Clinical Science for Surgeons

Basic Surgical Practice

Second Edition

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Foreword

The process of getting well is the excitement of surgery for patient and surgeon alike.

An eminent Professor of Medicine once said, 'The specialty of Surgery is the specialty of getting people well'. Coming from a teacher of internal medicine, this was especially significant. The surgeon often deals with diseases that are acute, focal, or traumatic, frequently occurring in previously healthy people. In most cases, the job of the surgeon is not to devise medication to keep the patient tied to the doctor's apron strings for life, but rather to get him or her well and discharged, back into the mainstream of society as wage earner or family leader. The internist *enrolls* patients to medical care; it is the job of the surgeon to *release* them back to society whenever possible.

Looking at this century in perspective, the most important advance in surgery has been simply that of promoting normal convalescence. We might call it the achievement of safe convalescence. At the turn of the century elective, clean, civilian surgery was often attended by devastating or lethal infection, by haemorrhage that could not be replaced, by misdiagnosis, or surgical clumsiness. Even my own surgical training 30 years later (in the late 1930s) included abundant examples of these disasters, which our younger generation attempted to avoid.

In the years since World War II, we have truly seen the advent of safe convalescence. One cannot identify any one advance as dominant. Blood transfusions have played a role, as have intravenous fluids, salts and feeding. Antibiotics have helped; new diagnostic imaging methods have played a major role. Most important of all may have been the progress in applied human biology and surgical engineering.

Surgery is engineering. While the strategy is usually known and the objective clear, the tactics of how to get there — the engineering — are up to the surgeon. Even with the advances of Lord Lister we were witnessing surgical engineering, how to do it better.

The sum of all these advances has reduced surgical morbidity in elective cases to a very low fraction. We are moving major surgery out of the hospital and placing it in the out-patient department. And yet, even when the mortality from an elective surgical procedure is in the region of 1 to 5 per cent, one can still assume that there are areas of diagnosis, treatment, or surgical technique that could be improved by additional experience and study. Only when the mortality in adults is down to between 0.1 and 0.5 per cent, are we dealing with an irreducible minimum of deaths from other unrelated events occurring during those few days in the hospital.

There remain many diseases that have a high surgical mortality. Ruptured aortic aneurysm, severe head injury, Gram-negative bacteraemia with renal failure and pulmonary insufficiency — all of these have mortalities in the double numbers. There is lots more work to do.

The purpose of this wonderful textbook by Vernon Marshall and John Ludbrook is to help surgeons, especially students and residents, learn both these things: the fine art of 'safe convalescence' and the ways of applied human biology that will meet new challenges.

In addition to its intellectual, scientific and biological side, surgery has an aspect of craftsmanship and skill not shared by many other fields of medical practice. Those fields do not put such a premium on manual dexterity, and the native workmanship talents of the individual practitioner. These things are so important in surgical care that in many cases they make the physiologic side seem trivial by comparison. There was a time, for example, when the speed and skill with which a bladder stone could be removed, or an amputation carried out, was the most important single factor in the patient's survival. The patient's inherent survival mechanisms, the Darwinian repertoire of healing, homeostasis and convalescence, did the rest if the surgeon did not interfere. Viewed from the vantage point of physiology and vertebrate evolution, it was the task of surgical

craftsmanship to complete the operation, leaving behind a minimum burden of deficits. Then, the fully evolved recovery mechanism of *Homo sapiens* could finish the job.

While surgical skill and manual dexterity remain important, the physiologic and biologic aspects have become increasingly important as the scope of surgery has extended to such areas as intracardiac repair, tissue transplantation, immunological manipulation and the microvasculature.

It is a thrill to read this book, to study it, and to sense the inspiration students will receive. Whether the reader of this book enters the practice of surgery or works in some other field of clinical practice, an understanding of surgical care and convalescence is critical to the welfare of his or her patients.

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Preface

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1921–1981

Professor William Burnett, editor of the first edition of *Clinical Science for Surgeons*, died just as the book was published. He had occupied the Mayne Chair of Surgery at the University of Queensland since 1962. He had presided over the growth of the university's department of surgery from having an academic staff establishment of five, at the Royal Brisbane Hospital, to a thriving establishment of seventeen with academic subdepartments of surgery at all four of Brisbane's major teaching hospitals. He had the additional pleasure of seeing former members of his department filling six chairs of surgery and one of anaesthesia. Though a graduate of the University of Aberdeen, whose previous collegiate allegiance had been the Royal College of Physicians and Surgeons of Glasgow, from the time that he came to Australia he actively and wholeheartedly engaged himself in the affairs of the Royal Australasian College of Surgeons, especially by his membership of its Board of Examiners. For his work, including first editorship of this book, and for many other contributions that he made to the aims of the Royal Australasian College of Surgeons he was awarded the College Medal posthumously.

