

A COMPANION IN SURGICAL STUDIES

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THE STAFF OF THE DEPARTMENT
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PREFACE TO SECOND EDITION

IN the second edition of this "Companion" I have benefited from the guidance of my surgical colleagues in their particular specialties, and this is reflected in the sections on which they have been kind enough to advise me. Nevertheless, responsibility for the statements in the book is mine alone, and the book remains the work of a single author.

The new edition is necessarily larger than its predecessor. About one-third of the text is new or re-written. The rapid advance which surgery has made in the interval since 1948, when the last edition appeared, has made it necessary to add some thousands of references and nearly 2000 of them to papers which have appeared since 1950.

Most reviewers have been kind to us, and many of them have been helpful. I have made some concession to those critics who took exception to a textbook without illustrations; there are two diagrams in the new edition. It has not been possible, of course, to take the advice of all our critics, for sometimes this has been conflicting. In spite of the size of this volume it has been decided to retain the form of a single volume work since most of our readers seemed to have found this less inconvenient than two volumes would have been.

On several occasions it has been suggested that I might have included orthopædics, but the preparation of a similar volume to cover the field of orthopædics and injuries would have been quite impossible for one who has been so long out of that field, and would have added immensely to the size of the book.

An extremely frequent criticism of the first edition was that the section on so unimportant a condition as "Congenital Earpit" was disproportionately long. In fact the disproportion was intentional, and this section was intended to be an example of a literary technique for covering fully and completely a single small field. In deference, however, to those whom the disproportion offended this section has been very much reduced in size.

It may be interesting to list here some of the new sections which have been included, since they indicate in some degree how much surgery has advanced during the last eight years. These sections cover wound healing; prognosis in and treatment of burns; flash burns, blast injuries and atomic injuries; the storage of blood; arterial and intra-cardiac transfusion; plasma substitutes; water and electrolyte balance; intravenous alimentation and the metabolic response to injury; the newer antibiotics including aureomycin, chloromycetin, terramycin and the antibiotics from lower bacteria; genetic influences in carcinogenesis; chemotherapy of malignant disease; aortography, aortic embolectomy and the Leriche syndrome; the effects of accidental intra-arterial injections; gravitational ulcer and the post-phlebitic syndrome; cerebral angiography; subdural abscess; post-operative brachial plexus palsy; per-axillary sympathectomy; tumours of the sympathetic system; diseases of the chest wall; tumours of heart and pericardium; meconium ileus and peritonitis; the surgical aspects of amœbic dysentery; the colostomy life; biliary fistula, internal and external; intravenous cholangiography; intrahepatic biliary obstruction; chronic relapsing pancreatitis; and congenital obstruction of the bladder neck.

Many sections, of greater or lesser extent, have had to be completely or largely re-written, and these include the treatment of burns; the pathology of inflammation; cellulitis; pulp infections of finger; complications of hand infections; treatment of tetanus; treatment of actinomycosis; melanoma; fibrosarcoma; chondrosarcoma;

