The Barber's Progress

An Inaugural Lecture

GIVEN IN THE UNIVERSITY COLLEGE OF RHODESIA

Professor John Malbon Mynors

UNIVERSITY COLLEGE OF RHODESIA

THE BARBER'S PROGRESS

An Inaugural Lecture
given in the
University College of Rhodesia
on 20 March 1969

by

JOHN MALBON MYNORS
Professor of Surgery

SALISBURY
UNIVERSITY COLLEGE OF RHODESIA
1969

PRINTED IN RHODESIA BY A. W. BARDWELL & CO. (PVT.) LTD.

THE BARBER'S PROGRESS

SOME of you are here because you may feel it is your duty, having had a free dinner; some of you may just feel it is your duty; some of you may even be interested; but I have been shanghaied!

In earlier days even the patients had to be shanghaied, or at least impressed; one famous, or *infamous*, surgeon of a couple of hundred years ago is recorded as having been seen pursuing a fleeing patient through the hospital corridors in order to bring him to the operating theatre, and small wonder, for thenadays it resembled nothing more than a torture chamber, succeeded in most cases by almost certain death. Perhaps my title should have been "A Barbarous Progress."

The physician of the middle ages was usually little more than a soothsayer or prescriber of charms and potions, and the surgeon but a barbarous fellow either employed by the physician, the man of letters, or else a sort of wandering tinker who let the blood, cut for stone, or administered a clyster (Figs. 1-6).

The Barbers—"Army surgeons" and so-called "bathers" to whom were relegated surgical cures—were despised by the academic physicians until 1686, when Charles François Felix operated successfully upon King Louis XIV for a fistula-in-ano (Fig. 7); thereafter surgery became respectable and a class of academic surgeons developed (Thorwald, 1957), and so we had the "surgeons of the short robe"—Barbers, and the "surgeons of the long robe"—qualified doctors who undertook surgery (Inglis, 1965).

Some idea of the pleasantries to which patients of these times were exposed or subjected may be gained from the description in the memoirs of Dr. Scarborough of the last days of King Charles II, who apparently died of a brain haemorrhage.

He was bled, cut, cupped. Emetics, purgatives and enemata were administered every two hours at first, though apparently more frequently as time wore on. Burgundy Pitch and pigeon dung were applied to the soles of his feet. Sad to relate, despite continuous bleedings and purgings and other medicaments, the King's condition grew worse, until finally, so as to leave no stone unturned, "a rallying dose of Raleigh's antidote which contained extracts of all the herbs and animals of the kingdom was forced down the King's throat" (Glasscheib, 1963).

This is a description of a genuine attempt at treatment of a patient, a very special patient.

We must not forget that a great deal of surgery was carried on by laymen, and even by the hangman. According to the laws regarding torture, the hangman was engaged not only to execute but also as an experimenter on human beings, although he was not allowed to carry out his experiments beyond a certain limit. It was his task to break bones and re-set them, to dislocate and replace joints, to burn the flesh and heal the burns. Then fresh torture could be endured. He had to see that eventually the tortured man was fit to walk to the scaffold, or to walk to the highway if granted a pardon. The purpose of the inquisition was to extort a confession, not to kill (Glasscheib, 1963). These were the days when the reward of the unrighteous might ultimately be a public anatomical dissection (Fig. 8).

Curiously, in earlier days, our surgeon seems to have been a more able fellow, as the trephine holes in the skulls of the ancient Egyptians, Hindus and others bear testimony (Figs. 9-12). This trephining was for the cure of headache, or to let out evil spirits, or perhaps for injuries as in modern times, but probably had a high mortality rate from infection.

The Hindu surgeons appear to have been more able than most, and clever withal; they employed ants to do their stitching of wounds: take an ant, a large ant with large mandibles, apply his head end to the wound, and when he bites twist his head off, and there we have it—a clip, unsurpassed until the Frenchman, Michel, invented his somewhat more costly clip at the beginning of this century. These same Hindu surgeons became proficient in the provision of new noses (Fig. 13)—a necessity in a country where the inhabitants had the habit of slicing off noses when their lasses were naughty, a habit you can still encounter today, at least, in the Middle East. In the Susruta of the 5th century A.D. the operation is described, the pattern of the nose being cut with the aid of a leaf, though using the skin of the cheek rather than the forehead as is usually depicted nowadays (Thorwald, 1957). Skin-grafting in one form or another has probably been in use on and off ever since (Fig. 14).

Our Hindu surgeon also practised a limited approach upon the lower abdomen when removing bladder stones, although not transgressing the peritoneal cavity. This method lapsed in favour of the perineal approach until the 19th century, apart from an isolated attack via the suprapubic route by Pierre Franco upon a child in 1556. There were, of course, many famous exponents of the perineal method of cutting for stone, such as Frère Jacques (de Beaulieu) in the 18th century, who established the record of 45 seconds for a lithotomy using a lateral perineal approach (Richardson, 1958).

Nevertheless, surgical horizons remained confined for centuries with a very limited armoury (Figs. 15 and 16), the majority of patients floundering through a slough of despond with their surgeons wallowing in a sea of blood, pus and excreta which steadily stiffened their operating coats which, of course, were never washed since the more encrusted they became the more hallowed and capable the surgeon was considered—obviously only a novice would have a clean coat!

The Frenchman, Ambroise Paré, did much for basic principles in military surgery when he abandoned the time-honoured method of sterilising wounds by pouring in boiling elder oil; true it was an accidental discovery, but he not only appreciated the significance of his observations, but had the temerity to apply the principles in defiance of accepted surgical practice—a very dangerous action for medical men throughout the ages which even brought eminent doctors before the inquisitors or to the stake. In the case of Ambroise Paré he was attending the wounded after the bitter fighting for the Susa Pass in Italy in 1537 when he ran out of elder oil (Fig. 17); whereupon he dressed a few of the men's wounds with an ointment composed of egg yolk, rose oil and turpentine, and found to his surprise next morning that the soldiers whose wounds had been treated with the ointment were in much better case than those who had received the conventional boiling oil (Glasscheib, 1963).

Paré also introduced ligature of the vessels rather than plunging the amputation stump into boiling pitch or applying white-hot irons to stop the haemorrhage—a pleasant practice in the absence of anaesthesia, and one which frequently failed to arrest the haemorrhage if the amputation was through living tissue. An amputation thenadays sounds a most fearsome procedure (Figs. 18 and 19), but it was not usually quite so bad as it appeared, because commonly gangrene was awaited and the amputation was through the gangrenous area. However, Paré's methods permitted amputation through living tissue with much better results for the patient, although obviously a terrible ordeal even though only measured in seconds in expert hands: 8 seconds for a simple amputation by a maestro; longer for the more complicated method with ligature of vessels. Larry, the famous French military surgeon during the Napoleonic wars, took 4 minutes overall for a thigh amputation of which about 15 seconds was cutting time (Glasscheib, 1963).

Despite this advance, which was only accepted by a very few surgeons, and indeed vigorously opposed by the Paris Faculty of Medicine, the significance of wound infection and cross-infection was not yet appreciated and to enter hospital meant an 80% chance of dying; virtually all operation wounds became septic (unless carried out in the wilds on the kitchen table), so that recovery from amputation of a breast or leg took several months, if you recovered at all.

The same applied to midwifery where puerperal sepsis was rife; it was in this sphere that the role of cross-infection was appreciated by Semmelweiss in Vienna in 1847 (Inglis, 1965). He suffered the usual scorn, calumny and jealously, and though he proved his point he ended up dying of septicaemia in an asylum with almost the whole medical profession against him.

Prior to this time almost all attempts to open the abdomen including the uterus (for Caesarian section), or any other body cavity, had resulted in almost certain death apart from isolated cases, mostly again in the rural parts. There were also occasional examples of gastrotomy (opening the stomach) for the removal of swallowed foreign bodies, and there was the famous example of the French-Canadian trapper, Alexis St. Martin, who in 1822 developed a gastric fistula after blowing off the front part of his upper abdomen when a shotgun went off accidentally (Thorwald, 1957).

