SERIES II

PROGRESS

IN

CLINICAL SURGERY

Edited by

RODNEY SMITH
M.S., F.R.C.S.

J. & A. Churchill Ltd.

PROGRESS IN CLINICAL SURGERY

BY VARIOUS AUTHORS

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PREFACE

In writing a book on clinical surgery it is today manifestly impossible to cover the subject completely, omitting nothing, unless it is intended to devote to it several volumes and upwards of a million words. There is, of course, nothing basically wrong in an ambitious approach of this kind, but the result inevitably becomes a reference work, apt to spend the evening upon a shelf rather than on the knee of the student. If, on the other hand, a book of readable length is the aim, much must be left out and it becomes of basic importance to decide at the outset for whom the book is to be written and what standard of knowledge is to be reached.

In the preparation of this book it has been my object to produce a volume especially helpful to the postgraduate student working for his final F.R.C.S. examination and the younger surgeon with a recent hospital appointment. It is thus intended to supplement, and not to replace, the standard surgical textbooks in general use in preparation for qualifying examinations. It is assumed that the reader already possesses sufficient knowledge to aim at a Fellowship and a surgical career. My object has been to build upon this by providing more complete information about those subjects in which it seemed that a big gap existed between the rather compressed information generally available outside specialized articles and the standard of knowledge required in the final F.R.C.S. examination.

Thus, in this book many common subjects will not even be mentioned if it is felt that they are adequately covered in standard works or that no important progress calls for description. The student will, for instance, search in vain in this book for an account of appendicitis, gall-stones or carcinoma of the rectum. Common everyday subjects are not completely omitted. It is by no means unusual to find that writings on a subject which, on the face of it, appears an elementary one, are nevertheless confused and difficult to follow on account of the multiplicity of procedures advocated by different authors. A chapter then by a senior authority taking some clear and definite line is of much value to the student. It is for this reason, for instance, that a chapter is included by Mr. Rodney Maingot on the repair of large herniæ, whilst the assessment of the present position in the treatment of hiatus hernia and reflux œsophagitis by Mr. Donald Barlow is a timely one and likely to help the student who has become bewildered by the many contradictory reports published in the last decade. Chapters on

diverticulitis coli by Mr. E. G. Muir and transplantation of the ureters by Mr. L. N. Pyrah are included for similar reasons.

The majority of the book, however, is made up of chapters focussed upon what may be termed the "growing edge of surgery", examining in detail progress in knowledge and technique or subjects in which some drastic reappraisal has been made in the last ten to fifteen years. The present position in cardio-vascular surgery naturally calls for examination and the first three chapters are devoted to important individual aspects of this special subject.

The endocrine glands are always likely to produce some new facets for examination and the time seems ripe for a re-examination of the problems of hyperparathyroidism, Cushing's disease and thyrotoxicosis, whilst the much new information relating to thyroiditis clearly cannot be omitted. Hepatic, biliary and pancreatic surgery have all seen advances, some of the utmost importance. The remaining individual chapters have been selected on the same basis. Each one spotlights some important advance and indicates the way ahead.

Inevitably each reader will find some subject omitted which he would like to have seen included, and attempts to make this possible would at least have doubled the length of this book. In apologizing now for such omissions as may appear significant, I hope that the deeds of my contributors will compensate for the misdeeds of their editor, and take this opportunity of thanking them for all the care and trouble they have taken to cover so fully and concisely these selected subjects.

149 Harley Street,
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CONTENTS

CHAPTER 1

PROGRESS IN CARDIAC SURGERY

by A. L. D'ABREU

Introduction

AFTER Gross in 1939 had operated successfully on the persistent ductus arteriosus the surgery of the great vessels and of the heart entered an era of progress; war experience showed that wounds of the heart could be sutured and metallic fragments safely removed from each of the four chambers (Harken, 1946). The success of the now obsolescent Blalock operation of anastomosing a systemic vessel, usually the subclavian, to the pulmonary artery in the tetralogy of Fallot had followed the surgical correction of coarctation of the aorta in 1944 (Crafoord, Gross).

In 1948, the real surgery of cardiac valves started. Sellors and Brock first performed "blind" operations on the stenosed pulmonary valve by the introduction of cutting instruments through a small incision in the right ventricle. In the same year, Bailey, Brock and Harken established the operation of mitral valvotomy, in essence using the approach first employed by Souttar (1925) years before. This operation, now widely performed, remains the commonest cardiac operation but has gained rapidly in technical perfection and achieved such a wide application that every patient with established mitral stenosis and a steady increase in dyspnœa is investigated by cardiologists with the possibility of surgical relief always in mind. The overall mortality rate of about 6 per cent is far lower in patients under the age of 40 if in normal rhythm.