extra-skeletal osteogenic sarcoma; the treatment of osteogenic sarcoma; plasmacytoma of bone; the treatment of arterio-venous fistula, and Raynaud's disease; sclerodactyly; the treatment of aortic aneurysm; dissecting aneurysms; angioma; the treatment of portal hypertension; chronic œdema; the treatment of cancer of the tongue; epulis; Mikulicz disease; platycephaly; acute pyogenic leptomeningitis; the operative management of brain tumours; leucotomy; brachial plexus injuries; differential diagnosis of brachial neuritis; laryngocele; branchial carcinoma; the etiology of simple goitre; the investigation and treatment of toxic goitre; the treatment of recurrent nerve palsy; respiratory obstruction after thyroidectomy; the pathology and treatment of carcinoma of the thyroid; tumours of nasopharynx; the treatment of cardiospasm; hiatus hernia, short œsophagus and reflux œsophagitis; the treatment of empyema; resection of tuberculous lung; hydatid disease; mitral stenosis; mediastinal cysts; tuberculosis of breast; the prognosis and treatment of breast cancer; retroperitoneal tumours; the treatment of cancer of the stomach; the technique and effects of gastrectomy; tumours of the small intestine; the history of appendicitis; the ætiology and treatment of megacolon; the treatment of ulcerative colitis; benign tumours of the rectum; operations for cancer of the rectum; pilonidal sinus; proctalgia fugax; pyæmic abscess of liver; resection of liver; congenital anomalies of the gall bladder; stricture of the common bile duct; the treatment of pancreatic calculi; pancreatic fistula; the differential diagnosis and treatment of islet cell tumour; the treatment of cancer of the pancreas; pancreatectomy; purpura; virilism and feminism; adrenal medullary tumours; adrenalectomy; renal function tests; the treatment of urinary tuberculosis; the ætiology of renal calculus; anuria; tumours of the ureter; transplantation of the ureters; the bladder mechanism in nervous diseases; sarcoma of the bladder; the pathology of bladder cancer; the technique of total cystectomy; tumours of the urethra; tumours of the epididymis; complications and faults in amputation stumps and kineplastic amputations.

In addition to these alterations, a number of smaller subjects which were omitted from the first edition or have been discovered since its publication, have required consideration. These include recent experiments in irreversible shock; thromboplastinogen; fish-handlers disease and cat scratch; benign calcified epithelioma of skin; epithelioma cuniculatum; xeroderma pigmentosum; melanophoroma; glands; meliodosis; moniliasis; cutaneous cysts; histiocytoma; ganglion; chondroblastoma; hæmangioma of bone; angiosarcoma of bone; cranial chordoma; the anterior tibial syndrome; internal carotid thrombosis; puerperal gangrene; tumour and foreign body embolism; phlegmasia cærulea dolens; benign Hodgkin's disease; the eosinophil granuloma of bone; parotid injuries; Sjögren's syndrome; Sturge-Weber syndrome; Bell's palsy; Horner's syndrome; the extra-cranial metastases of intra-cranial tumour; tumours and colloid cysts of the third ventricle; fluorescein localization of brain tumours; glosso-pharyngeal neuralgia; topectomy, thalamectomy and cingulectomy; visceral neurofibromatosis; giant-cell thyroiditis; epidemic toxic goitre; reconstruction of trachea; treatment of nasopharyngeal fibrosarcoma; plasma cell tumours of pharynx; hypertrophic stenosis of the œsophagus; dysphagia lusoria; benign tumours of the œsophagus; closed wounds of lung; surgical emphysema; traumatic chylothorax; classification of lung abscess; bronchovascular segments of lung; paraffinoma of lung; congenital intracardiac fistulæ; fistula of lactiferous ducts; abdominal wound disruption; talc granuloma; tumours of the peritoneum; Maingot's keel operation for umbilical hernia; sclerosing angioma; mesenteric, omental and peritoneal tumours; inheritance of congenital pyloric stenosis; gastro-duodenal intussusception; aspiration treatment of perforated peptic ulcer; the association between the ABO blood groups and gastric disease; neural and other rare tumours of the stomach; perforation of the intestine; necrotizing enteritis; traumatic rupture of the duodenum; cysts of the

duodenum; the hormonal effects of intestinal carcinoid; the effects of resection and short-circuiting of small intestine; congenital anomalies of the appendix; acute appendicitis in pregnancy; injuries of the colon; lymphosarcoma of the appendix; acute phlegmonous colitis; carcinoid tumours of rectum; sarcoma of rectum; presacral teratoma; cholangiography; aneurysm of hepatic artery; limewater gall bladder; gall bladder disease in childhood; the surgical anatomy of pancreatic veins; myeloid sclerosis; aldosteronism; spontaneous perirenal hæmatoma; calyceal diverticulum; actinomycosis of kidney; partial nephrectomy; hydroureter; retrocaval ureter; bilharzia of ureter; Marion's disease; tumours of spermatic cord; afibrinogenæmia; amyloidosis; Peyronie's disease; interstitial-cell tumour of testis.