It is very doubtful whether Julius Caesar was, in fact, delivered by Caesarian section, since there seems to be good evidence that his mother was still alive many years after his birth. Probably the term arises from a decree of Numa Pompilius, the second of the seven legendary kings of Rome, to the effect that no female dying in childbirth should be buried without the child being first removed through the abdomen (Richardson, 1958)—a tenet that was maintained until very recent times under edicts from the Catholic Church.

No clear evidence exists that anyone successfully breached the abdomen of a living patient until in 1500 a brave Swiss pork-butcher named Jakob Sigershausen performed a Caesarian section upon his own, far braver, wife, who survived (Thorwald, 1957). Still no anaesthetic, don't forget—not far removed from the state we see depicted here (Fig. 20). Unfortunately, there is now considerable doubt about the authenticity of this Swiss story. There seems no doubt, however, that a surgeon named Trautmann did perform a Caesarian section in Wittenberg, Germany, in 1610 under the direction of two physicians—a usual procedure for the times—but the mother died. Such was normally the result from haemorrhage or infection or both, apart from isolated examples in the wilds such as Dr. Bennett's delivery of his wife in Virginia in 1794, until Porro in Italy in 1876 performed a Caesarian section and proceeded to remove the uterus also and was rewarded with a live mother and a live child. Thereafter many others successfully followed his example.

By now the two greatest advances in surgery, until recent times, had been made, namely, the understanding of infection and cross-infection and the use of anaesthesia.

The significance of infection and cross-infection had been appreciated by Semmelweiss; its cause, micro-organisms, suggested even in Roman times, resurrected by a few

18th century obstetricians and later by Oliver Wendell Holmes in Boston in 1843, and defined by Pasteur in 1863; and its control during surgery instituted in 1866 by Lister, who introduced the concept of antisepsis using carbolic acid (Thorwald, 1957) (Figs. 21 and 22). As usual, the innovator suffered rebuff, particularly at the hands of the self-opinionated and vain Dr. Simpson (of anaesthetic fame), who accused Lister of his very own fault, namely, claiming others' discoveries as his own, quite apart from decrying completely the use and effect of carbolic acid.

The origins of anaesthesia lay in public performances of inhalation of gases, including laughing gas (N_2O) at so-called "laughing gas parties", the significance of which was appreciated by an American dentist named Wells in 1844, who shortly afterwards communicated it to another American dentist, Morton, who had been his pupil. Wells suffered defeat by force of circumstances and by his more cunning rival, Morton; became an addict, and committed suicide. Morton received the acclaim, attempted to keep the discovery secret in order to profit from it, and is today frequently hailed as the father of anaesthesia (Figs. 23 and 24). There seems little doubt that this crown really belongs to Wells; but the discovery of the anaesthetic properties of gases is now known to extend further back in time, to at least as early as 1800 when Sir Humphrey Davey, the English chemist, who was at that time a 20-year-old surgeon's assistant, had relieved toothache by inhaling nitrous oxide and wrote that "it may probably be used to advantage during surgical operations" (Thorwald, 1957). Crawford Long, a general practitioner of Georgia, U.S.A., used ether from 1842 onwards (Richardson, 1958). It is interesting to notice how much dentists figure in these early anaesthetic adventures, probably because repeat attendances of their patients depended so much upon the amount of pain inflicted (Fig. 25), whereas the surgeons expected to inflict considerable pain and to see their patients "once only".

These unseemly and heated, not to say sordid, quarrels were characteristic of the medical profession as a whole then; indeed, both before and since. Another example comes from those who pioneered the opening of the abdominal cavity—not Porro, to whom I have already referred, but the ovariotomists who numbered among their ranks such famous men as Spencer Wells and Lawson Tait, that red-headed, somewhat uncouth firebrand from Birmingham, our sponsoring University, who in 1858 braved the wrath of his fellows and the profession in general by removing ovaries from the abdominal cavity and later, in 1874, tumours from the womb; although he had been preceded by McDowell in Kentucky, America, in 1809, who had shown great courage in removing an ovarian cyst from a Mrs. Crawford, for had he been unsuccessful a lynching awaited him from an angry mob howling outside his house while the operation was in progress (Richardson, 1958) (Fig. 26). This master surgeon of the backwoods performed ovariotomy 13 times during his lifetime and 8 of his patients recovered (Bishop, 1960).

Lawson Tait was voluble, caustic, even vitriolic in his own defence and went his own successful way. He was, in point of fact, a great adversary of Lister's and rejected antisepsis in favour of the strictest possible cleanliness that soap, water and steam could provide (Inglis, 1965)—a return to the principles of Semmelweiss who became so unpopular when he insisted on all doctors, students and midwives washing their hands in chloride solution before entering the ward from the post-mortem room, and later in between the examination of individual patients.

Today we employ a combination of both methods; personnel and patient cleansing, and clean, even sterile air as, for example, has long been supplied in the Burns Unit in the Birmingham Accident Hospital, not that even this concept is new.

In 1869 there was another famous and deductive first. Simon, in Heidelberg, successfully removed a kidney from Margaretha Kleb, a working mother of two, an outcast from her family because of a continuous, uncontrollable discharge of urine following damage to the left ureter during removal of a large ovarian tumour.

After four unsuccessful attempts to close the fistula and two attempts to block the fistula by cautery with silver nitrate, he finally decided upon removal of the kidney on the side of the fistula. This must have been a matter of great daring then, though of no concern to us today. All authorities over the centuries had stated categorically that to remove a kidney would prove fatal. The wisdom and care of Simon were shown by his approach to the problem —having been so courageous as to even consider removal of a kidney, he took care to experiment upon dogs and discovered that if they survived the operation for removal of a kidney they remained perfectly fit. He also investigated the anatomy and found it was possible to remove the kidney without damaging the peritoneum, thereby avoiding the dangers of peritoneal contamination. Thus emboldened, he proceeded to remove his patient's kidney, having explained the risk to her with great care and having assembled an audience of notable doctors in order to protect himself, if possible, in the event of a fatal outcome (Thorwald, 1957).

Ten years later, in 1879, Lawson Tait secured the attack upon another segment of the abdomen when he successfully removed the gall bladder, although there are records of an earlier cholecystectomy, in 1743, by Jean Louis Petit (Richardson, 1958). One year later, in 1880, Tait became the first surgeon to remove the appendix, although appendix abscesses had been drained as far back as 1759

(Richardson, 1958) . There are of course many famous names connected with the appendix such as Professor Charles McBurney, seen here operating in Roosevelt Hospital, New York (Fig. 27); and above all King Edward VII whose coronation was postponed because of his appendix abscess (Fig. 28).

We now revert once more from the surgeon's deeds to his surroundings and trappings.

We have seen how cleanliness (asepsis) and antisepsis were borne in upon the changing attitude of the surgeon (or some surgeons) to infection.

Rubber gloves first appeared at the Johns Hopkins Hospital in Baltimore in the U.S.A. in 1890. This arose out of Halsted's concern to protect his theatre sister's hands from dermatitis engendered by the frequent scrubbing and disinfecting of her hands with antiseptic (Fig. 29—compare this with the scene, in the ward, at Bellevue Hospital, New York, less than 20 years before (Fig. 30)).

The face mask was introduced in 1896 by Mikulicz when his bacteriologist colleague at Breslau had proved to him that bacteria were sprayed out in droplets carried in the breath during speech, although it was not until the 1920's that masks were accepted as essential (Richardson, 1958). And so we proceeded to capping, gowning and booting; and eventually to a complete change of clothing, towelling of the patient, and all the aseptic ritual of today, although a rigid aseptic ritual was in fact introduced by Gustav Adolf Neuber in Kiel in the 1880's (Glaser, 1960) and much of it appears to have been appreciated by Indian surgeons long before Christ, and subsequently even up to the 10th century in Europe (Inglis, 1965), after which it unaccountably disappeared.

