Analyst, and Data Manager.39 The same author reported that the average number of years of experience of professional staff in medical education was seven and their average annual salary (based on 100% FTE) 56,000 U.S. dollars. A mixture of tenure and non-tenure staff with full-time or part-time commitment contribute to the activities of the unit.1, 23, 39, 47

INTERNAL ORGANISATION
Different kinds of sections exist within MEUs depending on their size and mission. Examples of these are course administration unit, computer assisted learning unit, clinical skills and simulation unit,46 community based education unit, ethics unit, staff development unit, communication skills unit, international programme unit, graduate studies unit, medical humanities unit, and research unit.1

FINANCIAL SUPPORT
Financial support can come from the university, hospital, medical school or government funds.1 In Australia, for example, grants from the health department enabled the establishment of MEUs in 3 universities.10 However, constraints on funding led the consortium of graduate medical schools in Australia to create different resources for their programmes.27 In developing countries, the WHO played a substantial part in setting up MEUs in several medical schools.11, 20, 26

In the North American context the median budget for each medical education unit was $650,000 with 75% of support coming from ‘hard’ university funds. The remainder of support came from research and training grants, services, and contracts with other institutions and government agencies.6 On average, the level of unit activities supported by external funds accounted for approximately 16% of unit finances in 200239 which is in contrast to 25% in 1998.2
OPPORTUNITIES AND CHALLENGES FOR THE ESTABLISHMENT AND CONTINUATION OF MEDICAL EDUCATION UNITS

The calls for reform in medical education created opportunities for the establishment of MEUs and the support came from a variety of sources, one of the key points of their success. Financial support whether it is from the university, hospital, external, or from international programmes, is important at least at the early stages of setting up the unit. Other important factors that contribute to the success and sustainability of the units are: MEU leaders able to motivate and provide a role model; educational relevance and professional alignment of the activities of the units; diversity of ideas and research methodologies; access to research expertise; focused and collaborative research; a culture of mutual support and mentorship; a clear faculty development initiative; access to learners; and protected time for scholarship.

Several challenges are faced when setting up MEU such as lack of full-time dedicated faculty, appropriate financial support, and finding the right balance between the research and service functions of the unit. Many units employ part-time faculty, but demands on productivity in their own professions might restrict their participation in the activities of the unit. To encourage their involvement, appropriate reward structures need to be set up.

Appropriate financial support is needed for setting up the unit and a great deal of this comes from 'hard' university funds. However, at times when institutes are becoming increasingly dependent on research grants there is paucity of funding for medical education research.

Finding the right balance between the research and service functions of the medical education unit is important for its continuity. If the unit concentrates on service at the expense of research, it will reduce its innovative capacity and wither. Several units have closed or downsized because the sole responsibility of the unit was service provision. On the other hand, if the unit concentrates on research at the expense of service it might come into conflict with the administration of the medical school whose interest lies in solving immediate institutional needs and problems. Finding the right point on the research-service continuum is a challenge. The units sometimes become entrapped in service provision because of the urgency of institutional needs. A solution for this would be to highlight to the medical school administration the enhanced reputation that the institute receives by being an innovator in educational research. Members of the medical education unit can also learn from their service activities and so generate scholarship material relevant beyond the home institution.

CONCLUSION

MEUs have been established in response to several contemporary needs. By providing specialised resources for teaching, service and a focus on educational research, they are essential to the continued development of medical education as a discipline.

REFERENCES


39. van der Vleuten C, Dolmans D, de Grave W, van Luijk S, Muijtjens A, Scherpbier A et al. Education research at the Faculty of Medicine, University of Maastricht: fostering the interrelationship between professional and education practice. Acad Med 2004; 79:990-996.

40. Gruppen L. The Department of Medical Education at the University of Michigan Medical School: a case study in medical education research productivity. Acad Med 2004; 79:997-1002.


45. National University of Singapore Medical Education


Regional Variation in the Prevalence of Asthma Symptoms among Omani School Children
Comparisons from Two Nationwide Cross-sectional Surveys Six Years Apart

*Omar A Al-Rawas,1 Bazdawi M Al-Riyami,1 Hussein Al-Kindy,2 Abdullah A Al-Maniri,3 Asya A Al-Riyami4

Abstract

Objectives: The International Study of Asthma and Allergies in Children (ISAAC) highlighted the presence of wide variations in asthma prevalence between and within countries. The aim of this study was to determine the changes in the prevalence of asthma and its symptoms across the different regions of Oman.

Methods: Two cross-sectional surveys were conducted as part of ISAAC phases I (1995) and III (2001) in two age groups (6-7 and 13-14 years) from nation-wide samples of Omani school children, with 7,067 participants in 1995 (3,893 young and 3,174 older group) and 7,879 participants in 2001 (4,126 young and 3,753 older group).

Results: Over the period of six years, the Sharqiya (Eastern) region continued to have the highest prevalence of self-reported asthma diagnosis and all asthma symptoms in both age groups, with a significant increase in the prevalence of wheeze in the past 12 months (from 8.7% to 13.8%; p=0.002) and asthma diagnosis (from 13.8% to 17.8%; p=0.046) in the young group, and a significant increase in night cough (from 21.6% to 27.8%; p=0.039) in the older group. All other regions had lower prevalence rates in 1995 in both age groups, and showed either no significant change or a decline in one or two of the self-reported asthma symptoms. The prevalence of asthma diagnosis among wheezy children remained unchanged across all regions. In addition, asthma under-diagnosis remains a problem with only 60% of children with severe wheeze reporting asthma diagnosis in both surveys.

Conclusion: The geographic variation in the prevalence of self-reported asthma symptoms among Omani school children persists with further increase in the Sharqiya region. The findings also suggest under-diagnosis and/or poor recognition of asthma which had not improved over time.

Key words: Asthma, prevalence; Children; Adolescents; Oman.
As one of the most common chronic conditions in children and is a major global health problem. It is also perceived to be one of the most common chronic conditions in Oman. Studies from many different countries showed that the prevalence of asthma has been increasing over the last three decades and the results of the International Study of Asthma and Allergies in Childhood (ISAAC) confirmed the wide international variation in the prevalence of asthma diagnosis and symptoms. 

Asthma management has many components; the first of which is surveillance, which determines how much asthma exists in the population, how severe it is and how well it is being detected and controlled. Such data enable healthcare providers to make evidence-based decisions in the development of asthma control programs.

Our participation in ISAAC phase I (conducted in 1995), yielded the first epidemiological survey into symptoms of asthma in Oman, and revealed that asthma diagnosis and symptoms in Omani children are not only common, but also associated with a relatively high prevalence of symptoms indicative of severe or uncontrolled asthma (sleep-disturbing wheeze, speech-limiting wheeze and frequent attacks of wheeze). In addition, these results suggested under-diagnosis and/or undertreatment of asthma in these children. We also found a wide variation in the prevalence of asthma diagnosis and symptoms among the different geographical regions of the country with the Sharqiya (Eastern) region scoring the highest prevalence rates of self-reported asthma diagnosis and all asthma symptoms in both age groups.

The aim of this study was to evaluate the changes in the prevalence of asthma symptoms and severity among Omani schoolchildren across the different geographic regions of Oman by comparing the data from ISAAC phases I (1995) and III (2001).

**METHODS**

The details of study design and methods have been previously described. The study used the data collected in two ISAAC surveys 6 years apart (Phase I in 1995 and Phase III in 2001) using identical ISAAC protocols during the same month of the year (April). In both surveys, the total national target samples were randomly selected from the ten administrative (representing the eight geographical) regions of Oman using the proportion allocation method. The total number of distributed questionnaires (Arabic version) was 7,625 (4,079 aged 6–7 years and 3,546 aged 13–14 years) in 1995 and 8,080 questionnaires (4,235 aged 6–7 years and 3,853 aged 13–14 years) in 2001. The study design and data quality assurance followed the ISAAC protocol in all aspects, including the double entry of data and translation guidelines.

In Phase III, in addition to the written questionnaire, 13-14 year old children completed the ISAAC asthma video questionnaire. The international version of the ISAAC video shows young adults from a variety of ethnic backgrounds manifesting different symptoms of asthma during a set of five different short sequences as follows: wheezing at rest, wheezing after exercise, waking at night by wheezing, night cough,
and severe wheeze. After each scene, the children ticked the answer whether or not they experienced the same problems with breathing as the person in the video ever in life and if yes, whether in the past 12 months. The terms asthma and wheezing were not mentioned in the video questionnaire in order to avoid language problems.

The primary outcome measure was the changes in the prevalence of wheeze in the past 12 months, “current wheeze” and self-reported asthma diagnosis. Secondary outcome measures included the prevalence of exercise induced wheeze, night cough and symptoms suggestive of severe asthma. For the purpose of this analysis severe asthma was defined as the presence (positive response to the written questionnaire) of one or more of any of the following during the past 12 months: frequent wheeze (four or more wheezing attacks), frequent sleep disturbance (one night or more

**Table 1: Regional distribution of the two age groups in two surveys ISAAC Phases I (1995) & III (2001)**

<table>
<thead>
<tr>
<th>Region</th>
<th>6-7 year age group</th>
<th>13-14 year age group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ISAAC Phase I number ( % of total sample)</td>
<td>ISAAC Phase III n (%)</td>
</tr>
<tr>
<td>Muscat</td>
<td>518 (13.7)</td>
<td>639 (16.0)</td>
</tr>
<tr>
<td>Batinah</td>
<td>1167 (30.9)</td>
<td>1519 (38)</td>
</tr>
<tr>
<td>Dakhiliya</td>
<td>550 (14.6)</td>
<td>434 (10.9)</td>
</tr>
<tr>
<td>Sharqiya</td>
<td>665 (17.6)</td>
<td>730 (18.3)</td>
</tr>
<tr>
<td>Dhahirah</td>
<td>384 (10.2)</td>
<td>355 (8.9)</td>
</tr>
<tr>
<td>Dhofar</td>
<td>493 (13.1)</td>
<td>319 (8)</td>
</tr>
<tr>
<td>Total national sample</td>
<td>3777 (100)</td>
<td>3996 (100)</td>
</tr>
</tbody>
</table>

**Table 2: Regional difference in the prevalence (%) of asthma symptoms and diagnosis in 6-7 year age group: Comparison between ISAAC Phases I (1995) and III (2001)**

<table>
<thead>
<tr>
<th>Region</th>
<th>12 Month Prevalence of</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Any wheeze</td>
<td>Exercise wheeze</td>
<td>Night cough</td>
<td>Severe asthma symptoms</td>
<td>Ever had Asthma</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phase I</td>
<td>Phase III</td>
<td>Phase I</td>
<td>Phase III</td>
<td>Phase I</td>
<td>Phase III</td>
<td>Phase I</td>
<td>Phase III</td>
<td>Phase I</td>
<td>Phase III</td>
</tr>
<tr>
<td>Muscat</td>
<td>5.4</td>
<td>7.2</td>
<td>5.6</td>
<td>4.4</td>
<td>17.8</td>
<td>16.6</td>
<td>4.2</td>
<td>3.3</td>
<td>9.5</td>
<td>9.7</td>
</tr>
<tr>
<td>Batinah</td>
<td>7.4</td>
<td>7.5</td>
<td>6.4</td>
<td>5.7</td>
<td>18.1</td>
<td>15.0*</td>
<td>6.3</td>
<td>4.8</td>
<td>9.4</td>
<td>8.8</td>
</tr>
<tr>
<td>Dakhiliya</td>
<td>7.5</td>
<td>5.8</td>
<td>7.5</td>
<td>5.3</td>
<td>20.7</td>
<td>13.4 *</td>
<td>7.6</td>
<td>3.5*</td>
<td>12.2</td>
<td>7.8*</td>
</tr>
<tr>
<td>Sharqiya</td>
<td>8.7</td>
<td>13.8</td>
<td>9.0</td>
<td>10.3</td>
<td>25.6</td>
<td>27.3</td>
<td>7.4</td>
<td>8.6</td>
<td>13.8</td>
<td>17.3*</td>
</tr>
<tr>
<td>Dhahirah</td>
<td>6.3</td>
<td>7.0</td>
<td>6.8</td>
<td>7.0</td>
<td>20.6</td>
<td>16.6</td>
<td>5.2</td>
<td>4.8</td>
<td>6.8</td>
<td>9.9</td>
</tr>
<tr>
<td>Dhofar</td>
<td>6.3</td>
<td>6.6</td>
<td>7.1</td>
<td>5.6</td>
<td>16.2</td>
<td>22.6*</td>
<td>4.9</td>
<td>3.4</td>
<td>11.8</td>
<td>11.6</td>
</tr>
<tr>
<td>Total sample</td>
<td>7.2</td>
<td>8.3*</td>
<td>7.0</td>
<td>6.4</td>
<td>19.8</td>
<td>18.1*</td>
<td>6.1</td>
<td>5.0*</td>
<td>10.6</td>
<td>10.7</td>
</tr>
</tbody>
</table>

*Significant change in prevalence ($p < 0.05$) between the two surveys adjusted for sex
Ethical approval of the study protocol was obtained from both the Ministry of Health and the Ministry of Education.

Data were collected and entered according to the ISAAC protocol and were analysed using the Statistical Package for the Social Sciences (SPSS) package for Windows, Version 13 (SPSS Inc., Chicago, IL, USA). Prevalence estimates were calculated by dividing the number of positive responses to each question by the total number of completed questionnaires. As the changes in males and females were very similar (both in the direction and magnitude of change), the findings were presented for both sexes combined adjusted for sex. Comparisons between the two surveys were performed using the Pearson Chi-square test and results were adjusted for sex using logistic regression analysis. A p value of <0.05 was considered statistically significant.

**RESULTS**

The sex distribution in the total national sample as well as regional samples was nearly equal for both groups and both surveys. Because of the small sample size of the Musandam and Wusta regions, the observed changes between the two surveys in these two regions may not be reliable and therefore were not included in the trend analysis. Table 1 shows the regional distribution of the two age groups for both surveys (Phase I in 1995 and Phase III in 2001). Table 2 shows the changes in the prevalence of asthma diagnosis and its symptoms in the 6 to 7 year old age group. There was no significant change over the 6 year period in the nationwide prevalence of self-reported asthma or any of the listed asthma symptoms except for wheeze in the last 12 months which had slightly increased from 7.2% to 8.3% (p = 0.041). This was mainly driven by the high increase in the Sharqiya region from 8.7% to 13.8% (p = 0.002). The Sharqiya region had the highest prevalence of parent-reported asthma diagnosis and symptoms in both surveys with a significant increase in self-reported asthma from 13.8% in 1995 to 17.8% in 2001 (p = 0.046). On the other hand, the Dakhiliya (Interior) region had a significant drop in self-reported asthma diagnosis (from 24.5% to 19.3%; p = 0.003) and in symptoms of severe asthma (from 8.8% to 6.4%; p = 0.02) with no significant change in other regions (Muscat, Batinah, Dhahirah and Dhofar), except for night cough which increased in Dhofar (from 16.2% to 22.6%; p = 0.025); and decreased in Batinah (18.1% to 15%; p = 0.039).

Table 3 shows the changes in the prevalence of asthma diagnosis and symptoms between Phase I and Phase III surveys in the 13-14 year old age group. Again, the Sharqiya region had the highest prevalence of asthma diagnosis and all asthma symptoms in both phases with significant increase in self-reported asthma from 12.2% to 7.8% (p = 0.016), night cough (from 20.7% to 13.4%; p = 0.003) and symptoms of severe asthma (from 7.6% to 3.5%; p = 0.005). There were no significant changes in asthma diagnosis and symptoms in any of the remaining regions (Muscat, Batinah, Dhahirah and Dhofar), except for night cough which increased in Dhofar (from 16.2% to 22.6%; p = 0.025) and decreased in Batinah (18.1% to 15%; p = 0.039).

Table 3: Regional difference in the prevalence (%) of asthma symptoms and diagnosis in 13-14 year age group: comparison between ISAAC Phases I (1995) and III (2001)

<table>
<thead>
<tr>
<th>Region</th>
<th>Any wheeze</th>
<th>Exercise Wheeze</th>
<th>Night Cough</th>
<th>Severe Asthma Symptoms</th>
<th>Ever had Asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Phase I</td>
<td>Phase III</td>
<td>Phase I</td>
<td>Phase III</td>
<td>Phase I</td>
</tr>
<tr>
<td>Batinah</td>
<td>11.9</td>
<td>10.6</td>
<td>23.1</td>
<td>20.8</td>
<td>21.7</td>
</tr>
<tr>
<td>Dakhiliya</td>
<td>5.8</td>
<td>5.6</td>
<td>16.9</td>
<td>20.9</td>
<td>19.2</td>
</tr>
<tr>
<td>Sharqiya</td>
<td>11.2</td>
<td>12.6</td>
<td>25.0</td>
<td>21.9</td>
<td>21.6</td>
</tr>
<tr>
<td>Dhahirah</td>
<td>7.9</td>
<td>11.5</td>
<td>17.8</td>
<td>17.4</td>
<td>19.0</td>
</tr>
<tr>
<td>Dhofar</td>
<td>7.7</td>
<td>4.3</td>
<td>17.6</td>
<td>13.9</td>
<td>21.8</td>
</tr>
<tr>
<td>Total sample</td>
<td>9.0</td>
<td>8.5</td>
<td>19.4</td>
<td>18.7</td>
<td>20.9</td>
</tr>
</tbody>
</table>

*Significant change (p<0.05) in prevalence adjusted for sex
symptoms. The only change in the Muscat region was in the prevalence of severe asthma symptoms which declined from 4.9% to 2.7% ($p = 0.048$). There was no significant change in asthma diagnosis or in any of the reported asthma symptoms in the remaining regions (Dakhiliya, Dhahirah and Dhofar) in this age group.

Figure 1 shows the prevalence rates of wheeze in the past 12 months calculated from the written and video questionnaire responses for each region in the 13-14 years old age group of Phase III. In the total national sample, the frequency of positive responses to the video questionnaire was significantly lower than written questionnaire (7.0% versus 8.4%; $p < 0.001$) with good correlation between the two responses ($r = 0.60$, $p < 0.001$). The ranking of the regions by responses to both questionnaires was similar, with the Sharqiya region recording the highest prevalence rate of wheeze in both questionnaires, with good correlation between the two responses in all regions ($r$ values ranged from 0.48 in Dhofar to 0.67 in Batinah). The responses to the video and written questionnaires were similar in regions with relatively low prevalence of wheeze (Dakhiliya, Dhofar and Muscat), whereas the responses to the video were lower than that of the written questionnaire in the regions with higher prevalence of wheeze (Batinah, Sharqiya, Dhahirah).

Figure 2 shows the changes in the prevalence of self-reported asthma diagnosis among children (both age groups combined) who reported symptoms of severe asthma by region. In the nationwide sample, as well as in most regions, approximately 60% (ranging from 48.7% in Dhahirah to 76.3% in Muscat) of all children with severe asthma symptoms reported the diagnosis of asthma with no significant change in either the national average or any of the regions over the 6 year period.

**DISCUSSION**

This study was a follow up on ISAAC Phase I which took place in 1995 and was the first study ever done in Oman on the prevalence of asthma in Omani schoolchildren.5, 6, 9 The results of Phase I highlighted two striking features of asthma in Omani schoolchildren: the first was the relatively high prevalence of severe asthma symptoms compared to regional and international prevalence rates, and the second was the significant variation in asthma diagnosis and symptoms between the different regions of Oman.5, 6 Participation in the ISAAC Phase III survey in 2001 has provided us with an opportunity to analyse the changes in the prevalence of asthma diagnosis and symptoms over a period of 6 years (between 1995 and 2001) in the different regions of Oman.

The results of this study revealed that over a period of six years the Sharqiya region continued to have the highest prevalence of self-reported asthma diagnosis and all symptoms of asthma in both age groups with a significant increase in the prevalence of current...
wheeze and asthma diagnosis in the 6 to 7 year old age group and a significant increase in night cough in the older group. All other regions had lower prevalence rates in 1995 in both age groups, and showed either no change or a decline in one or two of the asthma symptoms. In general, the prevalence of asthma symptoms in the different regions of Oman in Phase III resembled Phase I results.

The regional variation in the prevalence of asthma symptoms within Oman is similar to reports from other countries and is consistent with ISAAC findings.9-11 The cause of the higher and increasing prevalence of asthma symptoms in the eastern (Sharqiya) region compared to other regions of Oman is not clear, and in the absence of previous information, all the possible factors of high asthma prevalence need to be considered and evaluated.12-15 Thus the observed regional difference may be explained by differences in one or more of the following factors: interpretation of the written questionnaire, recognition of asthma diagnosis and symptoms, healthcare utilization and prevalence of genetic and environmental risk factors.13

Although the possibility of regional differences in the interpretation of the written questionnaire can not be completely excluded, our analysis suggests that it is unlikely to be a significant factor.16 The Arabic version of the written questionnaire had been previously validated,17 and the Arabic translation of the English term “wheeze” used descriptive words/phrases common to all regions of Oman. In addition, the pattern of difference in the prevalence of cough, a symptom with more uniform interpretation, mirrored that of wheeze. Furthermore, the ranking of the regions for the prevalence of wheeze in the past 12 months was similar in both the written and the video questionnaires (Sharqiya region had the highest rates in both questionnaires). By showing, rather than describing, symptoms of asthma, the ISAAC video questionnaire was developed to minimise the effect of language, culture, and literacy.18, 19 Like most centres, the frequency of positive responses of our children to question on wheezing in the last 12 months on the video questionnaire was lower than the written questionnaire.9, 20 It has been suggested that the visible and audible scenes on a video are likely to represent more severe symptoms than the full spectrum from mild to severe asthma covered by the written questionnaire.21

Another possible factor to be considered is poor recognition and/or under-diagnosis of asthma. Children and parents who are more alert to asthma and its symptoms are more likely to report it, and physicians who are more alert to a particular condition, tend to diagnose more cases.22-25 In addition, under-diagnosis and/or under-treatment of asthma is associated with higher prevalence of severe asthma symptoms.26, 27 In our study, only 60% of children with severe asthma

Figure 2: The changes in the prevalence of self-reported asthma diagnosis among children (both age groups combined) who reported symptoms of severe asthma by region.
Regional Variation in the Prevalence of Asthma Symptoms among Omani School Children

Symptoms reported asthma diagnosis, with no significant difference between Sharqiya and other regions. Although this suggests poor recognition and/or under-diagnosis of asthma across the country, which has not improved over time and merits attention, it does not explain the observed differences between regions.

Since this study did not investigate the pattern of asthma management or the health seeking behaviour among asthmatics, it is not possible to determine if there were regional differences in the use of effective treatment, especially inhaled corticosteroids which could reduce the prevalence of severe asthma symptom.\textsuperscript{28-31} It is possible that the observed decline in the prevalence of severe asthma symptoms in most regions was due to improved use of effective treatment. However, the use of effective treatment is unlikely to affect the prevalence of asthma diagnosis, and is therefore unlikely to explain the regional difference in prevalence of asthma.

Although there is no information available on the prevalence of ‘established’ asthma risk factors in Oman, the observed regional difference in asthma symptoms may be due to differences in the prevalence of genetic and/or environmental risk factors.\textsuperscript{2} Potential factors include family history of atopy, sensitisation to aeroallergens such as house dust mite, respiratory infections, dietary habits, parental smoking, and residence in urban areas. These factors may influence the pathogenesis and severity of asthma and require investigation. The finding of the regional difference in the prevalence of asthma symptoms in both age groups, suggest that the causes of this difference exert their effect early in childhood.\textsuperscript{10}

**Conclusion**

In conclusion, this study demonstrated a relatively high prevalence of asthma in Omani schoolchildren with significant variations between its regions. It alerts healthcare planners and providers to the particularly high and rising prevalence of asthma symptoms in the Sharqiya region and to the need to investigate the possible causes and prioritise resources for asthma control.

**Acknowledgements**

This study was supported by a grant from Sultan Qaboos University Research Fund, Sultanate of Oman.

We thank all children and parents of children who participated in the study. We also thank the school health physicians of the Ministry of Health for distributing and retrieving the questionnaires.

**References**

14. Wong GW, Chow CM. Childhood asthma epidemiology: Insights from comparative studies of rural and ur-


Familial Mineralocorticoid Induced Hypertension in the Sultanate of Oman

Nicholas JY Woodhouse,1 *Omayma T Elshafie,2 Fatma Ben Abid,2 Suhail A Doi3

Objectives: In Oman, many hypertensive patients with a family history of the disease respond to treatment with spironolactone, a mineralocorticoid receptor (MC-R) blocking agent thus suggesting a high prevalence of mineralocorticoid (MC) induced disease. The aim of this study was to document the prevalence of MC induced disease in patients with a positive family history of hypertension (HTN).

Methods: Serum calcium, potassium, creatinine, aldosterone and renin levels were measured under standard conditions in all patients together with an abdominal ultrasound scan and an adrenal computed tomography (CT) scan in four patients.

Results: In this small study, we show that 18 of the 27 patients (66%) had undetectable (suppressed) renin levels with usually normal aldosterone values (14 patients) and respond to treatment with spironolactone.

Conclusion: We suggest that MC induced hypertension is likely to be common in the Middle East. In evolutionary terms, this makes sense as the ability to conserve salt in hot climates might be expected to confer a definite survival advantage.

Key words: Hypertension, familial; Mineralocorticoids; High prevalence; Oman

Advances in Knowledge
• This is the first study uniquely selecting patients with familial hypertension
• Mineralocorticoid induced hypertension is reported in 10% or more of the general hypertensive population. We have only studied patients with a positive family history of the disease and found a much higher prevalence (66%) with mineralocorticoid (MC) induced disease

Application to Patient Care
• Patients with a positive family history of hypertension should undergo a short one month trial of a mineralocorticoid blocking drug such as spironolactone.

1Department of Medicine, College of Medicine & Health Sciences, Sultan Qaboos University, Muscat, Sultanate of Oman; 2Department of Medicine, Sultan Qaboos University Hospital, Muscat, Sultanate of Oman; 3Department of Medicine, Mubarek Al-Kabeer Hospital, Kuwait

*To whom correspondence should be addressed. Email: omayma0@hotmail.com
It has generally been recommended\(^{1,2}\) that screening for hyperaldosteronism be considered at least for hypertensive patients with spontaneous hypokalemia (K < 3.5 mmol/L), or with marked diuretic-induced hypokalemia (K < 3.0 mmol/L), with hypertension refractory to treatment with three or more drugs or those found to have an incidental adrenal adenoma. Previously, primary hyperaldosteronism (PAL) was not believed to be familial and thought to account for less than 1% of hypertensive patients and hypokalemia was considered a prerequisite for pursuing diagnostic tests\(^3\). Recent studies with screening of both hypokalemic and normokalemic hypertensives have reported now a much higher prevalence of this disease, with primary hyperaldosteronism accounting for up to 12% of hypertensive patients most of them being normokalemic\(^4,5\). Furthermore, in 1991, a second form of familial hyperaldosteronism (FH-II) that was not glucocorticoid remediable was first reported. There were six patients, four with aldosterone-producing adenoma (APA) and two with bilateral adrenal hyperplasia (BAH) among three families\(^6\). Till 2001, a total of 68 patients among 27 families have been described, making FH-II more common than FH-I (34 patients among five families)\(^7\). To date, two familial forms of hyperaldosteronism have been identified: glucocorticoid suppressible, familial hypertension Type 1 (FH1) and glucocorticoid non-suppressible disease, (FH2)\(^6,7\).

We recently reported a potentially high prevalence of familial mineralocorticoid (MC) induced hypertension (HTN) in patients attending our general endocrine clinics\(^8\) and found that in 39 of 45 patients (80%) their blood pressure could be controlled using spironolactone alone. We therefore concluded that the prevalence of MC induced disease in Oman might prove to be quite high\(^8\). In the UK, a recent study of more than 800 hypertensive patients in a general practice setting, who were without a positive family history, revealed that 14% responded to spironolactone with a fall in BP of 26/11 mmHg. All of them had suppressed renin levels, but as in our study, the aldosterone levels were only occasionally raised\(^8\). Only 1 of these patients had Conn's syndrome. We are now providing a more detailed account of 27 additional subjects with familial disease, but in addition their circulating renin and aldosterone levels were measured before starting treatment with spironolactone.

**METHODS**

These 27 hypertensive patients were from different families having one or more affected parents and siblings, twenty four were Omani and three Sudanese. They had been randomly selected from our general endocrine clinics if they had a positive family history of hypertension. Serum calcium, potassium, creatinine, aldosterone (n. 28-440 pmol/L) and renin (n. 2.4-21.9 ng/L) levels were measured after lying supine for 6 hours and after stopping β-blockers under supervision for 4 days\(^9\). Renal ultrasounds were obtained in all patients, as well as a contrast adrenal computed tomography (CT) scan, with 2-3mm slices, in those with documented hyperaldosteronism and suppressed renin levels. The patients with suppressed renin levels were given a 1 month course of spironolactone 50-100 mg daily alone to four newly diagnosed patients, or in addition to other antihypertensives in the remainder. These were on a minimum of two drugs (16 patients) or ≥ three drugs (7 patients). The usual combination of medications was angiotensin-converting enzyme (ACE) inhibitors, angiotensin II (AT2) receptor blockers, diuretics or beta-blockers (4 patients). No patients were taking methyldopa or clonidine. If the blood pressure (BP) was controlled (<140/80), after 2-4 weeks the other medications were sequentially withdrawn at weekly intervals until the patient was taking spironolactone alone for at least one month. Renin was measured using a renin immunoradiometric assay (IRMA) kit (DSL-25100) from Diagnostic Systems Laboratories Inc. and aldosterone was measured via radioimmunoassay (RIA) kit from Dia Sorin Inc. The normal ranges used are from the North American data provided by the relevant companies. Formal suppression tests of aldosterone secretion were not performed. Fully informed consent was obtained from all patients. There was no conflict of interest financial or otherwise.