This "Companion" was originally designed to assist registrars and residents in surgery in their studies. It is gratifying to know that it has been of some assistance to others as well. I myself have found it of use in preparing clinical lectures and demonstrations, and in refreshing my own memory in demonstrating patients to postgraduates. It appears to have been of some assistance to postgraduates preparing for the Fellowship Examination in this country and the Specialists Boards of other countries. The first edition has been cited sufficiently often in the literature to suggest that it is of some use in guiding the field-workers of the natural history of disease to new discovery. This is an advanced book for undergraduates, but these too have used it in close study of particular surgical diseases or particular patients. It does not attempt to be of much value to the General Practitioner in his practical work, but some General Practitioners have sought in it an explanation of the surgical investigation and therapeutic procedures to which their patients have been submitted after admission to hospital.

The bibliography may be regarded as fairly complete as far as the first week in August, 1956.

Finally, in this second edition, I must pay tribute to the many readers of the first edition who favoured me with lists of corrections and emendations.

A handwritten signature in dark ink, reading "Ian Chird." The signature is fluid and cursive, with a long horizontal stroke at the beginning and a small dot at the end.

Postgraduate Medical School of London,
University of London.
November 1956.

PREFACE TO FIRST EDITION

IN the Introduction I have outlined the scope and purpose of this volume; I desire here to record my indebtedness to many sources of inspiration.

The debt I owe to surgical literature and to surgical authors is so great that I cannot pay full tribute in the limited space at my disposal; the whole book is an expression of that complete acknowledgment. I hope I have not lost accuracy in trying to avoid plagiarism. One variety of plagiarism I have cultivated rather than avoided, for I have consciously modelled my habit of thought for years on that of my previous teachers, and if there is any good in the book it is the re-expression of their observations and opinions so far as I have remembered them. Not only did I try to learn something of the specialties which they have made their own from James M. Graham, James R. Learmonth, Evarts A. Graham, Norman M. Dott, and the late Sir David Wilkie, but I endeavoured to study, understand, and copy something of their surgical philosophy, and I hope that there may be some re-distillation of their philosophy in these pages.

I owe my education to many universities, but my educational debt is greatest to the medical schools of Edinburgh, St. Louis (Missouri) and London. To the last of these my debt is still growing, and I am conscious particularly of the continuing influence of all my colleagues in all departments of the Postgraduate Medical School of London. These colleagues have all played a vicarious part in my authorship; the truth is theirs, the errors are mine. To Mr. Maurice R. Ewing, Senior Lecturer in my Department, I am grateful for untiring and constructive proof-reading.

For liberal and unrestricted permission to quote verbatim the text of original articles of mine I must thank H.M. Stationery Office, and the editors and proprietors of *The Annals of the Royal College of Surgeons of England*, *Annals of Surgery*, *British Journal of Surgery*, *British Medical Journal*, *Bulletin of War Medicine*, *Edinburgh Medical Journal*, *Lancet*, *Medical World*, *Postgraduate Medical Journal*, *Proceedings of the Royal Society of Medicine*, and *Surgery, Gynaecology and Obstetrics*. Each extract is individually acknowledged in the text.

Only those of my fellow-authors whose names are included in Livingstone's list will appreciate fully the understanding and co-operation which I have enjoyed from Mr. C. Macmillan and the firm of E. & S. Livingstone Ltd., who regard to-day's publishing difficulties as a stimulating challenge rather than as a restriction. Mr. Macmillan is an inspiration to authorship. Mr. W. M. Todd and his historic firm, T. and A. Constable Ltd., have printed my book with an expedition which one would not have thought possible, and with an accuracy and beauty which one would expect.



