During the past 3 decades, Oman (a sultanate), a country with deep-rooted history, culture, and traditions, has undergone a remarkable transformation and modernization in all fields, including education and health care. It has progressively established a nationwide network of modern health services that are accessible even at the village level and have ranked Oman with the developed world. More than 300 surgeons provide a full range of surgical services for a population of 2.5 million. Medical education is firmly established, and accredited surgical residency training has assumed increasing importance during the past decade. Given the sustained growth and dynamic planning, the surgical services will continue to develop, with Omani surgeons playing an increasing role in the future.

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Oman is a blend of modern prosperity and ancient traditions. The practice of surgery is comparatively recent and is better understood in the context of the country’s geography, demography, history, and socioeconomic development and the evolution of the health care system, medical education, surgical training, and services.

GEOGRAPHY, DEMOGRAPHY, AND ECONOMY

Oman lies in the southeastern corner of the Arabian Peninsula (Figure 1). It shares borders with the United Arab Emirates, Saudi Arabia, and Yemen, and is separated by only 55 km from Iran by the Strait of Hormuz. It has a total area of 309,500 km² and a 1700-km magnificent coastline touching on 3 seas: the Arabian Gulf, the Gulf of Oman, and the Arabian Sea. The terrain is starkly rich and varied, with plains, wadis, desert, and mountains. The coastal plains form 3% of the total area and the mountain ranges about 15%; the remaining area (about 82%) is largely wadis and desert.1 The climate varies from hot and humid in the coastal areas in summer to hot and dry in the interior, but the higher mountainous regions and the southern Dhofar region enjoy a moderate climate throughout the year.

The population at mid 2002 was estimated at 2.5 million, of which about 26% were non-Omanis. The Omani population is young, with 41.2% younger than 15 years and only 4.9% 60 years and older.1 The country is rather sparsely populated, with 56% of the population concentrated in Muscat, the capital, and the adjoining northwestern coastal plains overlooking the Gulf of Oman (Figure 1). Muscat is the center of government, commerce, and industry. The economy depends heavily on modest oil and gas exports, which provide about 76% of government revenues, with agriculture, fishing, industrial activity, and services contributing the rest.1

HISTORY

Oman is a country steeped in history, culture, and tradition, with influences from Arabia, Yemen, Mesopotamia, Iran, the Indian subcontinent, and Africa. In about 630 AD, Oman was one of the first coun-
tries to embrace Islam. Throughout its long history, spanning some 6 millennia, it maintained its independence, except for comparatively brief periods of occupation by the Persians and the Portuguese. Its heritage of hundreds of forts, castles, and watchtowers reflects various periods of its colorful history. From ages past, Oman lay strategically along the sea trade routes between the East and the West. As renowned seafarers and merchants, the Omanis explored and charted new trade routes to distant lands; Omani were said to be the first to sail to China. The American Mission brought in a long line of missionaries to embrace Islam. Throughout its long history, spanning some 6 millennia, it maintained its independence, except for comparatively brief periods of occupation by the Persians and the Portuguese. Its heritage of hundreds of forts, castles, and watchtowers reflects various periods of its colorful history. From ages past, Oman lay strategically along the sea trade routes between the East and the West. As renowned seafarers and merchants, the OMANIS explora and charted new trade routes to distant lands; Omanis were said to be the first to sail to China.

In 1900, there were no proper schools or hospitals in the whole of Oman. The British government and the Arabian Mission, a branch of the Reformed Church of America, played significant roles in the early development of health services in Oman. The British Residency started medical work in Muscat in 1800, and maintained a medical staff throughout the century. One of the responsibilities of the staff was a role as port quarantine officer for Muscat harbor. In 1910, the British Consulate built the first hospital in Oman, called Muscat Charitable Hospital, with 20 beds. It remained active until 1970.