**RESULTS**

Of the 27 patients studied, renin levels were suppressed in 18 (66%), but aldosterone values were normal in 13, elevated in 4 and undetectable in one case. The remaining 9 patients had normal values of aldosterone, but renin levels were low in 3 of them [Table 1]. Of the 18 patients with suppressed renin levels, 14 were available for follow up whilst taking spironolactone and in 1 other case taking moduretic. Their final median BP was 130/70 with a range of 140/70-100/70.
Serum calcium and potassium levels were normal in every patient. Serum creatinine levels were mildly elevated in two cases at 129 and 147 µmol/L [Table 1]. There were 5 patients in consanguineous marriages in this group.

**Table 1:** Data from 27 patients with familial hypertension. The median basal blood pressure of the 4 patients not on medication was 155/105, with a range of 170/95 – 150/110 (patients 1, 3, 10, 17). Basal blood pressure values of patients already on treatment are not shown as they were only slightly elevated.

<table>
<thead>
<tr>
<th>Patient No</th>
<th>Age</th>
<th>Sex</th>
<th>Renin ng/L</th>
<th>Aldosterone pmol/L</th>
<th>Final BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45</td>
<td>F</td>
<td>&lt;0.5</td>
<td>380</td>
<td>125/70</td>
</tr>
<tr>
<td>2</td>
<td>49</td>
<td>M</td>
<td>&lt;0.5</td>
<td>140</td>
<td>125/70</td>
</tr>
<tr>
<td>3</td>
<td>56</td>
<td>F</td>
<td>&lt;0.5</td>
<td>57</td>
<td>130/70</td>
</tr>
<tr>
<td>4</td>
<td>44</td>
<td>F</td>
<td>&lt;0.5</td>
<td>112</td>
<td>130/70</td>
</tr>
<tr>
<td>5</td>
<td>55</td>
<td>M</td>
<td>&lt;0.5</td>
<td>168</td>
<td>LTFU</td>
</tr>
<tr>
<td>6</td>
<td>45</td>
<td>M</td>
<td>&lt;0.5</td>
<td>225</td>
<td>LTFU</td>
</tr>
<tr>
<td>7</td>
<td>44</td>
<td>F</td>
<td>&lt;0.5</td>
<td>70</td>
<td>125/70</td>
</tr>
<tr>
<td>8</td>
<td>58</td>
<td>M</td>
<td>&lt;0.5</td>
<td>108</td>
<td>100/70</td>
</tr>
<tr>
<td>9</td>
<td>42</td>
<td>F</td>
<td>&lt;0.5</td>
<td>227</td>
<td>LTFU</td>
</tr>
<tr>
<td>10</td>
<td>58</td>
<td>F</td>
<td>&lt;0.5</td>
<td>220</td>
<td>135/85</td>
</tr>
<tr>
<td>11</td>
<td>51</td>
<td>F</td>
<td>&lt;0.5</td>
<td>40</td>
<td>LTFU</td>
</tr>
<tr>
<td>12</td>
<td>46</td>
<td>F</td>
<td>&lt;0.5</td>
<td>136</td>
<td>135/70</td>
</tr>
<tr>
<td>13</td>
<td>42</td>
<td>M</td>
<td>&lt;0.5</td>
<td>351</td>
<td>130/80</td>
</tr>
<tr>
<td>14</td>
<td>44</td>
<td>F</td>
<td>&lt;0.5</td>
<td>&lt;20</td>
<td>130/75</td>
</tr>
<tr>
<td>15</td>
<td>56</td>
<td>F</td>
<td>&lt;0.5</td>
<td>575</td>
<td>140/70</td>
</tr>
<tr>
<td>16</td>
<td>42</td>
<td>F</td>
<td>&lt;0.5</td>
<td>508</td>
<td>120/70</td>
</tr>
<tr>
<td>17</td>
<td>69</td>
<td>F</td>
<td>&lt;0.5</td>
<td>543</td>
<td>130/80</td>
</tr>
<tr>
<td>18</td>
<td>49</td>
<td>M</td>
<td>&lt;0.5</td>
<td>500</td>
<td>120/70</td>
</tr>
<tr>
<td>19</td>
<td>48</td>
<td>F</td>
<td>2.3</td>
<td>407</td>
<td>LTFU</td>
</tr>
<tr>
<td>20</td>
<td>42</td>
<td>F</td>
<td>0.5</td>
<td>321</td>
<td>130/70</td>
</tr>
<tr>
<td>21</td>
<td>38</td>
<td>F</td>
<td>1.3</td>
<td>323</td>
<td>110/75</td>
</tr>
<tr>
<td>22</td>
<td>36</td>
<td>M</td>
<td>2.7</td>
<td>79</td>
<td>150/85</td>
</tr>
<tr>
<td>23</td>
<td>39</td>
<td>F</td>
<td>2.5</td>
<td>140</td>
<td>145/85</td>
</tr>
<tr>
<td>24</td>
<td>54</td>
<td>M</td>
<td>4.7</td>
<td>383</td>
<td>155/90</td>
</tr>
<tr>
<td>25</td>
<td>45</td>
<td>M</td>
<td>3.1</td>
<td>381</td>
<td>150/80</td>
</tr>
<tr>
<td>26</td>
<td>42</td>
<td>M</td>
<td>2.6</td>
<td>300</td>
<td>140/80</td>
</tr>
<tr>
<td>27</td>
<td>50</td>
<td>F</td>
<td>20</td>
<td>448</td>
<td>145/80</td>
</tr>
</tbody>
</table>

Normal range
Supine > 6 hrs 2.4-21.9 28-440

Discussion
The results of this study further support our original suggestion that there is a high prevalence of MC-induced HTN in patients who have a strong family history of the disease. Two thirds of our patients in this study had suppressed renin levels with autonomous
aldosterone production, and their BP was controlled using spironolactone a known MC receptor blocking agent. It is now recognized that primary aldosteronism occurs in more than 10 percent of the general hypertensive population and that hypokalaemia is an uncommon presenting feature. In fact, of the 72 patients with familial disease we have studied so far, only 6 were hypokalaemic at presentation including the one patient with Conn’s syndrome. We did not carry out dexamathasone suppression tests in these patients, but suspect that the majority have FH2 as we earlier found only one responsive family in 15 that were tested. The pathophysiology of FH2 is not known with certainty, but presumably results from one or more activating mutations in the renin/angiotensin/aldosterone pathway. Of interest is the one patient who had suppressed renin and aldosterone levels. This combination occurs in Liddle’s syndrome and apparent mineralocorticoid excess (AME). Both result from excessive renal tubular reabsorption of sodium; the former caused by activating mutations of the epithelial sodium channels (ENaC) and the latter activation of the type I MC-receptor. In AME there is an inherited or acquired deficiency of the renal isoform of 11-b-OH steroid dehydrogenase (11-b-OH SD). Normally this enzyme converts cortisol to inactive cortisone. In its absence, tissue cortisol levels increase activating the MC-receptor. Our patient does not have Liddle’s syndrome, however, as this disorder does not respond to a MC-receptor blocking drug. AME is also unlikely as there is no history of childhood ill health hypokalemia or ingestion of compounds known to inactivate 11-b-OH SD such as liquorice or chewing tobacco. We are currently exploring the possibility that she might be secreting another MC-receptor stimulating compound.

Figure 3: Shows aldosterone values in patients with suppressed (●) normal renin (●) levels
The Brisbane group has suggested that FH-II (familial hypertension type 2) has an autosomal dominant mode of transmission with linkage to 7p22 and gender distribution that is roughly equal. However, apart from being familial, FH-II has no specific clinical, biochemical or morphological hallmarks that permit distinction from apparently non-familial PAL, with the two groups demonstrating similar mean ages, gender distributions, hypokalaemic percentages, mean upright plasma aldosterone and PRA levels, with these and the use of other investigative techniques. This suggests that the genetic defects that underlie the development of FH-II may also be operative in many patients with apparently non-familial PAL and may be picked up earlier by family screening. Indeed, it has been suggested that PAL passes through four phases in its evolution: low renin normotension, normokalaemic primary aldosteronism and finally hypokalaemic primary aldosteronism.

**CONCLUSION**

MC induced disease seems to be common in Oman. In evolutionary terms this makes sense as the ability to conserve salt in hot climates might be expected to confer a definite survival advantage. We recommend that all patients with a positive family history of HTN should be screened for MC induced disease or at least receive a short therapeutic trial of spironolactone to avoid unnecessary complications. To our knowledge there have been no previous reports documenting MC induced disease in patients screened using a positive family history only.

**REFERENCES**


Extended-spectrum β-lactamase (ESBL) in Omani Children

Study of prevalence, risk factors and clinical outcomes at Sultan Qaboos University Hospital, Sultanate of Oman

Zakariya Al Muharrmi,1 *Akbar M Rafay,1 Abdullah Balkhair,2 Salem Al-Tamemi,3 Ali Al Mawali,4 Hilal Al Sadiri4

Abstract Objectives: Antimicrobial resistance is a growing problem worldwide, which imposes difficulties in the selection of appropriate empirical antimicrobial therapy. This study evaluated extended-spectrum β-lactamase (ESBL) isolates in 2005 in The Department of Child Health at Sultan Qaboos University Hospital (SQUH), Oman. Methods: During the 12 month period from January 2005 to December 2005, ESBL isolates from paediatrics inpatients were identified and analysed. Risk factors for the patients who grew ESBLs were analysed. Results: 13.3% of E. coli and 16.6% of Klebsiella pneumoniae isolated were ESBL producers. Most of the ESBLs were from urine (46.2%) and blood (42.6%). The main risk factors for ESBL in these children were previous exposure to antimicrobials (100%), prolonged hospital stay, severe illness (92.3%) and female gender (84.6%). Sensitivity of 100% was observed to carbapenems whereas 92% of the isolates were susceptible to amikacin. The oximino-cephalosporins were 100% resistant. *Klebsiella pneumoniae were 100% resistant to piperacillin-tazobactam and nitrofurantoin. E. coli was 100% resistant to trimethoprim-sulfamethoxazole and ciprofloxacin. No resistance was recorded for the following combinations: amikacin plus piperacillin-tazobactam, amikacin plus nitrofurantoin and gentamicin plus nitrofurantoin. Conclusion: ESBL-producing organisms are becoming a major problem in Omani children. Exposure to antimicrobials and long admissions are modifiable risk factors that should be targeted for better control. Carbapenems are the most sensitive and reliable treatment options for infections caused by ESBLs. Amikacin plus piperacillin-tazobactam or nitrofurantoin are good alternatives.

Keywords: Extended-spectrum β-lactamase; Escherichia coli; Klebsiella pneumonia; Anti-infective agents; Risk factors; Oman.
Antimicrobial resistance is a growing problem worldwide, which imposes difficulties in the selection of appropriate empirical antimicrobial therapy. Since the first extended-spectrum β-lactamase (ESBL) producing *Klebsiella pneumoniae* were discovered in Western Europe in the mid-1980s, the ESBL producing *Enterobacteriaceae* became the focus of many scientific research studies and investigations.1-5 ESBL are enzymes belonging to either class A or class D β-lactamas. Class A ESBLs belong to three types: SHV with more than 50 varieties currently recognized on the basis of unique combinations of aminoacid replacements; TEM with more than 130 TEM enzymes currently recognized; and CTX-M with more than 40 CTX-M enzymes currently known.6 Other uncommon class A ESBLs are BES-1, GES-1, GES-2, IBC-1, IBC-2, PER-1, SFO-1, TLA-1, VEB-1 and VEB-2.6 There are also at least twelve ESBLs belonging to the OXA type (class D).6 ESBLs are plasmid-mediated, and their potential for transfer makes it increasingly difficult to control and treat these organisms effectively.7 As of 25 January 2005, there were 138 TEM- (TEM-1 to TEM-139) and 62 SHV-types (SHV-1 to SHV-63) of β-lactamas, mostly found in *K. pneumoniae* and *E. coli* strains.8 These mutant enzymes were termed ‘Extended-Spectrum β-Lactamase’ by Philippon et al9 in 1989. ESBLs hydrolyse extended spectrum cephalosporins with an oxyimino side chain.10 These cephalosporins include cefotaxime, ceftriaxone and ceftazidime, as well as the oxyimino-monobactam aztreonam. In addition, ESBL-producing organisms are frequently resistant to many other classes of antibiotics, including fluorquinolones, the monobactam aztreonam, while resistance to trimethoprim–sulfamethoxazole and aminoglycosides is frequently co-transferred on the same plasmid.9, 11-14 ESBLs are sensitive to cephemycins (cefoxitin, cefotetan) and carbapenems. ESBL-producing organisms are poorly responsive to treatment with wide spectrum cephalosporins such as ceftazidime and cefepime.7, 15 ESBL-producing organisms are difficult to differentiate from AmpC β-lactamase-producing *Enterobacteriaceae*; however, most ESBL producers are generally susceptible to cephemycins (e.g. cefoxitin) in vitro. ESBLs are plasmid-mediated while AmpC β-lactamase enzymes are located on the chromosomes of *Enterobacter sp*, *Citrobacter freundii*, *Morganella morganii*, *Serratia marcescens*, and *Pseudomonas aeruginosa*. The appearance of similar plasmid-mediated β-lactamas in *K. pneumoniae* and *E. coli* raises concerns over the spread of resistance,7 which will further increase the difficulties of phenotypically identifying β-lactamas.16-21

There are many precipitating factors for selection of ESBL producing organisms. These include the increasing use of oxyimino-β-lactams such as ceftazidime, cefotaxime and ceftriaxone. Other risk factors for the acquisition of ESBLs include presence of intravascular catheters; emergency intra-abdominal surgery; a gastrostomy or jejunostomy tube; gastrointestinal colonisation; length of hospital or intensive care unit stay; prior antibiotics (including third-generation cephalosporins); prior nursing home stay; severity of illness; presence of a urinary catheter and ventilator assistance.22

The problem of ESBL production is still relatively unappreciated by most clinicians.23, 24 This may be due in part to difficulty in laboratory identification of ESBLs and misreporting them as sensitive organisms.15, 25-27 Many ESBL-producing isolates are not always phenotypically resistant to all oximino-cephalosporins; however, patients suffering from infections caused by ESBL-producing organisms are at risk of treatment failure if treated with one of the oximino-cephalosporins.9, 28, 29 Therefore, it is imperative for the clinical microbiology laboratory to identify isolates that possess increased minimum inhibitory concentrations (MICs) (≥2 µg/mL) to oximino-cephalosporins, even though they may be equal to or below the susceptibility breakpoint (MIC ≤8 µg/mL).9

The rate of ESBL varies from country to country. The prevalence of ESBLs in the UK in 2002 was 7.4%.30 In Europe, the prevalence of ESBL producing *E. coli* is 10.8% while *K. pneumoniae* is 13.6%.31 In the USA, the prevalence of ESBL producing *E. coli* is 1.4% while *K. pneumoniae* is 4.4%.31 The prevalence of ESBL at Sultan Qaboos University Hospital, (SQUH), Oman is not yet known. We have analysed the sensitivity and distribution of some ESBL isolates in SQUH previously without studying the prevalence rate of ESBL in SQUH as a whole, or in individual departments. In this article, we are reporting the prevalence of ESBL isolates in paediatric patients admitted to SQUH with an analysis of the risk factors and clinical outcomes of ESBLs infections.
METHODS

SQUH is a 500-bed tertiary and teaching hospital covering all major medical specialties. It is located on the campus of Sultan Qaboos University in Muscat, Oman. The Department of Child Health occupies three different wards. Each ward accommodates 24 beds of which 4 beds are for isolation.

All specimens received from Department of Child Health from January-December 2005 were properly processed to identify ESBLs. Initially, the isolates were screened by a commercial system (Phoenix Identification and Susceptibility System from Becton Dickinson) for ESBL production. The positive results were further confirmed using the Clinical and Laboratory Standards Institute (CLSI) approved double-disk diffusion method, which is based on a synergistic increase of inhibition zone of ceftazidime and cefotaxime when they are combined with clavulanate. The test is considered positive when the increase of the inhibition zone is (>/= 5 mm).

Susceptibility results were recorded for the following antimicrobials using the Phoenix Identification and Susceptibility System: gentamicin, amikacin, imipenem, meropenem, cefotaxime, ceftazidime, cefepime, ciprofloxacin, piperacillin-tazobactam, trimethoprim/sulfamethoxazole and nitrofurantoin.

There was no resistance recorded for the following combinations: amikacin plus piperacillin-tazobactam, amikacin plus nitrofurantoin and gentamicin plus nitrofurantoin.

RESULTS

A total of 87 isolates of E. coli and Klebsiella pneumoniae were isolated from patients admitted to paediatric wards in SQUH in 2005. Out of these 13 (14.9 %) were ESBL producers, out of which 6 (46.2%) were E. coli and 7 (53.8%) were Klebsiella pneumoniae [Table 1]. The percentage of E. coli producing ESBL from the total number of E. coli isolated in 2005 was 13.3% [Table 1]. While the percentage of Klebsiella pneumoniae producing ESBL from the total number of Klebsiella pneumoniae isolated in 2005 was 16.6% [Table 1].

Most of the ESBLs isolates were from urine (46.2%) and blood (42.6%) [Table 2]. A total of 85.7% of ESBL producing Klebsiella pneumoniae were isolated from urine samples, while 83.3% of ESBL producing E. coli were from blood [Table 1]. No ESBL were isolated from wound and pus swabs.

The main risk factors for ESBL in these children were the previous exposure to antimicrobials (100%) [Table 3], hospital stays of more than 5 days (92.3%) and female sex (84.6%). Malignancies, admission to the Intensive Care Unit and the use of a urinary catheter were each (38.5%) associated with ESBL. Only one patient (1/13) was ventilated. Abdominal surgery and obstructive disease of the urinary tract were not found to be risk factors in our patients.

The carbapenems (imipenem and meropenem) were the most active antibiotics against the ESBLs tested, with no resistance recorded [Table 4], followed by amikacin with 8% resistance. All the ESBLs were resistant to oximino-cephalosporins.

All ESBL producing Klebsiella pneumoniae were sensitive to gentamycin and amikacin [Table 4], whereas all E. coli were resistant to gentamycin and but only 18% were resistant to amikacin.

All Klebsiella pneumoniae were resistant to piperacillin-tazobactam and nitrofurantoin, whereas no resistance was seen in E. coli to nitrofurantoin and only 16% were resistant to piperacillin-tazobactam. All E. coli were resistant to ciprofloxacin and trimethoprim/sulfamethoxazole, while 14% of Klebsiella pneumoniae

<table>
<thead>
<tr>
<th>Isolates</th>
<th>Blood</th>
<th>Respiratory</th>
<th>Swabs</th>
<th>Urine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Klebsiella pneumoniae</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>E. coli</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6</strong></td>
<td><strong>1</strong></td>
<td><strong>0</strong></td>
<td><strong>6</strong></td>
</tr>
</tbody>
</table>

Table 2: Source of ESBL isolates from paediatric wards
were resistant to ciprofloxacin and 28% were resistant to trimethoprim/sulfamethoxazole [Table 4].

No resistance was recorded for the following combinations: amikacin plus piperacillin-tazobactam, amikacin plus nitrofurantoin and gentamicin plus nitrofurantoin [Table 5]. Klebsiella pneumoniae isolates were sensitive to all combinations containing gentamicin and amikacin [Table 5]. E. coli isolates were sensitive to all combination containing nitrofurantoin [Table 5].

All patients (100%) were isolated in a single room and nursed using gloves. They were all treated with a carbapenem (imipenem or meropenem). All patients (100%) cleared the infection.

**DISCUSSION**

The percentage of ESBL producing E. coli and Klebsiella pneumoniae in children admitted at SQUH was low compared to other SQUH wards. The prevalence of ESBLs in medical wards was 28.3% (unpublished data); however, the prevalence rate of ESBLs among E. coli and Klebsiella pneumoniae isolated from paediatrics patients was significantly high (13.3% and 16.6% respectively) compared to the prevalence of ESBLs in the USA in 2004 (1.4% for E. coli and 4.4% Klebsiella pneumoniae) and Europe (10.8% for E. coli and 13.6% for Klebsiella pneumoniae). The rate of ESBL among E. coli (13.3%) was lower than that for Klebsiella pneumoniae (16.6%). This was the same as the prevalence in USA (1.4% for E. coli versus 4.4% for Klebsiella pneumoniae) and Europe (10.8% for E. coli versus 13.6% for Klebsiella pneumoniae).

Urine (70.8%) was the main source of ESBLs from all patients, followed by blood (15%). The high rate of ESBLs in urine samples is not striking if we consider the high prevalence of ESBLs in the gut as shown in Hong Kong where the faecal carriage rates of ESBL is 19% in general outpatients, 19.3% in hospitalized patients, 22.5% in healthy inmates, and 33.3% in convalescent patients. In one Middle East country, 1.25% of all gram-negative organisms causing community acquired urinary tract infections during 1999 were reported as ESBL producers.

Previous exposure to antimicrobials, female sex, and age were risk factors for ESBL production.
prolonged hospital stays of more than 5 days, malignancies, admission to the Intensive Care Unit and the use of a urinary catheter were all found to be risk factors for ESBL acquisition. Exposure to antimicrobials was present in 100% of cases, which supports the need for antimicrobial control. 84.6% of cases were female, this might be explained by the increased frequency of urinary tract infections (UTI) in females.

All the ESBL isolates in SQUH were susceptible to carbapenems (100%). The susceptibility rate is similar to ESBLs in the USA where they were 100% susceptible to meropenem and imipenem. Moropenem and imipenem activity against ESBL producing *E. coli* and *Klebsiella spp.* collected in Europe during 1997–2004 was between 96.9–100.0%, which was lower than the susceptibility of ESBLs in SQUH and the USA. Susceptibility of ESBLs from SQUH to amikacin was very high (95.9% for *E. coli* and 90% for *Klebsiella pneumoniae*). Kizirgil et al have shown similar susceptibility patterns to amikacin for ESBLs in Turkey (94.5 for *E. coli* and 83.3% for *Klebsiella pneumoniae*), which makes amikacin a good antibiotic in treatment of ESBLs especially in combination therapy. On the contrary, gentamicin had very low activity against ESBLs at SQUH. Gentamicin had only (28.8%) activity against *E. coli* compared to Europe and USA where the *E. coli* susceptibility to gentamicin was 66.7% and 80% respectively in 2004. Gentamicin had only 25% activity against *Klebsiella pneumoniae* which is similar to the USA (26.3%), which are lower rates than those (47.5%) reported in Europe in 2004.

ESBLs at SQUH had low susceptibility against piperacillin/tazobactam (50.7% for *E. coli* and 32.5% *Klebsiella pneumoniae*). This level was lower than that reported in Europe (72.5% *E. coli* and 38.6% *Klebsiella pneumoniae*) and the USA (80.0% for *E. coli* and 42.1% for *Klebsiella pneumoniae*), which does not make piperacillin/tazobactam a good empirical choice if suspicion of ESBL is high.

Ciprofloxacin had very low activity against ESBLs in SQUH. It was only 16.4% active against *E. coli* which is similar to Europe (20.2%) and the USA (20%) in 2004, whereas higher activity against *Klebsiella pneumoniae* (32.5%) was recorded. This higher activity compared to *E. coli* has also been demonstrated in Europe (57.5%) and the USA (36.8%) in 2004. The opposite situation has been detected in Turkey where ciprofloxacin was more active against *E. coli* (33.3%) compared to *Klebsiella pneumoniae* (25.9%).

The best non-carbapenem containing combinations were amikacin plus piperacillin-tazobactam, amikacin plus nitrofurantoin and gentamicin plus nitrofurantoin. So if ESBL is expected in a severely ill patient the best empirical combination therapy would be amikacin plus piperacillin-tazobactam. If *Klebsiella pneumoniae* were cultured and a suspension of ESBL was present, the empirical combination therapy should include either gentamicin or amikacin. If *E. coli* was isolated from a urine culture of a stable patient nitrofurantoin would be the drug of choice.

All patients underwent a good infection control procedure of isolation and barrier nursing according to accepted standards. All patients made a full clinical recovery with microbiologic eradication of ESBLs on carbapenem.

Overall prevalence of ESBL-producing isolates in Omani children was high compared to other countries. Prevention and good infection control practices should be our priority because these organisms have very limited treatment options. Modification of risk factors and control of antimicrobials should be considered. Carbapenem should be the drug of choice in treatment of ESBLs, which theoretically may lead to increase in carbapenem-resistant *Acinetobacter sp* and carbapenem-resistant *P. aeruginosa*. However, Robert G et al have not seen any increase in carbapenem

<table>
<thead>
<tr>
<th>Isolates</th>
<th>CN</th>
<th>AK</th>
<th>IMI</th>
<th>MEM</th>
<th>CTX</th>
<th>CAZ</th>
<th>CEFI</th>
<th>CIP</th>
<th>TAZ</th>
<th>SXT</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Klebsiella pneumoniae</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>1</td>
<td>7</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>1</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

CN = gentamicin, AK = amikacin, IMI = imipenem, MEM = meropenem, CTX = cefotaxime, CAZ = ceftazidime, CEFI = cefepime, CIP = ciprofloxacin, TAZ = tazocin, SXT = cotrimoxazole, F = nitrofurantoin.
resistance despite continued use of meropenem and imipenem. Other options would be amikacin plus piperacillin-tazobactam or nitrofurantoin. Wong-Berlinger suggested the use of piperacillin–tazobactam in the case of a non-outbreak situation, to preserve the therapeutic value of carbapenem.

**CONCLUSION**

ESBL-producing organisms are becoming a major problem in Omani children. Exposure to antimicrobials and long admissions are modifiable risk factors that should be targeted for better control. Carbapenems are the most sensitive and reliable treatment options for infections caused by ESBLs. Amikacin plus piperacillin-tazobactam or nitrofurantoin are good alternatives.

**REFERENCES**


15. Paterson DL, Ko WC, Von Gottberg A, Casellas JM, Mulazimoglu L, Klugman KP, et al. Outcome of cephalosporin treatment for serious infections due to apparently susceptible organisms producing extended-spectrum b-lactamases: implications for the clini-


ABSTRACT Objectives: To evaluate the prevalence of hypertension, its control and management at Sultan Qaboos University (SQU) Health Centre, Oman. Methods: This was a retrospective cross-sectional study, in which were enrolled all the subjects (≥18 years), with the diagnosis of essential hypertension, who attended the SQU Health Centre between 1998 and 2002. The systolic and diastolic blood pressure (BP) values of the last three visits were used for analysis. BP control was defined using the Joint National Committee (JNC-7) criteria, <140 mmHg and <90 mmHg for systolic and diastolic BPs, respectively. Analyses were performed using univariate statistics. Results: Among the 7,702 medical records reviewed, the prevalence of hypertension was 2.4% (n = 187). The overall mean age of the cohort was 55±11 years, 54% (n = 101) were females, and majority of the subjects were Omanis (n = 123; 66%). The proportion of subjects who had their BP controlled was 41% (n = 77) with Omanis significantly less likely to have their BP controlled compared to non-Omanis (53% versus 35%; p = 0.017). The most frequent B-blockers were on mono therapy (n = 64; 34%) and angiotensin-converting enzyme (ACE) inhibitors (n = 47; 25%). Among the dual combination therapies, the most common prescribed regimens were ACE inhibitor plus B-blocker (n = 14; 8%) and B-blocker plus diuretic (n = 12; 7%). Conclusion: The prevalence of hypertension in this patient population was low compared to the national average. This study shows that control of hypertension is not optimal, but higher than those reported elsewhere.

Key words: Hypertension; Prevention and control; Disease management; Oman.
Hypertension is a common disease with significant morbidity and mortality. It is the leading diagnosis made in physician offices in the United States. Twenty-six percent of the world adult population has hypertension. Moreover, the proportion is expected to rise further in 2025 to 29.2% with an estimated total number of 1.56 billion affected adults. The reported prevalence varies around the world with the lowest prevalence in rural India (3.4% in men and 6.8% in women) and the highest prevalence in Poland (68.9% in men and 72.5% in women). In Oman, a community based survey conducted in 2000 estimated the prevalence of hypertension to be 33%.

High blood pressure (BP) leads to an increasing risk of stroke, myocardial infarction and cardiovascular disease, all of which cause mortality. Furthermore, hypertension contributes to the prevalence of other cardiovascular risk factors, such as insulin resistance, lipid abnormalities, changes in renal function, obesity, left ventricular hypertrophy, diastolic dysfunction, and abnormalities in vascular structure. Clinical trials have unequivocally shown that lowering BP reduces cardiovascular morbidity and mortality in patients with hypertension of all degrees of severity. Despite the significance of the problem with respect to overall health, control of high blood pressure (BP < 140/90 mmHg while on antihypertensive medication) is far from being optimal. Data from the USA (the National Health and Nutrition Survey) have shown that those achieving target BP account only for 36% of the hypertensive population. A control rate of 25% was reported from a primary health care in Saudi Arabia. Researchers from Bahrain have reported a control rate of 16.5%. Similar data on hypertension control from Oman is lacking.