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CHAPTER I

INTRODUCTION

IT is universally accepted that the ideal reading for the advanced student of surgery is the original article and the monograph, and I cannot without apology present so large a work written by a single hand, nor without diffidence publish an account of so many different surgical fields. If it is admitted, as it may not be, that the advanced student can benefit from a textbook, it is usually adjoined that the ideal manual for his study is a composite work of multiple authorship, each contributor having a high pre-eminence in the subject which is apportioned to him and having been personally responsible in some degree for the advancement of knowledge in his specialty.

We have all subscribed to these high principles of surgical publication and advanced study for a generation, and textbooks of multiple authorship, some of them encyclopædic, are available in considerable numbers; yet in the twenty-six years during which I have been partly or wholly engaged in post-graduate teaching, I have been impressed by the difficulties which embarrass the advanced student in the prosecution of his private study. The apprentice in general surgery could not, if he would, cover his subject by reading the innumerable monographs and articles which concern him, for even the collection of an adequate bibliography would occupy him for months. The trainee in a more specialized branch of surgery—orthopædics, or urology, or plastic surgery, or neuro-surgery—labours under the same difficulties if he attempts to obtain by reading a comprehensive view of surgery as a whole.

When the student turns to a multiple-author textbook he finds that it suffers from certain disadvantages. Not all experts manifest an equal facility in presenting their specialties lucidly to the student of general surgery, and books of multiple authorship, however expert and diplomatic their editors, vary greatly from section to section in the value and clarity of their content. Space is usually strictly rationed, and the author, in cutting his coat to the available cloth, has often to choose between omission, over-simplification and a condensation of style which amounts to falsification. Nor does multiple authorship make for ease in reading at length or for close familiarity between student and text; rapid switches in the pattern of the thought and in the texture of the style jangle the mind as by a too frequent change of gear. Single authorship, whatever its defects, at least offers a unity of style and of thought which makes a work either acceptable or unacceptable as a whole. The reader puts all his eggs in one basket, buys all his pigs in one poke.

The title of this book has been chosen to avoid any suggestion that it is a manual or textbook designed to teach the reader how to conduct a surgical practice or to perform operations. Surgery is learnt by apprenticeship and not from textbooks, not even from one profusely illustrated. The surgical student's illustration is the living patient and his blackboard is the operation wound. Yet to make the most of his clinical opportunities, the student must have ready and rapid access to the ever-growing canon of established surgical fact; he should be aware of the surgical conquests of the past, the tactics of the present and the strategy of the immediate future. When he examines a patient he should be armed already with a vicarious experience gained from reading and should be able to distinguish between the symptoms and signs which illustrate, and those which contradict, the observations of his clinical predecessors. Only so can he proceed to a detailed study of the individual patient. A doctor not widely read cannot collect clinical data from a patient, much less interpret and collate them.

So too when the surgical apprentice assists at an operation. The steps of that operation are chosen by his principal from many alternatives, and to understand a technique the assistant must not only know its details but be familiar with its alternatives and appreciate the reasons for its choice.

Yet access to available surgical knowledge, in any wealth of detail and undistorted by simplification, is not easy. To consult a long series of original articles is a desirable ambition in an advanced student or resident, but textbooks are economical of references, and consultation of the indexes of medical literature is a slow process even for those who are practised in their use. It is hoped that this book will be found convenient for employment in the hospital ward and ante-theatre, no less than in the study, as a kind of commentary to the clinical illustrations which the ward and operating-theatre afford. For this reason, and for economy of space, diagrams have been entirely excluded; an illustrated text would have been impossible within the compass of a single portable volume. The omission of diagrams has obvious demerits, but it has one advantage: it avoids the falsity of over-simplification. There is no doubt that the commonest type of memory is that which relies on visual impressions. Yet too close a dependence on visual memory enchains the intellect; the highest faculty of the intellect and the finest medium for communication is language. I have endeavoured to present fact and argument in a form to render illustrations unnecessary to the reader who has some knowledge of anatomy or, failing that, access to an anatomical atlas.