The American Mission started its work in Oman in 1893 and played a major role in the provision of health services for the next 80 odd years. It established its first medical clinic in Muttrah (in the capital area) in 1904, and, in 1913, opened a small Women’s Hospital in Muscat. In 1934, it opened Oman’s first large general hospital, the American Mission Hospital. It was the only hospital with surgical facilities in the whole country. The hospital equipment was basic, and an x-ray machine was installed in 1940. By 1950, the hospital had a capacity of 100 beds, and 10 to 12 operations were performed daily. The American Mission supplemented the health services with periodic outreach touring clinics to the interior of the country, treating and operating on many patients. The American Mission brought in a long line of US surgical personnel. Notable among them were Dr Paul Harrison (1925-1939), Dr Wells Thoms (1939-1970), and Dr Donald Bosch (1955-1974). In his memoirs, Bosch wrote:

Considering the health problems during the 1950s and 1960s, we generally assumed that every patient had five diseases before he came to the hospital complaining of yet another problem. The five diseases were malaria, trachoma, intestinal parasites, malnutrition and anaemia. But what brought the patient to the hospital was usually something else, such as a broken bone, a serious burn, pneumonia, meningitis, tetanus, strangulated hernias, obstructed labour, intestinal obstruction, serious trauma such as camel bites or fishing accidents. We rarely saw cases of appendicitis, gallbladder disease, gastric ulcers or heart attacks. Obesity was virtually unheard of. If we encountered these diseases, it was in a patient who had been off-loaded from a ship in the harbour or an individual who was not an Omani. But as prosperity came to the country and eating habits changed, all these diseases became common.

Government medical services started modestly in 1958, in response to a development subsidy from the British government, with the establishment of a few dispensaries and health centers in the interior, a 13-bed military hospital in the capital area, and a Mobile Clinic, a touring medical service. However, the services remained rudimentary until the early 1970s. From 1961 to 1970 was a difficult period for the American Mission Hospital. Stil largely the only general hospital in the country, the patient load became increasingly larger while government policies became more restrictive. Managing the hospital without electricity and, therefore, without air conditioning facilities posed major...
challenges, especially in the operating room. In the summer, when the heat was so intense, elective surgery was deferred until cooler weather set in. The installation of an electric generator at the hospital in 1964 eased some of the difficulties. From 1968 to 1969, the outpatient load increased by 30% to 51800 cases, the total number of operations performed increased by 23% to 2385 cases, and the number of eye operations increased by 50% to 985 cases.8

The accession of Sultan Qaboos to power in 1970 marked a major turning point as the country swiftly embarked on socioeconomic development. In 1971, the American Mission Hospital voluntarily joined the government’s new Ministry of Health (MOH), thus creating a united health service.9 The MOH subsequently embarked on a program of developing a modern health care system covering the whole country. The MOH is today the main health care provider and also acts as the regulator. Its expenditure in 2002 accounted for 5.8% of the total government expenditure.10 Overall, Oman spends about 3.9% of the gross domestic product on health. The impressive achievements in the health services have had a positive impact on all health indicators, and have ranked Oman among the developed countries with respect to health system performance.8 In 2002, the life expectancy at birth had increased to 73.8 years, the crude death rate had decreased to 2.5 per 1000 persons, and the infant mortality rate had declined to 16.2 per 1000 live births.7 The MOH provides free health care for all Omani and expatriate government employees and their dependents. It has established an extensive network of well-equipped modern hospitals, health centers, and mobile units throughout the country, which has been divided administratively into 10 semiautonomous health regions. Each health region has a regional referral hospital supported by a network of primary and secondary health services. Muscat has 4 tertiary hospitals that act as national referral centers. The MOH runs 48 hospitals and 128 health centers throughout the country. It also has a well-established national health information system and cancer registry, and publishes a health survey report annually.

In addition to the MOH, other governmental organizations, including the defense and security forces, provide free medical services for their many employees and dependents. Sultan Qaboos University Hospital, a teaching hospital, also provides secondary and tertiary care for the general population. Expatriate employees of private companies and institutions are covered by either private health insurance or their employers, and depend largely on the private health sector, which is also playing an increasingly important role in the provision of health care. In 2002, there were 3 private hospitals and 631 private clinics. Altogether, there are 56 hospitals in the country, with 2,04 beds per 1000 persons.7 The achievements in the health services during the past 30 years have resulted in a shift in the pattern of diseases from communicable to noncommunicable diseases related to changes in lifestyle and population structure (eg, obesity, diabetes mellitus, and hypertension).

MEDICAL WORKFORCE

The number of physicians in Oman increased substantially from around 20 in 1970 to 3536 in 2002, providing a physician-population ratio of 13.9 per 10000. Specialists constitute just more than one third of the medical workforce, with surgeons numbering more than 300.7 Of the surgeons, only about 15% are Omani. Nearly 80% of all physicians and 90% of all specialists work full-time in the government sector, including university practice. Senior specialists in the government sector have recently been permitted by the MOH to engage in private practice after office hours. The MOH acts as the main accreditation body and solely regulates the private practice sector.