However, to return to our surgical exploits. There were still three regions as yet unconquered by the surgeon: the heart, the brain and the spinal cord. The heart yielded to the surgeon in 1896 when Rehn of Frankfurt successfully repaired a heart wound in one Wilhelm Justus, a young gardener's helper. For 2,000 years medical writers had asserted that all heart wounds were fatal and would ever be so, and that any attempt by the surgeon to touch the heart with his knife, or even the suturing needle, would necessarily paralyse it. Even the brilliant, venturesome and kindly Billroth had remarked shortly before Rehn's success that "the surgeon who ever attempts to stitch up a wound in the heart may be certain that he will lose all his colleagues' respect for ever" (Thorwald, 1957).

Thereafter, surgery made slow progress during the early part of the 20th century with some stimulation during the First World War, when amongst other things blood transfusion advanced; but progress accelerated just before the Second World War with the discovery of the sulphonamides, chemotherapeutic substances and, later, penicillin and the antibiotics. Thereafter came major advances in anaesthesia, our understanding of the body's controls, and to some degree our temporary take-over of body functions allowing advances in vascular and brain surgery and even organ transplantation.

Perhaps we should digress a moment here to consider the story of blood transfusion.

Vague references to the transfusion of blood are found in old writings, but medical men were obsessed with blood-letting rather than blood-infusing. There is an unsubstantiated story of an attempt by a Jewish physician about 1490 to prolong the life of Pope Innocent VIII by means of a transfusion or a drink of blood, taken from three small boys.

Several Italian physicians suggested it in the early 17th century, but the first serious attempts at blood transfusion were made in England and France in the mid-17th century. Sir Christopher Wren experimented with the injection of various liquids into animals' veins; on one occasion he made a dog drunk by the injection of beer and wine into its veins. The Royal Society, of which he was one of the founders, reported his work in 1667 and included a reference to transfusing blood. In 1665 Dr. Richard Lower of Oxford carried out successful transfusions of blood from artery to vein in dogs, using quills at first but later silver tubes connected with a piece of a cervical artery of an ox. He went on in association with Dr. Edmund King to perform, on 23rd November 1667, a successful transfusion of the blood of a sheep into one Arthur Coga, a Bachelor of Divinity of Cambridge, aged 32—the patient did well (Fig. 31).

The previous June (on 15th) Jean Denys, a Professor in the medical faculty in Paris, had successfully transfused blood from a lamb into a 15-year-old youth who had been bled into a state of shock as treatment for a fever. Denys continued to transfuse patients thereafter, some with good results, some bad; but in 1668 one of his patients died after the third of a series of transfusions, law suits followed, and transfusion was forbidden in France in 1670. This had repercussions in England and transfusion fell into disuse, until revived 150 years later by James Blundell, an obstetrician attached to Guy's Hospital and St. Thomas's Hospital in London.

Blundell performed the first transfusion of human blood on 26th September 1818, when a man received 12-14 ozs. of blood from several donors. The patient improved temporarily, but relapsed and died 56 hours after transfusion. Blundell persevered through several failures until in 1829 he had a success (recorded in the *Lancet*) with a young woman who had a severe post-partum haemorrhage (Fig. 32).

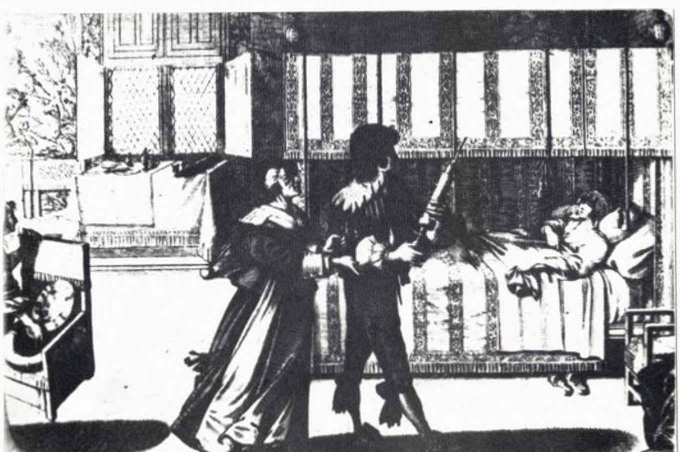
In 1901 Karl Landsteiner demonstrated the agglutinins in the blood, and in 1907 the four main blood groups were

PHOTOGRAPHS . .

1.

2.

3.

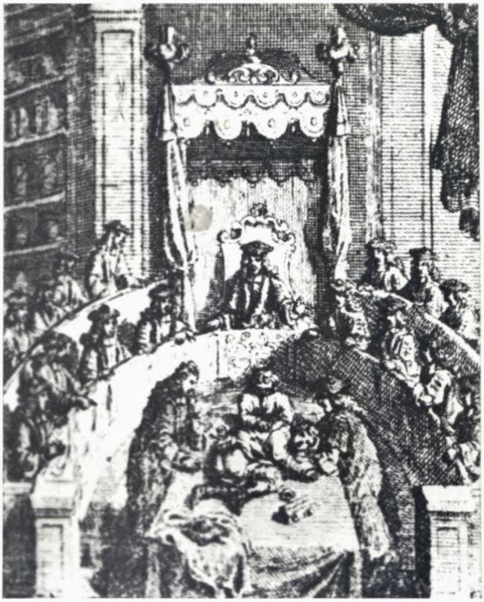


4.

5.

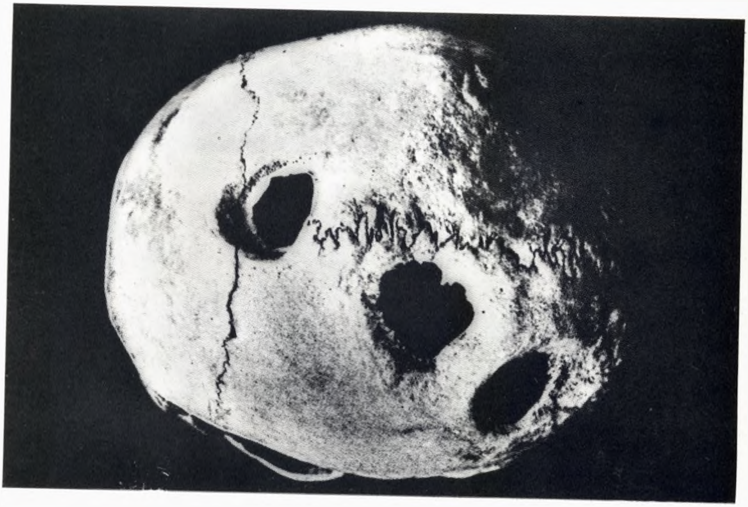
6.

7.



8.

9.

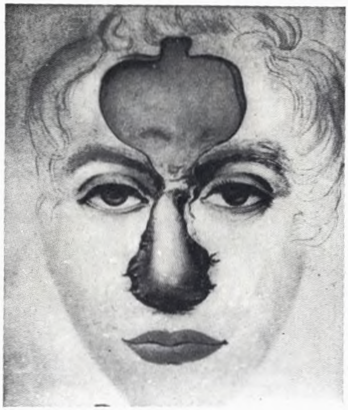


10.

11.

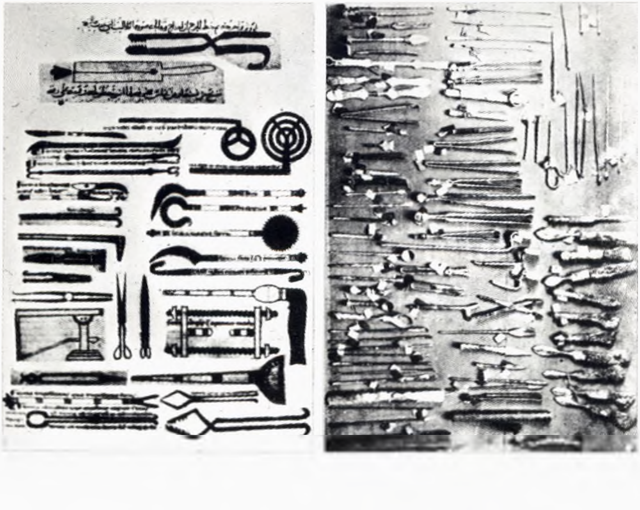
12.