In my present appointment as director of a department of surgery in the post-graduate school of a university, I had intended to spend most of my clinical teaching hours in discussing the pathological basis of symptoms, the physiological basis of treatment, and the reason for divergence of the signs and symptoms of the individual patient from the classical clinical picture of his or her responsible disease. Before such an exposition could be attempted the student audience had to be in possession of certain basic and elementary facts. My students and I have found that these facts are nowhere presented in detail sufficient and in form convenient for a mature post-graduate student. Too great a part of our time has consequently been spent upon a consideration of facts and principles, and too little of it before the difficult minutiae of the individual patient. This book is an attempt to gather a canon of surgical knowledge to act as a spring-board or rocket-platform from which the student may project himself on the one hand into the difficult realities of clinical surgery, or on the other into the neater and tidier, but nearly immeasurable, repository of observation and deduction which medical literature affords. I hope that it will save myself, and my own and other students, a great deal of tedious labour in the lecture-room.

Though this introductory chapter is to some extent an apologia, I make no apology for the "academic" arrangement of the content of my book. "Academic surgery" might be defined as an attempt to obtain an ordered view of the relationship between those deranged anatomical and physiological events whose procession may be altered, to the patient's advantage, by surgical action. Such a definition entails, as it should, a previous education in the basic sciences of anatomy, physiology and pathology. The reader is assumed to have an intimate knowledge of the first two of these, but the anatomical details required for the understanding of operative procedures, and the physiological principles which underlie all treatment, operative and non-operative, are given as fully as possible. Pathological detail receives special attention, not wholly because it has been one of my own particular interests, but also because the surgeon, even more than the physician, must regard symptoms and signs merely as the superficial expression of an underlying pathology, a pathology which includes not only the morbid anatomy of the part as it may later appear in the bottled trophy, but the morbid histology of the diseased organ and the morbid physiology of the patient's whole organism. The eye and hand of the surgeon should convey to him

not only the size, shape, outline, surface and consistence of a tumour, but also, penetrating the unreal sensual shell, a clear concept of the fine three-dimensional structure of its microscopic pattern, which is usually nearer to truth. So, too, a dry skin, a scanty urine and a hollow cheek should be read at once in terms of biochemical disorder. Pathological details are relegated to smaller print not because they are unimportant, but because the adequately educated post-graduate student should already be in possession of them.

The book has a three-fold origin. It incorporates a collection of lecture notes which I published privately before the war for the convenience of my post-graduate students of that time, and these are supplemented by records of more recent systematic lectures and by certain of my own original articles transcribed in their entirety. The great bulk of it is an epitome of the published work of others, for excessive originality in a teacher makes for bigotry and bias, but pen and paper have been used rather than scissors and paste; I have tried to predigest the written work of others by the enzymes of a personal experience admittedly limited. In a few places, where my own observations have seemed pertinent, these have been included.

The book is intended primarily for the trainee in general surgery, and for the apprentice in a more restricted specialty who wishes to obtain a contemporary view of general surgery, and of surgical specialties other than his own. In preparing the chapters on the more specialized subjects I have been guided not by the intention of teaching students how to treat patients suffering, for example, from cerebral, thoracic or urinary disease, but by the desire to present to general surgeons those principles and methods of the ultra-specialist which perhaps have a general application. It may be of advantage that a general surgeon with some special experience, rather than a pure specialist, should serve as an interpreter on occasions when the requirements of the student are held to take precedence before the interest of the teacher.

I have omitted all mention of orthopædics and of fractures. My personal knowledge of orthopædics is even scantier than my knowledge of her sister specialties and, in any case, the gap between general surgery and the specialized surgery of the skeleton is so wide, and orthopædic technique is so dependent upon mechanical principles which cannot readily be applied to other branches of surgery, that the omission of orthopædics seems not unnatural.