This second edition differs in a number of ways from its predecessor. There are several reasons for this. One is that there has been continuing evolution of the syllabus for the Part 1 examination towards the FRACS and in its assessment. This has occurred especially in the direction of emphasising the application of basic sciences to the practice of surgery, during the early clinical training of all surgeons. Another is that a good deal of the material that comprised the first edition can be found in current texts of anatomy, physiology and pathology (although not always in the form that is most appropriate to intending surgeons). Another has been the growth of knowledge in many surgically associated fields, and in new technologies.

In putting together this second edition it has been our goal to provide a text for the trainee surgeon during his early stage of development; one which still places major emphasis on the scientific basis of surgery, but which also provides a theoretical basis for the practical aspects of the early years of training in clinical skills. This has necessitated an entire rewriting of the book; its new direction is indicated by its subtitle *Basic Surgical Practice*. It concentrates on those aspects of clinical practice which are the common experience of surgeons in all disciplines. Thus it provides only a taste (we hope an appetite-whetting one) of the unique principles and techniques of the various specialised branches of surgery — including those that lie within the broad domain of general surgery.

These aspects are covered in chapters on ophthalmology and otorhinolaryngology, head and neck and neurosurgery, cardiothoracic and vascular surgery, gastroenterology, endocrinology, oncology, urology, trauma and burns, plastic surgery and microsurgery, orthopaedics, transplantation, paediatrics, gynaecology and breast surgery. We have given special attention to the various diagnostic modalities and technological advances which have such an important part to play in modern surgical practice — in chapters dedicated to organ imaging, endoscopy, and prostheses. Our anaesthetic colleagues have made a generous contribution to the book in matters such as general and local anaesthesia, pain and pain relief, hazards and precautions in the operating theatre, and intensive care. We have also placed great emphasis on the principles that underlie such technical matters as surgical access, basic surgical procedures, and surgical egress and wound closure. These are skills that every surgeon must possess.

Subjects also fundamental to surgery in general include an appreciation of its evolving history, of principles of clinical water and salt balance and nutrition, of intravenous care, of clinical pharmacology and infection control, and of perioperative assessment and management. The art and science of making the best clinical decision for one's patient, and knowledge of clinical epidemiology, auditing, trials and statistics, are all part of the young surgeon's required range of clinical talents.

Finally the seductive attractions of operative procedures must not divorce the surgeon from an appreciation of the psychosocial and human needs of his patients; from compassion and understanding of suffering, death and bereavement; and from striving, wherever possible, for full rehabilitation beyond the narrow limits of the hospital ward.

In choosing our contributors we have retained the Australasian flavour of the first edition. No doubt the way in which surgery is practised in Australia and New Zealand does differ in some matters of detail (and etymology) from the way in which it is conducted in other parts of the world. However, we believe that the principles that are expounded in this book are universal ones.

There are a great many people whom we must thank for their help in preparing this book. First and foremost, of course, are our contributors, who have borne patiently our requests, cajolings and sometimes threats. We thank especially Joe Freidin, who has done so much with pen and paper to produce many of the illustrations. We are warmly grateful to Franny Moore, who has been mentor and friend to us and to a succession of antipodean surgeons, for his generous Foreword. June Lehmann and her staff of the Part 1 Board have suffered patiently our presence in their offices, and our often unreasonable demands for help. Mary Delafield has given outstanding assistance in checking references and proof-reading. John Rowe, and the staff of Butterworths Australia, waited patiently for the manuscript, and have rendered it into printed form to our complete satisfaction.

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March, 1988

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Contents

1: History of Surgery

G Douglas Tracy

1.1 INTRODUCTION

Those who aspire to a surgical career should begin their training with at least an outline knowledge of the history of surgery. As intending surgeons progress in their training, they find that the special study of an aspect of surgery, or a research project, involves a much more detailed exploration of historical background. Critical insight is enhanced by such study, as the achievements of surgical pioneers relate not only to the skills and techniques of surgery, but also to its scientific basis and its ethical and educational foundations.