13.



14.

15.

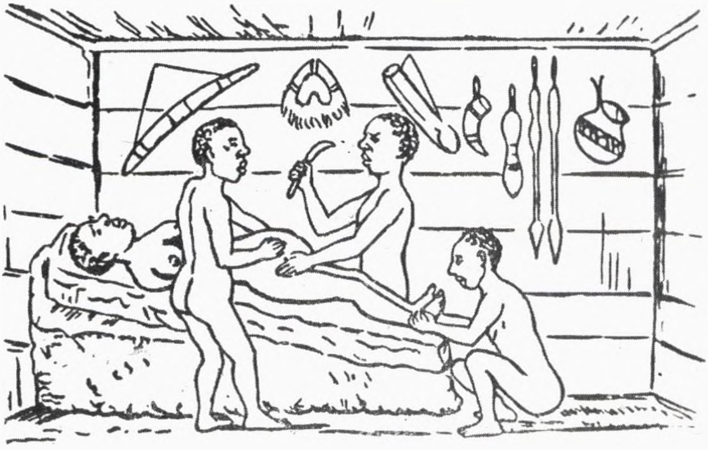


16.

17.

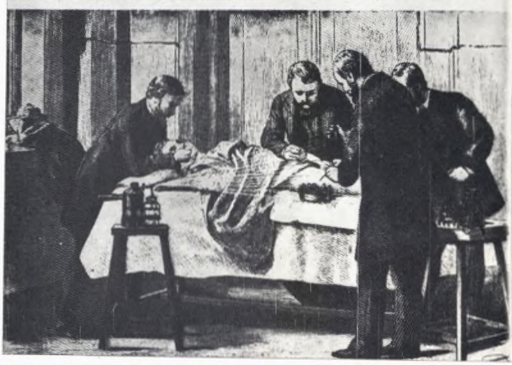
18.

19.



20

PLATE 5. Joseph Lister (1827–1912) the pioneer of antiseptic surgery. (*Below*) An operation in the early days of antiseptic surgery. Chloroform anaesthesia and the carbolic spray, worked by a steam apparatus, are being used.



21.

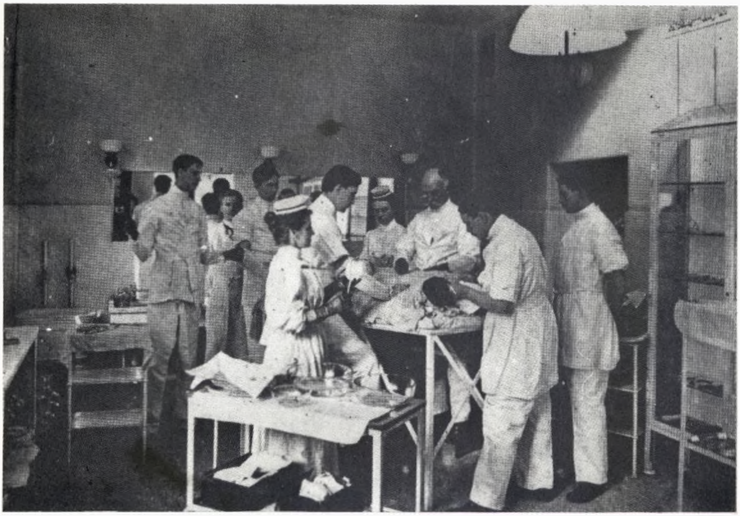
22.

23.

24.

25.

26.



27.

POSTPONEMENT OF THE CORONATION.

To the consternation of the nation, and indeed of the world, came the announcement on June 24 that owing to the illness of the King the Coronation Ceremony had been indefinitely postponed.

The official bulletin was as follows: " The King is undergoing a surgical operation. The King is suffering from perityphlitis. His condition on Saturday was so satisfactory that it was hoped that with care his Majesty would be able to go through the Coronation Ceremony. On Monday evening a recrudescence became manifest, rendering a surgical operation necessary to-day."

Signed—

LISTER.
THOS. SMITH.
FRANCIS H. LAKING.
THOS. BARLOW.

51. Original bulletin concerning the illness of King Edward VII as it was posted at noon of June 24, 1902, on the gate of Buckingham Palace.

28.

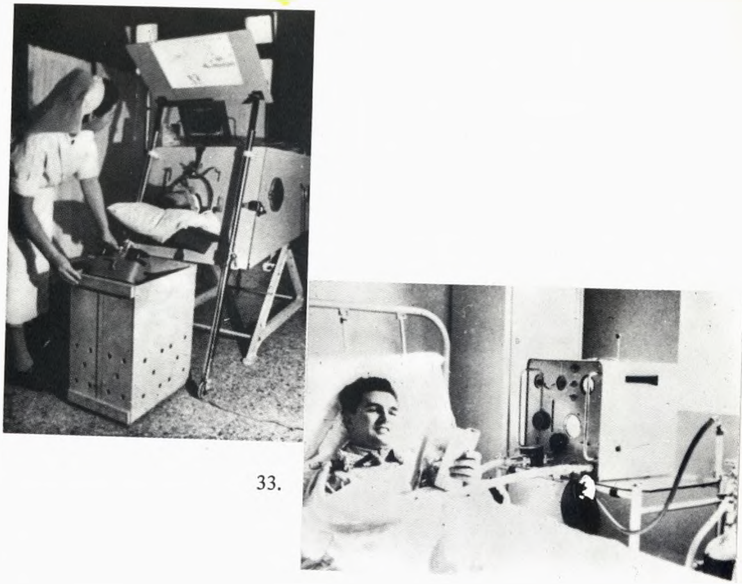
29.

30.

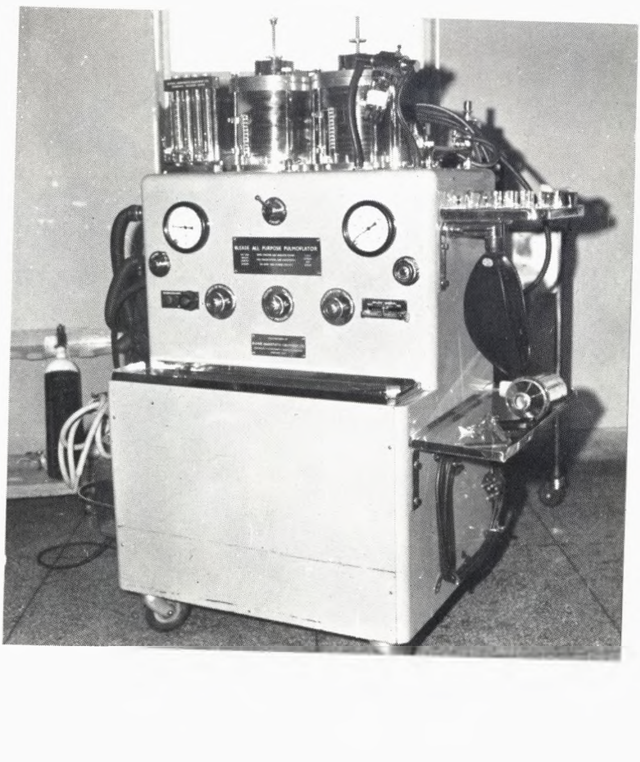
31.

Position of the Patient and the Blood Donor.