I hope that the book will be of value as a companion to the surgical trainee, graded surgeon and surgical apprentice, and that they will find it helpful in their consideration of the patients whom they attend and the operations at which they assist; it may prepare them for the practical teaching they receive during their general training, and for the instruction given them by their masters in the specialties. Senior medical students will perhaps find it helpful in the detailed study of particular cases. I do not presume to instruct the established surgeon and the teacher, but I hope that the work may serve these, too, as at least a ready reference to surgical literature.

Two main types of print have been used so that in preparing for a higher examination a student may readily distinguish between those sections which are suitable for a first reading and those which require closer study. The undergraduate student may omit all the small print, and most of the operative detail, except in places of special interest to him.

The list of references is not intended to be exhaustive. Those papers are cited which are particularly stimulating or particularly encyclopædic, or which are of historical importance; most are from British or American literature. Recent authors have been quoted in preference to earlier writers, not because of a desire to be in the forefront of fashion, but because the recent papers furnish references to their predecessors, and the student in search of a bibliography swims to best advantage against the stream of chronology; the snowball of references grows as it rolls from paper to paper into the past.

In style I have striven for directness and simplicity rather than for effect, and in content I have tried to omit statements which are hallowed only by textbook repetition. A senior colleague recently said to me, "I wish someone would publish a textbook in which every statement is *true*," but the truth is a tall order. The whole truth is too complex a thing to attain, in surgery as in every kind of human endeavour. Even those diseases which we claim to understand are so vast in their scope, so infinite in their variety, so apparently erratic in their incidence, and so sensitively modulated by the soil on which they fall that the resources of the human mind would be baffled, the easy flexibility of the English language would freeze, and the spatial confines of paper and print would be uncontrollably violated if any serious attempt were made to document the whole truth even about them. I have, however, tried to weigh every statement I have made in the scales of my own experience, and I hope that my less equivocal statements are, in the main, a fairly accurate record of surgical events and processes. Unverified statements I have usually laid at the door of a responsible authority, and it is my hope that, when the student has followed my statements to their source, has heard them confirmed or contradicted by his own masters, and has tested them in the light of his own experience, he will have come within a measurable distance of the truth as we know it now, and will be in some degree prepared for the gradual extension of surgical knowledge as it proceeds in the future.

CHAPTER II

THE LOCAL EFFECTS OF TRAUMA

WOUNDS

A WOUND is a solution of continuity of the tissues produced by external violence. There are many categories of wounds, but a simple classification will be followed here.

Wounds may be classified as *closed* or *open*. Closed wounds may further be subdivided into *contusions*, *abrasions* and *hæmatomas*. Open wounds may be classified as *incisions*, *stab* or *puncture* wounds, *penetrating* wounds (without a wound of exit), *perforating* wounds (with a wound of exit) and *lacerated* wounds.

NATURAL REPAIR

In healing by *first intention* or *primary union*, inflammatory phenomena are not obtrusive. Capillaries cease to bleed by contraction of their walls. The fibrin already poured out sticks the wound surfaces together as a scab. Any dead tissue is removed by macrophages and fibroblasts and new blood vessels develop from the large mononuclear polyblasts.

Healing may be delayed by such local factors as foreign bodies, infection, blood clots, and by such general factors as age, cachectic states, lack of vitamin C (which acts specifically to produce the ground-substance between cells), lack of vitamin A, and lack of protein. Where one of these influences prevents healing the polyblasts fail to mature into fibroblasts, collagen production fails too, and plasma cells and large mononuclears gather as "granulations."