The aim of this study was to determine the prevalence of hypertension, its control and management at Sultan Qaboos University (SQU) Health Centre in Muscat, Oman. The SQU Health Centre provides free health care services to all university employees and their dependants.

**METHODS**

This study included all patients, 18 years and above, who were documented to have "essential hypertension" in their medical records at the Health Centre. The cohort had to have a minimum period of one year follow up. The charts reviewed were of those patients attending the Health Centre over a five-year period between January 1st 1998 and December 31st 2002. The following information was collected: age, gender, nationality (Omani, non-Omani), the three most recent BP readings, medications, current smoking status (yes, no), body mass index (BMI), the frequency of attendance at the outpatient clinic (within 3 months, 3-6 months, > 6 months), associated chronic diseases and the presence of any complications secondary to
Hypertension.

Descriptive statistics were used to describe the data. For categorical variables, frequencies and percentages were reported. Differences between groups were analyzed using Pearson’s χ² tests or Fisher’s exact tests (for cells less than 5). For continuous variables, means and standard deviations (±SD) were presented.

### Table 1: Demographic, clinical, healthcare resource use, and pharmaceutical characteristics of the study cohort stratified by blood pressure (BP) goal attainment as per the Joint National Committee (JNC-7) recommendations

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Blood Pressure Goal Attainment as per JNC-7</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No (n = 110)</td>
<td>Yes (n = 77)</td>
</tr>
<tr>
<td><strong>Demographic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, mean±SD, in years</td>
<td>54±11</td>
<td>55±11</td>
</tr>
<tr>
<td>Female gender, n (%)</td>
<td>57 (52%)</td>
<td>44 (57%)</td>
</tr>
<tr>
<td>Omani national, n (%)</td>
<td>80 (73%)</td>
<td>43 (56%)</td>
</tr>
<tr>
<td>BMI, mean±SD, in kg/m²</td>
<td>30±5.7</td>
<td>31±6.4</td>
</tr>
<tr>
<td>Smoking status, n (%)</td>
<td>8 (7.3%)</td>
<td>4 (5.2%)</td>
</tr>
<tr>
<td><strong>Clinical</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dyslipidaemia, n (%)</td>
<td>44 (40%)</td>
<td>34 (44%)</td>
</tr>
<tr>
<td>Diabetes mellitus, n (%)</td>
<td>34 (31%)</td>
<td>25 (32%)</td>
</tr>
<tr>
<td>Cardiac disease, n (%)</td>
<td>13 (12%)</td>
<td>5 (6.5%)</td>
</tr>
<tr>
<td>Diabetic nephropathy, n (%)</td>
<td>4 (3.6%)</td>
<td>1 (1.3%)</td>
</tr>
<tr>
<td>Diabetic retinopathy, n (%)</td>
<td>3 (2.7%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Stroke, n (%)</td>
<td>3 (2.7%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td><strong>Healthcare Resource Use</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attendance of OPD Visits, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within 3 months, n (%)</td>
<td>91 (83%)</td>
<td>63 (82%)</td>
</tr>
<tr>
<td>Between 3-6 month, n (%)</td>
<td>13 (12%)</td>
<td>10 (13%)</td>
</tr>
<tr>
<td>After 6 months, n (%)</td>
<td>6 (5.5%)</td>
<td>4 (5.2%)</td>
</tr>
<tr>
<td><strong>Pharmaceutical</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not on anti-hypertensive, n (%)</td>
<td>4 (3.6%)</td>
<td>2 (2.6 %)</td>
</tr>
<tr>
<td>Monotherapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beta-Blocker, n (%)</td>
<td>35 (32%)</td>
<td>29 (38%)</td>
</tr>
<tr>
<td>ACEI, n (%)</td>
<td>23 (21%)</td>
<td>24 (31%)</td>
</tr>
<tr>
<td>ARB, n (%)</td>
<td>7 (6.4%)</td>
<td>1 (1.3%)</td>
</tr>
<tr>
<td>CCB, n (%)</td>
<td>4 (3.6%)</td>
<td>1 (1.3%)</td>
</tr>
<tr>
<td>Diuretic, n (%)</td>
<td>5 (4.6%)</td>
<td>2 (2.6%)</td>
</tr>
<tr>
<td>Dual therapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACEI + Beta-Blocker, n (%)</td>
<td>9 (8.2%)</td>
<td>5 (6.5%)</td>
</tr>
<tr>
<td>ACEI + CCB</td>
<td>3 (2.7%)</td>
<td>1 (1.3%)</td>
</tr>
<tr>
<td>ACEI + Diuretic</td>
<td>2 (1.8%)</td>
<td>1 (1.3%)</td>
</tr>
<tr>
<td>ACEI + ARB</td>
<td>1 (1.0 %)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Beta-Blocker + Diuretic, n (%)</td>
<td>7 (6.4%)</td>
<td>5 (6.5%)</td>
</tr>
<tr>
<td>Beta-Blocker + CCB, n (%)</td>
<td>3 (2.7%)</td>
<td>2 (2.6%)</td>
</tr>
<tr>
<td>Beta-Blocker + ARB, n (%)</td>
<td>2 (1.8%)</td>
<td>2 (2.6%)</td>
</tr>
<tr>
<td>Diuretic + ARB</td>
<td>2 (1.8%)</td>
<td>1 (1.3%)</td>
</tr>
<tr>
<td>CCB + ARB, n (%)</td>
<td>2 (1.8%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>CCB + Diuretic, n (%)</td>
<td>1 (1.0%)</td>
<td>1 (1.3%)</td>
</tr>
</tbody>
</table>

SD = Standard deviation; BMI = Body Mass Index; OPD = Outpatient Department; ACEI = Angiotensin Converting Enzyme Inhibitor; ARB = Angiotensin Receptor Blocker; CCB = Calcium Channel Blocker; BP control was defined as casual BP of <140 (systolic) and <90 mmHg (diastolic) as per the JNC-7; Percents are column percents; Differences between groups were analyzed using unpaired Student’s t-test, Pearson’s χ² test, and Fisher’s Exact test whenever appropriate.

Mean differences between groups were analysed using unpaired Student’s t-tests. An a priori two-tailed level of significance was set at the 0.05 level. Statistical analyses were performed using STATA version 9.2 software (StataCorp 2006, Stata Statistical Software; Release 9.2, College Station, TX, USA).
RESULTS

Among the 7,702 charts reviewed, the prevalence of hypertension was 2.4% (n = 187). The characteristics of the study cohort are shown in Table 1. The overall mean age of the cohort was 55±11 years, 54% (n = 101) were females, and majority of the subjects were Omani (n = 123; 66%). The proportion of subjects who had their BP controlled was 41% (n = 77) with Omanis significantly less likely to have their BP controlled compared to non-Omanis (35% versus 53%; p = 0.017). Omanis were also slightly more obese compared to the non-Omanis (BMI was 31 versus 29 kg/m²; p = 0.091). The proportion of diabetic subjects who had their BP controlled (<130 mmHg systolic and <80 mmHg diastolic) was only 10% (n = 6 out of 59 diabetics) [Table 1].

Males were more likely to be smokers than females (12% versus 2%; p = 0.013). Furthermore, females were also more obese than their male counterparts (BMI was 31 versus 29 kg/m²; p = 0.048). However, there was no statistical difference in hypertension goal attainment between the genders (39% male versus 44% female; p = 0.472). The majority of the subjects were on monotherapy (n = 131; 70%) followed by dual regimens (n = 50; 27%). The most frequent mono anti-hypertensive therapies were B-blockers (n = 64; 34%) and angiotensin-converting enzyme (ACE) inhibitors (n = 47; 25%). Among the dual combination therapies, the most common prescribed regimens were ACE inhibitor plus B-blocker (n = 14; 28%) and B-blocker plus diuretic (n = 12; 24%). Those on dual therapies were less likely to attain their goal than those on monotherapies (36% versus 44%; p = 0.359; power 12%). However, the dual regimen group also consisted of more diabetics (38% versus 27%; p = 0.169; power 25%) as well as those with dyslipidaemia (54% versus 37%; p = 0.043).

DISCUSSION

The three main findings in our study were the following: the majority of our subjects (59%) were not treated so as to achieve their target BP, particularly diabetics; Omanis were less likely to have their BP controlled compared to non-Omanis, and the majority of our patients were on monotherapy.

Research conducted worldwide points clearly to the difficulty in achieving satisfactory BP control in a large proportion of treated patients. Worldwide, control rates vary from as low as 5.4% in Korea to as high as 58% in Barbados.1 Numerous factors may contribute to ineffective hypertension control.12 Non-adherence with medication is very common amongst hypertensive patients. It has been reported that up to 60% of patients discontinue their anti-hypertensive medications within the first 12 months.13 Reasons include complex medication regimens, adverse effects, convenience factors such as dosing frequency, personal health beliefs, and attitudes regarding treatment of an often asymptomatic condition.14 Physician behaviour could also be a major obstacle to the successful achievement of target BP goals. The major concern relates to the reluctance of physicians to change treatment when BP control is inadequate.15 The physician might not also be aware of the recent treatment guidelines. For example, a study from the USA reveals that 41% of physicians have not heard of or are not familiar with the reports of the Joint National Committee (JNC), Detection, Evaluation, and Treatment of High Blood Pressure and their hypertension treatment guidelines.16

Patients who have both diabetes and hypertension are at a higher risk of cardiovascular events compared to non-diabetics.17 The United Kingdom Prospective Diabetes Study (UKPDS) suggests that tight control of BP prevents the development of microvascular and macrovascular complications in patients with Type 2 diabetes.18 The guidelines of the seventh report of the JNC recommend a target BP of 130/80 in patients who have concomitant diabetes.19 Physicians, however, appear to be doing a poor job of helping patients with diabetes achieve this goal. In a study by Abbott and colleagues, only 11% of the diabetic patients treated for hypertension were reported to have achieved the systolic BP goal of <130 mmHg.20 In our study, the BP control in diabetics was similar (10%); furthermore, only 27% (16 out of 59) of the diabetics were on dual anti-hypertensive therapies in our study. This is against the JNC recommendations, which clearly state that diabetics be treated with at least two anti-hypertensive medications to obtain optimal BP control.

Possible reasons for the poor control of BP among Omani are ethnicity, higher prevalence of male gender (55% versus 45%; p = 0.003) and obesity (31 versus 29 kg/m²; p = 0.091). Racial differences have been documented as a cause for differences in the prevalence, course, and control of hypertension.21 For instance, African-Americans were reported to have an increased prevalence of hypertension, higher mean BP levels, and higher morbidity and mortality rates attributable
to hypertension, compared to white Americans. Hypertensive blacks have a higher incidence of left ventricular dysfunction, stroke, and renal damage, but a lower incidence of ischaemic heart disease, than do hypertensive whites. Hypertensive blacks also have lower rates of BP control. Furthermore, the two races respond differently to anti-hypertensive medications. Blacks respond well to thiazide diuretics, but poorly to B-blockers and angiotensin-converting enzyme (ACE) inhibitors compared to whites. Pathophysiological differences between the two populations such as salt sensitivity, rennin levels and dopamine response to a salt load might be responsible for the differences in effectiveness.

Recent clinical trials have shown that effective BP control can be achieved in most hypertensive patients, but to do so requires two or more antihypertensive drugs for most patients. Thirty to 60% of patients will be controlled with a single drug regimen, while two drugs in combination are likely to improve control rates in 80 to 85%; three or more drugs will provide control in 90 to 95% of patients. Most of our patients were on monotherapy. In fact, this might have contributed to unsatisfactory BP control in our subjects. In addition, diuretics which are widely recommended as a first line therapy were only rarely used in our cohort (3.7%) [Table 1]. This low use could be due to the fact that the pharmaceutical industry promotes the use of newer and more expensive alternatives.

This study has two major limitations. The study population is highly educated, and the treatment of hypertension may not be representative of those experienced by the general population. The ideal setting at the university which ensures the availability of a wide variety of anti-hypertensive medications and easy access to the facilities of a tertiary care hospital differ widely from the setting and population in the general community.

**CONCLUSION**

In conclusion, hypertension is not adequately controlled in our cohort particularly in diabetics. The racial background was a significant factor correlating with BP control. Anti-hypertensive medications were mainly used as monotherapy in contrast to the recent hypertension guidelines as recommended by JNC-7. Further research in a community setting is needed in order to draw more accurate conclusions about the state of hypertension control in Oman.

**REFERENCES**


Assessment of the Relationship of Hepatic Enzymes with Obesity and Insulin Resistance in Adults in Saudi Arabia

Ali Ibrahim Al-Sultan

ABSTRACT

Objectives: This study was conducted to assess the relationship of hepatic enzymes and serum albumin to obesity and insulin resistance in adults in Saudi Arabia. Methods: A comparative study of 136 Saudi adults, comprising of 68 obese and 68 non-obese was conducted. Anthropometric measurements, hepatic enzymes, serum albumin, blood glucose, serum insulin, lipid profile, and homeostasis model assessment of insulin resistance (HOMA IR) were measured. Results: The study showed significantly higher levels of gamma glutamyl transpeptidase (GGT), alkaline phosphatase, fasting glucose, serum insulin, and HOMA IR among obese subjects. GGT had the strongest associations. Significant inverse correlation was found between serum albumin and BMI, HOMA IR, and serum insulin, respectively. Conclusion: Deranged liver functions, especially GGT, had the strongest correlations with obesity and HOMA IR. GGT might be a better marker of hepatic pathology associated with obesity and insulin resistance in Saudi adults with restricted alcohol intake. The results also propose that albumin metabolism might be altered in obesity.

Keywords: Obesity; Insulin resistance; Transaminases; Serum albumin; Saudi Arabia.

Advances in Knowledge

• Gamma glutamyl transpeptidase might be a better marker of hepatic pathology associated with obesity and insulin resistance in Saudi adults with restricted alcohol intake.
Obesity is a major health problem. Non-alcoholic fatty liver disease is a hepatic dysfunction frequently associated with obesity, and the fatty liver changes correlate with the severity of obesity. The literature is well documented for the association of the levels of hepatic enzymes and obesity, and for measured percentage body fat. This association with obesity had been shown for non-alcoholic fatty liver disease either diagnosed by ultrasound or liver biopsy. The relationship of hepatic enzymes as markers of non-alcoholic fatty liver disease and insulin resistance was appreciated by the prediction of metabolic syndrome and Type 2 diabetes mellitus. Alanine aminotransferase (ALT) predicts metabolic syndrome or correlates with its components, as well gamma glutamyl transpeptidase (GGT), or both. ALT predicts diabetes mellitus, and similar observations are attributed to GGT, or both. ALT and GGT correlates with surrogates of insulin resistance, and with directly measured insulin resistance. GGT is a sensitive marker for liver damage, but less specific than other hepatic enzymes.

The aim of the study was to assess the relationship of hepatic enzymes and serum albumin to obesity and insulin resistance in adult Saudi individuals.

METHODS

The study was conducted over a one year period (2004 - 2005) at the Departments of Internal Medicine in the Colleges of Medicine in Al-Ahsa and Dammam, at King Faisal University, Kingdom of Saudi Arabia. A total of 136 volunteer subjects were included. They were non-diabetic with normal blood urea nitrogen and serum creatinine, and had no microalbuminuria (urine albumin to creatinine ratio less than 0.03 mg/mg in overnight early morning sample). They were stratified into obese and non-obese groups according to international criteria. Serum liver chemistry, fasting glucose, insulin and lipid profile were measured. The scores for homeostasis model assessment of insulin resistance (HOMA IR) were calculated with the formula: fasting serum insulin (µU/ml) X fasting serum glucose (mmol/l) / 22.5 as described by Matthews and his colleagues.

There were 68 (34 males and 34 females) non-obese subjects with normal body mass index (BMI) less than 25, and 68 (34 males and 34 females) obese subjects with BMI equal or more than 30. Non-obese subjects had normal liver chemistry except 8 subjects (11.7%) with only alanine aminotransferase (ALT) increased, which was less than 2 times the normal upper limit. There were nine subjects (13.2%) with blood pressure > 18.66/11.99 KPa (> 140 / 90 mmHg), eight subjects (11.7%) with impaired fasting glucose, two subjects (2.9%) with impaired glucose tolerance, and the rest had normal oral glucose tolerance.

Subjects were included with following criteria: age between 18 - 65 years, Saudi nationals, normal total bilirubin and no microalbuminuria (urine albumin to creatinine ratio less than 0.03 mg/mg), normal blood urea nitrogen and serum creatinine, normal total blood urea nitrogen and serum creatinine, normal total bilirubin and no microalbuminuria (urine albumin to creatinine ratio less than 0.03 mg/mg in overnight early morning sample). Subjects were excluded if they were diabetic, had abnormal hepatitis B or C serology, known liver disease, alcohol intake, medications, and current acute or chronic illness. The study was approved by the Research and Ethical Committee of King Faisal University and consent was taken from study subjects.

Height and weight was measured using Detecto scale to the nearest 0.5 cm and 0.1 kg respectively. Body mass index (BMI) was defined as the weight in kilograms divided by the square of the height in meters. Waist circumference was measured at the highest point of the iliac crest and hip circumference measured at the maximum circumference of the buttocks. Normal waist to hip ratio was < 0.9 for men and < 0.85 for women. A mean of two measurements of blood

Application to Patient Care

- In patients with non-alcoholic fatty liver disease, gamma glutamyl transpeptidase has a stronger positive correlation to obesity than other hepatic enzymes in Saudi adults.
pressure at lying and sitting positions was calculated. Serum glucose, total cholesterol, triglycerides, high-density lipoprotein (HDL)-cholesterol, blood urea nitrogen (BUN), creatinine, serum albumin, total bilirubin, alanine aminotransferase (ALT), aspartate aminotransferases (AST), gamma glutamyl transpeptidase (GGT), and alkaline phosphatase (ALP) were measured by the Dimension RXL analyzer (Dade Behring). Serum insulin was measured by a microenzyme immunoassay using IMX analyzer (Abbott Diagnostics). Urine for micro-albumin was measured by a particle-enhanced turbidimetric inhibition immunoassay using the ACA Star analyzer by Dade Behring.

A 75 g oral glucose tolerance test and early morning urine sample for microalbuminuria were carried out for all subjects. Venous blood samples were obtained in the morning after 12 hours overnight fast. Serum specimens were stored at -70°C until analysis. Normal ranges for liver chemistries in our hospital were total bilirubin 1.7 – 17.1 µmol/l, total protein 60 - 80 g/l, albumin 35 - 48 g/l, ALT 20 - 65 U/l, AST 7 - 41 U/l, GGT 5 - 85 U/l, and ALP 50 -140 U/l.

A quality control program was carried out regularly in our laboratories including system check, quality controls, and calibrations/verifications according to system manufacturers’ instructions and recommendations. The sample size is based on assuming the worse acceptable probability of the adverse outcome: ‘elevated hepatic transaminases’ to be 20% in obese and 2% in non-obese adult individuals with a type II error of 20% to achieve statistical significance at a confidence level of 95% and power of 80%. The least total number of obese and non-obese subjects would be 56 each.

Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences) statistical software version 12.0. Student t - test, and Mann-Whitney test were carried out according to the results of Levene’s test of homogeneity for equal variances as appropriate. Pearson correlation coefficients were

### Table 1: Clinical and biochemical characteristics of all 136 study subjects.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-Obese</th>
<th>Obese</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of subjects</td>
<td>68</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>Males (%)</td>
<td>34 (50%)</td>
<td>34 (50%)</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>24.6 + 3.7</td>
<td>28.8 + 6.9</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Body mass index</td>
<td>22.7 + 2.2</td>
<td>36.5 + 7.3</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Waist to hip ratio</td>
<td>0.796 + 0.094</td>
<td>0.885 + 0.083</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Systolic BP (KPa)</td>
<td>15.13 + 1.73</td>
<td>16.17 + 1.97</td>
<td>&lt;0.007</td>
</tr>
<tr>
<td>Diastolic BP (KPa)</td>
<td>9.53 + 1.12</td>
<td>10.29 + 1.28</td>
<td>&lt;0.002</td>
</tr>
<tr>
<td>Albumin (g/L)</td>
<td>42.9 + 2.6</td>
<td>40.0 + 3.0</td>
<td>NS</td>
</tr>
<tr>
<td>ALT (U/l)</td>
<td>38.6 + 11.8</td>
<td>44.9 + 19.5</td>
<td>NS</td>
</tr>
<tr>
<td>AST (U/l)</td>
<td>17.8 + 5.5</td>
<td>20.0 + 8.6</td>
<td>NS</td>
</tr>
<tr>
<td>GGT (U/l)</td>
<td>24.3 + 8.9</td>
<td>33.6 + 16.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>ALP (U/l)</td>
<td>73.96 + 20.83</td>
<td>85.79 + 18.84</td>
<td>&lt;0.004</td>
</tr>
<tr>
<td>HOMA-IR</td>
<td>2.09 + 1.4</td>
<td>3.86 + 1.9</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Insulin (pmol/L)</td>
<td>56 + 35</td>
<td>98 + 44</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Fasting glucose (mmol/L)</td>
<td>4.9 + 0.3</td>
<td>5.2 + 0.6</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>Total cholesterol (mmol/L)</td>
<td>4.40 + 0.73</td>
<td>4.76 + 0.84</td>
<td>&lt;0.023</td>
</tr>
<tr>
<td>Triglyceride (mmol/L)</td>
<td>0.82 + 0.41</td>
<td>1.15 + 0.59</td>
<td>&lt;0.002</td>
</tr>
<tr>
<td>HDL-Cholesterol (mmol/L)</td>
<td>1.47 + 0.40</td>
<td>1.29 + 0.33</td>
<td>&lt;0.02</td>
</tr>
</tbody>
</table>

Values are means ± SD; NS = not significant.

Legend: BP = Blood pressure; ALT = Alanine aminotransferase; AST = Aspartate aminotransferase; GGT = Gamma glutamyl transpeptidase; ALP = alkaline phosphatase; HOMA IR = homeostasis model assessment of insulin resistance; HDL = High Density Lipoprotein
measured. Results are presented as mean ± standard deviation.

**RESULTS**

The clinical and biochemical characteristics of study subjects are shown in Table 1. The obes subjects were significantly older than non-obese (p<0.0001). Obese individuals had a mean age 28.8 ± 6.9 years with a median 27.00 and a minimum and maximum age of 19 and 47 respectively. Non-obese individuals had a mean age 24.6 ± 3.7 years with a median 24.00 and a minimum and maximum age of 20 and 41 respectively. Obese subjects had higher BMI, waist-to-hip ratio (WHR), systolic and diastolic blood pressure (p<0.0001, <0.0001, < 0.007 and <0.002 respectively).

Table 2: Correlations of hepatic enzymes and serum albumin with the clinical and biochemical parameters of all 136 study subjects.

<table>
<thead>
<tr>
<th></th>
<th>Serum Albumin (g/dl)</th>
<th>ALT (U/l)</th>
<th>AST (U/l)</th>
<th>GGT (U/l)</th>
<th>ALP (U/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body mass index</td>
<td>0.426 **</td>
<td>0.263 **</td>
<td>0.320 **</td>
<td>0.339 **</td>
<td>0.290**</td>
</tr>
<tr>
<td>Waist to hip ratio</td>
<td>-0.041</td>
<td>0.302 **</td>
<td>0.313 **</td>
<td>0.509 **</td>
<td>0.145</td>
</tr>
<tr>
<td>Systolic blood pressure</td>
<td>0.117</td>
<td>0.263 **</td>
<td>0.313 **</td>
<td>0.369 **</td>
<td>0.273**</td>
</tr>
<tr>
<td>Diastolic blood pressure</td>
<td>0.055</td>
<td>0.085</td>
<td>0.000</td>
<td>0.189</td>
<td>0.257*</td>
</tr>
<tr>
<td>HOMA-IR</td>
<td>-0.251 *</td>
<td>0.462 **</td>
<td>0.354 **</td>
<td>0.481 **</td>
<td>0.143</td>
</tr>
<tr>
<td>Insulin</td>
<td>0.279 **</td>
<td>0.414 **</td>
<td>0.318 **</td>
<td>0.476 **</td>
<td>0.146</td>
</tr>
<tr>
<td>Fasting glucose</td>
<td>0.053</td>
<td>0.280 **</td>
<td>0.278 **</td>
<td>0.230 *</td>
<td>0.132</td>
</tr>
<tr>
<td>Total Cholesterol</td>
<td>0.039</td>
<td>0.204 *</td>
<td>0.150</td>
<td>0.295 **</td>
<td>0.228*</td>
</tr>
<tr>
<td>Triglyceride</td>
<td>0.144</td>
<td>0.314 **</td>
<td>0.206 *</td>
<td>0.493 **</td>
<td>0.189</td>
</tr>
<tr>
<td>HDL-Cholesterol</td>
<td>0.047</td>
<td>-0.311 **</td>
<td>-0.285 **</td>
<td>-0.365 **</td>
<td>-0.118</td>
</tr>
</tbody>
</table>

* p < 0.05 and ** p value < 0.01

Legend: ALT = Alanine aminotransferase; AST = Aspartate aminotransferase; GGT = Gamma glutamyl transpeptidase; ALP = alkaline phosphatase; HOMA IR = homeostasis model assessment of insulin resistance; HDL = High Density Lipoprotein

The means of serum albumin levels were lower, and ALT and AST levels were higher in obese individuals, but there was no significant statistical difference. The obese subjects had significantly higher GGT, and ALP levels (p < 0.001 and 0.004 respectively). Obese individuals had significantly higher fasting blood glucose, (p < 0.005). HOMA IR scores, and insulin were significantly higher in obese subjects (p <0.0001). Total cholesterol, triglycerides, and HDL-cholesterol were significantly higher in obese individuals (p <0.023, <0.002, and <0.02 respectively).

Table 2 shows correlations of liver function tests with clinical and biochemical variables. All hepatic enzymes (ALT, AST, GGT, and ALP) were associated with measures of obesity including BMI, and WHR, but GGT had the strongest correlations with r 0.339, r 0.509 respectively, (p < 0.01). Figure 1 shows the line graph of the correlation of ALT, AST, and GGT with BMI. Serum albumin was inversely associated with BMI r - 0.426, (p < 0.01). Systolic blood pressure correlated significantly with ALT, AST, GGT, and ALP, (p <0.01, <0.01, <0.01, and <0.01 respectively). Diastolic blood pressure correlated significantly with ALP, (p <0.05).

ALT, AST, and GGT correlated with measures of insulin resistance including HOMA IR, insulin, and fasting glucose. GGT had the strongest correlations with HOMA IR, and insulin r 0.481, r 0.476, respectively (p < 0.01). Figure 2 shows the line graph of the
correlation of ALT, AST, and GGT with HOMA IR. ALT, GGT, and ALP correlated with total cholesterol. ALT, AST, and GGT correlated with triglycerides, and inversely with HDL-cholesterol. Serum albumin had significant negative correlation with HOMA IR, and insulin $r = -0.251$, $r = -0.279$ ($p < 0.05$ and $<0.01$ respectively).

**DISCUSSION**

GGT and ALP were significantly higher in obese than non-obese subjects, while ALT and AST did not show a significant difference. ALT, AST, and GGT correlated significantly with BMI. A similar significant correlation was found with WHR and systolic blood pressure. HOMA-IR and serum insulin correlated significantly with ALT, AST, and GGT. In various studies, aminotransferases, especially ALT, have been shown to correlate with obesity, and insulin resistance. Among hepatic enzymes, ALT is the most specific indicator of hepatic pathology in non-alcoholic fatty liver disease. GGT is considered to be a sensitive marker of hepatic damage, but it is not specific especially in societies with abundance of alcohol intake. In this study, GGT had the strongest correlations for BMI $r = 0.339$, WHR $r = 0.509$, systolic blood pressure $r = 0.369$, insulin levels $r = 0.476$, and HOMA IR $r = 0.481$, compared to other liver enzymes. In addition, GGT correlated significantly with fasting glucose, total cholesterol, triglycerides, and inversely with HDL-cholesterol, $r = 0.230$, $r = 0.295$, $r = 0.493$, $r = 0.365$ ($p < 0.05$, $<0.01$, and $<0.01$ respectively). Previous studies have shown positive correlation between GGT and measures of obesity and insulin resistance, and to predict diabetes mellitus. It is also reported to be increased in patients with ischaemic heart disease. The findings of this study and the literature suggest a major role of GGT in the manifestation of liver pathology associated with obesity and insulin resistance.

In this study, ALP correlated significantly with BMI, systolic and diastolic blood pressure, and to-
tal cholesterol. It had been reported to be higher in obese than non-obese subjects as has been observed in this study,\textsuperscript{31,32} without significant correlation with HOMA-IR.