Subsequently the surgical relief of aortic and tricuspid stenosis followed. Aneurysms of the thoracic aorta became amenable to treatment, either by excision of the saccular type or by replacement of large segments of the aorta (including the arch itself) after their excision, by homografts or "plastic" tubes. Cardiac tumours, e.g. myxoma of the left atrium and hydatid cysts were successfully removed and cardiac aneurysms (the result of infarction) were repaired. It is still too early to assess the value of the different operations carried out for cardiac ischæmia.

The next great step forward was the introduction of open cardiac surgery; the development and application of safe hypothermia enabled us to occlude the inflow and outflow tracks of the heart so that the right

atrium could be opened widely to allow atrial septal defects to be closed deliberately under vision; this defect had already been closed by blind methods in which part of the atrial septal wall was sutured against the septal defect (Bailey) or by the semi-blind method of Gross in which a "well" was sutured to an incision in the atrial wall; the low pressure in the right atrium allowed blood to half-fill this well without preventing the normal flow of blood into the right ventricle; by "feel" without direct vision the surgeon was able to close defects by the use of this well. Most surgeons now prefer open surgery with repair under direct vision.

Hypothermia can be produced by immersion in a cold bath, by the circulation of cold fluid through blankets, the veno-venous method of rapid cooling in which blood is allowed to flow from an atrial cannula into a cooling cell from which blood is then returned to another venous channel, or by placing ice packs around the patient.

As a further drop of 2°C. occurs during the thoracotomy after the patient has left the bath or the blankets have been opened, the operation is started when the temperature is about 32°–33°C. If the blood flow to the heart is arrested at a temperature of about 30°C. the surgeon will have six to nine minutes of operating time without the risk of serious cerebral or visceral damage taking place.

This type of hypothermia is suitable for:

(i) The repair of atrial septal defects (secundum type).

(ii) Open operations on the stenosed pulmonary valve done deliberately through an incision in the main pulmonary arterial stem.

(iii) Open operations on the stenosed aortic valve by an incision made in the ascending aorta.

The mortality rate of operations on the first two is well below 4 per cent; the aortic valvotomy mortality rate depends largely on the stage at which surgical relief is employed, the death rate being high in patients who are in severe left ventricular trouble. Those patients with aortic stenosis who have grossly hypertrophied left ventricles are particularly prone to develop ventricular fibrillation under hypothermia. This condition will probably be dealt with more frequently under by-pass conditions in the future.

The culmination of these efforts has been the establishment of open cardiac surgery by the use of total cardio-pulmonary bypass: Gibbon of Philadelphia had worked on the problem of an efficient heart lung machine since 1937; Melrose in this country has pursued the problem for years and great success has been achieved. Lillehei before he with de Wall and others in Minneapolis had developed their now famous

"bubble-oxygenator" machine, had operated with astonishing success on ventricular septal defects by the use of human cross-circulation in which the donor's lungs provided the perfect physiological requirements; the obvious contra-indication to this method was the risk to the donor but the method proved that open cardiac surgery was the correct method of dealing with certain intracardiac defects. Since Lillehei's

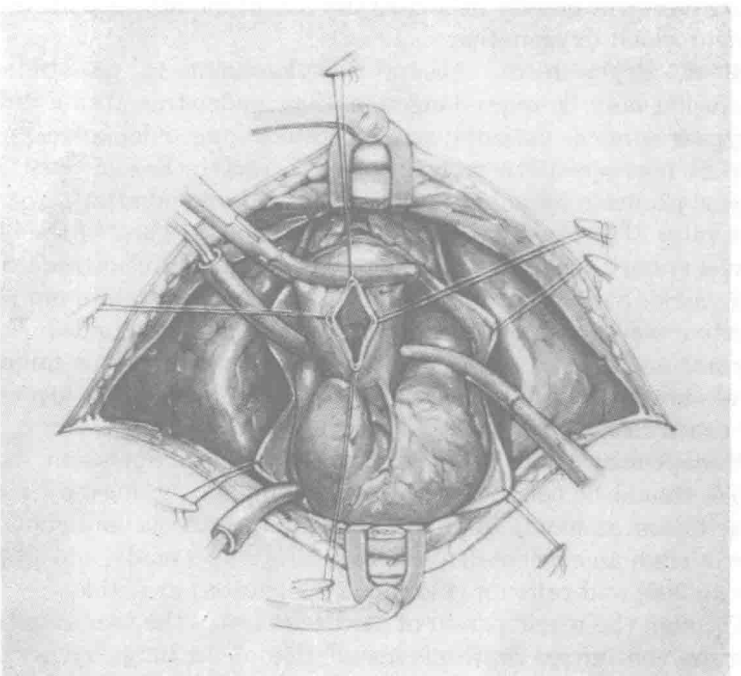

FIG. 1. Open aortic valvotomy performed through the ascending aorta. The caval vessels have been occluded by means of thin rubber tubing used as tourniquets. When the carotid pulsation had disappeared the aorta and the pulmonary artery were cross-clamped.