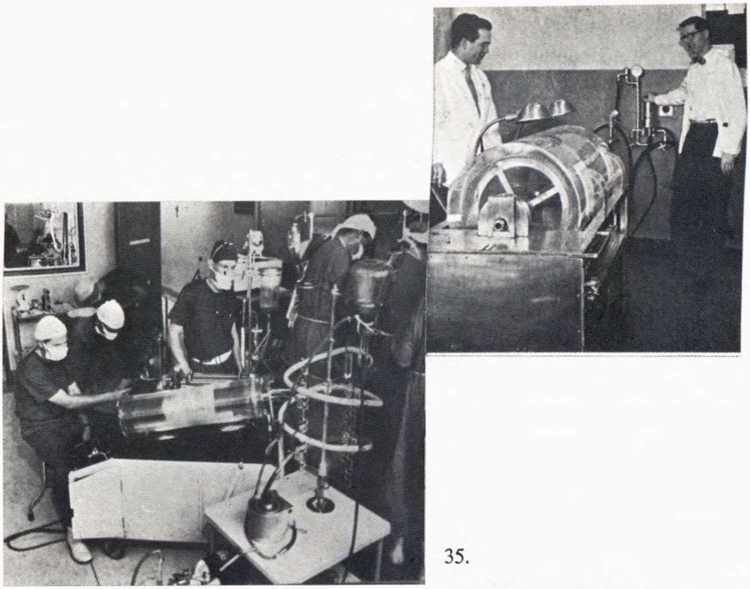
32.



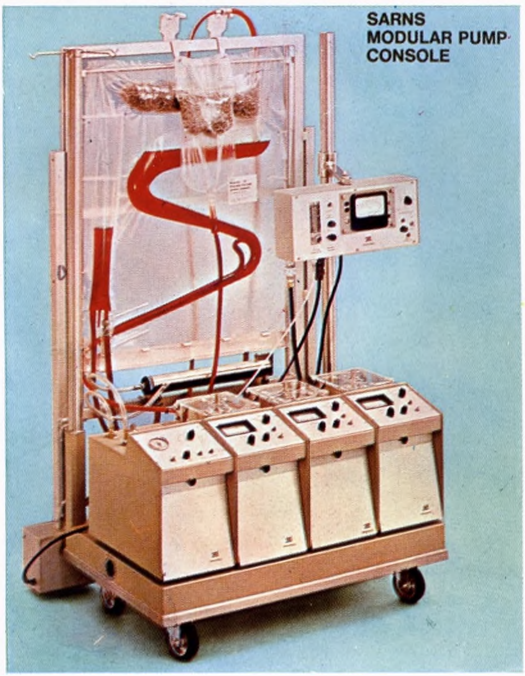
33.



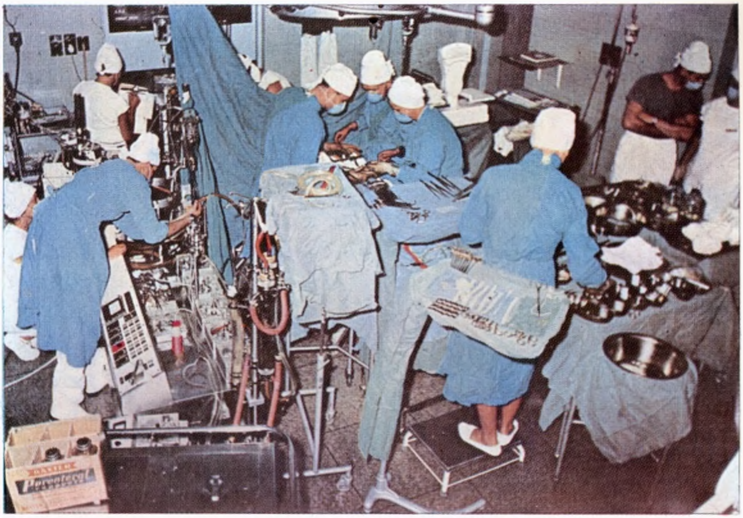
34.



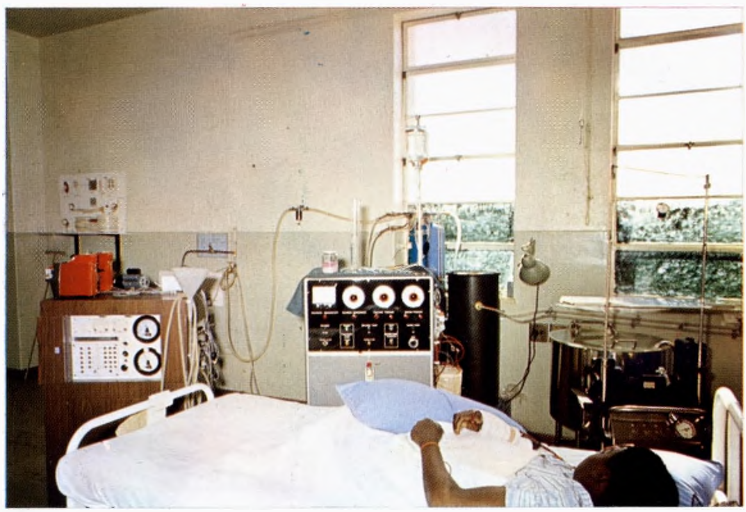
35.



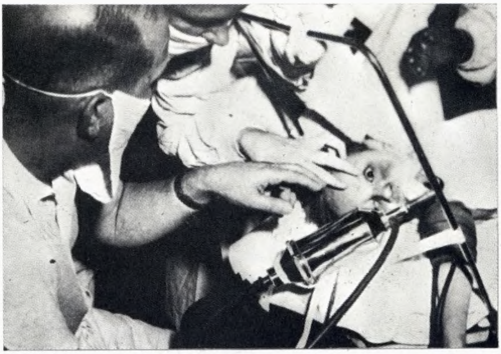
36.



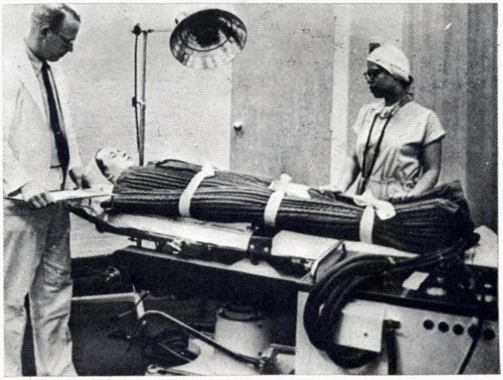
37.

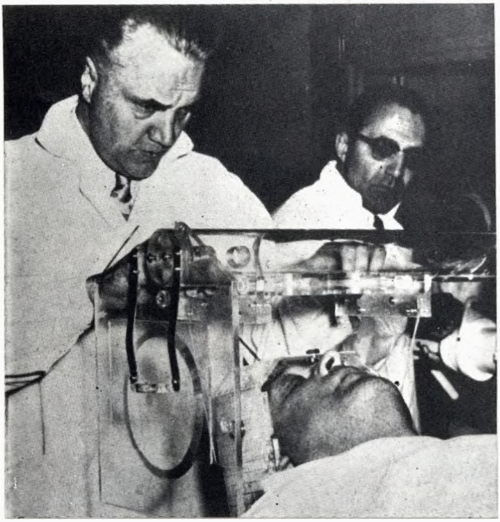


38.

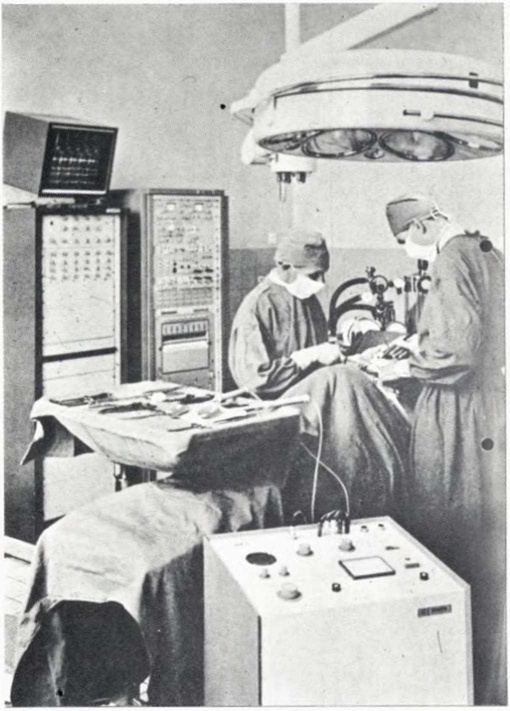


39.