Serum albumin showed significant inverse correlation with BMI, HOMA IR, and serum insulin. It has been reported that glycated albumin is associated negatively with obesity in non-diabetic children,\textsuperscript{25} and more recently in non-diabetic adults.\textsuperscript{33} Glycated albumin is lower in obese diabetics,\textsuperscript{34} and correlates negatively with body mass index.\textsuperscript{35} The etiology of this observation is not yet known. In this study, a negative association between serum albumin and obesity was found. Serum albumin level reflects the rate of synthesis, degradation, and volume of distribution. Increase vasopermeability is suggested by literature reports of increase in albumin extravasation in skeletal muscles in the obese Zucker rat model,\textsuperscript{36} and as well by an increase in transcapillary escape rate of albumin in hypertensive patients with metabolic syndrome.\textsuperscript{37} Endothelial dysfunction had been reported to be related to elevated ALT levels among patients with diabetes mellitus.\textsuperscript{38} Although microalbuminuria was not present in the study subjects as per inclusion criteria, it is another potential explanation and mechanism for the observed relationship of albumin and obesity. Microalbuminuria is an established marker of cardiovascular disease and reflects vascular dysfunction as a manifestation of a proposed low grade inflammation associated with obesity and insulin resistance.\textsuperscript{39} Obesity is an independent risk for microalbuminuria,\textsuperscript{40,41} with the risk being parallel to changes in weight.\textsuperscript{42}

**CONCLUSION**

In conclusion, ALT, AST, and GGT correlated with measures of obesity, and HOMA-IR. GGT had the strongest correlations and might be a better marker of hepatic pathology associated with obesity, and insulin resistance in Saudi and other subjects with no alcohol intake. Serum albumin correlated inversely with BMI and HOMA-IR suggesting an altered metabolism or handling of albumin in obesity.

**ACKNOWLEDGEMENTS**

The author would like to thank Dr. Abdulmohsin Al-Elq, Professor Prem Nath Dogra, Professor Shabid Baig, and Professor Amro Heshmat Rustem at the Departments of Internal Medicine, Surgery, and Biomedical Sciences at King Faisal University, Carmen Lizardo, Jacqueline Manaois, Purita Cabinian, and Issa Jebree from the laboratories of King Fahd Hospital of the University, for collection of data, review of manuscript and technical help.

**REFERENCES**


10. Wannamethee SG, Shaper AG, Lennon L, Whincup PH. Hepatic enzymes, the metabolic syndrome, and the


191


Varied Presentations of Acute Glomerulonephritis in Children
Single centre experience from a developing country

*Kalpana Malla, Moinak S Sarma, Tejesh Malla, Anna Thapalia

Abstract: Objectives: The objective of this prospective study, carried out at Manipal Teaching Hospital, Pokhara, was to document the various clinical presentations of children with acute glomerulonephritis and compare them with the available biological parameters in Western Nepal. Methods: Clinical and laboratory parameters of children with oedema and microscopic/macroscopic haematuria. Results: For seven years (2000-2007), 92 cases of children were clinically diagnosed with acute glomerulonephritis (AGN). Other clinical and laboratory analyses were also eventful. Conclusion: The present study highlights the varied presentations of AGN, atypical presentations or complications of glomerulonephritis being more common than the classical presentation in the Western Region of Nepal.

Key words: Renal disease; Glomerulonephritis, acute; Urinary tract infection; Nepal.

Glomerulonephritis (GN) is the term generally reserved for the variety of renal diseases in which inflammation of the glomerulus, manifested by proliferation of cellular elements, is secondary to an immunologic mechanism. Most incidents of AGN appear to be associated with a postinfectious state with known aetiological agents like bacteria, parasite, virus. Amongst the GN secondary to bacterial infections, post-streptococcal GN is the most frequent and usually presents with typical clinical findings; however, the scenario in this study was different. Out of 92 cases of acute glomerulonephritis, only 33 cases presented with typical clinical features of GN; the remaining 59 had atypical clinical presentations. Atypical postinfectious glomerulonephritis (PIGN) may mimic a great variety of glomerular diseases.

Methods
This prospective study was conducted between September 2000 and March 2007 at the Department of Pediatrics, Manipal Teaching Hospital, Pokhara, Nepal. The case collection was from September 2000 to February 2005 and follow-up was continued until March 2007. Ninety-two children of all age groups presenting either with oedema (facial puffiness and/or
pedal oedema) and haematuria (microscopic or frank and/or cola coloured urine) were considered for this study. Borderline cases, those with urinary stones and with hypercholesterolemia suggestive of nephrotic syndrome, (4+ protemuria with high cholesterol level requiring treatment with prednisolone) were excluded from the study. Both outpatients as well as hospitalized patients were enrolled for the study. Consent of the patients was taken and the parents or guardians received information about the study and follow-ups. A detailed history was taken and a clinical examination performed, followed by relevant available investigations. The investigations included urine routine and microscopic examination, urine culture and sensitivity, renal function tests, antistreptolysin O (ASO) titres and ultrasound of the abdomen. Facilities for doing serum complement levels, electron microscopy and immunofluorescence studies for renal biopsy were not available in this centre. These cases were followed up for two years.

**RESULTS**

Of the 92 children, 57 (61.95%) were male and 35 (38.05%) were female. All were diagnosed to have acute glomerulonephritis (AGN). The male:female ratio was 1.6:1. Eighty-eight children (95.7%) were above 5 years (school going age group); only four (4.3%) of the children were under 5 years (preschool age group) [Table 1]. The classical presentation of AGN was seen only in 33 (35.9%) cases, while 59 (64.1%) presented with atypical findings or complications [Figure 1]. The pattern of atypical presentations/complications were hypertensive encephalopathy (n = 11, 18.6%); nephrotic onset (n = 10, 16.9%); urinary tract infection (UTI) (n = 10, 16.9%); joint pains and rash (n = 2, 3.3%); heart failure (HF) (n = 6, 10.1%); combined HF and UTI (n = 3, 5.1%); rapid deterioration or progression (n = 5, 8.5%); acute renal failure (n = 4, 6.7 %); combined cardiac and renal failure (n = 1, 1.69 %), associated with rheumatic fever (n = 3, 5.1%); epistaxis (n = 2, 3.3%); malena (n = 1, 1.69%); associated with enteric fever and UTI (n = 1, 1.69 %) [Table 2].

Clinically, all (100%) children had facial puffiness and/or pedal oedema and macroscopic haematuria (frank and/or cola coloured urine). Other main clinical features were hypertension (n = 80, 86.9%), fever (n = 60, 65.2%), headache (n = 58, 63.0%) and oliguria (n = 50, 54.3%) followed by pyoderma, vomiting, burning micturition, painful abdomen, sore throat, altered sensorium, convulsions and shortness of breath. Some rare clinical features were also noted cough (n = 14, 15.2%), systolic murmur (n = 7, 7.6%), joint pains and rash (n = 2, 2.1 %), hepatomegaly (n = 3, 3.2 %), diarrhoea (n = 3, 3.2 %), epistaxis (n = 2, 2.1 %), malena (n = 1, 1.0 %) [Table 3].

Table 4 shows the results of the investigations into urea, creatinine and albumin levels in these patients. ASO titres were found to be positive in only 50% of

### Table 1: Age and Sex distribution of patients at presentation

<table>
<thead>
<tr>
<th>Age</th>
<th>&lt;1yr</th>
<th>&gt;1-5yr</th>
<th>&gt;5-10yr</th>
<th>&gt;10yr</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>0</td>
<td>3</td>
<td>21</td>
<td>33</td>
<td>93</td>
</tr>
<tr>
<td>Female</td>
<td>0</td>
<td>1</td>
<td>12</td>
<td>22</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>4</td>
<td>33</td>
<td>55</td>
<td>92</td>
</tr>
</tbody>
</table>

**Fig 1: Clinical Presentation**

194
VARIED PRESENTATIONS OF ACUTE GLOMERULONEPHRITIS IN CHILDREN

The cases. An ultrasonography (USG) of the kidney, ureters and bladder revealed Grade I renal parenchymal changes (RPC) in 48%; Grade II RPC, mild renal dysfunction (MRD) in 24%; Grade III RPC in 6.5% and normal in 22% cases [Figure 2]. All the three renal biopsies showed crescentic glomerulonephritis.

**DISCUSSION**

The global burden of severe Group A streptococcal disease is concentrated largely in developing countries including Nepal. Group A streptococcal diseases are more common in children than in adults with diseases ranging from pharyngitis and impetigo to invasive infections and the post-streptococcal sequelae: acute rheumatic fever and acute post-streptococcal glomerulonephritis. Acute post-streptococcal glomerulonephritis is the commonest cause of AGN in this country which usually exhibits milder symptoms or signs like haematuria, mild oedema, oliguria and hypertension which has a simple clinical course and an excellent prognosis. On the other hand, atypical presentations may mimic a great variety of glomerular disease, have a worse prognosis and need better diagnosis and care. Glomerular disease with atypical presentations will include mild mesangial and/or endocapillary glomerulonephritis (GN); focal segmental glomerulosclerosis (FSGS) with diffuse IgM mesangial deposits; rapidly progressive or crescentic GN with C3 hump-like deposits or with microabscesses; focal mesangiocapillary GN superimposed on endocapillary pattern; membranous GN with diffuse exudative changes and postinfectious glomerulonephritis with anti-glomerular basement membrane (anti-GBM) linear deposits. Some other study states that mesangial proliferative GN is the commonest histopathological lesion forming 66% of all primary GN. Minimal lesion, focal global sclerosis and focal segmental glomerulosclerosis accounted for 7% each. Membranous GN was uncommon (3%), while mesangiocapillary GN, diffuse endocapillary GN and crescentic GN were even rarer. In this study, we tried to ascertain age incidence, sex ratio, common clinical presentations and available biochemical parameters of primary glomerulonephritis. Out of 92 children, there were 59 atypical findings of AGN. Those with positive ASO titres were treated as poststreptococcal glomerulonephritis cases. The others were given the benefit of the doubt and treated for the same. Hence the confirmatory diagnosis could not be made in these cases. Like other studies, this study also showed a preponderance of males (61.95%) as

<table>
<thead>
<tr>
<th>Table 2: Pattern of atypical presentations/complications of acute glomerulonephritis (AGN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGN cases (n = 59)</td>
</tr>
<tr>
<td>AGN with hypertensive encephalopathy</td>
</tr>
<tr>
<td>AGN with nephrotic picture</td>
</tr>
<tr>
<td>AGN with urinary tract infection (UTI)</td>
</tr>
<tr>
<td>AGN with heart failure</td>
</tr>
<tr>
<td>AGN with rapid progressive GN</td>
</tr>
<tr>
<td>AGN with acute renal failure</td>
</tr>
<tr>
<td>AGN with rheumatic fever</td>
</tr>
<tr>
<td>AGN with heart failure + UTI</td>
</tr>
<tr>
<td>AGN with joint pains and rash</td>
</tr>
<tr>
<td>AGN with epistaxis</td>
</tr>
<tr>
<td>AGN with malena</td>
</tr>
<tr>
<td>AGN with heart failure and acute renal failure</td>
</tr>
<tr>
<td>AGN with enteric fever and urinary tract infection</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3: Signs and Symptoms of patients at presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs and symptoms</td>
</tr>
<tr>
<td>Hypertension</td>
</tr>
<tr>
<td>Fever</td>
</tr>
<tr>
<td>Headache</td>
</tr>
<tr>
<td>Oliguria</td>
</tr>
<tr>
<td>Pyoderma</td>
</tr>
<tr>
<td>Vomiting</td>
</tr>
<tr>
<td>Burning urine</td>
</tr>
<tr>
<td>Pain abdomen</td>
</tr>
<tr>
<td>Sore throat</td>
</tr>
<tr>
<td>Altered sensorium</td>
</tr>
<tr>
<td>Convulsions</td>
</tr>
<tr>
<td>Shortness of breath</td>
</tr>
<tr>
<td>Cough</td>
</tr>
<tr>
<td>Systolic murmur</td>
</tr>
<tr>
<td>Hepatomegaly</td>
</tr>
<tr>
<td>Diarrhoea</td>
</tr>
<tr>
<td>Joint pain with rash</td>
</tr>
<tr>
<td>Epistaxis</td>
</tr>
<tr>
<td>Malena</td>
</tr>
</tbody>
</table>

docapillary glomerulonephritis (GN); focal segmental glomerulosclerosis (FSGS) with diffuse IgM mesangial deposits; rapidly progressive or crescentic GN with C3 hump-like deposits or with microabscesses; focal mesangiocapillary GN superimposed on endocapillary pattern; membranous GN with diffuse exudative changes and postinfectious glomerulonephritis with anti-glomerular basement membrane (anti-GBM) linear deposits. Some other study states that mesangial proliferative GN is the commonest histopathological lesion forming 66% of all primary GN. Minimal lesion, focal global sclerosis and focal segmental glomerulosclerosis accounted for 7% each. Membranous GN was uncommon (3%), while mesangiocapillary GN, diffuse endocapillary GN and crescentic GN were even rarer. In this study, we tried to ascertain age incidence, sex ratio, common clinical presentations and available biochemical parameters of primary glomerulonephritis. Out of 92 children, there were 59 atypical findings of AGN. Those with positive ASO titres were treated as poststreptococcal glomerulonephritis cases. The others were given the benefit of the doubt and treated for the same. Hence the confirmatory diagnosis could not be made in these cases. Like other studies, this study also showed a preponderance of males (61.95%) as
compared to females (38.05%) with the ratio 1.6:1. The reasons for this male predominance are not known. As in other studies, most children were above 10 yrs (57.9%). Hypertensive encephalopathy was found in 18.6%, a much higher percentage compared to 5% & 4.3% in other studies. In these patients, hypertension is usually difficult to control and accompanied by signs of central nervous system dysfunction such as headaches, vomiting, depressed sensorium, confusion, visual disturbances, aphasia, memory loss, coma, and convulsions. All these features were also noted in our study. Twelve of the cases, which presented as nephrotic onset, had anasarca with proteinuria >40 mg/m2/hr. All of them (100%) had haematuria and hypertension; their features resolved with symptomatic treatment and did not require steroids. The incidence of nephrotic features was higher in other studies, 61.7%, 66%, 29% and 34.48% respectively as compared to ours which was only 13%. Seventeen percent had associated UTI which is quite frequently seen. AGN complicated by UTI was also observed in 20% cases in a study in Nigeria. Rapidly progressive glomerulonephritis (RPGN) is a disease of the kidney that results in a rapid decrease in the glomerular filtration rate of at least 50% over a short period, from a few days to 3 months and is irreversible. This was observed in 8.5% in our study. The frequency is estimated at 1-2 cases per 100,000 persons internationally. The main pathologic finding is fibrinoid necrosis (>90% of biopsy specimens); extensive crescent formation is present in at least 50% of glomeruli. As biopsy was not done in our cases we could not confirm the quency was higher. Heart failure (HF) and acute renal failure (ARF) were the sole systemic complications in 7/29 and 2/29 in AGN patients respectively, noted by Olowa WA in Nigeria. Heart failure was seen in 3% cases in another study, whereas in our study 10% presented with shortness of breath, cough, hepatomegaly. Acute renal failure is defined as abrupt or rapid decline in renal filtration function. The condition is often transient and usually completely reversible. Acute renal failure was present in 56 (76%) in one study and dialysis required in 14, but this presentation was much less in our study and only 4 required dialysis. We also observed some rare features like rheumatic fever (5%), epistaxis in 2 patients, melena in one. Literature on these presentations was not available. A few double systemic complications were also noted: AGN with enteric fever with UTI (1.69%), AGN with HF and ARF (1.69%). Three patients had double systemic complications in another study: one with hypertensive encephalopathy (HTE) with HF, and two with acute renal failure (ARF) with HF. The development of clinical nephritis (i.e. haematuria and/or oedema) either during or within 2-5 days after the onset of a respiratory tract infection is atypical and suggests the possibility of some other form of GN. In our study, nephritis developed following respiratory infection in 15% cases. Hypertension was the commonest mode of presentation (87%) in a study by Corpa, Soares V. The prevalence of arterial hypertension was 62.7% and it was 50% and 86.7% respectively in another study. The pathogenesis of the hypertension is unknown; howev-

<table>
<thead>
<tr>
<th>Table 4: Biochemical parameters of the patients</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Urea</strong>: Normal range 0.535-14.28mmol/L (15-40mg/dl)</td>
<td>40</td>
<td>43.5%</td>
</tr>
<tr>
<td>&lt;14.28mmol/L (40mg/dl)</td>
<td>22</td>
<td>24%</td>
</tr>
<tr>
<td>14.63-17.85mmol/L (41-50mg/dl)</td>
<td>20</td>
<td>22%</td>
</tr>
<tr>
<td>&gt;17.85mmol/L (&gt;50mg/dl)</td>
<td>9</td>
<td>10%</td>
</tr>
<tr>
<td><strong>Creatinine</strong>: Normal range 53.04-132.6µmol/L (0.6-1.5mg/dl)</td>
<td>54</td>
<td>59%</td>
</tr>
<tr>
<td>&lt;132.6µmol/L (&lt;1.5mg/dl)</td>
<td>23</td>
<td>25%</td>
</tr>
<tr>
<td>&gt;132.6µmol/L (&gt;1.5mg/dl)</td>
<td>15</td>
<td>16%</td>
</tr>
<tr>
<td><strong>Albumin</strong>: Normal range 3.5-5gm/dl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;25gm/L (2.5 g/dl)</td>
<td>16</td>
<td>17.4%</td>
</tr>
<tr>
<td>26-30gm/L (2.6 -3.0g/dl)</td>
<td>38</td>
<td>41%</td>
</tr>
<tr>
<td>31-35gm/L (3.1 - 3.5 g/dl)</td>
<td>18</td>
<td>19.6%</td>
</tr>
<tr>
<td>&gt;35gm/L (3.5g/dl)</td>
<td>20</td>
<td>22%</td>
</tr>
</tbody>
</table>
er, it is probably multifactorial and related only in part to extracellular fluid (ECF) volume expansion. Haematuria and proteinuria was present in 41% in one study and in 48.8% in another study.\(^5\) According to some investigators, oedema is found in approximately 85% of patients.\(^15\) Oedema usually appears abruptly and the degree of oedema varies markedly and depends on a number of factors, including the severity of glomerular involvement, the fluid intake, and the degree of hypoalbuminaemia. In our study also the degree of oedema was variable. Gross haematuria occurs at onset in 30-50% of children with poststreptococcal glomerulonephritis (PSGN) who require hospitalisation.\(^18\) The cardinal features are associated with various degrees of malaise, lethargy, anorexia, fever, abdominal pain and headache. Observant parents may also note oliguria. All these features were observed in this study. Almost characteristic by their absence are arthralgia, arthritis, carditis, hepatic involvement, and gastrointestinal bleeding,\(^19,17\) but in this study these findings were also noted. Systolic murmur was observed in 7.6% of the cases, hepatomegaly in 3%, diarrhoea in 3% and joint pain with rash in 2%. In this study, pyoderma and sore throat were the preceding cause of GN in 46% and 30% of cases respectively. This indicates the possibility of post streptococcal origin; however, in the remaining 24% cases there was no preceding pyoderma or sore throat. Other postinfectious causes that have been reported are: *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Rickettsia rickettsiae*, *Mycoplasma species*, *Meningococcus* species, *Leptospira* species. Also, viral illnesses have preceded the onset of typical AGN; among the most common are the varicella zoster virus, cytomegalo virus, and the Epstein-Barr virus.\(^20\) In the analysis of laboratory parameters, it was noted that impairment of urea was seen in 56% and impairment of creatinine in 41%. Renal impairment observed in other studies was 33.3%\(^6\) and 5.5% respectively.\(^8,21\) Low albumin levels of >35gm/L were observed in 78% of cases (25gm/L in 17.4%; 26-30gm/L in 41%; 31-35gm/L in 19.6%) and normal levels of >35gm/L in 22%. In the majority (60.6%) of cases it was between 2.6 - 3.5 g/dl. The reason why many patients had albumin levels slightly on the low side can be explained by the fact that these children were malnourished, which is again a common problem of this country. A rise in the titer of ASO is observed in only 50% of patients.\(^22,20\) In our study too, ASO was positive in 50% of cases. Ultrason of the kidney, ureters and bladder was normal in 22% cases.\(^18\) Forty-eight percent of patients with RPC had RPC Grade I (RPC), 24% had Grade II, and 6.5% had Grade III. RPC Grade I is echogenicity of kidney the same as the liver, RPC Grade II is echogenicity of the kidney more than the liver. RPC Grade III means that renal fat sinus and renal parenchyma cannot be differentiated with accentuated/ATT - corticomedullary differentiation.\(^23,21\)

The follow-up of this study was not good as just over half the patients (52.5%) did not return for follow-up. Maybe the referral to a higher level centre was the reason for this. Among those who came for follow-up, the ones with classical presentation AGN had complete resolution of the disease. Complete resolution was also observed in 42.85% cases that had atypical or complicated presentations. This means many may still have fallen into postinfectious forms, which are very common in our environment. Of these, 32.14%

---

**Table 5: Follow-up of patients**

<table>
<thead>
<tr>
<th>Follow-up</th>
<th>Classical presentation (n = 33)</th>
<th>Atypical or complicated presentation (n = 59)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>33 (100%)</td>
<td>28 (30.4%)</td>
</tr>
<tr>
<td></td>
<td>0 (0%)</td>
<td>31 (52.5%)</td>
</tr>
<tr>
<td>No</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>- Complete resolution</td>
<td>33 (100%)</td>
<td>12 (42.85%)</td>
</tr>
<tr>
<td>- With impaired renal function</td>
<td>0 (0%)</td>
<td>9 (32.14%)</td>
</tr>
<tr>
<td>- End stage renal disease on haemodialysis at higher centre</td>
<td>0 (0%)</td>
<td>5 (17.63%)</td>
</tr>
<tr>
<td>- Mortality</td>
<td>0 (0%)</td>
<td>2 (7%)</td>
</tr>
</tbody>
</table>

\(n = 33\) means 33 patients were observed, and \(n = 59\) means 59 patients were observed.
had impaired renal function and 17.85% had gone into end stage renal disease and were on haemodialysis at a higher level centre. There was 7% mortality [Table 5].

The enlisted cases were provisionally assumed to be of poststreptococcal origin and were treated likewise since PSGN is the commonest cause in a developing country like ours. However, these cases, especially the ones which were ASO negative, needed better diagnostic and confirmatory support such as complement C3, C4 levels and immunofluorescence for the biopsy specimens. These investigations were unfortunately unavailable at our setup and elsewhere in the city. Many investigations were also limited due to financial constraints of the patients. As optimum workup was required, we referred many of the cases to higher level centres. Some of these cases were subsequently lost to follow-up.

**CONCLUSION**

We conclude that AGN is common in children of the Western region of Nepal and that an unusual atypical presentation is frequent. Better outcomes can be achieved with more detailed laboratory and diagnostic methods which are limited at present. Renal biopsy in these cases is mandatory and helpful, especially in allowing rational use of corticosteroids and other immunosuppressive drugs. Financial constraints are a major contributing factor in a developing country like Nepal. Nevertheless as PSGN is the commonest cause of GN in our country, it is justified to give the benefit of treatment to these patients before considering other causes. Symptomatic treatments and careful supportive care will allow the majority of children to recover from post streptococcal AGN.

**ACKNOWLEDGEMENTS**

The authors wish to thank all the patients and their parents for their co-operation.

**REFERENCES**


ABSTRACT

Objectives: The world over, tonsillectomy is one of the operations most frequently performed by otolaryngologists, who are in search of a technique of tonsillectomy where the operation time and operative blood loss is reduced. This study was carried out to evaluate the effect of hydrogen peroxide 3% on tonsillectomy times, blood loss during the surgery and on the number of ties used.

Methods: A pilot study of 30 patients was carried out in the Department of Otolaryngology of Basrah General Hospital, Iraq, in the period from February to July 2006. Tonsillectomy was performed using hydrogen peroxide 3% as a haemostatic agent in Group A (n = 15), while in Group B (n = 15) no agent was used with the gauze pack. Results: The application of hydrogen peroxide 3% in the tonsillar fossae reduced the operation time by 31%, the operative blood loss by 32.9% and also reduced the number of ties used by 50% in Group A. All these results are statistically significant.

Conclusion: The local application of 3% hydrogen peroxide on the tonsillar bed after tonsillectomy is beneficial in regard to decreasing the procedure time, the volume of blood loss, and the number of ties used.

Keywords: Tonsillectomy; Hydrogen peroxide; Haemostasis.

As far as we know, Celsus was the first person to recognize tonsillar disease and its relationship to infection performing the first tonsillectomy in 40 A.D.1 The popularity of tonsillectomy peaked in the 1930s, but after the use of antibiotics became widespread, enthusiasm for the procedure waned and its use had decreased dramatically by the 1960s. Concerned about the morbidity inherent in the surgical procedure, paediatricians began to question its value relative to medical management with antimicrobials. The tide turned again in the 1980s, when Paradise et al demonstrated that surgery significantly improved patient outcomes compared with medical therapy.2

Chronic tonsillitis is one of the most common and frequent illnesses within otolaryngology. Tonsillectomy is also one of the most frequently performed surgical procedures. Patients’ quality of life and general health becomes demonstrably reduced by chronic palate and pharyngeal infections.3 Hitherto tonsillectomy outcome studies were mostly done on children.4, 5

Hydrogen peroxide has been used as a disinfectant.6 Delivering hydrogen peroxide into wounds kills fibroblasts and occludes local microvasculature.7, 8 It has been used for decades as an effervescent haemostatic agent in arthroplasty in orthopedics.9

Hydrogen Peroxide 3%: Is it Beneficial in Tonsillectomy?

*Ahmed M Al-Abbasi,1 Zahra K Saeed2

1Department of Surgery, Basrah Medical College, Basrah, Iraq; 2Basrah Dentistry College, Basrah, Iraq

*To whom correspondence should be addressed. Email: mmalabbasi@yahoo.com
The aims of this prospective study were to evaluate the effects of hydrogen peroxide 3% on tonsillectomy time, operative blood loss and the number of ties used to achieve complete haemostasis.

METHODS

Thirty randomly selected patients underwent tonsillectomy in the Department of Otolaryngology of Basrah General Hospital, Iraq. As air embolism is occasionally known following H$_2$O$_2$ usage, the risk was mentioned to all patients. Some then refused to take part in the study, but all those who were included accepted the possibility of risk and gave their permission. In Group A (n = 15), a hydrogen peroxide 3% impregnated gauze pack was applied to one tonsillar fossa after the tonsil had been removed; in Group B (n = 15), no agent was used with the pack. The tonsillectomy was performed by the conventional dissection and snare method. The stubborn bleeders were ligated with silk suture.

Tonsillectomy operation time was calculated as the time interval between the first incision to the time when all bleeding and oozing was secured completely. The operative blood loss was calculated by weighing the blood impregnated gauze packs against an equal number of unused packs as well by measuring the volume of blood for each group separately, subtracting the volume of hydrogen peroxide used. The volume of blood in the packs was calculated by dividing the weight of blood on the pack by the specific gravity of blood, i.e. 1.055. The results of the study were statistically analysed by using paired t-test for significance.

RESULTS

The age range of the studied patients was 2-32 years: 17 were males and 13 were females. The average time for tonsillectomy in the non-hydrogen peroxide group was 12.9 minutes. With the use of hydrogen peroxide 3%, the average time was reduced to 8.9 minutes, which meant a reduction in tonsillectomy time of 31%. This is statistically significant ($p < 0.0001$). The average operative blood loss was calculated by weighing the blood impregnated gauze packs against an equal number of unused packs as well by measuring the volume of blood for each group separately, subtracting the volume of hydrogen peroxide used. The volume of blood in the packs was calculated by dividing the weight of blood on the pack by the specific gravity of blood, i.e. 1.055. The results of the study were statistically analysed by using paired t-test for significance.

Table 1: Comparison between non-H$_2$O$_2$ and H$_2$O$_2$ groups regarding time, blood loss and number of ties in tonsillectomy.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Average</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time of tonsillectomy in minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group B (n=15), Non-H$_2$O$_2$</td>
<td>12.9</td>
<td></td>
</tr>
<tr>
<td>Group A (n=15), H$_2$O$_2$</td>
<td>8.9</td>
<td>31</td>
</tr>
<tr>
<td>Blood loss (ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group B, Non-H$_2$O$_2$</td>
<td>45.5</td>
<td></td>
</tr>
<tr>
<td>Group A, H$_2$O$_2$</td>
<td>30.5</td>
<td>32.9</td>
</tr>
<tr>
<td>No. of ties used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group B, Non-H$_2$O$_2$</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Group A, H$_2$O$_2$</td>
<td>0.75</td>
<td>50</td>
</tr>
</tbody>
</table>

was 0.75. This mean a 50% reduction in the number of ligatures used in tonsillectomy after the use of hydrogen peroxide as a haemostatic agent, which is also statistically significant ($p < 0.0001$). All these results are shown in Table 1.

DISCUSSION

The first known tonsillectomy was performed by Cornelius Celsius about 2000 years ago. After enucleating the tonsil with his fingernail, he suggested the fossae should be washed with vinegar and painted with a medication to reduce bleeding. Since that time techniques for faster tonsillectomy with less bleeding have been searched for and various haemostatic agents and technique been tried. Sharp and Rogers, used calcium alginate swabs to achieve haemostasis after tonsillectomy, but reduction in both tonsillectomy time and blood loss was not significant.

In the past, many studies were done utilizing electrocauterization for haemostasis with Papangelou demonstrated a 30% reduction. Waston and Murty, in their study of 1,036 cases, achieved good haemostasis and a tonsillectomy time of 9.2 ± 40min, but the use of electro-cauterization results in increased postoperative pain and excessive slough formation in the tonsillar bed which results in infection and secondary haemorrhage. Laser tonsillectomy under general anaesthesia is shown to reduce surgical blood loss and postoperative pain as well as increase the recovery rate.

The use of hydrogen peroxide as a haemostatic agent in tonsillectomy was not found when review-
ing the available literature. Hydrogen peroxide has been used for decades as a haemostatic agent in orthopaedics. Chang et al. carried out a study in 120 pediatric patients undergoing adenoidectomy with use of cold hydrogen peroxide. They found that the incidence of oozing and active bleeding decreased when cold hydrogen peroxide was applied.