first dramatic report in 1955 large series of operations on ventricular septal defects, Fallot's tetralogy and ostium primum defect of the atrial septum (mentioned later) have been done with the use of several different types of heart lung machine of which those most in use are the Mayo-Gibbon, the Lillehei-de Wall bubble oxygenator and the Melrose machine. These rapid advances, which have taken place since 1948, represent the most important technical changes in cardiac surgery in recent years and only the briefest account of the progress can be given.

Some Technical Considerations Pertinent to the Surgery of the Heart and Great Vessels

Anæsthesia. The lightest plane of anæsthesia possible is used; the aim always is to have a conscious co-operative patient at the end of the operation; the minimum dosage of pentothal and relaxants are accompanied by deliberate hyperventilation and carbon dioxide abstraction; this greatly decreases the risk of metabolic acidosis and of deficient blood oxygenation.

Blood Replacement. Accurate replacement is essential: over-transfusion may be more dangerous than under-transfusion especially in bypass surgical patients; post-operative lung œdema was a major cause of post-operative mortality in the early series of open cardiac surgery: accurate weighing of the patient before and after surgery is of great value. The exact checking by weighing swabs and of the blood in the sucker bottle enables a most accurate check of infusion requirements to be made. Saline solution infusions are kept to a minimum as post-operative water and salt retention must always be avoided. Extreme dehydration by modern methods in patients with cardiac failure (e.g. mitral stenosis) may, however, lead to dangerous hypo-natremia and here exact electrolyte studies are essential.

Management of Cardiac Arrest. No surgical operation, however simple, should be conducted without having all the means for cardiac resuscitation at hand, from the moment anæsthesia induction starts. These include an efficient defibrillator and syringes ready, and adrenaline (1 in 10,000) and calcium chloride (2% solution) available.

Through the whole period of cardiac massage the two essentials are to ensure continuous rhythmic insufflation of the lungs by oxygen and a manual squeezing of the heart sufficient to maintain an easily palpable pulse in the carotid vessels.

If the heart shows ventricular fibrillation massage should be continued for several minutes before electrical defibrillation is employed; the reason for this is the need to get fully oxygenated blood to the brain and to provide a sufficient flow of blood into the coronary arteries. If the latter object is achieved the heart muscle will become pinker.

Defibrillation. Efficient defibrillators are available; one should be available in every operating suite and each hospital should have instructions clearly established for dealing with this emergency. If serious arrhythmias such as heart block develop (this is seen most commonly after the closure of ventricular septal defect) efficient electrical pace-makers are now available; the leads are lightly sutured to the heart muscle and can be retained in position for several days.

The Newer Surgical Instruments. The development of safe, efficient clamps has been a major development; the original Potts' toothed clamp is the basis of many of these allowing the surgeon to place powerful, but light clamps on structures such as the lateral walls of the aorta, pulmonary artery and the atria or on the neck of saccular aneurysms. Powerful atraumatic clamps are available for the cross-clamping of the aorta and the pulmonary artery during open operations such as the closure of atrial septal defects under hypothermia, and open operations on the aortic and pulmonary valves through incisions in the main stems of these vessels under hypothermia and temporary occlusion of the inflow and outflow of blood from the heart.

The increased use of plastic materials has been noticeable in all types of heart-lung machine; the venous and arterial cannulæ and the hoses connecting these with the venous and arterial side of the pump-oxygenator are made in different sizes over a wide range; their non-wettable frictionless and non-traumatic surfaces allow blood to be propelled through them without appreciable hæmolysis or defibrination.

Deliberate Cardiac Arrest. The potassium citrate method of producing cardiac arrest (Melrose) has been of great value in making open cardiac surgery under bypass conditions simpler and safer. When the extra-corporeal circulation has been established the aorta is cross-clamped above the coronary vessel and a solution of potassium citrate (2·5%) is rapidly injected below the clamp; the effect of the potassium citrate after it has perfused the coronary vessels is to produce arrest; the cardiac muscle's metabolism is greatly decreased and periods of arrest of well over 35 minutes are well tolerated: as soon as the cardiac operation has been completed the removal of the aortic clamp allows fully oxygenated blood from the artificially perfused aorta to pass through the coronary vessels and wash out the potassium solution. Within a few seconds the heart will resume a normal beat: this may be followed by a short period of ventricular fibrillation which usually responds to electrical defibrillation. Cardiac arrest is also possible by means of acetyl-choline and anoxia. The potassium method is being used less and less because muscle damage may follow. Many cardiac surgeons now prefer "Anoxic" arrest to "drug" arrest: this method relies on using periods of arrest produced by intermittent cross clamping of the aorta.