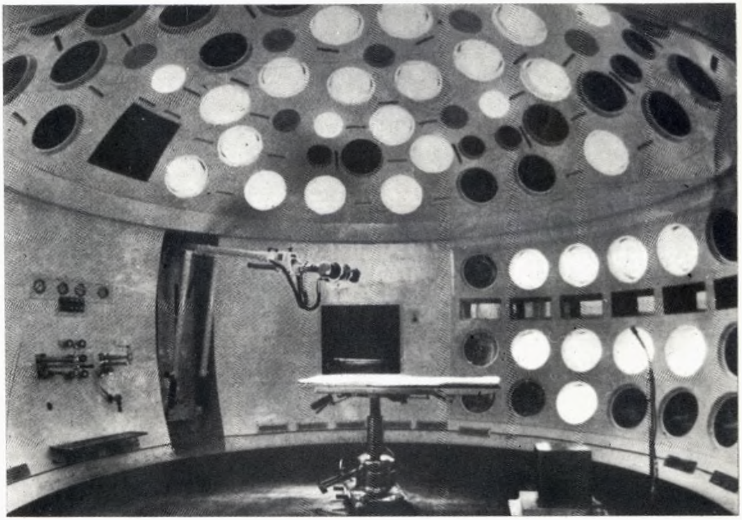




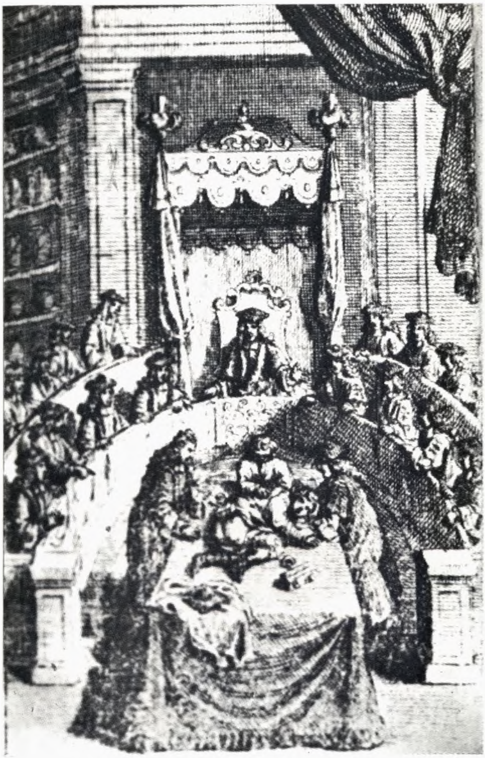
40.



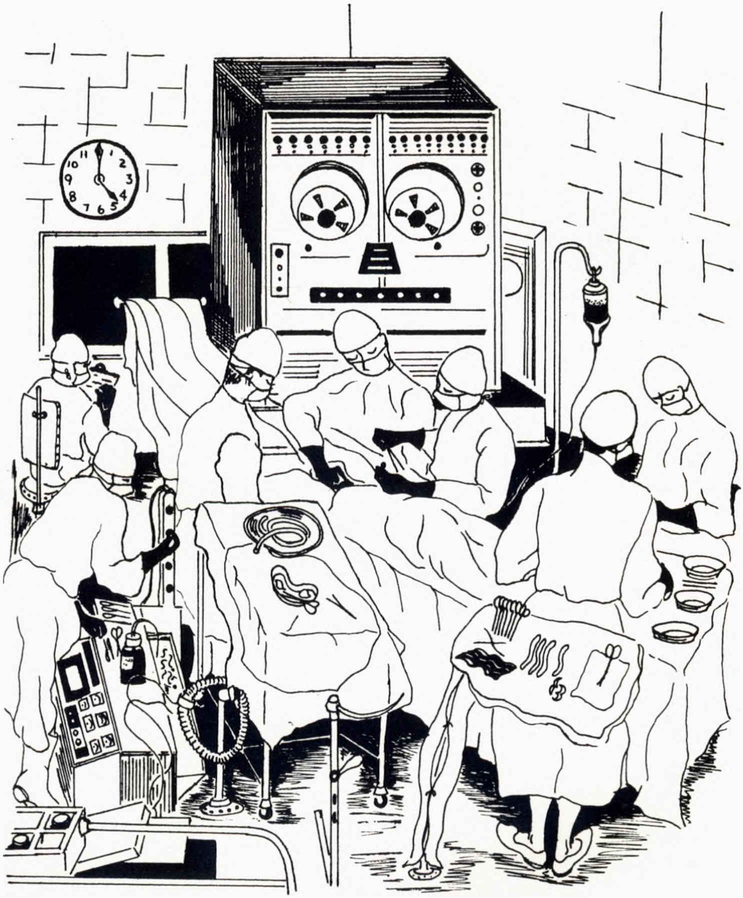
41.



42.



43.



44.

determined by Jansky of Prague. Further progress was made during the First World War, one of the most important being the use of sodium citrate as an anticoagulant (Bishop, 1960).

Today blood transfusion is an enormously helpful aid in medicine, albeit an everyday occurrence. Without its aid many surgical advances would have been hazardous if not impossible, and much of modern surgery could not take place.

In association with blood transfusion has come the infusion of other fluids and an understanding of the mechanisms whereby the body controls its fluid, electrolyte and nutritional balances. It is commonplace in a modern surgical ward to see a forest of bottles on stands slowly running differing liquids into the veins of a variety of patients. Such matters are turning the modern surgeon from one who is basically an operating anatomist to an operating physiologist cum anatomist, or perhaps even an operating physician. Such understanding as we have of these processes has enabled us to gain far greater success in our treatment of major injuries and in our preparation of the patient for major operations and our control of the state of the patient during the operation and in the post-operative period. Without such knowledge, shock would frequently defeat us and the successful major assaults which we can now make upon the body would have been impossible.

Other handmaidens of modern surgery which have made possible its advances and its present success are the chemical substances and antibiotics which are such powerful weapons against infection, the development of anaesthesia and the mechanisation of medicine with the increasing employment of mechanical, physical and electrical means and devices, together with our increasing knowledge of the body's defence processes.

We must turn back the pages of history once again in order to follow a little more of the story of anaesthesia. The use of anaesthesia and its rapid recent progress have been and still are of tremendous importance to the advance of surgery.

The maintenance of an airway by the introduction of a tube purely for respiratory processes can be traced back to the 16th century when it was used for anatomy demonstrations on animals, but its use for anaesthesia was not of course contemplated until the introduction of inhalational anaesthetics in 1844. In 1871 Friedrich Trendelenburg produced a tube with an inflatable cuff which he inserted into the windpipe through an incision in the neck, and anaesthetic gases were administered through it. Seven years later a brass tube was inserted into the trachea through the mouth by Sir William MacEwen of Glasgow (Richardson, 1958).

Intravenous anaesthesia was added to inhalation of gases in 1934 when John Lundy began using cyclopentone (pentothal) at the Mayo Clinic.

Then came a revolutionary change permitting an enormous degree of control of the patient's body processes. This was the introduction in 1942 by H. R. Griffith and Enid Johnson of Montreal of muscular paralysis by the injection of curare, the South American Indian arrow poison (Richardson, 1958). This meant the patient could be completely paralysed allowing the surgeon easy access and easy working conditions, with a minimum of noxious anaesthetic substances to keep the patient asleep, rather than having to use large amounts of anaesthetic bringing the patient nigh unto death's door in order to paralyse him. It also, of course, meant that the patient's breathing had to be done for him, at first by squeezing the anaesthetic bag, but this being too tedious, machines were soon invented to do it—and from this we proceed to the modern machines giving respiratory support not only during operations, but for people whose respiration is failing or has failed for some reason, such as poliomyelitis (Figs. 33 and 34) or tetanus, where the patient is deliberately paralysed for many days to overcome the muscle spasms.