The present study confirms that the use of hydrogen peroxide in tonsillectomy achieved a reduction in tonsillectomy time and operative blood loss by 31% and 32.9%, respectively. All these results are statistically significant.

No adverse effect was reported by the use of hydrogen peroxide in tonsillectomy in the present study despite some reports stating that dangerous sequelae can result from the use of such a preparation, especially when used in neurosurgical fields. Dubey et al. presented a case of suspected gas embolism following hydrogen peroxide irrigation of the surgical field during posterior fossa surgery in the prone position. Severe cardiovascular collapse occurred when the wound was irrigated with a hydrogen peroxide solution.

The interesting additional benefit of hydrogen peroxide is its action to clarify the exact localizations of bleeders which need to be ligated, especially in cases of difficult dissection in fibrotic tonsils with excessive bleeding. This advantage has been utilized by Kalloo et al, who used hydrogen peroxide spray through an endoscope. This resulted in enhancement of clot dissolution and endoscopic visualization of the bleeding source. The limitations of this present study are the absence of testing the long term effect of hydrogen peroxide and no long term follow-up of the patients. The number of patients studied was also relatively small, indicating the need to perform a broader study with a longer period of follow up.

**CONCLUSION**

Local application of 3% hydrogen peroxide on the tonsillar bed after tonsillectomy is beneficial as it decreases the procedure time and the volume of blood loss as well as number of ties used.

**REFERENCES**


Intravenous Lidocaine for Refractory Chronic Orofacial Pain
Two case reports and a literature review

Abdulaziz Almahrezi,1 Louise Lamb,2 Mark A Ware,2 Yoram Shir,2 *Ibrahim Al-Zakwani3

1Department of Family Medicine and Public Health, College of Medicine & Health Sciences, Sultan Qaboos University, Muscat, Oman; 2McGill University Health Centre, Pain Centre, Montreal General Hospital, Montreal, Quebec, Canada; 3Department of Pharmacy, Sultan Qaboos University Hospital, Muscat, Oman

*To whom correspondence should be addressed. Email: ial_zakwani@yahoo.com

ABSTRACT This report presents the results of treatment of two adults, at the Pain Center of Montreal General Hospital, Canada, with intravenous lidocaine for intractable orofacial pain. Repeated lidocaine infusions (1 mg/kg in a bolus, followed by 4 mg/kg infused over 1 hour) resulted in satisfactory pain relief in both patients, and the drug was well tolerated. Intravenous lidocaine therapy may be considered for intractable orofacial pain; further research is warranted.

Keywords: Facial pain; Lidocaine; Therapeutics; Humans; Review; Literature; Case reports; Canada

Chronic orofacial pain includes a group of disorders with diverse etiologies affecting approximately 10% of the adult population and 50% of the elderly1 of whom at least 50% seek medical treatment.2 Diagnosis is difficult due to lack of a clear diagnostic classification3 and routine treatment modalities are often not effective.4 Surgery may be considered in selected cases; however, current international guidelines recommend multi-modal approaches for the management of orofacial pain. These include pharmacological, nerve blocks, physiotherapy and psychological therapies.5, 6

Intravenous lidocaine has been used in a variety of neuropathic pain syndromes such as diabetic neuropathy7 and post herpetic neuralgia.8 To date, few published reports exist on the therapeutic role for intravenous lidocaine in chronic orofacial pain.9 Here we describe two patients, who presented at the Pain Center, Montreal General Hospital, Canada with features of a mixed nociceptive-neuropathic pain syndrome, but with a primarily nociceptive etiology. They both experienced long-term pain relief after repeated lidocaine infusions.

CASE 1
This 46-year old female presented with a long history of pain in the area of both temporomandibular joints (TMJ). The pain was constant and sharp in nature and woke the patient up to 2-3 times per night. The average pain was 8 out of 10 on a visual analogue scale (VAS), a measure of pain intensity expressed on a zero to ten score. In addition, the patient described severe
attacks of intermittent ‘pulling-like’ pain, lasting for 30 to 60 minutes. The pain was provoked by chewing solid foods and exposure to humid weather. Mild pain relief was obtained with local ice packs and rest. She had undertaken five surgical procedures on both TMJs, including a prosthesis on the right and an osteotomy on the left.

Apart from a small area of dysaesthesia in the distribution of the mandibular division of the right trigeminal nerve, the rest of the neurological examination yielded no pathologies. In particular, the patient had no evidence of facial muscles atrophy, weakness or allodynia. However, tenderness bilaterally over the TMJs was noted. The patient was diagnosed with a mixed nociceptive-neuropathic pain syndrome and she was treated with the following medications sequentially: amitriptyline, 25mg/day, gabapentin, up to 900mg/day and sustained release oxycodone up to 20mg/day. Trials with each of these medications had to be abandoned prematurely due intolerable side effects experienced by the patient despite a very slow and careful titration. In view of the patient’s poor tolerance, further trials with other oral medications were not initiated. Nerve blocks were not offered. Furthermore, a trial of physiotherapy which included transcutaneous electrical nerve stimulation (TENS) did not yield any significant result.

As an alternative, the patient was given a trial of intravenous lidocaine, using 1 mg/kg in a bolus followed by an infusion of 4 mg/kg over 1 hour. Response to treatment was recorded using both the VAS and the Neuropathic Pain Scale (NPS)\(^\text{10}\); pre-infusion and at 1 hour, 4 days and 14 days post-infusion. During the infusion, and for 14 days thereafter, the patient’s pain decreased by more than 70% [Figure 1]. She reported no pain while chewing, and was able to have a solid meal for the first time in years. The patient received four lidocaine infusions during a period of four months with ongoing pain relief. Since beginning lidocaine treatment the patient has not been taking any other pain medications.

**C A S E  2**

This 51 year old female presented with chronic pain over the right mandible. The patient had a history of a benign right mandibular cyst for which she had mandibular condyle and disc removal with graft reconstruction. The pain was refractory to botulinum toxin.
injections, sympathetic ganglion blocks, and various oral medications including opioids and anti-convulsants. The patient underwent replacement of the right TMJ; however, despite significant improvement in function, the pain persisted. The pain was described as constant, deep, with numbness and tingling at the painful area and was triggered by eating and speaking.

On examination, she had difficulty opening her mouth and moving her chin from side to side. The patient had no facial weakness or asymmetry. Tactile and cold hyperalgesia was detected over the lower part of the right face. The remainder of the neurological assessment including cranial nerves, motor, sensory, and cerebellar examination was normal. At the time of referral, she was taking amitriptyline 75mg/day, gabapentin 1800mg/day, lorazepam 1.5mg/day, and ketorolac 10 mg as necessary. Further titration of the doses of both amitriptyline and gabapentin had previously failed due to the development of intolerable side effects. Her average VAS daily pain score was 8 out of 10.

The patient was diagnosed with a mixed nociceptive-neuropathic chronic postsurgical pain. A trial of low dose methadone had to be stopped due to an allergic reaction. The patient was given a trial of intravenous lidocaine, 1 mg/kg in a bolus followed by an infusion of 4 mg/kg over 1 hour. One hour after the treatment the patient experienced total pain relief [Figure 1]. Pain levels increased during the ensuing two weeks, but remained low compared to the pre-infusion period. The patient subsequently received nine infusions in eight months, with ongoing pain relief and improved function, and has decreased her pain medications by 20-30%.

**Discussion**

Lidocaine, an amide local anesthetic and an anti-arrhythmic agent, possesses analgesic properties when given systemically particularly in chronic neuropathic pain conditions, cancer pain, fibromyalgia, and chronic daily headaches. Findings from experimental models of neuropathic pain suggest that lidocaine acts by suppression of abnormal ectopic discharges which are generated by damaged primary afferents or dorsal root ganglion neurons. Intravenous lidocaine was also shown to produce suppression of mechanical allodynia and hyperalgesia. The postulated mechanism of action was thought to be peripheral in origin; however, this view was later challenged with several lines of evidence suggesting that lidocaine may also have central effects. Some of these observations include: suppression of polysynaptic C-fibre evoked flexor responses without evidence of conduction block at the periphery; suppression of the activity of dorsal horn neurons evoked by ionophoretically administered glutamate; selective inhibition of a nociceptive response in the isolated rat spinal cord. Clinical studies and human experimental models have reached similar conclusions as to the action of intravenous lidocaine on mechanical allodynia and hyperalgesia. In one study on healthy volunteers using the heat/capsaicin sensitisation model, intravenous lidocaine (5 mg/kg) was shown to have a selective effect on secondary hyperalgesia.

Several well-designed studies have documented the effectiveness of intravenous lidocaine. A randomised double-blind cross-over study showed that intravenous lidocaine (5mg/kg over 30 minutes), but not saline, reduced symptoms of pain, dysesthesia, paraesthesia and nightly pain exacerbation as well as sleep disturbance in patients with chronic diabetic neuropathy for a period of 3-21 days. According to VAS, 11 out of 15 patients had a significant reduction (a reduction of greater than 15 millimetres on the VAS) in pain for a period of 3 days and no reported side effects. Another similarly designed study investigated the effect of two different doses (1 mg/kg and 5 mg/kg over 2 hours) of intravenous lidocaine on 24 patients of postherpetic neuralgia. The investigators reported a significant reduction in VAS for evoked pain and a decline in the area of allodynia for up to 120 minutes following treatment with intravenous lidocaine. Circumoral paraesthesia was the only side effect reported by patients who received the higher dose. In a similar study investigating the effects of intravenous lidocaine (5 mg/kg over 30 minutes) on neuropathic central pain, a significant reduction (VAS score decreased by 50% or more) in spontaneous pain was reported. This response was achieved by 10 out of 16 patients. The period of observation in this study was for 45 minutes after the infusion. Investigators, using quantitative sensory testing, also reported a reduction in the intensity of mechanical allodynia and hyperalgesia. Side effects were reported as moderate and consisted mainly of lightheadedness, somnolence, nausea and dysarthria. Sorenson et al studied...
11 fibromyalgia patients who were randomised to lidocaine (5 mg/kg over 30 minutes) and saline in a double-blind and crossed-over design trial. Four patients were reported as responders (a reduction of 16 millimetres or greater on the VAS). Three of the responders had a reduction in pain for 4-7 days. Side effects were mild and included nausea, perioral numbness, drowsiness, dysarthria and tremor. In another study of postamputation pain, intravenous lidocaine (1 mg/kg bolus + 4 mg/kg over 40 minutes), but not the placebo (diphenhydramine) decreased stump pain until 30 minutes after the infusion. No side effects were reported.

Both of our patients had reported nausea and light-headedness during the period of the infusion. This is consistent with previously mentioned studies which documented only mild and transient adverse effects; however, serious side effects such as arrhythmias and pulmonary edema can occur with high doses. Close monitoring of the patient while receiving the infusion is therefore recommended. This is usually performed by means of a continuous electrocardiogram (ECG) and a regular check-up of blood pressure and heart rate.

Besides side effects, other problems associated with the use of intravenous lidocaine include: invasiveness and the inconvenience of the intravenous route. Possible alternatives to intravenous lidocaine are transdermal lidocaine and oral congeners such as mexilitine. A lidocaine patch has been shown to be effective in a randomised controlled trial in postherpetic neuralgia; however, patients may find it inconvenient to apply a patch on the face. Furthermore, it is not known if a good response to intravenous lidocaine would predict a similar response to transdermal lidocaine since the concentration of plasma lidocaine would be much lower with local administration. Mexilitine has been suggested as an alternative particularly in patients who respond negatively to intravenous lidocaine; however, the use of this drug is associated with frequent side effects which limit its usefulness.

In randomised controlled trials of chronic pain, the doses of intravenous lidocaine used ranged between 1 to 5 mg/kg. However, we elected to use a total dose of 5 mg/kg since this dose seems to be the best documented effective dose according to a systematic review of these trials.

The significance of our case reports is twofold: first, they provide the first evidence of the usefulness of intravenous lidocaine as a therapeutic option in the management of chronic orofacial pain. Second, these reports raise the likelihood that intravenous lidocaine is not only effective in pure neuropathic pain syndromes, as the current literature suggests, but may also be effective in mixed nociceptive and neuropathic pain conditions that are primarily nociceptive in origin. The observations that lidocaine is effective in non-neuropathic pain conditions such as burns and fibromyalgia, together with the variable effect of lidocaine in peripheral or central neuropathic pain conditions and its effect beyond the pharmacological half-life, are all supportive of this latter conclusion.

**CONCLUSION**

In summary, based on this experience, intravenous lidocaine was a powerful and successful treatment option after several insufficient therapeutic attempts that included oral pharmacotherapy, nerve blocks and surgery. A trial of intravenous lidocaine should be considered much earlier, even if a multimodal management approach is used. Moreover, intravenous lidocaine should also be tried in pain syndromes of nociceptive origin rather than reserving it only for patients with pure neuropathic pain conditions. However, further research is needed to determine the exact role of intravenous lidocaine in the treatment of orofacial pain.

**REFERENCES**


Cushing’s Disease
Pituitary Surgery versus Adrenalectomy

Omayma El-Shafie,1 Fatma B Abid,1 Nayal Al-Kindy,1 Dilip Sankhla,2 Nicholas J Woodhouse3

ABSTRACT We describe two patients of the Department of Medicine at Sultan Qaboos University Hospital, Muscat, Oman, with Cushing’s disease. Their magnetic resonance imaging scans of the pituitary were negative. One patient was treated by transsphenoidal surgery and the other by bilateral endoscopic adrenalectomy. Both procedures were successful and the patients cured. The advantages and disadvantages of these two approaches are discussed.

Key words: Cushing’s disease; Surgery, pituitary; Endoscopy; Adrenalectomy; Case report; Oman.

Cushing’s disease is an uncommon and complex disorder.1 Only six cases have been seen at Sultan Qaboos University Hospital, (Oman) since 1986 (personal observation by Nicholas J Woodhouse). Cushing’s disease is caused by excessive adrenocorticotropin hormone (ACTH) production by a pituitary tumour2 and must be distinguished from Cushing’s syndrome, due to ectopic ACTH overproduction by endocrine tumours of the lung, pancreas and other rarer sites.3 In this article, we describe two patients with Cushing’s disease whose pituitary magnetic resonance imaging (MRI) scans were negative. Additional studies were then required to document the presence of a pituitary lesion and exclude an ectopic ACTH source. Our adult female patient was cured by transsphenoidal surgery (TSS) and the young boy with growth retardation by bilateral endoscopic adrenalectomy. The reasons for these different therapeutic approaches are discussed below.

CASE 1
A 40-year-old English woman was referred for further investigation of recent onset hypertension. On examination, central obesity was observed. She also had ulcerated mosquito bites on both shins that had not healed for four months. Cushing’s syndrome was suspected clinically and ACTH dependant disease confirmed by finding raised cortisol and ACTH levels. Cortisol levels were suppressed by more than 50% by high dose dexamethasone which suggested pituitary

Department of1 Medicine, 2Radiology & Molecular Imaging, Sultan Qaboos University Hospital, Muscat, Oman; 3Department of Medicine, College of Medicine & Health Sciences, Sultan Qaboos University, Muscat, Oman

*To whom correspondence should be addressed. Email: omayma0@hotmail.com
disease. As there was no evidence of a pituitary or ectopic tumour on the MRI or computed tomography (CT) scans, her disorder was initially controlled using oral ketoconazole and metyrapone. She was then referred to the endocrine unit at the Hammersmith Hospital in London where she underwent selective inferior petrosal sinus sampling with ACTH measurement following the intravenous administration of cortisol releasing hormone. This confirmed the presence of a left-sided pituitary lesion, and subsequently the left side of the pituitary gland was blindly removed by TSS surgery. Histology revealed a basophilic tumour positive for ACTH on immunofluorescence. She remains well four years later, only taking replacement thyroxine.

**CASE 2**

A 14-year-old boy was referred with a five-year history of growth retardation, hypertension, obesity, delayed sexual development (testosterone 1.8 (n = 6-27nmol/l)) and severe low back pain. Earlier studies had shown ACTH levels repeatedly within the ‘normal’ (4.2, 4.0, 3.5 [n=2.2-10.0pmol/l]) range at a time when his cortisol levels were elevated (923, 918, 812 [n = 240-620nmol/L]). Upon examination, he was clinically short with a height of 128 cm, and cushingoid features. His BP was 140/80 on lisinopril. An X-ray of the lumbar spine revealed severe loss of bone mineral density and multiple wedge compression fractures [Figure 1]. The bone densitometry was very low at 0.542 g/cm². Cortisol levels were suppressed by 95% after high dose dexamethasone suppression [Table 1] indicative of pituitary ACTH production, but as in Case 1, there was no evidence of a pituitary tumour on his initial MRI scan. Ectopic ACTH production was deemed unlikely in the absence of any obvious source on the CT or MRI scans of the lungs or abdomen; furthermore, the administration of octreotide (100 mcg 8 hourly subcutaneously for 3 days), failed to lower his cortisol levels. The patient then under-
height had increased from 123 to 140 cm and testosterone from 1.8 to 10.1 nmol/l. Unfortunately, there was only minimal improvement of his bone mineral density 0.554 g/cm², but his total skeletal calcium must have increased considerably having grown 17 cm. We expect his bone mineral density to increase when his growth spurt is completed. Twenty six months later, however, he had become more pigmented, the ACTH level having increased from 4 to 22.6 pmol/L and he developed an obvious microadenoma in the anterior lobe of the pituitary [Figure 2]. He was then referred for TSS abroad.

DISCUSSION

Both of these patients had Cushing’s disease but their pituitary tumours were not visible on MRI at presentation. This is reportedly the case in up to 40% of newly diagnosed patients. In these circumstances, therapeutic decision-making becomes more difficult as invasive measures are required to document the pituitary origin of the excess circulatory ACTH levels before referral for surgery. The first patient underwent canulation with sampling of the petrosal sinus veins, and later removal of the left half of her pituitary gland. The disease was cured, but five years later she still requires thyroxine replacement therapy. Varying degrees of postoperative hypopituitarism are seen in 30-40% of all cases particularly those whose surgery is carried out blindly as in this case. Recently the European Cushing’s disease survey group reviewed 668 patients: major non-hormonal complications of trans-septosphenoidal occurred in 14.5% of the patients; hypogonadism in 14-53%; hypothyroidism in 14-40%, and severe growth hormone deficiency in 13%. We concluded that the second patient also had pituitary dependant disease evidenced by his response to high dose dexamethasone and an absence of any obvious ectopic ACTH source on CT or MRI scanning of the lungs and abdomen. Furthermore, there was no response to octreotide; cortisol levels are usually unchanged in Cushing’s disease whereas a fall is observed in patients with ectopic ACTH production as such tumours express somatostatin receptors. In the 14-year-old boy whose complaints were short stature and back ache, we were faced with two options: either to refer him abroad for petrosal sinus sampling and pituitary surgery, or to remove his adrenals. The former procedure would involve the risk of developing growth or sex hormone deficiencies whereas adrenalectomy by laparoscopy is safe and immediately curative. Moreover, the patient’s sphenoid sinus had failed to pneumatise making a transsphenoidal approach more difficult. We therefore proceeded with laparoscopic bilateral adrenalectomy. Nelson’s syndrome, characterized by accelerated growth of the pituitary tumour in the face of postoperatively reduced cortisol levels, occurs in between 8 and 38% of patients with Cushing’s disease after adrenalectomy, usually 7 to 24 years after surgery. After 26 months, he became more pigmented, his ACTH level increased and an MRI scan showed an 8 mm anterior lobe tumour [Figure 2]. The rapid growth of our patient’s tumour is unusual and might have been related to the dramatic response to dexamethasone evidenced by a 95% reduction of his cortisol level during testing. This observation prompted us to speculate that patients with Cushing’s disease who have the most dexamethasone sensitive pituitary tumours are more likely to develop Nelson’s syndrome following adrenalectomy than those whose tumours are more resistant. However, in two other reports, the degree of susceptibility to the dexamethasone suppression test did not provide evidence for prediction of Nelson’s syndrome. Age itself appears to be important; Nelson’s syndrome being more common in young patients.
and rare after the age of 40. The patient has now been referred for TSS abroad.

REFERENCES


**CASE REPORT**

**Occlusion of Upper Genital Tract Following Lower Segment Caesarean Section for Placenta Praevia**

*Mini B Poothavelil, Ilham Hamdi, Geeta Zunjurwad*

**ABSTRACT**

Uterine cavity occlusion following caesarean section for central placenta praevia culminating in haematometra and thereby amenorrhoea is one of the rarest long term complications of lower segment caesarean section. We report a case of 28 year old primigravida with Grade 4 placenta praevia who underwent elective lower segment caesarean section at 35+ week’s gestation. She was presented at Nizwa Hospital, Sultanate of Oman, after 7 months with cyclical lower abdominal pain and amenorrhoea. She was treated by hysteroscopic adhesiolysis and an in utero Foley’s catheter. She had complete resolution of her condition within 2 months and resumption of menstrual cycles. Multiple haemostatic sutures at caesarean section for placenta praevia can be an causative factor for such a complication along with other risk factors like multiple caesarean sections, chorioamniotis etc. Recognition of these factors, meticulous surgical technique and appropriate post operative care can effectively prevent it.

**Keywords:** Placenta previa; Adhesions, intrauterine; Occlusion; Genital tract; Case report, Oman.

---

**WHEN THE PLACENTA IS IMPLANTED** partially or completely over the relatively noncontractile lower uterine segment, it is termed placenta praevia.1 In an attempt to achieve haemostasis during caesarean section, a number of innovative techniques have been tried apart from the usual method of oversewing the open bleeding sinuses on the lower segment.2, 3, 4 None of the methods have been known to cause postoperative intrauterine adhesions, haematometra or amenorrhoea. In our unique case, there was absence of any other risk factors like previous caesarean section, placenta accreta or polyps.

---

Department of Obstetrics and Gynaecology, Nizwa Hospital, Nizwa, Sultanate of Oman

*To whom correspondence should be addressed. Email: drminibenny@hotmail.com*
teral and extending posteriorly covering the cervical internal os. Multiple haemostatic sutures were made with polyglactin 910 number 0 in the posterior uterine wall in view of the multiple bleeding vessels from the placental bed. A small vertical extension around 1.5cm at the right side of the anterior lower segment was sutured with polyglactin 910 number 0. The internal os was digitally checked. The postoperative period was uneventful and the patient was discharged on the third postoperative day.

The patient returned after 7 months to Nizwa Hospital Outpatient Department with complaints of cyclical lower abdominal pain and amenorrhoea. Detailed ultrasonography revealed a distended uterine cavity with hypoechoic shadows resembling haematometra with bilocular endometrium in between [Figure 1].

The patient underwent cervical dilatation and diagnostic hysteroscopy with adhesiolysis. Intraoperatively, the cervix was pinpoint dilated gradually with Hegars dilator until no. 9 under ultrasound guidance. During the process, flimsy adhesions around the internal os area were broken followed by drainage of the haematometra. Hysteroscopy revealed flimsy adhesions around the internal os and the lower uterine cavity, the cavity being filled with dark altered blood [Figure 2].

Foleys catheter no.16 was introduced into the uterine cavity and the bulb dilated till 10cc to facilitate
the drainage of the intrauterine blood, the procedure being uneventful [Figure 3]. The patient was administered intravenous antibiotics and discharged on the third postoperative day after removal of the intrauterine Foley’s catheter. After 2 weeks, she resumed her menstrual cycle with a normal flow of 5 days with minimal dysmenorrhoea.

A follow up ultrasonography revealed complete resolution of the haematometra and no evidence of any intrauterine adhesions [Figure 4]. The patient was followed up for 10 months after the procedure and found to have continued regular menstrual cycle with normal flow. Ultrasonography confirmed no persistent cervical stenosis.

**DISCUSSION**

Intrauterine adhesions following lower segment caesarean section are one of the rare complications with few case reports available in the literature.

Our patient was a primigravida with no previous history of uterine surgery, no other antepartum events suggesting chorioamnionitis, no postpartum evidence suggesting endometritis-like fever, uterine tenderness, offensive lochia or absence of lochia. A normal amount of lochia was observed in the postpartum period. She was asymptomatic for approximately 5 to 6 months thereafter. Our investigations of the patient led to the diagnosis of intrauterine synchie and haematometra as result of the multiple hemostatic sutures that were made in the raw surface of the lower segment in an attempt for quick haemostasis.

These adhesions were flimsy and could be easily broken during slow gradual dilatation, followed by hysteroscopy. Insertion of a Foley’s catheter served two purposes: first, easy and complete drainage of the hematometra and second, preventing apposition of the uterine walls and allowing the regeneration of the endometrium. Lower segment caesarean section for placenta preavia will eventually lead to bleeding from open sinuses of the relatively noncontractile lower segment that can be catastrophically heavy. Such events can be severe in the presence of a morbidly adherent placenta or placenta accreta or percreta. After the delivery of the placenta, the bleeding vessels are oversewn by haemostatic sutures usually polyglactin 910 or daxon. When we are confronted with a patient experiencing placenta preavia with massive haemorrhage in cesarean delivery, haemostasis is first attempted using uterotonic drugs, uterine massage, and intrauterine packing. However, if these manoeuvres fail, a number of surgical techniques to control severe bleeding at cesarean delivery have been proposed, such as uterine artery ligation, hypogastric artery ligation, and uterine compression suturing. Perhaps these procedures alone or in combination can successfully control the haemorrhage. Every obstetrician must be familiar with these simple methods in order to avoid having to perform a hysterectomy and thus preserving the reproductive capability, as well as diminishing the operative morbidity.

There are a few other techniques such as the isthmocervical apposition, an intrauterine balloon or a B-Lynch uterine brace suture. Women with multiple previous cesarean deliveries risk the development of uterine synchie and ventral fixation of the uterus to the abdominal wall. Hysteroscopic treatment of in-
trauterine adhesions is a safe and effective treatment for the restoration of normal menstruation.8

**CONCLUSION**

Although rare, the occurrence of intrauterine adhesions and haematometra/pyometra can be a long-term sequel of caesarean section.9 The associated risks factors include placenta praevia, placenta accreta, percreta, choorioamnionitis with prolonged rupture of membranes, multiple caesarean sections or a scarred uterus, postpartum endometritis and iatrogenic occlusion of the posterior uterine wall. Manual removal of the placenta can contribute significantly to these complications.10 The use of multiple sutures through the uterus is effective to control postpartum hemorrhage, but may lead to uterine synechiae.

**REFERENCES**


ABSTRACT Traumatic rupture of the diaphragm (TRD) poses a challenge to both radiologists and surgeons. They are uncommon and occur following blunt abdominal or lower thoracic trauma. The right side involvement is less common than the left side and is easily missed. Spiral computed tomography (Spiral CT) with image reformation is very useful in the diagnosis of TRD and identifying associated injuries. Early diagnosis and repair reduces mortality and morbidity. We present the case of a 16 year old boy who was involved in a high speed traffic accident with blunt injury to his thorax and abdomen. He was referred from a peripheral hospital in Oman for further management at Sultan Qaboos University Hospital. A spiral CT scan of thorax and abdomen with image reformation helped in the early diagnosis and management of the traumatic rupture of his right hemidiaphragm.

Key words: Right hemidiaphragm; Rupture; Computerized tomography; Case report; Oman.

CASE REPORT

A 16 year old male patient who was involved in a high speed traffic accident with blunt trauma to chest and abdomen was admitted to a peripheral hospital in the Sultanate of Oman. The patient was treated for a suspected haemothorax on the right side with intercostal tube drainage and transferred after five days to Sultan Qaboos University Hospital for further management.

An initial chest X-ray showed an elevated right hemidiaphragm with mild superomedial tenting and with normal pleural spaces. There were no rib frac-
tures. It also showed a suboptimally placed right intercostal drainage catheter tube [Figure 1]. A follow-up spiral CT scan of thorax and abdomen showed features of right diaphragm rupture and liver herniation into the thorax [Figures 2 and 3]. The axial scans showed a subtle indentation on the posterolateral and medial aspects of the liver (arrow heads) which caused the ‘collar sign’. The waist-like constriction in the liver and its herniation into the thorax are well shown in the reformatted coronal and sagittal oblique images. Associated injuries were liver contusion and a small subcapsular haematoma and thorax images showed a posterior segmental atelectasis of the right lower lobe [Figure 2].

The abdominal findings were confirmed at surgery and the diaphragm was repaired. No surgical intervention was performed for the liver injury as it was small. The suboptimally positioned intercostal catheter was removed.