Until the late nineteenth century, with the development of anaesthesia and the discovery of ways to overcome microbial infection, the scope for surgery was limited. Although most rapid advances have occurred within the lifetime of today's surgeons, the surgery of wound care actually began in antiquity, and an amazing range of operative procedures was accomplished without anaesthesia, asepsis or supportive therapy.

Education and training in surgery also have an interesting history, since it is only in the last few centuries that surgery has been elevated from a craft, noted more for its brutality and coarseness than for any intellectual qualities, to its present position as a scientific discipline within the profession of medicine.

Both our ethical standards and the beginnings of scientific observation can be seen to have originated from the time of Hippocrates, and this brief historical outline begins with the origins of surgery in antiquity.

1.2 SURGERY IN ANTIQUITY

1.2.1 Egypt

The origins of surgery can be traced to Mesopotamia and Egypt — the oldest cultures of which there is written record. Within these societies, the healing art was developed to a higher level than is found in some primitive societies today. The earliest of the 11 hieroglyphic texts to which we owe our knowledge of ancient Egyptian medicine dates from the year 2900 BC. This text, the Edwin Smith Papyrus, remained indecipherable until the discovery of the Rosetta Stone by Napoleon's expeditionary force in 1799. Indeed, it was not until 1922 that the first complete translation of this text, first bought in 1862 from a native trader in Luxor, was published by the American Egyptologist James H Breasted. Edwin Smith had possessed another papyrus, 'Papyrus Ebers', which was bought from him by George Ebers of Leipzig in 1786; this was the chief source of knowledge of Egyptian medicine until 1922.

Egyptian physicians, who were also priests, tended to specialise in one group of diseases, so that there were specialists for the eye, for the body, for the anus, and other organs. The surgical procedures which were undertaken included trephining of the skull. The surgical skills developed in Mesopotamia and Egypt largely became extinct with these civilisations, though some skills were passed on to Greek medicine.

1.2.2 India

In India, ancient medical practice and teaching survive to the present day. The Ayurveda, one of four ancient Sanskrit texts dating from about 1400 BC (the oldest products of Indian literature), still has an important place in Hindu medicine. In Pakistan, the systems of Brahminical medicine were written by Charaka (first century AD), Susruta (fifth century AD) and Vagbhata (seventh century AD). Susruta is the author whose writings are of greatest interest to surgeons. He describes astonishing operations, including abdominal section, intestinal suture, lithotomy and Caesarean section. The ancient Indians also performed plastic surgery for the repair of severed ears, lips and noses. On the Indian subcontinent, in contrast to medieval and Renaissance Europe, surgery was linked with internal medicine. Susruta wrote: 'Only the union of medicine and surgery constitute the complete doctor. The doctor who lacks knowledge of one of these branches is like a bird with one wing'. He also refers to the education and training of the surgeon. He prescribed an elaborate system of training surgeons, through exercises on soft fruits, plants, dead animals and dummies. In the choice of his pupils, the teacher was exhorted to pay attention to 'honourable parentage, to the morals of his pupils, to their health and to their spiritual and corporal qualities'. A teacher was allowed to train only four to six pupils at one time. The writings of Susruta indicate that he used the drugs cannabis and hyoscyamus for surgical analgesia.

1.2.3 China

Although modern scientific medicine is practised in China, today it exists alongside traditional healers who practise in a style that is little different from that found one thousand years ago. The historical foundations of Chinese medicine can be traced to the twenty-ninth century BC, but its true flowering began in the time of the Han dynasty (206 BC–AD 220) when medical schools were established in all the provinces of China.

Physical examination formed the most important aspect of diagnosis. No fewer than fifty-one types of pulse were distinguished, and thirty-seven different appearances of the tongue. Acupuncture, moxibustion and cupping were important methods of treatment. Acupuncture, a method of pricking the patient with needles of gold or silver, required the study of 388 named points of the body. It is still extensively practised in modern China for pain relief and anaesthesia, and today enjoys a vogue in Western countries.

The Chinese materia medica is based on a collection of 52 books produced in the sixteenth century, which gives prescriptions for the use of about 1900 drugs.

1.2.4 Japan

Chinese traditional medicine was followed in Japan until the arrival of the Spanish missionary, St Francis Xavier, in AD 1549. However, the rapid Europeanisation of Japanese medicine is said to date from 1771, when Japanese doctors witnessed the dissection of an execution victim and became convinced of the correctness of Dutch medical books and the errors of Chinese works. The year 1868, when the Japanese embargo on foreign influence came to an end, was a decisive turning point. In the spring of 1871, two German doctors, Muller and Hoffman, came to take charge of the Tokyo medical school. For a time, German became the scientific language of Japan, and medical schools were organised on the German model.