This major advance in taking-over body processes, allied to our knowledge of fluid balance and transfusion and so on, led to further partial or complete replacement of body activities such as the heart-lung machines and the kidney machine (Figs. 35-38).

Heart-lung machines are basically machines which temporarily take over the function of the heart in propelling blood around the body, carrying oxygen to the cells and removing breakdown products; the function of the lungs may or may not be taken over, but if taken over, then some method of oxygenating the blood must be introduced into the circuit. I have brought along an example of this type of machine so that those of you who wish may inspect it afterwards.

In the early open-heart operations the heart had to be stopped deliberately and one way in which this was done was by injecting potassium, a substance very necessary for life but lethal if present in too great a concentration. Subsequently it became evident that a heart cooled below 29° C. was liable to stop; in fact, cooling below that level is now used to stop the heart, and cooling to far lower levels is commonplace, because where tissues are cooled their metabolic processes are less active and they can therefore survive longer with a limited or absent blood supply (Fig. 39).

Cooling itself has been applied to prolong the period for which vital organs like the brain can be deprived of their blood supply, allowing one time to carry out special operations upon them or upon the heart or main blood vessels supplying them, e.g., the brain at normal temperature (37° C.) can only survive for 3 minutes without oxygen being brought to it by the blood, but for 10 minutes at 29° C. This effect of cooling has also been utilised for the preservation of tissues and organs for transplantation, which if rapidly cooled and kept cool show only minimal damage.

Talking of the oxygen needs of the patient's cells, another approach has been to attempt to supply the tissues' needs by placing the patient in a chamber where there is oxygen under pressure (2-3 atmospheres usually). The oxygen is then dissolved in the liquid of the blood in significant quantities as well as carried in its red cells, and it diffuses through the tissue fluids. Great hopes were held out for the use of this hyperbaric oxygenation in the treatment of conditions where the blood vessels were being narrowed and not delivering enough blood, and it still has some use where there is injury to vessels or gas-gangrene is present, but in general the good effect produced by dissolved oxygen is counteracted by the spasm it causes in small blood vessels. At one time it was even being considered as an alternative to heart-lung by-pass. It is a fascinating thought to imagine the surgical team working over a patient all enclosed in a sort of large boiler—there was one perched on the roof of the Glasgow Royal Infirmary and so far as I know still is, but even back in 1904 Ferdinand Sauerbruch had tried operating inside a large cabinet for lung disease, though in this case the heads of the patient, the surgeon and his assistants were all outside the cabinet, rather like a large iron lung, and there was a negative pressure inside (Richardson, 1958). It must have been an extraordinary sight.

There have recently been a few other little surgical quirks such as the "bed" to prevent bed sores, or for patients who cannot readily be nursed lying in bed, such as those with severe burns. The pulsating mattress is one of these; it resembles the cooling mattress you have seen, numbers of tubes side by side, every other one blows up for a minute, say, then the intervening ones for a minute and so on—this way you keep lying on different bits of skin without moving. But far more intriguing is the jet bed which has been suggested and, I believe invented; in this the patient is suspended on multiple jets of warm air; just imagine your surgeon going into the ward where the patients are kept up by jets just like those celluloid balls at the fair. This could be a most useful method of dealing with extensive burns where constant changes of pressure are needed, together with exposure and drying in most cases.

I obviously cannot detail all the possible avenues up which our attempts at surgical advance are taking us, but to mention a few: We have returned in time, in a parallel sense, to animal blood transfusion with our attempts to help those patients whose livers have failed temporarily, by connecting the patient's blood stream to a pig's and using the pig's liver to detoxicate the patient's blood; with temporary improvement. Sometimes this has been followed, with some short-term survivors, by actually grafting in a pig's liver to go on doing the duty of the patient's.

Several limbs have been re-attached successfully, in contradistinction to the more usual removal of limbs or parts for disease, which has even reached the somewhat horrifying hemicorpectomy (removing the lower half of the body for otherwise incurable cancer).

For cancer all sorts of methods are being tried; new chemicals and substances which attack the cancer cell processes more than the normal cells of the body; even leading the blood outside the body and irradiating it for certain blood cancers.

A very limited success is being claimed for attempts to join up divided parts of the central nervous system, such as the spinal cord, where up until recently it was held that no regeneration occurred.

Where there is lack of control of body functions, in some cases it has been possible to institute or re-introduce this; regular electrical stimulation of the heart to keep it beating steadily, for example—needed from time to time in heart operations, electrical "corks" to insert into the anus for incontinence, electrical stimulation of the bladder to try to initiate emptying where paralysis has occurred, due to spinal injury, for example. Artificial hands and fingers moved by the remains of the tendons, or actually worked by mechanisms set in motion by small electric currents produced by the nerves which were going to the lost part. Perhaps then we will be able to replace lost or absent functions to an increasing degree.

Even the basic methods of surgery are changing; here for example (Fig. 40) we see an "operation" being performed upon the brain without the usual knife and surgical paraphernalia—a Proton beam is being used (we can also use ultrasonics) to destroy a small piece of brain within seconds; the patient was conscious and without pain the whole time. The "furniture"—the same (Figs. 41 and 42); the modern operating theatre has become a portable balloon, which is inflated within a suitable space.

But where will all this lead us? To a row of American Presidents' heads on poles around a room all being neatly perfused, or even further? It is impossible to say. Fantasy is daily becoming fact, but we must never forget that life must surely have both quality as well as quantity (or existence). Our borders are in some respects becoming blurred. Men and women (and doctors are men and women) are not gods, and the patient's wish must be final.

What of tissue transplantation, whose aim is not an alternative but a retention of the whole organism, as a whole? So much has been said and written about this that I do not intend to say much now (Welch, 1966).

Skin grafting goes back at least to early Hindu medicine (the new noses, for example, which I have already mentioned) which, with the exception of blood transfusion, a type of transplantation, is still the most extensively practised form of tissue transplantation. Skin grafting is nearly always confined to autografting, i.e., transferring the tissue from one place to another in the same individual. Occasionally for widespread burns homografts are used, e.g., from mother to child; these take for a few weeks and give a breathing space whilst sufficient of the child's own skin becomes available, but are eventually treated as foreign material and rejected.

Herein lies the problem of homografting. Rejection. The body has built-in defence mechanisms which have always so far produced a rejection reaction to tissues not its own, and even to its own proteins if they get out of their normal place.

In all homografting, then, with the possible exception of identical twins, rejection reactions will occur if the graft comes into contact with the blood stream or with certain cells. An example where this does not occur is the cornea; corneal grafts take because the cornea does not contact these cells or the blood, but even they become rejected if inflammation occurs and blood vessels grow in.

So in all homografting there is the problem of rejection to be faced. This may be eased by matching the tissues as far as possible, as with blood grouping. It can be reduced by attacking the body's defence mechanisms by chemicals, by irradiation or more specifically by anti-lymphocyte serum. This last has been recently developed for attacking the cells ultimately responsible for these immune reactions which result in rejection. Wherever one reduces the body's defence mechanisms it may improve the chances of survival of the graft, but it inevitably renders the patient susceptible, to infection, for example; so a balance has to be struck.

So you see what we are faced with at cellular level (physiologically). At technical level we can ultimately transplant most organs or tissues—the least likely being the brain, where physiologically growth of connections has so far failed, even if we join up divided pieces in the same individual—so it would be even less hopeful in a homograft.

However, kidneys, livers and now hearts are being successfully transplanted and functioning, and in the future we will doubtless be able to transfer intestines, lungs and so forth.

But there is a possible alternative.

A mechanism instead of an organ—a robot instead of a Frankenstein's monster!