**DISCUSSION**

Acute traumatic diaphragmatic ruptures are uncommon and occur in about 0.8-8% of major blunt trauma victims.¹ Left-sided tears are more common than right-sided tears.² Blunt trauma to lower thorax or abdomen secondary to a motor vehicle accident is the most common cause of close rupture of the hemidiaphragm.¹, ³ There are two possible mechanisms for rupture of a hemidiaphragm. One is a lateral impact which causes shearing of the diaphragm due to distortion of the chest wall; the other is frontal impact which leads to an increase in intra-abdominal pressure.⁴ Penetrating injuries can also cause diaphragmatic injuries but these are usually small.²

The injury to left hemidiaphragm is more frequent following blunt trauma, possibly due to a buffering effect of the liver on the right hemidiaphragm. However, the relative infrequency of right-sided injury may also be associated with under-diagnosis.¹ Associated injuries like liver injuries are also common.⁴

Chest X-rays and spiral CT scanning with image reformation are useful in the early diagnosis of TRD. On axial CT images, the axis of the image is tangential to the dome of the diaphragm, so axial images alone are suboptimal for the diagnosis of diaphragmatic rupture. CT is also helpful in identifying associated injuries with TRD as in our patient who also had liver contusion with subcapsular haematoma and right lower lobe segmental atelectasis. Other imaging mo-

---

**Figure 1:** Chest X-ray frontal and lateral projections showing elevated right hemidiaphragm with superomedial tenting. An intercostal drainage tube is shown on the right side.
Trumatic Rupture of the Right Hemidiaphragm: Diagnosis aided by Computerized Tomography and

Diagnostics like ultrasound and magnetic resonance imaging are also used, however to a lesser extent in patients with polytrauma. Chest X-ray findings of TRD include elevation of hemidiaphragm, distortion or obliteration of the outline of the hemidiaphragm and contralateral movement of mediastinum. Our patient showed a markedly elevated right hemidiaphragm with some “tenting” of the superomedial aspect [Figure 1]. Right diaphragm injuries are more difficult to detect on the radiograph. The liver serves to block the herniation of abdominal contents into the thorax. Herniation of the liver is often overlooked. The differential diagnosis for elevated right hemidiaphragm includes right lower lobe atelectasis, pleural effusion and pulmonary contusion. 

The use of spiral CT has improved the accuracy in the diagnosis of TRD with an overall sensitivity of 71% and specificity of 100%. A recent study by Nchimi A et al, has suggested that diaphragmatic discontinuity, diaphragmatic thickening, segmental non-recognition of the diaphragm, intrathoracic herniation of abdominal viscera, elevation of the diaphragm, and both haemothorax and haemoperitoneum were strong predictors of blunt diaphragmatic rupture. Other CT findings include the ‘collar sign’ a waist-like constriction of the hollow viscus or solid organ at the site of diaphragmatic tear and the dependent visceral sign. In the dependent visceral sign, the diaphragmatic injury allows the upper portion of the liver to drop posteriorly against the ribs.

The collar sign on the right side [Figure 2] appears as a focal indentation of the liver (arrow heads). This is a subtle sign which can be easily overlooked. This requires careful analysis of the sagittal/coronal multiplanar reformatted images [Figure 3]. An increase in sensitivity from 16.7% to 50% in cases of right hemidiaphragm rupture with additional use of reformation images has been reported.

Although spiral CT images with multiplanar reformation are quite useful one should be aware of the false positive and negative CT findings in the diagnosis of TRD. Not all diaphragmatic defects are specific for rupture. Posterolateral defects are shown in about 6% of asymptomatic adults which are mainly on the left side. Not all diaphragmatic defects are related to trauma, they can be congenital such as Bochdalek’s

Figure 2: Axial contrast enhanced spiral CT. Shows ‘collar sign’. A subtle indentation (arrow heads) on the posterolateral and medial aspect of the liver. Note also the liver laceration.
foramen dorsally. It is also difficult to identify the margins of the hemidiaphragm following thoracic trauma because of pleural effusion, particularly in small tears and in the absence of intra abdominal contents herniation into the thorax.¹

CONCLUSION

We report a case of a young patient with traumatic rupture of the right hemidiaphragm with liver herniation into the thorax. Spiral CT with image reformation helped in the early diagnosis and management of the patient. CT is also useful in assessing associated thoraco-abdominal injuries. Early diagnosis of this condition and repair of the diaphragmatic tear are desirable as it reduces the mortality and morbidity.

REFERENCES


Fracture of Supracondylar Process of the Humerus

S S Suresh

**Abstract**

The supracondylar process of the humerus is a rare skeletal anomaly, which is usually an incidental finding when X-rays are taken for some other purpose. The process can fracture resulting in pain and tender mobile swelling over the medial aspect of the arm, and consequent neurovascular symptoms, or entrapment neuropathies. The anomaly, which fractured in a clinical situation, is described, followed by a review of the literature.

**Keywords:** Hemeral fractures; Median nerve; Entrapment neuropathies; Osteochondroma; Case Report; Oman.

**Case Report**

A forty year old man presented at Ibri Regional Hospital, Oman with a painful right elbow following a road traffic accident. He had an undisplaced fracture of the ala of the sacrum, with a break in the inferior pubic ramus. There was a tender mobile swelling over the medial aspect of the distal humerus which was noticed on admission. There was no distal neurovascular deficit. X-rays revealed a fracture of the supracondylar process.

The patient was given an arm sling for three weeks. Subsequent periodical assessment did not reveal any neurovascular compromise.

**Discussion**

A supracondylar process, an anomaly seen in about 1% of the population, is a bony projection found about 5-7 cm above the medial epicondyle of the humerus. It arises from the anteromedial aspect of the distal humerus and is directed downward, forward and medially pointing to the medial epicondyle. A fibrous band called the ligament of Struthers, is typically associated with the supracondylar spur and connects it to the medial epicondyle, thereby forming a ring. The median nerve and the brachial artery pass through this. It is usually an incidental finding when X-rays are taken for some other purpose. The fibrous band of Struthers corresponds to the lower part of the tendon of the vestigial latissimocondyloideus muscle seen in climbing mammals. The supracondylar process, the fibrous
The suprachondylar process and the suprachondylar foramen form a foramen. This is similar to the supratrochlear foramen seen in many animals. Accessory slips of pronator teres may arise from the suprachondylar process. The incidence varies from 1-3.5%. Knox in 1841 first reported its occurrence in man, as it was previously thought to be present only in animals. The suprachondylar process was described in detail by Struthers in 1849. In 1930, Lund presented the first case of a fracture of the suprachondylar process. The process gets fractured occasionally when it is felt as a tender mobile piece of bone just above the elbow medially and it is easily made out in radiographs. If it has fractured, the treatment is excision with due care to the neurovascular structures. Conservative management is recommended if there are no neurovascular symptoms after a fracture.

Compression of the nerve or artery can occur at many sites in the upper limb, and the least common cause of compression is the suprachondylar process and the suprachondylar foramen. The suprachondylar foramen may be a site for entrapment of the brachial artery and the median nerve. Solieri in 1929 first described the spur and the ligament as a cause of median nerve compression. The symptomatology can mimic carpal tunnel syndrome or may cause features of claudication pain in the forearm. The branching pattern of the median nerve in the forearm is abnormal in those with a spur and a Struthers ligament. Occasionally, the ulnar nerve may be stretched over the spur and can result in ulnar nerve palsy. The symptoms are exaggerated by active extension and pronation of the forearm. It should be differentiated from osteochondroma, which projects away from the elbow joint, and the bony cortex of the humerus is continuous with the tumor. Usually it is seen in an asymptomatic patient as a painless mass or on an X-ray taken for some other purpose. The anatomic relationship with the neurovascular structures is well demonstrated by magnetic resonance imaging (MRI). Pecina et al recommend MRI in peripheral nerve compression syndromes, and they reported an anomaly which they named "incomplete Struthers ligament". In their case though the ligament was incomplete it functioned the same way as a complete ligament.

**CONCLUSION**

Purpose of this paper is to raise awareness of this entity and its clinical significance. It should also be differentiated from the osteochondromas arising from the lower medial border of the distal humerus. Distal humeral osteochondromas project away from the elbow. In a patient with pain and sensory disturbance of the forearm and hand, the elbow should be routinely examined for the presence of a suprachondylar spur.

**REFERENCES**

4. Pieper I. On the incidence of the suprachondyloid proc-
Fracture of Supracondylar Process of the Humerus


Figure 2: Computed tomography scan (3-D) showing supracondylar process

Figure 3: Computed tomography scan (axial view) showing healing of the supracondylar process fracture
Unilateral Anomalous Arterial Pattern of Human Upper Limb
Anatomical Description and Clinical Implications

*Vandana Mehta, Jyoti Arora, R K Suri, Gayatri Rath

ABSTRACT A unilateral case of variations in the brachial and antebrachial arterial branching pattern of a human upper limb is reported. A high bifurcation of brachial artery along with superficial course of ulnar artery was observed. Additionally, the profunda brachii and common interosseous artery originated from the radial artery instead of brachial and ulnar arteries respectively. An atypical branching pattern of arteries in an upper limb could pose a challenging problem to vascular surgeons while performing reconstructive procedures.

Key words: Brachial artery; Anomalies; Case Report; India.

STRIKING ANATOMICAL VARIATIONS IN THE origin and course of major arteries of the upper limb have always been of interest among anatomists, hand surgeons and radiologists.1 This study describes a unilateral case of a high division of the brachial artery into a superficially coursing ulnar artery and a relatively deeper radial artery. The high origin of the radial artery is the most frequent anomaly in the arterial pattern of upper limb of human beings (incidence of 14.27% in dissected material),2 whereas a superficial ulnar artery has been reported in 2% of cases.3 This case report presents a case from an anatomical perspective and also highlights the clinical implications.

Novel diagnostic procedures such as Doppler pressure studies and ultrasonography are being widely used in vascular surgery;4 therefore, anomalies in the vascular pattern of upper extremity are of immense significance for clinicians, especially radiologists and surgeons.

CASE REPORT

The following variations in the arterial pattern of left upper limb was observed in a forty-year-old male cadaver during the course of an undergraduate medical training programme at Varhman Mahair Medical College, New Delhi, India.

First, a high division of the brachial artery was ob-
served. The brachial artery as usual was seen to be a continuation of axillary artery at the lower border of teres major; however, it extended to the upper border of latissimus dorsi and measured only 1.4 cm in length. It was found to divide into the radial and ulnar arteries, 9.8 cm proximal to the neck of the radius. The lateral root of the median nerve was found to be interposed between radial and ulnar arteries [Figures 1 and 3].

Second, there was an anomaly of the radial artery. It was seen to branch off the profunda brachii artery in the mid-arm and the common interosseous at the level of neck of radius in the cubital fossa [Figure 2]. It then continued as the radial artery in the forearm and hand. The common interosseous artery as usual was found to divide into the anterior and posterior interosseous arteries.

Third, there was an anomaly of the ulnar artery. It traversed superficially to the epitrochlear muscles and continued to be in the same plane in the forearm as well. It was found to be the sole contributor to the superficial arterial arch in the palm.

**DISCUSSION**

Accurate and detailed knowledge of the relationships and possible anatomical variations of the arterial branching pattern of the upper extremity is vital during reparative surgery in this region. In addition, trauma in this area may lead to a life threatening haemorrhage from these aberrant vessels. Inadequate
knowledge of the anatomical variations of the arterial pattern may render surgery difficult.

A high origin of the radial artery is reported to be the commonest variation in the arterial pattern of upper limb with an incidence of 14.27% in dissected specimens. It is considered as a kind of persistent superficial brachial artery. However, a high origin of an ulnar artery is quite uncommon (2.26%). In the present specimen, the ulnar artery remained superficial to the epitrochlear muscles, and was found to be the sole contributor to the superficial palmar arch. It appears that the superficial course of the ulnar artery in the present case has been referred to as a "superficial ulnar artery" in earlier studies.

An unusual variation of the superficial ulnar artery was reported where it was found to be rudimentary. Giving only small branches to the biceps in the arm and in the hand, it anastomosed with the radial artery to complete the superficial palmar arch. Contrarily, in the present study, the superficial ulnar artery was not rudimentary and, in the hand, was found to be the sole contributor to the palmar arch.

As per standard textbook descriptions, the arrangement of structures in the cubital fossa from lateral to medial side is biceps tendon, brachial artery and median nerve. Interestingly, in the present report, this arrangement differed as the median nerve interposed between the radial and ulnar arteries; therefore, this altered the topographical relationship of vessels in the elbow. This would make simple clinical procedures such as blood pressure recording a complicated ordeal. We also suggest that a surgeon, while performing operations in the arm, would have to exercise extra caution not to injure the lateral root of median nerve since it is interposed between the radial and ulnar arteries.

The anomalies of various blood vessels of upper extremity can be explained on the basis of embryological development of the vascular plexus of limb buds. The lateral branch of the lateral intersegmental artery gets enlarged to form the axial artery of the upper limb, which later terminates in a capillary plexus from which digital branches arise.

The brachial artery is the proximal part of this axial artery beyond the lateral border of teres major while the distal portion, beyond the cubital fossa, is the interosseous artery. The radial and ulnar arteries arise relatively late in development as new vessels branch from brachial and interosseous arteries respectively. Embryologically, the radial artery arises from the brachial artery in the arm, disappearing at a later stage, resulting in one main artery running along the flexor aspect of the limb. Thus it may be inferred that the primitive axial and superficial arteries play a role in the embryogenesis of the arteries of the upper limb.

In an earlier study, the axillary artery gave off medial and lateral divisions. The superficial/medial division coursed along the path of ulnar artery. The deep/lateral division provided the branches of brachial artery in the arm while in the cubital fossa it gave branches, which normally arise from the ulnar artery. In the present investigation, we prefer to designate this lateral branch as brachio-radial as it subserves the distribution of brachial artery in the arm and at the level of cubital fossa continues as the radial artery.

The superficial position of the ulnar artery renders
it vulnerable to trauma. However, it also makes it amenable to cannulation if required. Understandably, the superficial position of the artery may also account for its mistaken identity as a vein and accidental injection of drugs may lead to serious consequences. Further, such vascular anomalies may cause confusion during interpretation of angiographic procedures.

**CONCLUSION**

The anatomical variations in this case report demonstrates a high bifurcation of the brachial artery into the radial and ulnar artery associated with the origin of the profunda brachii and common interosseous arteries from the radial artery in the arm and forearm respectively, along with superficial course of ulnar artery. Such an aberrant arterial anomaly of the upper limb is an extremely rare finding.

Awareness of variations in the vasculature of upper limb is an important consideration, as a large number of diagnostic and therapeutic procedures are performed in this region. Precise knowledge of arterial anatomy of the region is also vital for logical interpretation of angiograms. Good insight into vascular anatomy of upper limb is imperative for successful reconstructive operations.

**REFERENCES**

Tracheal Bronchus

*Anupam K Kakaria, Sukhpal Sawhney, Rajeev Jain

The patient is a young female who presented at Sultan Qaboos University Hospital, Oman, with symmetrical joint pains, erythema nodosum and episcleritis. She was suspected to have sarcoidosis and a computed tomography (CT) chest scan was performed to look for mediastinal lymphadenopathy. The mediastinum showed evidence of enlarged lymph nodes. Incidentally detected was a bronchus arising from the trachea a short distance before the carina. The tracheal bronchus is seen to arise from the right posterior wall of the trachea [Figures 1-3].

The tracheal bronchus maybe supernumerary if the right upper lobe trifurcates and supplies the upper lobe normally and the accessory bronchus supplies an extra segment of right upper lobe. If the right upper lobe bronchus bifurcates into two, the accessory bronchus usually supplies the apical segment of the right upper lobe and it is a displaced bronchus. In our case, the right upper lobe bronchus shows a bifurcation [Figure 3] suggesting this is a case of a displaced right apical bronchus. Figure 4 shows a virtual bronchoscopic reconstruction.

The anomaly is a rare entity with a reported in-
cidence of 0.1-3%.² Most of the tracheal bronchi are asymptomatic; however, some children with tracheal bronchus may suffer from stridor, recurrent infections and respiratory distress. In adults, this condition may be associated with difficulties in intubation and ventilation during anaesthesia. Accidental intubation of the tracheal bronchus may lead to inadequate ventilation of the rest of the lung. It may also cause overinflation of the lobe supplied by the tracheal bronchus and pneumothorax. Accidental occlusion of the tracheal bronchus by the endotracheal tube can lead to atelectasis of the involved lobe. If patient is aware of this condition, the anaesthesiologist should be alerted prior to any elective surgery to allow precautions to be taken.

REFERENCES
Despite the fact that we are in the age of globalisation, it is apparent that health, distress, illness and disability are still influenced and shaped by local and socio-cultural forces. This is not a new idea as it owes its origin to the father of medicine, Hippocrates, and it is borne out by a myriad of empirical research studies in more recent years. Despite this, one of the lingering fallacies of modern health care is a blind adherence to the biomedical model which myopically assumes that the repertoires of human behaviour and its counterpart, ill-health, have a direct and simple association with the functions or dysfunctions of our body. Heralding a new perspective from the Arab part of the world, such prevailing dogma is about to be dented with this volume focusing on healthcare for the Arab population. The volume extrapolates from available literature to shed light on the importance of psychosocial variables in the matrix of health care and diseases.

The conceptual outlook of the book is grounded within a biopsychosocial model that emphasises the interplay between biological and social milieus as central to the predisposition, onset, course and outcome of most disorders. The volume aims to provide a practical and patient-centred guide to assist health professionals in dispensing better clinical care to Arab patients. The book is divided into 17 chapters. The editors of this volume selected authors from the region with the most credentials in the field of caring for the Arab patients. Thus, the message from this volume comes from the people in the field rather than from arm-chair researchers living far from the region.

The themes covered in this volume are diverse including health education, palliative care and factors leading to care-seeking as well as the culturally specific odium of distress. Within biopsychosocial perspectives, the volume also tackles how to care for Arab patients with specific disorders including anxiety, depression, somatoform disorders, post-traumatic stress disorders, eating disorders and substance abuse. If you feel these are ‘Cinderella’ topics or you are simply a ‘hard science type’, then you will also find in this volume topics like genetic disorders highlighting the molecular side of such endeavours in the Arab world.

If one expects to be enlightened in this volume on background social-cultural teachings for the care of
Arab patients, then one would be disappointed. Far from presenting the literature relevant to the region, the coverage is nothing more than a good literature review deriving largely from non-Arab population and narrated in a Euro-American vernacular. Most of the literature for this comes from that accessible through PubMed. Work published in Arabic or local journals is ostensibly absent. Reading individual chapters, no coherent theme emerged germane to the biopsychosocial model. Most of the chapters simply narrated trends in the Western population with no explicit implications for the situation in the Arab part of the world. The coverage is basically a typical textbook presentation of common disorders and other issues that authors vaguely deemed to have biopsychosocial trajectories. Mundane themes for patients care from a biopsychosocial perspective such as clinical communications and the doctor-patient relationship receive scant attention. This volume also perpetuates the myth that there is a prototype Arab character. Empirical evidence suggests that Arab countries are heterogeneous, characterised by a mosaic of sub-cultural diversities.

Is this then one of those books which someone like Edward Said would perceive to present a veneer of ‘orientalism’ in this case gowned with medical science? The volume is a bold attempt to chart some directions in biopsychosocial research in a region where such quest has largely remained dormant. The volume hinges on the assumption that health is inescapably social, a view largely ignored in research coming from the Arab world. The volume should be on the shelves of everyone who is directly or otherwise involved in all matters related to patient care, healthcare management, health sciences research, and, for that matter, policy makers. In the era of ‘Arab bashing,’ the strength of this volume is that it teach us that ailing Arab persons should receive the same level of compassion and care from their doctors as their counterparts elsewhere.

Reviewer
Samir Al Adawi
Department of Behavioural Medicine, College of Medicine & Health Sciences, Sultan Qaboos University, Muscat, Sultanate of Oman
Email: adawi@squ.edu.om
Whether it is the effect of global warming or just that satellite TVs are instantaneously connecting us to different parts of the world, dealing with the aftermath of natural disasters is becoming an increasingly common phenomenon. Huge efforts are expended on the key tasks of saving and rebuilding lives and rehabilitating infrastructure, but natural and other disasters also leave many people with subtle yet intransient emotional disorders. In the mental health fraternity, the sequelae of such disasters are labelled post-traumatic stress disorders (PTSD). In Western populations, PTSD affects approximately 3.6% of the population and the impact and of distress this condition constitute a serious public health problem.

In the ‘decade of the brain’ with neurogenetic hegemony, negative experiences which manifest as PTSD have been compared to brain injury where exposure to the events leads to structural and functional changes in the brain. The emotional reaction has been attributed to adverse conditioning. These two views have been the mainstays of treatment modalities available for sufferers of PTSD.

Everyone began to think that the psychoanalytic approach had been consigned to footnotes in history books. It is better to think again. This volume, Wounded by Reality by Ghislaine Boulanger came to add spice to the established approach to PTSD. This book not only rekindles the psychoanalytic approach, but the volume brings fresh insight into the treatment modalities of PTSD. The book specifically focuses on adult onset trauma. The author’s interest in the field began in the 1970s among Vietnam veterans. Her thirty years of experience of examining and treating PTSD and survivors of adult onset trauma has been concretised in this volume. The strength of the book is its focus on demarcating the difference between childhood trauma and trauma that is experienced in adulthood. The book is written succinctly and does not pretend to reach the general public. The book is intended for American psychoanalysts who have a substantial knowledge not only of Freud, but also of psychoanalysis as a field, and who focus on treating PTSD using the method of psychoanalysis. This volume presents many fascinating clinical vignettes that are likely to grab the reader’s attention. However, when one reflects, the clinical descriptions are nothing more than theoretical constructs stemming from a Freudian perspective.

The unique issue on which Boulanger focuses, and which has not been widely explored by many clinicians, is the fact that trauma faced at different stages in life results in different outcomes; this automatically creates the need for a different approach to treatment. The author proposes, and pertinently makes the case for, this alternative modus operandi. This is valuable in itself as most other professionals in the field focus on
psychopharmacology when it comes to rehabilitating PTSD. Not long ago, it was essential to ‘listen’ to prozac, now this volume poses new questions about the unconscious mind of those who have been wounded by natural or other disasters.

With the increasing numbers of trauma-causing disasters around the world, the need is growing for a treatment system that can be applied internationally. Yet, there is no evidence that this volume will be a panacea for the global challenges posed by natural and other disasters. This volume may not meet the needs of the 80% of the global population living outside Western Europe, North America and Argentina. Many have testified, be it bush-doctors in equatorial Africa or psychiatrists in urban Asia that different cultures neither perceive nor experience trauma alike. With much of the world aloof to the psychoanalytical approach, this book would be more useful for practitioners, psychoanalytic ones in particular, in New York and Buenos Aires rather than Jakarta or Muscat.

REVIEWER

Hazar Al-Zadjali

Department of Behavioural Medicine, College of Medicine & Health Sciences, Sultan Qaboos University, Muscat, Sultanate of Oman

Email: zadjali21@hotmail.com
Molecular Anatomic Imaging: Pet-CT and SPECT-CT Integrated Modality Imaging


Author: Gustav K. Von Schulthess (and over 70 contributors)
Publisher: Lippincott Williams & Wilkins
ISBN: 0-7817-7674-0

This book is a revised edition of Clinical Molecular Anatomic Imaging (2003) by the same author. Since the publishing of the first edition, the importance of positron emission tomography (PET) and single photon emission tomography (SPECT) in the clinical arena has evolved achieving a definite place in the realm of clinical investigations of patients. PET is today recognized as the best tumour imaging modality by the scientific community worldwide while SPECT has almost completely replaced planar imaging in many nuclear medicine investigations. Although very sensitive compared to other imaging modalities, PET and SPECT lack the ability to define anatomical landmarks precisely. This book discusses how this shortfall is currently overcome by integrating PET and SPECT with computed tomography (CT). The combination with CT anatomical imaging with PET and SPECT functional/molecular imaging has revolutionised patient investigation. The addition of CT allows more accurate attenuation correction of the photons by overlying tissues and organs.

This edition is written in a style that makes it more useful to those in clinical practice rather than those interested in research into molecular imaging. The book is divided into 7 parts which are further subdivided into a total of 68 chapters.

- **Part 1 (chapters 1-13)** covers the basic aspects of PET, SPECT and CT scanning as well as those of PET/CT and SPECT/CT. It provides a quick review of basic physics of radioactivity, radioactive decay and production of radionuclides as well as basic physics of PET and SPECT instrumentation, image production and image processing. There are some minor data inaccuracies in this part, e.g. the authors mention that $^{99m}$Tc is extracted from the alumina column as $^{99m}$Tc ion. It should actually be technetium pertechnetate ($^{99m}$TcO$_4^-$). Perhaps the authors could have expanded a bit more about the generator which is a source of 85% of our radiopharmaceuticals. The basic physics of PET and SPECT, is in generally well covered, clear and easy to be understood by the targeted clinicians and residents in-training. The
section on image co-registration and image rendering is great with good use of good illustrations. The chapters on quantification of PET and imaging are well developed, but would be more useful for researchers rather than clinicians.

- **Part 2 (chapters 14-20)** discusses the transition of PET and SPECT from research to clinical practice. The focus is on the various radiopharmaceuticals used in these investigations and also on clinical protocols. Although $^{18}$F-FDG is the most commonly used radiopharmaceuticals for PET, the authors cover the use of this and a broader set of other radiopharmaceuticals currently in clinical use, as well as those with strong clinical potential including C-11-labeled radiopharmaceuticals. This section summarises some of the important considerations regarding these radiopharmaceuticals and their desirable properties. Part 2 ends with a comprehensive treatment of the latest standards and imaging protocols for PET, PET-CT, SPECT and SPECT-CT.

- **Part 3 (chapters 21-27)** covers the clinical application of PET and SPECT in brain diseases. This section covers benign and malignant tumours of the brain, epilepsy, dementia, extrapyramidal disorders, cerebral infections as well as cerebrovascular disease. Using very good illustrations the authors begin by discussing normal brain findings in SPECT and PET. Then the focus is on brain tumours, specifically imaging of astrocytoma, oligodendroglioma and glioblastoma and also their metastases and radiation injury. Imaging of cerebral infection with PET using fluorodeoxyglucose (FDG) is well covered in this section, particularly since MRI and CT have difficulty in distinguishing between brain abscess and tumours, especially if the tumour is necrotic. An argument of how FDG-PET may be helpful in this area is made as well as the use of FDG-PET in distinguishing between toxoplasmosis and lymphoma in HIV patients. The chapter on cerebrovascular disease also includes an interesting section on methodologies for quantitive perfusion imaging. Chapter 20 is a good review of the existing types SPECT-CT hardware. It stresses the importance of quality control (QC). The tabulation of the protocols makes it easy for the reader to find what they need. The authors add a section on patient scheduling that may be useful for the organisation of a new department.

- **Part 4 (chapters 28-32)** covers the use of PET and SPECT investigations for the heart. The emphasis is on coronary artery disease and applications of PET and SPECT in the diagnosis. Of particularly interest in this section is the discussion of flow tracers in SPECT and PET and also metabolic tracers. Chapter 32 discusses integrated SPECT-CT in cardiac imaging and the use of attenuation correction.

- **Part 5 (chapters 33-57)** covers most aspects of body imaging in oncology including head and neck, thyroid, lung, pleura, gastrointestinal, colorectal and anal, breast, kidney, testicular, prostate and bone with very good illustrations. These chapters deal mainly with PET-CT and SPECT-CT imaging of tumours for staging and therapy monitoring and also radiation therapy planning. Regarding PET/CT, the focus is on $^{18}$F-FDG imaging of tumours which is currently the most important application of PET. This section also explains the use of the standardized uptake value (SUV) of lesions to differentiate benign from malignant tumours. Image artifacts due to technical and physiological problems are relevant to both molecular imaging and anatomical imaging techniques. The resulting artifacts in integrated images can be a problem in interpretation and need to be recognised. They are well covered and illustrated so this section would be helpful for any clinician who wishes to learn more about them. One chapter is reserved for PET and PET-CT applications in the planning of radiation therapy. PET/CT in radiation oncology planning is becoming more popular because it is capable of anatomic imaging and shows a wide variety of biochemical and biologic features of tumours that are known to influence radiation response and hence the potential of remission. The chapter is well organized and again well illustrated.

- **Part 6 (chapters 58-62)** is a short section that discusses imaging of inflammation in the body and the use of FDG-PET and SPECT-CT to detect infection and inflammation in various clinical settings. It includes musculoskeletal problems as well as infection in patients with prostheses and rheumatology disease.
Part 7 (Chapters 63-68) is concerned with miscellaneous and non-standard applications of PET-CT and SPECT-CT. It includes benign disease conditions, notably thyroid and parathyroid as well as benign bone tumours. There is a short section on the use of SPECT-CT in the diagnosis of pulmonary thromboembolism. The book ends with a discussion of paediatric applications in a set of separate chapters because of the particularities of investigations in children using ionizing radiation.

Overall, this is a good textbook of clinical molecular imaging. It discusses well the clinically practical aspects of this modality. Its contents are well organised, each chapter starting with an informative abstract of contents. The references are mostly up-to-date, with suggestions for further reading.

Although the book is fairly comprehensive in molecular imaging with respect to PET and SPECT, some sections could be improved e.g. the cardiac section could be more comprehensive at least for the nuclear physicians working at cardiac centres. In addition, it would have been good to include a section on optical molecular imaging which is a rapidly evolving clinical imaging modality, as well as a few statements on the newer hybrid imaging tools such as optical-ultrasound mammography and optical-MRI tools. The book comes with a CD-ROM that contains over 80 full cases that can be studied separately, but which are also referenced in the book making the reading more interactive.

Residents, radiologists, nuclear physicians and practising clinicians who would like a quick reference on topics such as PET, SPECT and integrated PET-CT and SPECT-CT will find this book very useful. I recommend it highly to this group and to students interested in the subject. Also it is a good book for basic scientists and their students interested in medical imaging and its relevance.