1.2.5 Greece

Hippocrates (460–377 BC) stands as the central figure of the classical period of Greek medicine. His lasting eminence is the direct result of three main achievements:

(1) the dissociation of medicine from theology and witchcraft;
(2) the innovation of scientific observation, with complete integrity in reporting failure as well as success;
(3) the enunciation of the ethical ideals which have given medicine its highest moral inspiration, so that today we still abide by an almost unmodified Hippocratic oath.

The voluminous works attributed to Hippocrates are better considered as the product of a Hippocratic school. They include treatises on fractures, dislocations and wounds. The description of dislocation of the shoulder and its method of reduction would be fitting today. They also contain the first description of healing by first and second intention, and stress the importance of cleanliness, rest, and immobilisation in wound care.

Unfortunately, after the time of Hippocrates the principles of wound care were forgotten until the beginning of the Renaissance, when Ambroise Paré rediscovered them.

1.2.6 Rome

Roman medicine was almost entirely in Greek hands, and the best account we have of it is the work of Celsus, who is responsible for the oldest European medical documents after the Hippocratic writings. The seventh of Celsus' books was surgical, and it contains one of the first accounts of the use of the ligature for haemorrhage control, as well as a classic description of lithotomy. Under the Roman Empire, surgery attained a degree of expertise which was not reached again before the time of Ambroise Paré.

Two hundred different surgical instruments were found at Pompeii. Herniotomy and plastic surgery were practised, as well as cataract extraction and Caesarean section. Hippocrates had said that 'war is the only proper school for the surgeon', and Roman surgeons were provided with ample experience in the treatment of gladiators, as well as in Rome's numerous military encounters.

During this period, Galen (AD 131–AD 201), the best-known Greek physician after Hippocrates, proceeded with ease and ingenuity to explain many phenomena in the light of pure theory. He thereby succeeded in substituting a convincing and pragmatic system of medical philosophy for the accurate description of observable facts taught by Hippocrates. This dogmatism and the legend of infallibility that grew around it has been claimed to have been the cause of the stagnation of European medicine for nearly 14 centuries.

Galen was a voluminous writer, and his works form a gigantic encyclopaedia of the knowledge of his time. They include nine books on anatomy, 17 on physiology, six on pathology, 30 on pharmacy, and numerous other essays. He was first to describe arterial aneurysm (distinguishing the traumatic from other forms). As an anatomist he gave many excellent descriptions, but much of his work was faulty and inaccurate since it was based on the dissection of animals rather than man. Galen was the foremost exponent of experimental physiology until Harvey. He made an experimental section of the spinal cord, produced aphonia by cutting the recurrent laryngeal nerve, and gave the first rational explanation of the mechanism of respiration. He also demonstrated the motor power of the heart by showing that blood pulsates between the heart and a ligated artery, but not beyond it.

Among Galenic theories which, though plausible, played a significant role in hindering the advance of medical science, was his idea that suppuration ('laudable pus') was an essential part of the healing process in wounds. This notion was not finally overthrown until the advent of Lister.

1.3 SURGERY IN THE MIDDLE AGES

1.3.1 Monastic medicine

During the Dark Ages after the collapse of the Roman Empire, from AD 476–1000, Western European civilisation was in a chaotic and formless state and endured a succession of Germanic and Moslem conquerors. Medicine was in the hands of Jewish and Arabic physicians.

In the Middle Ages, AD 1096–1438, racial groups began to resolve themselves into new nations. This feudal and ecclesiastical period is noted for its bigotry, pedantry and cruelty, and for a servile obeisance to authority. In this climate, the Church was the only foster mother that science could find. There began an era of monastic medicine in which the Benedictine Order acquired great importance.

St Benedict founded a monastery at Monte Cassino in AD 529; and in the eighth, ninth and tenth centuries priestly scholars, who translated the works of the Greek and Hebrew physicians into Latin, became the custodians of medical knowledge. However, a series of papal edicts came into force at the beginning of the tenth century to stop monks from practising medicine, particularly the shedding of blood — because of this a special odium became attached to surgery which persisted for some generations.

It is postulated that the barber surgeons of the Middle Ages were originally barbers who performed the monks' tonsure and blood letting, and that when the monks were obliged by papal instruction to abstain from surgical treatment, the barbers began to practise their skills on the general population.