There are active continuing medical education programs in all hospitals, and specialty groupings regularly organize local and international conferences and workshops. Since the early 1990s, an International Surgical Update has been held biennially in Muscat in conjunction with the Royal College of Surgeons of Edinburgh. An Oman chapter of the Royal College of Surgeons of Edinburgh was inaugurated about 3 years ago.

MEDICAL EDUCATION

Education has been one of the country’s key pillars of growth since 1970, with impressive developments in free primary, secondary, and tertiary education. The number of schools increased from only 3 in 1970 to 1019 in 2002.1 The first generation of Omani physicians, who are few, received their secondary and medical education abroad because facilities were then nonexistent in Oman. Sultan Qaboos University was established in 1986, with the College of Medicine as 1 of its 7 constituent colleges. Entry into the College of Medicine is based on performance in the final secondary school examination. The course is conducted in English. Students enter a 7-year program that is divided into 2 phases. The first phase includes an initial foundation year studying English, Arabic, Oman and Islamic civilization, and elective courses, followed by a 3-year preclinical sciences program leading to the award of a bachelor of science in health sciences degree. Successful candidates proceed to the second phase, which is a 3-year clinical program, leading to a doctor of medicine degree. Graduates then undergo a mandatory 1-year rotating internship before registration and postgraduate training.

The first batch of Omani physicians graduated in 1993. Since then, Sultan Qaboos University has graduated 764 physicians and enrolls up to 130 students per year. There is a sustained demand for medical education in Oman that has only been partially met by the increased intake during the past 5 years. There are 273 Omani students studying medicine abroad.1 A new private medical school, Oman Medical College, was set up 3 years ago by a local entrepreneur in academic partnership with West Virginia University’s School of Medicine. It offers a 7-year integrated program leading to the doctor of medicine degree. The medium of instruction is English. Sixty-nine students were enrolled in the first year, with annual admission presently limited to 100 students.
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most were trained in the United Kingdom or India. Figure 2 shows their distribution by specialty. About half
work in the major public hospitals in Muscat. The rest are
distributed among the 9 regional hospitals, with a few in
the private sector. The regional hospitals together per-
formed more than 37,000 operations in 2002. Four pub-
tertiary hospitals in Muscat (the Royal Hospital, Khoul
Hospital, Al Nahdah Hospital, and Sultan Qaboos Uni-
versity Hospital) together provide a wide range of special-
izations to meet the needs of the whole country.

The Royal Hospital was opened in 1987 and is the flag-
ship in the MOH's network. It has 630 beds and is under-
going expansion to incorporate a new National Cancer Cen-
ter. It is an affiliated teaching hospital and the hub of the surgical training programs. More than 8500 surgical op-
erations were performed in 2002, including more than 700 open heart surgical procedures. The national Renal Trans-
plantation Programme, a joint effort of the MOH and Sul-
tan Qaboos University, is centered here. Since its incep-
tion 15 years ago, 105 renal transplantations, predominantly living-related donor transplantations, have been performed. Cadaveric donation is rare. The long-term shortage of donors plus cultural and traditional practices se-
verely limit the number of renal transplantations performed locally.20 Most patients able to undergo transplantation go abroad of their own accord for living-nonrelated donor re-
nal transplantation, mainly in India, Pakistan, Iraq, and Iran. In 2002, as many as 62 Omani patients underwent living-
nonrelated donor transplantations abroad, while only 10 living-related donor transplantations were performed in Oman.

Khoul Hospital, the first general hospital to be built
by the MOH, opened in 1974 and is now a 428-bed na-
tional referral center for trauma and orthopedics, neuro-
surgery, and plastic and reconstructive surgery. It is accredited for surgical residency and undergraduate train-
ing. More than 7000 operations are performed per year.
Al Nahdah Hospital, opened in 1973, is a 95-bed spe-
cialist center for eye and otolaryngological disorders only.
More than 4500 operations are performed per year.