Hæmodynamic and Physiological measurements. Since successful cardiac surgery depends on team work, the surgeon must be in possession of certain essential information before embarking on the operation: during many cardiac operations certain monitoring information must be provided: immense help has been derived from the studies made on

patients by cardiac catheterization, angio-cardiography, cine-angio-cardiography, by direct venous and arterial tracings, by data obtained from direct left atrial puncture (obtained through a needle passed via a bronchoscope) and by direct left ventricular puncture. The use of electro-encephalography during certain cardiac operations, particularly those done under "bypass" is the only reliable way of assessing the degree of cerebral oxygenation. Diagnostic methods have improved so rapidly that it is now possible to know pre-operatively the exact lesions (and these are often multiple) that will be encountered during the surgical procedures.

Surgery of the Ductus Arteriosus and for Coarctation of the Aorta

The place of surgery in uncomplicated persistent ductus arteriosus and for coarctation of the aorta has been established: ideally both conditions should be corrected before serious cardiac and vascular damage has taken place. In virtually every case of persistent ductus, closure should be achieved in symptomless patients as soon as the diagnosis has been made in patients between the ages of 3 and 15; at the age of 3 to 4 surgical occlusion (which should be by division and suture rather than by simple ligation) is straightforward and the mortality rate is well below 1 per cent; if the ductus has been closed before the age of 5 there will be no interference with the child's schooling and the risks of cardiac damage or of the development of subacute bacterial endocarditis will have been abolished. There is need for employing caution in advising surgery in "atypical" ductus patients: in these there is already evidence of pulmonary hypertension which when it has reached a severe degree will be accompanied by a reversal of blood flow through the ductus due to steady increase in right ventricular pressure secondary to the rising vascular resistance in the damaged pulmonary blood vessels; a decision to operate or not in patients in this category will only be made after the fullest cardiac catheter studies have been made. In these patients the classical machinery murmur is replaced by a systolic one. Should surgery be advised, in these atypical patients, before the ductus is permanently occluded, pressures should be taken in the aorta and the pulmonary artery after the ductus has been clamped: should the pressures rise in the pulmonary artery and the E.C.G. show increasing right ventricular strain the operation should be abandoned.

Ductus Surgery in Infancy

It is being more and more recognized that some infants die in the first few months of life with the only abnormality present being a large

ductus arteriosus. These infants usually have lung symptoms and fail to thrive; the heart is enlarged, and there are signs of heart failure; often the murmur heard is systolic only. The diagnosis of other conditions such as ventricular septal defect is best made by angio-cardiography, preferably of the "cine" type. As soon as the cardiac failure has responded to treatment the ductus should be divided; the rapid progress of the infant after operation is gratifyingly good.

Coarctation of the Aorta

The need for surgery in most patients with coarctation of the aorta has become generally acceptable, the mortality rate after the operation being incomparably less than that from the natural hazards of the disease (fatal hypertension, aortic rupture, rupture of berry aneurysms at the site of entrance of the intercostal vessels into the aorta, heart failure, etc.). Most thoracic surgeons believe that operation should be done between the ages of 7 and 15. Recently surgery has been used more frequently in infants: these are usually those with the "adult" type of coarctation who are admitted in heart failure: efforts are made to tide the infants over this by medical measures in the hope that efficient collaterals will develop: if, however, the heart continues to enlarge surgery is employed: the repair should be by interrupted sutures after the coarcted segment has been resected as this offers the best chance of the aortic wall at the site of the anastomosis enlarging with growth. Unfortunately this defect is not uncommonly associated with a ventricular septal defect; however, a successful coarctation operation in such circumstances may be followed a few years later by closure of the septal defect.

Progress in the Surgery of the Mitral Valve

Mitral valvotomy is the commonest cardiac operation in use; the low mortality rate and the general level of relief given to dyspnœic patients have fully established the operation; undoubtedly the best results are obtained in patients in the younger age group (15–40) who are in sinus rhythm but are becoming increasingly breathless; ideally they should not have been allowed to pass into heart failure or to have developed the more serious degrees of pulmonary hypertension. Usually the valve diameter from commissure to commissure will be about 1 cm. Less suitable but none the less worthy of valvotomy are those patients with advanced disease in atrial fibrillation. Many patients done in the early days of this surgery (1948–1953) having had relief for 3 to 5 years, have relapsed and many have been re-operated: the cause of this relapse may be re-stenosis but probably more commonly because the