REVIEWER
Hadia Bererhi
Medical Physics Unit, Department of Radiology, College of Medicine & Health Sciences, Sultan Qaboos University, Muscat, Sultanate of Oman
Email: haddiab@squ.edu.om
Re: Continuity of Care - Literature Review and Implications

To the Editor,

We read the paper “Continuity of Care Literature review and implications” by Alazri M et al. with interest, and were gratified to find that it supported most of our personal biases regarding the benefits of continuity of care, in particular page 201, column 2, paragraph 3, lines 1-3, “In Type 2 diabetes, relational and longitudinal continuity could decrease diabetes related complications and improve the quality of life” [Reference 53] - exactly what we would expect from a strong, supportive, caring environment!

It was only when we got to the follow-on, page 201, column 2 and paragraph 3, lines 3-5 that some disquiet set in when we read “…however, another study showed that longitudinal continuity was associated with more diabetic complications” [Reference 52]. Perhaps, we reflected, the primary health care team in this study might have delayed appropriate referral for eye, renal or other complications, a problem that might be associated with the lack of proper secondary/tertiary diabetes support services.

However, page 201, paragraph 6, lines 7-9, goes on to state "In diabetes, longitudinal continuity has been associated with worsening diabetic control and increased risk of complications” [Reference 53]. This appeared to be in direct conflict with the earlier citation of reference 53.

On review of the references, it appears that Reference 52 is unrelated to diabetes; the paper by Love and colleagues deals only with asthma in adults.

Reference 53 by Hanninen et al. addresses the benefits of continuity of care in diabetes. Apart from its virtues, these authors also found that good continuity of care was associated with less satisfactory glucose control (Hb A1c 8.9 +/- 2.0 (+/- SD) vs. 8.3 +/- 2.0, P=0.04). Otherwise, we could not find any other evidence that continuity of care is bad for diabetic complications. It would be speculative to consider that a difference of Hb A1c of 0.6 percent, that was barely statistically significant in that study, is equivalent to “increased risk of complications.” In a recent comprehensive analysis of diabetic outcomes in Northern Europe, Wandell supports the concept that good continuity of care in diabetics was associated with better health related quality of life.

We would be grateful if you shared our concerns with Dr. Alazri and his co-authors. Some clarification would be gratefully appreciated.

George Carruthers and Hussain Saadi,
Department of Internal Medicine and Office of the Dean,
Faculty of Medicine & Health Sciences,
UAE University,
Al Ain, UAE

REFERENCES


**AUTHOR’S RESPONSE**

Thank you for the comments of Prof. Carruthers, Dean of Medicine at UAE University, and his colleague about our paper published in the SQUMJ, Continuity of Care - Literature Review and Implications.¹ Our response to his comments is as follows:

- We agree with Dr. Carruthers regarding reference no. 52 which is not related to diabetes, but to asthma and it came to the reference list by mistake. The correct reference for the study, which showed that longitudinal continuity has been associated with worsening diabetic control and increased risk of complications, is: Overland J, Yue DK, Mira M. Continuity of care in diabetes: to whom does it matter?² However, this study used data derived from patients referred by general practitioners to a diabetic clinic in a teaching hospital in Australia, thus, there is a possibility of sampling bias, as patients who do not have longitudinal continuity may have less chances to be referred. Furthermore, some of those patients might have developed already diabetes-related complications, thus, they have been referred to the hospital.

- Reference no. 52 has been corrected and now relates to diabetes.²

- Paragraph 6, lines 7-9, states “in diabetes, longitudinal continuity has been associated with worsening diabetic control and increased risk of complications.” The reference to this statement should be no. 52 (corrected) and not no. 53 in the article.

- I agree with Dr Carruthers that in the Hanninen et al study³ good continuity of care was associated with less satisfactory glucose control (Hb A1c 8.9 +/- 2.0 (+/- SD) vs. 8.3 +/- 2.0, p = 0.04) which could have a significant effect on the long term outcomes. In fact, the explanation for the poor glycaemic control has not been explored in this study, but an assumption is made that patients would like to be treated for diabetes with their usual GP who accepts less strict glucose control and concentrates more on achieving better well-being.

Overall, I would like to thank Dr. Carruthers for his valuable comments.

Mohammed Alazri
Department of Family Medicine and Public Health
College of Medicine and Health Sciences
Sultan Qaboos University

REFERENCES
Re: Prevalence and Determinants of Waterpipe (‘sheesha’) Tobacco use among Adolescents in Oman

To the Editor,

We write in response to the above mentioned article which appeared in the March 2008 issue of SQUMJ.1 The incidence of this emerging trend of waterpipe use is increasing at an alarming rate.2 Concerted efforts need to be made to actively alert young people in Oman to the potential hazards of this form of drug abuse. The importance of this should not be underestimated, as the waterpipe could easily become a means of not only tobacco consumption, but also other inhaled drugs of abuse.

At SQU College of Medicine, we have conducted a similar study using an anonymous questionnaire which was distributed to young Omanis in different regions of Oman. The main difference in our study was that our target group was young Omanis, age range 16-26 years as compared to school going adolescents in the above study. Participants were SQU students, medical students and other young people from elsewhere in Oman and the total number was 1,000. Overall, our study showed a lower prevalence of sheesha smoking in young people compared to other studies.3

We fully endorse the comments of the authors of the above study regarding introduction of comprehensive tobacco control legislation in Oman. Can we not campaign to increase awareness of the dangers of sheesha use among the youth of Oman?

Ragini Vaishnav
Department of Pharmacology & Clinical Pharmacy
College of Medicine & Health Sciences
Sultan Qaboos University

Talal Al-Aghbari, Thuraiya Al-Masoudi, Maha Al-Jabri - Medical students
College of Medicine & Health Sciences
Sultan Qaboos University

REFERENCES
FUTURE LEAN HOSPITALS (INTRODUCTION OF THE CONCEPT OF LEAN HOSPITALS TO GCC)

Mohamed Buheji, Itqan Management Consultancy, Oman.

It is about time to try to transfer the concept of ‘lean management’ to the GCC. All healthcare organisations are challenged to put performance excellence into practice through being as safe, thorough, productive, cost-effective, efficient and accurate as possible. That is really a challenge and, while many organisations are striving to achieve this goal, how they get there differs a lot from one healthcare organisation to the next. Lean management – Kaizen – and Toyota principles have managed to spread across many world-class hospitals which have tried different means to address the issue of quality-cost-delivery. Many projects undertaken in our hospitals fail or do not achieve results because they depend on sustainability, top management commitment, resource availability and staff culture. The good thing about the lean concept is that we can reduce the impact of these factors and still establish the lean processes. We present the principle of lean management in healthcare and how we expect future lean hospitals to look in practice i.e. how they deal with lengthy waiting lists, inefficient processes for discharging in-patients, delayed admissions, bottle necks between urgently needed surgeries, limitations of operating theatres and long waits at the pharmacy, or the challenge of enhancing bed occupancy rates for one day surgery. We will also discuss the importance of mapping and understanding and observing the process through teams. Elements of lean thinking were combined with this map to help identify “muda” (a Japanese word for waste). To understand which steps were not contributing to timely discharge, aspects of the existing process are categorised as value-added, non-value-added and waste.

FALLS - A KEY PERFORMANCE INDICATOR

Phang Ah Looi, Nursing Directorate, Sultan Qaboos University Hospital, Muscat, Oman.

Falls in healthcare settings are among the serious risk management issues facing the healthcare industry. Prevention of falls among patients and residents in acute and long term care healthcare settings requires a multifaceted approach and challenges healthcare providers to create a safe environment. In 2005, the incidence of falls in Sultan Qaboos University Hospital SQUH was found to be the second highest amongst incidences reported. A survey was done and presented to Nursing Management in February 2006. A reduction target of reduction in falls by 10% by December 2006 was set and an action plan implemented. A re-survey was carried out in early 2007 and a comparison was done for the years 2006 and 2007. Findings revealed a reduction in falls in 2006 by 12.5% compared to 2005. In-depth analysis showed that in 2005 there were 24 falls out of 17,239 total admissions with a percentage of 0.14% and in 2006 there were 21 falls out of 18,491 total admissions with a percentage of 0.11%.

OUTCOME AS A MEASURE OF QUALITY OF CARE IN ONCOLOGY: SQUH EXPERIENCE

Ikram A Burney, Mansour S Al Moundhri, Azhar J Rizvi, Shyam S Ganguly, Rashid Al Abri, Rafi A Ashrafi. Departments of Medicine, Family Medicine and Public Health, and Quality Management, Sultan Qaboos University Hospital, and College of Commerce and Economics, Sultan Qaboos University, Muscat, Oman. Email: ikramburney@hotmail.com

Measurement of outcomes is increasingly been employed not only in clinical practice but also as an indicator of quality of clinical care. The most commonly measured outcome in oncology practice remains overall survival rate. SQUH is on road to achieving excellence through quality and has already received ISO 9001:2000 certification. In an effort to seek continual improvement, quality measurement exercises have been initiated through out the hospital. The section of Medical Oncology is an integral part of the Department of Medicine, and endeavours to promote teaching, research and clinical service in accordance with the vision and mission of the University Hospital. Herein, we present the overall survival of four of the ten most common cancers diagnosed in the Sultanate of Oman. These include, in the order of occurrence, non-Hodgkin’s lymphoma (NHL), breast cancer, stomach cancer and Hodgkin’s lymphoma (HL). The studies were all retrospective in nature. The overall survival was compared with studies both from within the region, and with bench-mark studies. For NHL, with a median follow-up of 8 months, the 2-year survival was 64%; 90% for the low risk, 55% for the intermediate risk, and 15% for the high risk groups according to the International Prognostic Index (IPI). For HL, the 2-year overall survival was 64% according to the International Prognostic Factor Project (IPFP), the survival was 76% for 0-2 risk factors and 32% for three or more risk factors. For breast cancer, the 5-year survival rate was 67%; were 24 falls out of 17,239 total admissions with a percentage of 0.11%.

Note: This study was published in full in SQUMJ, Vol. 8, Issue 1, p. 21-36. Available at: www.squ.edu.om/squmj
Monitoring Clinical Care with Indicators
Shahnaz Wasti, Division of Obstetrics & Gynaecology, Royal Hospital, Muscat, Oman.

Quality improvement is not a goal it is a continuous process and requires planning, control and teamwork. Monitoring clinical care with indicators offers an opportunity for improvement in clinical care given to patients. The objective of initiating this programme in the Department of Obstetrics & Gynaecology in Khoula Hospital was to monitor care in an efficient and systematic manner and to match care with the standards that were set. Our aim was to assess the trends and traits of indicators before and after implementation of a specific intervention. Indicators were selected from the American College of Obstetrics and Gynaecology Manual of Obstetric care. Every indicator had a standard against which it was matched. These indicators were presented in the departmental meeting and consensus was obtained regarding implementation of this programme. The programme was initiated in January 2002 and results up to 31 January 2003 are presented. Avoidable factors were ascertained, guidelines were reviewed and a plan of management was formulated. Main outcome measures were trends of clinical indicators and the effect of educational measures, presentations and discussions on clinical care. Improvement in clinical care resulted in the following indicators: 1) In hospital maternal red blood cell transfusion rate; 2) In hospital initiation of antibiotics 24 hours or more so after term vaginal delivery; 3) Unplanned readmissions within 14 days of discharge; 4) Rate of caesarean section showing an increase; 5) Repeat caesarean section rate increased from 17.5% to 20%; 6) Post-partum unplanned return to operation theatre or delivery room showing a downward trend; 7) Laparoscopic surgery performed during this period monitored with indicators. An effective quality improvement can be established and implemented in a clinical department with existing resources. The observed changes presented were a direct result of monitoring clinical care with indicators on an ongoing basis. Commitment to the cause is important.

Bala Al-Marimutu, Nursing Services; Department of Behavioural Medicine, Sultan Qaboos University, Muscat, Oman and Lead Auditor Quality Management Department, Sultan Qaboos University, Muscat, Oman.

The Psychiatric Outpatients Clinic at Sultan Qaboos University Hospital (SQUH) Oman, is a referral clinic and operates on all five weekdays. All new and follow-up patients are given appointment dates for consultations and review, however, the increasing number of patients walking-in without appointments and the high number of patients not attending the clinic as per appointments was causing disruption to the effective implementation of the appointment system where resources could be planned and managed according to expected workload to provide quality patient-care. A 12-month retrospective study was carried to measure the prevalence of patients who ‘walk-in’ for consultation and patients who did not keep their appointments. The objectives were to identify any trend or pattern of patients who ‘walk-in’ without appointments and non-compliant behaviour of patients who did not attend given appointments. The accumulated data could be used to understand and possibly initiate a customer friendly outpatient’s consultation system without compromising on quality customer service. The study was carried from 1 January to 31 December 2006. The study revealed that 33.2% of patients walked-in without prior appointments and 34.4 % patients did not keep their appointments. The number of ‘walk-in’ appears to be related to the number of patients who did not keep their appointments. It is postulated that patients who did not turn-up for the appointments most probably turned up later as walk-ins. Psychiatric patients by virtue of their illness do relapse and need immediate interventions to prevent exacerbation of their illness. Accommodating ‘walk-in’ patients enables patients to have consultations at their own convenience with little disruptions to their work and social obligations. Clinics must meet customer needs or else these patients may default on medication and relapse or may seek alternative care elsewhere. The Department of Behavioural Medicine in SQUH in initiating a process for accommodating ‘walk-ins’ contributes positively towards meeting customer needs. A paradigm shift amongst health care managers is imminent.

Requirements of Adverse Events Reporting System: A Patient Safety Challenge in Omani Hospitals
Amr M Taman, Faculty of Medicine, University of Cairo, Cairo, Egypt and Quality Management Consultant, Head Quarters, Ministry of Health, Oman.

Reporting adverse events is an essential component of patient safety enhancement. The present cross-sectional study examined the perspectives of physicians and nurses working in two Omani hospitals regarding the requirements of reporting adverse events. Data were collected using a pre-tested self-administered anonymous questionnaire that included doctors’ and nurses’ opinions regarding the preferred model and requirements of an adverse events reporting system. Most respondents (67.65%) confirmed the presence of a reporting system of adverse events in their department. Nearly 60% did not accept the anonymous model, whereas the majority (91.5%) preferred the confidential one. Most respondents wished the recipient to belong to their own profession and over half (51.4%) admitted that they were reluctant to provide information about adverse events. The highest percentages claimed they did not report adverse events so as not to appear incompetent or incur negative consequences on their future career. Most respondents (71.8%) expected to receive a rebuke face to face and be closely watched in the future by their leader if they made an error. The majority of respondents mentioned that it is important to give the patient an expression of regret and an explanation of why the error happened (90.6%) as well as the hospital acknowledging its responsibility. The majority (more than 93%) perceived that it is important to offer support and professional help to colleagues who have been involved in adverse events. Nearly two-thirds strongly agreed that their wards are good at learning from errors, whereas about half stated that their wards are careful and thorough when giving information to patients after events. More than half confirmed that the mistake makes them try never to leave risky and demanding tasks to their colleagues or inclines them to change their work, whereas, only 39.6% expressed that it is distressing them. The study recommended confidentiality, protection of reporters and discretionary reporting of adverse events with guidelines, as well as an open and participative climate in which education is emphasised. The hospital should acknowledge its responsibilities and offer support, feedback and professional help to the staff who have been involved in adverse events.
Total Quality Strategy in Health Care: Oman Experience
Amr M Taman, Faculty of Medicine, University of Cairo, Cairo, Egypt and Quality Management Consultant, Head Quarters, Ministry of Health, Oman.

Over the last three decades, the Sultanate of Oman has achieved exponential strides in health development, reflected in the widely acclaimed rapid improvement in health indicators and the building of a comprehensive modern health infrastructure. However, the challenge facing the Omani Health System is to sustain its success and continue improvement. Therefore, the issue of health care quality assurance/ improvement assumed a pivotal importance for future health development prospects and is placed high on the Omani Ministry of Health agenda. The presentation will highlight the practical methodology for establishing Quality Management Systems (QMSs) in public healthcare (PHC) facilities and the different strategies, challenges and future perspectives of the National Quality Assurance/Improvement Program in PHC in Oman.

Guidelines for Total Quality Management in Health Care
Ali Al-Qaeda, National Guard Health Affairs, King Khalid University, Saudi Arabia.

Quality of healthcare is a concern in any health organisation. Quality is defined as best practice or customer satisfaction when the patients get what they need within the available facility. It is a broad management philosophy ensuring quality and leadership commitment which provide the energy and the rationale for the implementation of the process of continuous quality improvement. The quality system has three important areas: system improvement, system control and system development. The main component of each system will be discussed. A quality system is team-work for planning, implementing, monitoring and evaluating what we do in each department. All staff must be consulted and there must be the use of incentive and motivation. Quality is detailed procedures requiring top management commitment and system control by job description and policy procedures guidelines based on statistics. Benchmarking and self-assessment are important factors to improve the system. A blame free reporting culture should exist. Finally, quality is the responsibility of every staff member.

Healthcare Accreditation in a Corporate Organisation
Waleed Albedawi, National Guard Health Affairs, Riyadh, Saudi Arabia.

We have just finished the long trip toward (JCI) Joint Commission International accreditation and achieved this important goal at the National Guard Health Affairs (NGHA), Saudi Arabia (a corporate four hospital, 2,000 bed organisation). This process was full of challenges (systematic i.e. structural, and process challenges) as NGHA is uniquely a corporate organisation rather than a single hospital. The presentation will cover the following topics: experience of a corporate 4 hospital, 2,000 bed organisation in JCI accreditation; understanding; structure; process per set of standards/team/function; timeline; other activities.

Health Technology Assessment & Management in Iran
Ahmad Moslemi, Ministry of Health, Tehran, Iran.

In this study, first the definition and history of health technology assessment (HTA) and the stages of HTA development around the world are explained. Then the different uses of HTA in healthcare systems are studied. The methodology of HTA is explained then a model of HTA in medical equipment offered. The following topics are covered: 1. Assessment and selection of health technology (a) what is HTA? (b) developing stages of HTA (c) HTA methodology (d) application of HTA in different levels of healthcare systems (e) management of health technology (medical equipment management). 2. Study methods (a) study specification (b) method of data gathering and analysis. 3. Results: review of existing state of selection and use of medical devices; stakeholders in medical devices field; new technologies; model of medical devices acquisition; main participants in acquisition of medical devices; planning and financing. 4. Need assessment. 5. Selection. 6. Safety and performance. 7. Standardization. 8. Procurement. 9. Vendors and supply. 10. Importation. 11. Installation and commissioning: utilising quality assurance. training; safety; maintenance and repair. 12. Optimized model of HTA. 13. Conclusion.

Multidisciplinary Approach to Critical Analysis of Hospital Outpatient Appointment System by Utilizing Ishikawa (Fishbone, Cause-Effect) Diagram
Shakil Akhmad, Health Authority Abu Dhabi, Abu Dhabi, United Arab Emirates.

Our objective was to analyse critically the outpatient appointment system, identify areas for improvement and recommend solutions to the management. In a hospital, outpatient patient appointments form a significant part of the system. A system may be defined as, “A set of functions or activities within an organisation that work together for the aim of the organisation”. Consequently, the main focus of this case study is how a quality tool, ‘cause - effect diagram’ is utilised for critical analysis of the outpatient appointment system. A multidisciplinary group (doctor, nurse, receptionist, outpatient department (OPD) manager) was formed that brainstormed and used the cause – effect diagram to pursue the following: 1a) Problem identification: we analysed the data of customer complaints received at the hospital related to outpatient services and found that 70% of patients complained about the inefficiency of the OPD appointment system and were dissatisfied with it; 1b) Identification of root causes: after discussion the team agreed to examine six main factors: resources, people, environment, equipment, policies, procedure; 1c) Causes identified after identifying the main factors: a detailed brainstorming to discover possible causes related to each factor. 2. Results of brainstorming: (a) policies - 18 out of 20 policies had not been updated; ambiguous job descriptions resulting in confusion and conflicts etc; (b) procedures, old patient file retrieval system; inadequate queuing system etc; (c) people: training – 8 out of 10 frontline staff were not fully computer literate causing data entry delay; language barriers – 7 out of 10 receptionists knew only Arabic resulting in miscommunication, transaction delays between patient and receptionist etc; (d) equipment (lack of addressograph machine; no token system etc; (e) resources: lack of staff (doctors, porters, clerks), lack of sitting space; (f) environment: housekeeping – no written schedule for cleaning resulting in erratic cleaning and thus the whole place appeared untidy; designated smoking area – none for visitors who smoke, exposing
non-smokers and children to passive smoking; 3. Urgent and non-urgent recommendations to the hospital management. 4. Conclusion: This study helped to confirm that (a) there were numerous correctable causes plaguing the appointment system; (b) the project was able to achieve its objective of identifying causes using the Ishikawa diagram and make evidence-based recommendations; (c) the project proved that the multidisciplinary approach and usage of quality tools can help to improve quality in healthcare and may be used in problem solving for other healthcare issues as well.

**Strategic Management and Quality**

*Wafaa H Jad, King Abdulaziz University Hospital, Jeddah, Saudi Arabia.*

*Email: wafaa_jad@hotmail.com*

In pursuit of excellence, today’s managers are challenged to manage and improve the existing system at the same time as rebuilding and renovating towards the future system. This is a difficult, but not impossible, task given proactive thinking, strategic planning and good management of their organisations. Making the right decisions at the right time is vital. Following through on those decisions is the challenge. Strategic management, through its different phases, is the right approach for managers to make the right decisions at the proper time (planning ahead), following through on them (operating and measuring performance), and guiding their organisations to success (monitored through the balanced scorecard). In short, ‘strategic management’ is the proper management approach and technique for policymakers, executives, and managers seeking excellence.

**Ways to Improve Patient Safety**

*Wafaa H Jad, King Abdulaziz University Hospital, Jeddah, Saudi Arabia.*

*Email: wafaa_jad@hotmail.com*

Healthcare providers have always considered the provision of safe patient care essential. Now, however, there is an increased emphasis on looking at the processes of care, and how healthcare organisations can identify patient safety risks and reduce the occurrence of medical errors. Studies of adverse patient incidents have heightened our awareness of the need to redesign processes to prevent human errors. It is time for organisations to use cognitive ergonomics and increase focus on human factors analysis to make health care services safer for patients. We will focus another following questions: “How can safety be improved? Are there other mistake-proofing techniques? Can barriers or safeguards prevent untoward events? Where are patients at risk? Where to start?” We will also emphasise: everyone has a role in patient safety; proactive and reactive actions to be taken to reduce risk; sharing safety improvement ideas with example of a sentinel event; examining the safety of processes; redesigning the process for safety improvement and how to test the redesigned process.

**Patient Safety and Nursing Education**

*Girija Kalayil, Nursing Program, Sultan Qaboos University, Muscat, Oman.*

*Email: girija@yahoo.com*

The challenge of achieving significant improvements in patient safety is one of the key tasks facing healthcare at the start of the 21st century. Patient safety is the foundation of healthcare practice and education internationally. Quality education is essential to ensure the continuous provision of safe and competent health professionals entering the workforce. The role of education in creating a safety culture through the inclusion of issues such as human factors theory from the outset of the practitioner preparation programme is explored. A patient safety incident was defined by the National Patient Safety Agency (NPSA), in 2004 as, “Any unintended or unexpected incident which could have or did lead to harm for one or more patients receiving NHS funded care”. NPSA issued a Seven Steps to Patient Safety Guide: 1. Build a safety culture. 2. Lead and support your staff. 3. Integrate your risk management activity. 4. Promote reporting. 5. Involve and communicate with patients and the public. 6. Learn and share safety lessons. 7. Implement solutions to prevent harm. Steps 1, 6, 7, are relevant to healthcare education. Concerns about the quality and safety of health care have changed practice expectations and created a mandate for change in the preparation of health care professionals. Quality and Safety Education for Nurses (QSEN) derived 6 core quality and safety competencies as follows: patient-centred care; teamwork and collaboration, evidence-based practice; quality improvement; safety, and informatics. The new emphasis on patient safety demands attention to both individual and system errors. Individual errors are of concern regarding nursing education and patient safety. Educators are encouraged to engage in a culture shift whereby student error is considered from an education systems perspective. Educators and schools are challenged to look within and systematically review how programme structures and processes may be contributing to student error and undermining patient safety. Training students by simulation based teaching and objective structured clinical evaluation reduces the risk and assures patient safety. Educators must address discontinuities between education and practice. Structures and processes for student supervision in clinical learning include: legislation of nursing; regulatory structures within health sectors and educational institutions; communication, collaboration and adequate preparation of staff to supervise students. Safe and competent practice is reliant on clearly articulated structures and operationalising processes between the health sector and higher educational institutions that can assist staff and students to meet the requisite standards of practice.

**Innovative Quality Health Care Activity by Quality Improvement Committee of Al Nahda Hospital, Oman**

*Suresh Venugopal, Al Nahdha Hospital, Muscat, Oman.*

*Email: sure5155@omantel.net.om*

The Quality Improvement Committee of Al Nahdha Hospital, Oman, conceived and conducted an innovative healthcare activity in 2007. A comprehensive preventive health check up of 100 Omani health care personnel from 25 departments/sections of Al Nahdha Hospital for body mass index, blood pressure, fasting blood sugar and cholesterol was done. The results were: 90% of staff tested was between 20 and 40 years of age. Twenty-eight % were obese and 30% were overweight; 28% had hypercholesterolaemia; 20% had prediabetes and 3% were diabetics; 35% had hypertension and 10% had hypertension. A synopsis of this study was distributed to the Director General, the Executive Director and all the Heads of department. “Are you waiting for the first heart attack to change your lifestyle? Change your lifestyle today!” was the clear
message to all. This innovative activity helped the staff understand the concept that ‘quality of healthcare begins with me’. It also established a feeling (inexplicable in words) that the Hospital Committee cares for the health of its staff.

**Learning from Adverse Clinical Outcomes – Root Cause Analysis**

Veena Paliwal, Ministry of Health, Salalah, Oman  
Email: paliwal@omantel.net.om

The objectives of the study were to learn from root cause analysis of adverse pregnancy outcome cases and to improve the quality of service and patient safety. The study was done at Sultan Qaboos Hospital, Salalah, from May to October 2007. Root cause analysis is a part of clinical risk management done in cases of patient complaints, critical events, near misses and poor neonatal out comes or still births. We present the results of important problems over a period of 6 months where we could make reasonable changes. Problems which were studied were either very serious or repetitive. As reported in earlier studies, communication was the biggest factor especially over the weekends. In high risk cases, especially in diabetes with still birth/shoulder dystocia, noncompliance was an important factor. This was dealt with more aggressively by providing dedicated clinic and health educators. Wound infection morbidity was dealt with by doctor and staff training in aseptic techniques. Management of massive obstetric haemorrhage was dealt with by putting stricter guidelines of blood loss management along with the audit for correct estimation of blood loss. We conclude that vigilance about adverse outcomes gives us feedback on our services. We can learn from our mistakes and take appropriate measures to prevent or dilute their effects on patients’ conditions. This also gives us guidelines to improve services and patient safety. Stress is put on team work, good communication and adequate supervision of new or junior doctors. Reminders are given to doctors and staff to follow guidelines and to consult senior doctors whenever required. High-quality healthcare requires a balance of risks, benefits, and patients’ preferences, not necessarily rigid adherence to clinical guidelines.

**Technology Impact on Patient Safety and Quality Improvement: Opportunity Costs Versus Opportunities Lost**

Rejeanna Freij Hunter, Solumedix Management Consultancy, Abu Dhabi, UAE.  
Email: rejjifreij@solumedix.com

Opportunity cost is defined as the value of foregone opportunities or alternatives unable to be achieved because of time or money utilised or dedicated towards some other option. Ultimately, it is the net balance or total of opportunity costs sustained, either tangible or intangible, in not taking certain opportunities and the costs of making alternative decisions. Because of the increased demand on limited resources, healthcare providers are increasingly required to make choices among competing claims. Opportunity cost as applied to healthcare also raises the issue of the quality or quantity of life. Part of the opportunity cost in resisting investment in technology solutions for healthcare organisations is increased patient safety. How is that measured? Number of lives? Number of near misses (if they are reported)? The bottom line? The universal existence of patient safety initiatives indicates that patient safety is an issue at the forefront of healthcare organisations and that priority of investment needs to be taken to address it. Clear communication and appropriate decision-making among clinical staff - often aided by technology and computer systems - are crucial elements to delivering the right care to the right patient at the right time. In the 2003 Healthcare Information and Management Systems Society (HIMSS) Patient Safety Survey, nearly all respondents indicated that technology can address at least one patient safety issue and 93% reported that technology is likely to play a significant role in reducing medication errors. Other areas of potential improvement cited included: the reduction of excessive time spent on administrative tasks; the improvement of the quality of care provided, and the increased consistency of care provided. These survey findings support what might be expected in any industry: information technology (IT) improves both quality and efficiency. Healthcare industry leaders and policy experts report that rapidly adopting information technology is the most effective cure for costly and harmful medical errors and increased patient safety. It is important for healthcare executives to recognise the importance of linking IT strategy and patient safety strategies. Like clinical expertise, IT expertise and the investment in IT solutions is required to produce the best patient safety solutions.