Sultan Qaboos University Hospital was opened in 1990,
with a capacity of 532 beds. It is the prime teaching hos-
pital in Oman and is underpinned by the College of Medi-
cine. The hospital houses the National Center for Bone Mar-
row Transplantation and has a substantial hematology-
oncology patient load. It has considerable experience in surgery of patients with sickle cell disease and thalas-
semia, which are fairly common in Oman.31 The range of

THE OMAN MEDICAL SPECIALTY BOARD

With the graduation of the first batch of Omani physi-
cians, the next step was to establish a residency training
program. The Oman Medical Specialty Board was establish-
ed in June 1994 to be the highest supervising body of all postgraduate medical training programs in Oman.4 Its major aim is to ensure that the country is provided with Omani medical specialists of the highest possible standard. The Oman Medical Specialty Board, which con-
sists of representatives from Sultan Qaboos University, MOH, and other relevant institutions, coordinates the training programs of 12 specialties. Each specialty has a committee composed of highly qualified, experienced, and committed professionals. The Surgical Specialty Com-
mitee represents the major surgical specialties, excluding ophthalmology, and is responsible for preparing training programs and selecting candidates.

SURGICAL TRAINING

The Surgical Specialty Committee adopted the 2-part struc-
tured training program of the Royal Colleges of Surgeons in the United Kingdom.5 The first part, termed basic surgical training, is a 2-year foundation rotational training loc-
cally in approved posts: 6 months each in general surgery and orthopedics and 4 months each in 3 other approved specialties, including unintentional injury and emergency medicine and intensive care. The trainee also has to complete a basic surgical skills course and the Oman Medical Specialty Board core program in basic medical sciences. After completing basic surgical training and pass-
ing the requisite examinations of the Royal Colleges of Surgeons, trainees commence the second part, higher sur-
gical training, in their chosen specialty, which lasts 4 to 6
years. The trainee undertakes specialty rotational train-
ing, in part or entirely, in the United Kingdom. The Royal College of Surgeons of Edinburgh recognizes 2 years of higher surgical training in Oman in 3 specialties (general surgery, orthopedics, and plastic surgery). Placement in the United Kingdom is often problematic, and Australia is becoming a realistic alternative. In the final year or at the end of training, the candidate takes the final examination. The successful candidate is eligible for a specialist (consultant) post in Oman. With respect to ears, nose, and throat training, the alternative pathway is a straight 5-year struc-
tured residency training undertaken locally in approved posts, leading to certification by the Arab Board of Surgery. In all, up to 8 trainees per year are enrolled in the sur-
gical training programs. Selection is by interview. There are
12 trainees in the basic surgical training program and 10 trainees at various levels of training in the higher surgical training program. In addition to the Oman Medical Specialty Board program, there are 11 sponsored Omani train-
ees enrolled in North American surgical residency train-
ing programs.

THE PROVISION OF SURGICAL SERVICES

There are more than 300 surgeons working in Oman, and most were trained in the United Kingdom or India. Figure 2 shows their distribution by specialty. About half
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row Transplantation and has a substantial hematology-
oncology patient load. It has considerable experience in surgery of patients with sickle cell disease and thalas-
semia, which are fairly common in Oman.31 The range of
expertise available includes advanced laparoscopic and hepatobiliary surgery. More than 5700 operations were performed in 2002.

RESEARCH

The College of Medicine and Sultan Qaboos University Hospital are the main centers of medical research, which has increased appreciably during the past 5 years. Sultan Qaboos University actively promotes and funds research through the Office of Postgraduate Studies and Research. The university commits an annual budget of about US $1.25 million to support internal research and to enhance its overall research capability. This fund is supplemented with a similar annual sum from the sultan to support research in areas of particular importance to Oman. International sources of funding are beginning to play a role, and research collaboration with external institutions is also increasing. Ongoing research of surgical interest includes multidisciplinary studies of breast and gastric cancer in Oman. Indeed, gastric cancer is the most common malignancy in Oman.12

Two peer-reviewed medical journals, both in English, are published regularly in Oman: the Oman Medical Journal and the SQU Journal for Scientific Research: Medical Sciences.

In conclusion, the achievements in health care during the past 3 decades have been remarkable and sustained. The practice of surgery will continue to grow and provide patients with the best evidence-based standards of care available. Reforms are already under way in areas such as trauma care, quality of care and patient safety, professional liability, and medical insurance, and the MOH is in the midst of implementing pilot projects in telemmedicine and Internet-related continuing medical education.

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Correspondence: Christopher S. Grant, MD, FRCSEd, Department of Surgery, College of Medicine and Health Sciences, Sultan Qaboos University, PO Box 35, Muscat 123, Oman (csgrant@squ.edu.om).

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