CLOSED WOUNDS

(1) **Contusion**, or a "contused wound," is a soft tissue injury unaccompanied by interruption of the skin surface. Tissue layers are separated, small blood vessels are torn, and the part becomes discoloured by extravasation of blood and swollen from the passage of plasma through the unnaturally permeable walls of capillaries damaged by violence or dilated by the local products of tissue injury. If the hæmorrhage extends from deeper structures to discolour the skin, a bruise or ecchymosis results. The discoloration is first red, from the extravasation of red blood cells and bilirubin. This later loses its oxygen and becomes a progressively darker blue. Soon it shades into the greenish-yellow of biliverdin, and finally fades to a yellowish colour with the appearance of hæmatoidin and hæmosiderin. Finally, the pigment is absorbed with return of the normal colour. If, however, tissue disruption is excessive, and if skin is devitalized by the initial trauma or by swelling, the part may contract from scarring, or telangiectases may persist in it.

(2) A **hæmatoma** forms when blood pours out and collects between fascial planes. The hæmatoma may be subperiosteal, submuscular, intermuscular or subcutaneous. Initially it is a collection of fluid blood. This may become infected if the skin over it is thin and damaged, or it may persist, becoming surrounded by a fibrous wall. Fibrous tissue is laid down peripherally and is preceded by peripheral clotting. Finally, it may extend to the centre of the hæmatoma, which quickly passes through phases of fluctuation, boggy impressibility and firmness. A hæmatoma may completely resolve by absorption of its contents; it may become infected; it may have its

pigment absorbed and its plasma replaced by tissue fluid (this is common in subdural hæmatoma, see p. 333); in rare cases it may calcify.

A hæmatoma is in the first instance treated conservatively. If it persists painfully for a few days it may be aspirated while still fluid, with full aseptic precautions and with a pressure dressing applied to it after aspiration, for a hæmatoma offers an attractive pabulum to invading organisms. If a hæmatoma persists painfully for more than a few days until it no longer fluctuates but gives a rather boggy sensation on palpation, it may be evacuated through a small incision.

(3) An **abrasion** results when the superficial layers of skin are scraped away. If this is effected by damage from the road surface in a traffic accident, fragments of dirt may be impregnated in the damaged skin and remain there after healing, to give the effect of tattooing. The abrasion is more painful than either of the preceding types of closed injury; for sensitive nerve endings are exposed. The lesion is virtually a "vaccination" by infected grit or hard rough surface, and infection is common, sometimes with wide-spread cellulitis. The treatment of an abrasion entails the removal of large grit particles embedded in the skin, careful cleansing and a dressing of penicillin cream or penicillin-sulphonamide powder.

OPEN WOUNDS

The **incised wound** is perhaps the most important form of interruption of the surface of the body from the point of view of the operating surgeon, and it is one of the most important forms of open injury. The incised wound may be produced intentionally at surgical operation or accidentally, or as the result of assault, by knives, fragments of glass and metal, and cutting instruments of all kinds. Sometimes a split skin, stretched violently over bone, may have all the appearances of an incised wound. Most incised wounds show a tendency to gape and for the subcutaneous tissue to protrude through them. The edges of the wound are clean-cut and there is no macroscopic injury to the tissues in the wound edges. Such a wound usually bleeds freely; the pain of its infliction is severe from the number of nerve ends cut, but subsequent pain is slight provided the wounded part is kept at rest. Incised wounds are not usually treated by excision provided it is known that the instrument which inflicted them was clean and that no infected material was subsequently introduced. The skin edges of the wound are cleaned and shaved of hair, the blade of the razor being moved along the wound first on one side and then on the other, at an oblique angle to the line of the wound. With full aseptic precautions, the wound is explored for injuries to vessels and nerves whose effects have already been clinically studied and whose interruption has already been predicted before operation. Bleeding is controlled by forceps and ligature, and the edges of the wound are apposed usually by interrupted sutures of a non-absorbable material.

Stab and puncture wounds are much deeper than they are long, and their chief danger lies in the risk of penetration to which deep organs may have been subjected, and the likelihood of infected material having been carried in to their depths. Opaque foreign bodies in such a wound may be radiologically demonstrable. Extensive operation for the excision of a stab wound is not usually undertaken unless presumptive evidence has been obtained of injury to an important vessel, nerve or viscus. The skin edges are excised and the skin wound is left open if small, or sutured if larger. The part is put to rest and chemotherapy is afforded; subsequent incision may be necessary if suppuration follows.