**The Effect of Double - Checking of Filled-Prescriptions in Reducing Potential Dispensing Errors at Outpatient Pharmacy in Sultan Qaboos University Hospital, Oman**

Waiel Al-Naeem, Pharmacy Department, SQUH, Muscat, Sultanate of Oman.  
Email: wadalnaeem@hotmail.com

Sultan Qaboos University Hospital (SQUH) is a government funded tertiary care teaching hospital. Outpatient pharmacy dispensing is one of the major activities at the SQUH Pharmacy. It dispenses an average of 350 outpatient prescriptions daily. In 2005, a total of 146,989 prescriptions containing 353,336 items were dispensed to outpatients. It is policy to double check all prepared prescriptions before handing the medications to the patient. The policy’s aims are to minimize dispensing errors, optimise pharmacotherapy and comply with good pharmacy practice. At SQUH, no previous study had looked into the number and types of dispensing errors detected by the double-checking of filled-prescriptions in the outpatient setting and whether there is any association with time of dispensing. This study was part of the continual improvement process in the Pharmacy and will be used for educational purposes. The objectives were: 1. To establish data on number and types of potential dispensing errors detected while double checking and identify if there is any relationship between dispensing errors and time of dispensing. 2. To identify the factors leading to dispensing errors and propose solutions. 3. To evaluate the clinical significance of the documented dispensing errors. A four week prospective interventional study was conducted at the Outpatient Pharmacy in SQUH from 11 November - 11 December 2006. The study included all prescriptions prepared by the pharmacy staff members and found to have a dispensing error. Data was captured in the data collection form. Two clinical pharmacists independently evaluated the clinical significance. During the study period, 180 potential dispensing errors were discovered. Seventy-four percent of these errors were in adult patients’ prescriptions and 26% in paediatric patients’ prescriptions (<12 years old). Seventy-eight percent of the errors took place between 10:00 hr and 14:30 hr. In 34% of the cases, the error was dispensing of inappropriate quantity of medicines to patients. Errors due to improper labelling of medicines were found in 15% of the prescriptions. In 11% of the cases, a wrong medicine was prepared, 6% of them were due to similar sounding names and the other 5% were due to similar looking medicines. Thirteen percent of the errors were due to dispensing a medicine of a wrong strength. Eighty-four percent of the dispensing errors were detected by pharmacists responsible for double checking prescriptions before handing medicines to patients and 16% were detected by pharmacy technicians. The potential clinical significance showed reduced effectiveness in 43% of the cases,
The Effectiveness of Establishing a Patient Safety Center in the Ministry of Health, Saudi Arabia

Saeed Al Qahtani, Mazaya Office for Health Consultations, Riyadh, Saudi Arabia.
Email: saeed1994@hotmail.com

It is very important to establish a patient safety centre (PSC) in Saudi Arabia to help all hospitals to promote the patient safety concept and reduce medical errors, through submitting sentinel reports. Indeed, without a PSC, we can not plan for health care services, especially for reducing medical errors. The PSC also encourages training, research, continuous quality improvement and communication among hospitals. The target clients in this survey were governmental, private and military hospitals and Ministry of Health staff. The objectives were: 1. To measure the feasibility of a PSC. 2. To find factors that support the patient safety culture in the Saudi health care system. 3. To assess the commitment of leadership toward a PSC. 4. To find major barriers to prevent the establishment of a PSC in the Ministry of Health. 5. To know the impact of communication among hospitals. 6. To determine the relationship between the types of reporting systems (voluntary, mandatory) and the success of a PSC. 7. To find factors that help and sustain the PSC structure. 8. To specify a suitable structure for the PSC. 9. To determine systematic surveillance for potential hazards through the PSC. We used a stratified sample from five regions in Saudi Arabia in order to receive various suggestions, ideas and comments from different respondents regarding feasibility, appropriate structure and leadership commitment to a PSC to reach our goal. The data collection tool was a questionnaire to study the impact of some factors in establishing a PSC: 1. Staff safety culture. 2. Communication among hospitals. 3. Chain of command and hiring new staff. 4. Implementing computerized physician order entry. 5. Use of the incident reporting system. Many outcomes, comments and recommendations were extracted to help in establishing a PSC in Saudi Arabia such as strengthening communication among health care providers and setting up a database to enhance accurate decision making.

Delivering High Quality Care: Whose Responsibility?

Rabiee Kayid Al-Rashidy, Armed Forces Medical Services, Muscat, Oman.
Email: rabikomal@omantel.net.om

Quality refers to the characteristics of and the pursuit of excellence. Excellence, on the other hand, is established by determining whether the outcomes of whatever we do favourably compare to the standards that we set. Within healthcare settings, quality is defined as the degree to which the provisions of our health services meet the needs and expectations of our patients and clients. In other words, it is the degree to which the services we offer for the individuals and population increase the likelihood of desired health outcomes and are consistent with current professional knowledge, standards and research evidence. But whose responsibility is it to deliver a high standard of care? Is it the government, professional agencies, structure, healthcare organisations, groups or individual healthcare workers? In this presentation, the aim is to define and highlight the importance of high quality care from the perspectives of various stakeholders and to present the role and responsibility of all concerned in the delivery of high standards of care. Furthermore, the presentation addresses issues or challenges within Omani society that could hinder the delivery of high quality care.

Managing Change in Healthcare

Rashid K Al-Abri, Quality Management Department, Sultan Qaboos University Hospital, Muscat, Oman.
Email: ralahabri@hotmail.com

One of the key concerns in healthcare management is the management of change. With healthcare professionals obligated to acquire and maintain the necessary professional expertise, change occurs continuously around us. We may want to support it, be indifferent to it, and be passive or participate in it. Managing change is about handling the complexity of the process: evaluating, planning and implementing operations, tactics and strategies and making sure that the change is worthwhile and relevant. Effective change has been characterized as unfreezing old behaviours, introducing new ones, and re-freezing them. Change may be continuous, sporadic, or rare and either predictable or not. The only sustainable competitive advantage today is the ability to change, adapt, and evolve - and to do it better than the competition. Failure comes from lack of vision and commitment from senior management, limited integration with other systems and processes in the organisation, and ill-conceived implementation plans. Employees want to understand why change is happening and how they will be affected. Promoting change is both demanding and fatiguing, needing a proactive attitude. Bringing about change requires: challenging precedents, persevering against established habits, focussing on key valves and time. Organisations will not perform well if they become overly bureaucratic and hierarchical as they will be less flexible, less amenable to change and less likely to empower staff. Leaders need to understand the change process, overcome obstacles and cope with chaos in order to have the capability to lead and manage change effectively. Leaders should help employees and other stakeholders structure and build effective teams. Establishing a clear vision about the direction of the change process as well as measuring and monitoring are key elements for assuring successful change. Changes in healthcare practice are welcome if they improve quality and safety, or save money. However, it is important to tailor healthcare delivery to the needs of the local population so awareness programmers and clear communication between the public and the organisation is essential.

Learning Organisation and Health Care Education

Rashid K Al-Abri, Intisar M Al-Hashmi, Quality Management Department, Sultan Qaboos University Hospital, Muscat, Oman.
Email: ralahabri@hotmail.com

The learning organisation is a concept first described by Peter Senge as an organisation where people continuously learn and enhance their
capabilities to create. It consists of five main disciplines; team learning, shared vision, mental models, personal mastery and systems thinking. These disciplines are dynamic and interact with each other. Systems thinking is the cornerstone of a true learning organisation and it is described as the discipline used to implement the disciplines. In a learning organisation, health care education aims to educate their members with up to date knowledge to produce competent and safety conscious personnel who could promote quality in healthcare services. In addition, there are some educational concepts and theoretical models which are of relevance to the learning organisation and can provide a framework for managerial decisions. Stages required to achieve the principles of a learning organisation are described in detail. Moreover, in a proper culture which supports the learning organisation, members continuously learn to improve the environment and never remain passive recipients.

Note: This study was published in full in SQUMJ, Vol. 7, Issue 3, p. 207-214. Available at: www.squ.edu.om/squmj

SQUH Journey Towards Accreditation
Yasmeen S Al Hatimy, Quality Management Department, Sultan Qaboos University Hospital, Muscat, Oman
Email: yaz4me2@yahoo.ca

Sultan Qaboos University Hospital (SQUH) is regarded as the Sultanate of Oman’s model healthcare institution, after having in 2005 been internationally recognised with ISO 9001:2000 certification, which stimulated the country’s interest and participation in quality healthcare. It is known as the national leading tertiary teaching hospital in the Sultanate of Oman. SQUH aims to provide continual improvement in health service provision and delivery. This presentation explores the preliminary approach SQUH is taking towards introducing hospital accreditation as a quality improvement approach and how the successful achievement of a certified quality management system (QMS) and its contributing factors influence and positively support this process.

AN Analysis of SQUH Staff Perception on Introducing Hospital Accreditation
Yasmeen S Al Hatimy, Quality Management Department, Sultan Qaboos University Hospital, Muscat, Oman.
Email: yaz4me2@yahoo.ca

SQUH is a national leading tertiary teaching hospital in the Sultanate of Oman, internationally recognised with ISO 9001:2000 certification. It is an institution which provides quality patient care, education and research. This paper focuses on the willingness and readiness of SQUH to consider introducing hospital accreditation. The initial survey questionnaire seeks perceptions of staff (clinicians, administrators, nurses, technicians and top management) to identify the aspects of accreditation that are considered important, timely and relevant to the hospital, and where they may not be. Combined with a Strengths Weaknesses Opportunities and Threat (SWOT) analysis drawn up by the quality team, in addition to contextual information, it then analyses the data to decide if or if not SQUH is willing and prepared to consider introducing hospital accreditation. Furthermore, following an accreditation workshop recently held at SQUH, an additional survey questionnaire attempts to capture the respondents’ view on the reasons for participation, but also what benefits are hoped to be gained by implementing hospital accreditation, as well as anticipated difficulties SQUH may face.

Confidentiality of Patients’ Information
Ahmed Al-Barwani, Quality Management Department, Sultan Qaboos University Hospital, Muscat, Oman.
Email: ahbbarwani@hotmail.com

Confidentiality, defined as the principle which protects personal writing and all other personal productions, not against theft and physical appropriation, but against publication in any form, is in reality not the principle of private property, but that of an inviolate personality. Duties of confidentiality arise when a person discloses information to another in circumstances where it is reasonable to expect that the information will be held in confidence. Protecting patient information is the duty of each individual working in a health organisation, and it is the organisation’s role to set policies to protect the confidentiality of patient information. Confidentiality has become as a major aspect in health care organisation because of the following points: a) Privacy is the right of individuals to control disclosure of their personal information; b) It is a key element in the quality of a health service; c) It creates trust in the clinical relationship; d) It builds reflect patient satisfaction and trust; e) Confidentiality is an ethical concept; f) Data security is an key to quality healthcare.

Ethical Principles Applied to Electronic Patient Records
Ahmed Al-Barwani, Quality Management Department, Sultan Qaboos University Hospital, Muscat, Oman.
Email: ahbbarwani@hotmail.com

Advances in health care technology have raised big concerns about medical ethics. Many discussions were held prior to implementing electronic patient records (EPR). Some people are in favour of implementing this technology and others are against because of ethical issues. This presentation will draw an attention to the following points: 1. The importance of EPR (supporting medical ethics). 2. Ethical Requirements for implementing EPR: a) maintaining confidentiality; b) consumer consent and control of records; c) security and authentication; d) messaging and communication; f) telecommunications; g) imaging and audio standards; h) protecting integrity; i) ensuring availability; j) demonstrating accountability. 3. Recommendations.

Telehealth as A New Innovation for Oman
Jamal Al-Busaidi, Hospital Information System, Sultan Qaboos University Hospital, Muscat, Oman.
Email: amalsat@squ.edu.om

Telehealth is an electronic audio-visual contact between a patient and healthcare practitioner relating to the healthcare diagnosis or treatment of the patient. Telehealth is a new innovation in healthcare services in the Sultanate of Oman. The presentation covers anticipated government involvement in supporting telehealth, evaluation efforts to date for such technology and, finally, concerns that need to be addressed in designing an affordable Internet-based technology and economic-based framework to evaluate the use and benefit of information and communication technology (Internet, mobile phones and wireless communication) especially to rural communities. Telehealth could be of major
benefit to Oman given the problems of rural areas: limited physical access to primary health care and recruitment and retention of healthcare personnel.

**Paramount Importance of Health Information Systems in Healthcare**

*Jamal Al-Busaidi, Health Information System, Sultan Qaboos University Hospital, Muscat, Oman. Email: jamalsat@squ.edu.om*

Changes in the demand and supply sides of healthcare information and communications technologies (ICT) have been gathering momentum in recent years in most parts of the world and promise to be more vibrant in future. A hospital information system (HIS) is an organised procedure or method to collect and store data. It can be an electronic (software) system and/or paper based. Hospital information systems are the driving force in healthcare organisations. A radial shift in the HIS market is expected which, according to new research, will result in stronger and more prolonged growth. For example, according to HBS-TekPlus consultants in healthcare and IT, “the European HIS market is predicted to grow by a compound annual growth rate of 4.5 percent, from $2.69 billion in 2001 to $3.2 billion in 2005.” The major drivers in the hospital information systems market include: a) The public’s demand for politicians and hospitals to improve healthcare quality; b) Hospitals beginning to understand the concept of return on investment; c) HIS becoming part of a wider healthcare IT integration. The success or failure of a new HIS depends on some components including: change management; failure to take account of the local healthcare culture; understanding the complexity of healthcare processes; staff turn-over; failure to learn lessons from past projects; staff shortages; responsibility of professional staff; etc.

**A Review Study of the Effectiveness of Biomedical Engineering Standards in Increasing Patient Safety**

*Abdullah Al-Hashmi, Sultan Qaboos University Hospital, Muscat, Oman.*

Biomedical equipment and devices are often identified as contributors to patient safety. A literature review was conducted for the role of biomedical engineering standards in increasing patient safety. Implementation of these standards was assessed in critical clinical areas to find out how these standards are contributing to increasing patient safety. This evaluation study indicated a need for further improvement in periodic preventive maintenance programmes, equipment safety standards awareness and introducing error recovery systems. This study highlighted the role of biomedical engineering standards in increasing patient safety.

**A Model of Integrating the Radiology Information System and Cardiology Equipment with the Hospital Information System, based on an Integrating Healthcare Enterprises Approach**

*Abdullah Al-Hashmi, Sultan Qaboos University Hospital, Muscat, Oman. Email: amhashmi@squ.edu.om*

Integrating healthcare enterprises (IHE) is an initiative by healthcare professionals and industry to improve the way computer systems in healthcare share information. The IHE approach models were established to integrate radiology and cardiology equipment with the SQU hospital information system (HIS). It was suggested that by using a Health Level Seven (HL7) interface the communication and data transfer between the radiology or cardiology information system and the HIS is achievable. However the study evaluated the difficulties in implementing such integrations.

**Job Satisfaction of Health Care Professionals in Oman**

*Amr M Taman, Faculty of Medicine, Cairo, Egypt; Quality Management Consultant, Ministry of Health, Muscat, Oman.*

Job satisfaction among health care professionals has become a pertinent issue because of its relationship with three major concerns of health administration: absenteeism, turnover and performance. This study aimed to measure the level of job satisfaction of primary healthcare (PHC) staff in Oman and to determine factors influencing it. A cross sectional study was conducted among PHC staff (390 respondents) in two regions in Oman. Data were collected using a pre-tested, self-administered and anonymous questionnaire sheet that included personal data, overall staff satisfaction with the profession and working in their facility and staff rating of 10 domains of the job: resources, pay, work content, autonomy, supervision, opportunity for advancement, job security, status/prestige, professional relationships and patient relationships. The overall staff satisfaction with their professions was 79.44%. Staff satisfaction scores were lower regarding availability of supplies and equipment for their practice (69.28%); pay and incentives (66.9%); opportunity to learn new skills and abilities (66.05%); amount of proper work (64.62%); workload (68.21%); their input in to organisational decisions (70.51%); opportunities for promotion and further studies (58.23%); job security (66.56%) and relationships with patients (68.2%); They expressed higher scores regarding safety and cleanliness of the working environment (80.87%); the importance of their work (85.64%) and status/prestige in belonging to the job (82.65%);The overall job satisfaction scores were significantly higher among nurses than physicians, among expatriates than the nationals, among females, older and married staff and among those who had graduated more than 10 years ago. The following recommendations are suggested to improve job satisfaction: provide the necessary supplies and equipment for proper practice; implement an appointment system in PHC facilities to help in managing the workload; ensure administrative support, job security and clinical autonomy; encourage staff input in organisational decisions; provide incentives, recognise and acknowledge good work; and provide the opportunity to learn new skills and abilities and develop basic communication skills to improve provider-user relationships.

**Discussion on Practical Applications of Medical Informatics**

*Dhananjaya Bulathwatta, Bukha Hospital, Ministry of Health, Musandam, Sultanate of Oman. Email: dbulathwatta@gmail.com*

This presentation will discuss the pros and cons of using Multiuser Medical Clinic Software. This particular interface module, which was created by the presenter, can be used in a private local area network of computers. Its use in the fields of medical statistics and its research and
A study on outpatient satisfaction at Al-Nahdha Hospital, Oman in 2006
Suresh Venugopal, Nahdha Hospital, Muscat, Oman.
Email: sure5155@omantel.net.om

A study on outpatient satisfaction at Al-Nahdha Hospital, Muscat, Oman, was conducted by its Quality Improvement Committee in 2006. A total of 500 patients were studied for patient satisfaction from the Dermatology, ENT, Eye, Dental and Medical outpatient departments (100 each) by way of questionnaires in Arabic and English. They were analysed with the EPI Info software package. The results were as follows: the male to female ratio was almost equal; 62% of patients were in their 20s and 30s; 49% had secondary school education and 13% were uneducated; 55% were employed and almost 45% unemployed (including females and children); 42% of patients waited for less than 29 minutes after the scheduled appointment time; 52% of patients spent 10 minutes or more with doctor; 33% of patients spent between 5 and 9 minutes and the rest less than 5 minutes. There were three main reasons for the visits: a) follow up (28%); b) chronic illness (24%); c) surgery (14%). In conclusion, the total overall patient satisfaction among outpatients was 94% of which 54% were highly satisfied and 40% were satisfied. The two main recommendations to improve patient satisfaction were a further reduction in the waiting time of patients after the scheduled appointment time and an increase in the time spent with doctor, from less than 10 minutes to more than 10 minutes for all patients.

Clinical Risk Management in Obstetrics
Veena Paliwal, Ministry of Health, Salalah, Oman.
Email: paliwal@omantel.net.om

Clinical risk management (CRM) is one approach to improve the quality of care, which places special emphasis on care episodes with unexpected outcomes where patients may have been harmed or disturbed. This approach to risk management entails doing a detailed study of adverse events to promote reflective practice and improve subsequent care rather than the litigation management approach. Obstetrics is the highest risk area and generates the most adverse events. The leading causes of litigation in maternity services are mental handicap, intrapartum stillbirth, Erb's palsy and missed congenital anomalies. Risk management can, therefore, be seen as the identification, analysis and control of risk. Clinical risk management, if practised, will be useful in giving highest possible quality care. CRM includes not only cases with a poor outcome, but also the near miss incidents where, despite good outcomes, more effective clinical management would have prevented a potentially dangerous situation developing in the first place. This strategy helps to change the focus from, “Why an error was made” to, “Why the relevant procedures did not prevent the error”.

Anticipating and Responding to Obstetric Emergencies
Veena Paliwal, Ministry of Health, Salalah, Sultanate of Oman
Email: paliwal@omantel.net.om

Improving emergency obstetric care is critical to improving global obstetric safety. High quality emergency obstetric care is the most important strategy to reduce global maternal mortality dramatically. In last 10 years, international attention has focused on the importance of medical errors and safety. Effective and efficient care is essential for good outcomes and safety. Obstetrics has the lowest rate of serious adverse events due to errors (1.5%), but the highest rate of negligent care (38.3%) as seen in the Confidential Enquiries in to Stillbirths and Deaths in Infancy (CESDI) survey. Suboptimal care leads to two thirds of intrapartem foetal deaths. Mothers and infants at risk is a global safety issue. The labour room is a complex and dynamic place: highly trained professionals of many disciplines all work in a fast-paced, unpredictable environment. Time, critical decision making, team communication and cooperation can make the difference between life and death. Quick identification of obstetrical emergencies and a rapid coordinated response is essential to good outcomes. Awareness, knowledge, and training for responding to obstetric emergencies is essential for anyone who cares for pregnant women. Rapid coordinated teamwork can save lives in obstetrics emergencies. Simulation can help to retain and enhance knowledge and skill that are not used frequently, see www.obsafety.org. Obstetric emergencies are the leading cause of maternal mortality and morbidity. Expect the unexpected. Fire drills are recommended to improve effectiveness and efficiency in response to obstetric emergencies. Clinical team drills may improve care process, guideline adherence and clinical outcomes.

Satisfaction Survey of Patients Attending Sultan Qaboos University Hospital Pharmacy, Oman
Wael Al-Naeem, Pharmacy Department, Sultan Qaboos University Hospital, Muscat, Sultanate of Oman.
Email: wadelnaeem@hotmail.com

Sultan Qaboos University Hospital (SQUH) is a government-funded tertiary care teaching hospital. The outpatient pharmacy in SQUH dispenses an average of 350 prescriptions daily. In the year 2005, a total of 146,989 prescriptions containing 353,336 items were dispensed at the outpatient pharmacy. A 1998 survey showed an 80% patient satisfaction rate. The objectives of this survey were: 1. To assess the patients' satisfaction rate. 2. To evaluate the clarity of written and verbal information. 3. To identify current strengths and weaknesses. A two week survey was conducted in May 2006 by a structured questionnaire to all patients presenting their prescriptions. A total of 328 filled questionnaires were returned, out of which 316 (96.3%) could be included in the analysis. Fifty percent of the participants were male. The age distribution was 63% between 15-35 years and 29% between 36-64 years. The majority (75%) were of secondary school or university level. The analysis showed 92% found that they were treated professionally and respectfully by the pharmacists. Twenty one percent of the participants reported they were notified about the approximate waiting time, while 19% reported that this was never done. The pharmacy waiting area was evaluated as comfortable by 64%, not comfortable by 23%. The waiting time in the pharmacy was considered intolerable by 17%, long by 51% and reasonable by 27%. Eighty-six percent of the participants said they got information and clear answers to questions about their medications, while 1% said they never got answer to their queries. Eighty eight percent reported difficulties in reading the instructions written on the medicines. Seventy-three percent of the participants reported satisfaction with the pharmacy services. Current strengths are professionalism and respectfulness and clarity of written and verbal information. Areas needing improvement are: advance notification on waiting time, reducing waiting time
and making waiting area more comfortable.

**Outpatient Pharmacists’ Interventions in Sultan Qaboos University Hospital, Oman**

Waiel Al-Naeem, Pharmacy Department, Sultan Qaboos University Hospital, Muscat, Sultanate of Oman.  
Email: wadalnaeem@hotmail.com

Sultan Qaboos University Hospital (SQUH) is a government-funded tertiary care teaching hospital. The outpatient pharmacy in SQUH dispenses an average of 350 prescriptions daily. In the year 2004, a total of 144,807 prescriptions containing 343,222 items were dispensed. Through their interventions, pharmacists ensure the accuracy of prescriptions and collaborate with doctors to optimise pharmacotherapy. However, no previous comprehensive study has attempted to determine the number and types of pharmacist interventions in an outpatient setting. A two week prospective interventional study, conducted at outpatient pharmacy in SQUH in 2004, established data on: 1) Number and types of interventions in the outpatient area; 2) Time involved in such interventions and 3) Clinical significance of the interventions. The study included all prescriptions received at the outpatient pharmacy with an intervention. During the study period, 2,475 prescriptions were received, of which 103 required an intervention. In these 103 prescriptions, 201 interventions were made. Fifty-one percent of the interventions were administrative and 49% were clinical. In 52% of the administrative interventions the doctor’s contact number was not on the prescriptions and 4% of the prescriptions were without doctor’s signature. Seventy-six percent of the clinical interventions were problems in the drug’s regimen and 24% due to the choice of drug. The pharmacist had to call the prescribers in 61% of the cases, another pharmacy colleague in 16%, and to consult the patient in 15%. The prescriptions were corrected and finally dispensed in 83% of the cases. Sixty percent of the interventions took < 10 minutes, while 17% took > 20 minutes to be solved. The total time spent on interventions during the study period was 39 hours which exceeds the weekly working hours (37 hours) of a full-time pharmacist. The potential clinical significance showed improved effectiveness in 58% of the cases, reduced effectiveness in 2%, avoidance of toxicity in 32%, increased toxicity in 1% and unknown in 7%. The grading of clinical significance showed that interventions prevented potential fatality or end-organ damage in 4% of the cases and were of major clinical significance in 34%, moderate in 48% and detrimental in 1%. Pharmacist interventions therefore led to modifications of prescriptions for different drug-related problems and contributed positively to the quality of pharmacotherapy. They prevented potentially fatal or end-organ damage in 4% of the cases. If a pharmacist were posted in clinics, most of these problems could have been averted 76%.

**Learning From our own Mistakes: Tenoxicam and Tamoxifen**

Badriya Al-Zadjali, Pharmacy Department, Sultan Qaboos University Hospital, Muscat, Sultanate of Oman.  
Email: zadjal@squ.edu.om

A computer-generated prescription was received in the pharmacy department for a 64 year old female. She was prescribed tenoxicam tablets 20mg once daily. The pharmacy technician prepared the prescription and it was checked and dispensed by another technician. The patient discovered that tenoxicam tablets were missing and tamoxifen tablets 20mg were dispensed instead of tenoxicam. She did not take any of the medications since she was fully aware of her disease, condition and medications and returned them to the pharmacy where the error was corrected. Medication error has occurred between tenoxicam and tamoxifen despite their use to treat different conditions and different storage shelves in the pharmacy. From our perspective, the similarities between the names, in addition to similarities in the route of administration, dosage form and dosage quantity may further increase the risk of confusion between tenoxicam and tamoxifen, particularly if healthcare providers are not educated concerning this potential for confusion. Clearly, patients with rheumatic disease or breast cancer who mistakenly receive an incorrect medication could experience severe health consequences, in addition to not receiving the appropriate life saving medication. A study reported that 83% of errors are discovered during counselling and corrected before the patient leaves the pharmacy. Medication errors caused by similar drug names may result in adverse events that cause harm to the patient, especially when two products have different uses. People who are especially vulnerable are the old, those on polypharmacy or those with concomitant medical conditions. However, few procedures exist to ensure safety. Therefore drug appropriate solutions must be identified to reduce the potential for confusion between products with similar names. Patient counselling plays an important role in preventing and reducing medication errors.
Forthcoming Medical Conferences, Courses and Workshops

19-21 AUGUST 2008
International Conference in Medicine & Child Health
Department of Medicine and Child Health, Sultan Qaboos Hospital and Ministry of Health, Salalah, Sultanate of Oman
Email: iconsalalah@gmail.com; Website: www.geocities.com/sqhicon/salalah

10-11 SEPTEMBER 2008
Advances in Maternity Nursing
King Fahd Medical City, Saudi Arabia.
Website: www.kfmc.sa/CME

16-18 OCTOBER 2008
Implementation of Primary Prevention Strategies for Type 2 Diabetes. Diabetes in Asia Study Group Conference in Collaboration with IDF
Kathmandu, Nepal
Website: http://www.da-sg.org/program.htm

28-29 OCTOBER 2008
Frontiers in Surgical Pathology Symposium
King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia
Email: web_symposia @ kfshrc.edu.sa; Web: www.kfshrc.edu.sa/symposia

26-28 OCTOBER 2008
Emergency Congress
Abu Dhabi National Exhibition Centre, Abu Dhabi, UAE
Web: www.emergencycongress.com

26-28 OCTOBER 2008
Patient Safety: Infection Control Congress
Abu Dhabi National Exhibition Centre, Abu Dhabi, UAE
Website: http://www.abudhabimed.com

26-28 OCTOBER 2008
Primary Health Care Congress
Abu Dhabi National Exhibition Centre, Abu Dhabi, UAE
Website: http://www.abudhabimed.com

4-5 NOVEMBER 2008
Diabetes Mellitus Update Workshop
King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia
Email: web_symposia @ kfshrc.edu.sa; Website: www.kfshrc.edu.sa/symposia

11-12 NOVEMBER 2008
Thrombosis and Hemostasis Update Workshop
King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia
Email: web_symposia @ kfshrc.edu.sa; Website: www.kfshrc.edu.sa/symposia
18-19 NOVEMBER 2008
International Symposium on Infections in Immunocompromised Host
King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia
Email: web_symposia@kfshrc.edu.sa; Website: www.kfshrc.edu.sa/symposia

2-3 DECEMBER 2008
Advances in Endoscopic Sinus Surgery
King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia
Email: web_symposia@kfshrc.edu.sa; Website: www.kfshrc.edu.sa/symposia

18-21 JANUARY 2009
6th International Scientific Conference for Medical Students in the GCC countries
Faculty of Medicine & Health Sciences, UAE University
Email: INFO.GCC6MCONF@uaeu.ac.ae; Website: www.gcc6mconf.uaeu.ac.ae

24-28 JANUARY 2009
Computational Biology Workshop
Department of Biochemistry, College of Medicine & Health Sciences, Sultan Qaboos University, Muscat, Sultanate of Oman in collaboration with Research Council of Oman, WHO and software companies.
Application deadline: 15 September 2008. Information
Email: bayoumi@squ.edu.om or taruna@squ.edu.om.

You are invited to submit details of medical events in Oman and the Middle East for inclusion in future Announcements pages. These announcements are also published on our web page: www.squ.edu.om/squmj

Please send the information to mjournal@squ.edu.om, putting ‘Information for SQUMJ Announcements Page’ in the subject box of the email.