Penetrating and perforating wounds are treated on the same lines as stab wounds provided the wound of entry, and of exit in perforating wounds, is relatively small. Injuries to deep organs may be suspected from clinical examination or from

an estimate of the track of the missile, and operation may be undertaken for this, or for a retained foreign body, a bullet for example, if one has been demonstrated radiologically.

The **lacerated wound** is common in war from injury by shell fragment. Not only is the surface broken, but the tissues round the wound are extensively traumatized, devascularized and liable to be the seat of subsequent infection. Such wounds are treated by formal excision. The skin is shaved and washed thoroughly and the skin edges are excised to leave a clean outline. Wide excision of skin is unnecessary unless it is extensively abraded. To gain access to the deeper parts of the wound the excision of the skin edges is extended in the line of the long axis of the wound and the edges are retracted. The deep fascia is now examined and the wound in it is excised too; deep sepsis and abscess formation are frequently encouraged by tight apposition of the edges of the fascial wound, and to abolish this dangerous barrier to drainage, the deep fascia, and especially the fascia lata, is divided widely across the line of its fibres, beyond the limits of the fascial wound. Muscle is excised, since devitalized muscle offers the most attractive pabulum for anaerobic organisms. All dead muscle is cut away with scissors to leave bleeding edges. The surface of the underlying bone is now exposed if the wound has extended to it. If the continuity of the bone is broken, incompletely detached and grossly contaminated fragments are removed; clean fragments, still attached by periosteum, are left.

Retained foreign bodies in a wound of this character are a potent cause of protracted sepsis, which, in a soft tissue wound, seldom occurs in their absence. The higher the proportion of foreign bodies removed early, the lower is the incidence of prolonged sepsis, and the sooner removal is attempted the more likely is the foreign body to be found. Where X-rays are available, removal is easier, but even without X-rays the track may usually be found by the finger, which is the best probe. The wound is "frosted" with penicillin-sulphonamide powder and vaseline gauze is laid over the superficial part of the wound and complete rest is afforded by some form of immobilization of the limb. Immobilization may be obtained by splint or plaster, but whichever of these is employed, it is removed after four or five days¹ for *delayed primary suture* to be performed. In the intervening period parenteral penicillin is given to prevent blood infection and to ensure a continued high penicillin concentration in the wound secretions.

There is no question that every wound should be afforded *skin cover* at the earliest possible time—either immediately, where skin loss has not been excessive, or by delayed primary suture, which is perhaps the greatest significant surgical advance contributed by the second World War. The surgeons who explored this principle in Egyptian Base Hospitals in 1941 builded better than they knew, and the advantage of penicillin a year later and its fairly general availability a year later after that, wrote "Finis" to the prolonged open treatment of wounds. The only protection a wound can have against secondary infection is skin.²

Sepsis in a lacerated wound treated by these methods is due usually to infection by gram-negative organisms, more particularly *B. coli*, *pyocyaneus* and *proteus*. Chloramphenicol or terramycin or 2 per cent. phenoxitol is more or less effective in removing these. Though not serious to life, these infections delay healing, but as soon as they have been eliminated, *secondary suture* may be undertaken.

Various "nostra"³ have been advanced to promote the early healing of wounds, but those that have been fully documented⁴ have shown to be less effective in promoting than in actually delaying healing. Adreno-cortical steroids, for example, delay the growth of granula-

¹ Lowry and Curtis (1950), *Amer. J. Surg.*, 80, 280.

² Essex-Lopresti (1950), *Lancet*, i, 745.

³ Lam (1948), *Amer. J. Surg.*, 75, 643.

⁴ Lam and Brush (1951), *Amer. J. Surg.*, 80, 204.