This has proved feasible for the kidney—very much so —we have a good functioning unit in Harari Hospital for short-term use in people whose own kidneys should recover function after a temporary illness. But so far, although it keeps people alive and improves them, it does not entirely replace their organs—such units can keep people alive for years—yet they seldom restore them to normal health, whereas a transplant may—for a time. Also they are bulky and expensive to run and to maintain. However, they are becoming smaller all the time.

Heart and lung by-pass machines are used daily all over the world to take over the functions of these organs for a short time whilst we perform certain operations where we need to stop the blood flowing. What of their more prolonged use?

Portions of artificial hearts, small enough for implantation in the body, have been tried and have functioned for several hours as heart replacements, or up to 10 days as heart assistors (partial replacers) (De Bakey, 1968).

There are many technical and physiological problems, but a combination of engineer, inventor, surgeon and immunologist should ultimately overcome most if not all of these problems so that eventually we should be able to make a reasonable attempt at mechanical replacement of several organs. Never so good as the original, but better than the diseased or damaged one whose place it took.

Does the future then lie in mechanisms or in transplants? Undoubtedly transplants occupy a most valuable position at present and will increasingly do so in the future. My own personal belief is that as mechanisms improve they will be substituted, but the majority opinion favours transplants. Perhaps, in the usual way, it will be a combination of both; but whatever we do, we must not lose sight entirely of the moral issues, nor must we forget that ultimately degeneration of the smaller tissues, such as small arteries, will defeat us for a very long time to come, perhaps even forever, but ever is a long time when applied to the future in science and even in medicine.

Our modern surgeon then has a vast array of technical knowledge to assist him; he needs the advice and assistance of many experts—the more complicated the procedures the greater the number of people involved.

Gone are the days when the surgeon stood in the centre of the public auditorium with, for his assistants, a few strong men to hold down the fully-conscious patient when he struggled. Gone are the days when surgery was scorned by physicians. Flesh was butchered in stinking hospitals by ignorant hacks. Bleeding was the cure for all ills (Rogers, 1963). Gone are the days when it was laid down in England, in the 17th century, that "no surgeon be so bold as to trepan, or open the belly except in the presence and on the advice of a physician" (Bishop, 1960) (Fig. 43).

The surgeon of the future will be but one of many people involved in the care of the patient. One may even consider him as mechanised, almost subservient to our electronic mechanisms (Fig. 44). He is too much of an individualist, however, to operate at the behest of the robot or computer, neither does he quite operate under its control, but he can be expected to operate more and more with its help and guidance.

Nevertheless the ultimate fate of the patient rests upon the skill and art of the surgeon and his associates who put the body in a position to carry out a successful repair—whether that repair *will* occur is ultimately in the care of the body itself and our Creator.

ACKNOWLEDGMENTS

The majority of the illustrations have been taken from the publications listed in the Bibliography under Bishop, Glaser, Glasscheib, Inglis and Thorwald, as follows:

Bishop: Figs. 3, 10, 12, 16 and 32.

Glaser: Figs. 7, 15, 18, 21, 33, 35, 39, 40, 42 and 43.

Glasscheib: Fig. 9.

Inglis: Figs. 1, 4, 5, 6, 8, 11, 14, 25 and 31.

Thorwald: Figs. 2, 13, 19, 20, 23, 24, 26, 27, 28, 29 and 30.

Figures 17 and 22 are taken from Parke-Davis publications.

Figures 34, 38 and 41 were taken in Harari Hospital, Salisbury.

Figures 36 and 37 are taken from Travenol Laboratories publication *Oxygenation* and *Scope* magazine respectively.

Figure 44 was drawn for me by Mrs. H. M. Goldsmid.

I am much indebted to Mr. R. D. Webber, Chief Technician in the Department of Surgery, University College of Rhodesia, for the production of the slides and for his work on the Rygg-Kysgaard IV heart-lung machine which was shown at the lecture; also to Dr. and Mrs. D. C. Dukes for their assistance with the machine and the figures. My secretaries, Miss W. R. Ogilvie and Mrs. P. Ferguson, and my wife have given me invaluable assistance.

BIBLIOGRAPHY

BISHOP, W. J. (1960). *The Early History of Surgery.* Pub. Oldbourne Book Co. Ltd., London. pp. 108, 112-114, 151-153.

DE BAKEY, M. E. (1968). *The Year Book of General Surgery.* Pub. Year Book Medical Publishers Inc., Chicago. pp. 52-62.

GLASER, H. (1960). *The Road to Modern Surgery.* Pub. Lutterworth Press, London. p. 42.

GLASSCHEIB, H. S. (1963). *The March of Medicine.* Pub. Macdonald & Co. (Publishers) Ltd., London. pp. 11, 109-111, 115, 162.

INGLIS, B. (1965). *A History of Medicine.* Pub. Weidenfeld and Nicolson, London. pp. 85, 150, 152-153.

RICHARDSON, R. G. (1958). *The Surgeon's Tale.* Pub. George Allen & Unwin Ltd., London. pp. 22, 52-53, 66, 69, 79, 84, 140, 187-188, 195.

ROGERS, G. (1963). *Brother Surgeons.* Pub. Corgi Books. Transworld Publishers Ltd., London. Preface.

THORWALD, J. (1957). *The Century of the Surgeon.* Pub. Thames and Hudson, London. pp. 4-6, 73, 77-155, 170-178, 196, 234-249, 302, 366-367.

WELCH, C. E. (1966). *Advances in Surgery,* Vol. 2. Pub. Year Book Medical Publishers Inc., Chicago.

LEGENDS TO FIGURES

1. Calendar showing the seasons propitious for blood-letting. Bleeding shown top left, cupping top right.
2. Frère Jacques (de Beaulieu) performing lithotomy around the end of the 17th century.
3. Lithotomy (on right), depicted in a 13th century manuscript of the surgery of Roland of Parma.
4. A lady about to receive her "clyster."
5. A patient awaiting a clyster. Satirised by Moliere who appears here as both M. de Porceaugnac with a gigantic syringe and as Argan in "Le malade imaginaire". Paris, 1868.
6. "The Surgeon" by David Ryckaert (1612-61).
7. An operation being performed at the College of Physicians at the beginning of the 18th century. This could conceivably be a fistula operation.
8. The "Reward of Cruelty" by Hogarth. Caricature of the anatomy lessons in medical schools. Greatly resembles the picture of Pieter Paauw (1564-1617) at Leyden.
9. Prehistoric skulls from Peru, with smooth round openings in the cranium (MacCurdy collection). Apparently trephine holes.

LEGENDS TO FIGURES

10. Pre-Columbian skull from Peru. Trephine holes.
11. Left: Medieval surgeon performing an operation on the skull.
    Right: Amputation, from Paracelsus' "Surgery" (1549).
12. An operation (trephining) in the home, from the "Chirurgia" of Giovanni Andres della Croce, Venice, 1573.
13. The "Indian Nose."
    Top left: The Indian shepherd, Cowasjee, whose prosthetic nose stimulated plastic surgery in Europe.
    Top right: Joseph Constantin Carpue (1764-1846) who successfully re-introduced the operation in England.
    Bottom: The forehead flap in place.
14. Right: Skin grafting in the 16th century.
    Left: Ambroise Paré aged 65.
15. Instruments prepared for modern operations.
16. Left: Arabic surgical instruments as illustrated in the writings of Albucasis (A.D. 963-1013).
    Right: Roman surgical instruments found at Pompeii (1st century A.D.).
17. Ambroise Paré runs out of elder oil after the fighting for the Susa Pass. 1537.
18. A surgeon of 200 years ago performing an amputation.
19. Amputation before the days of anaesthesia. Painting by Francken the elder.
20. Caesarian section being performed by Africans in Kiahura, Uganda, in the summer of 1879. Drawing by the English explorer, R. W. Felkin.
21. Joseph Lister (1827-1912) and his carbolic spray. The anaesthetic is chloroform.
22. Lister introduces antisepsis. Scene in the wards of Glasgow Royal Infirmary. The lad, James Greenlees, had a compound fracture of his leg which Lister treated successfully with carbolic acid dressings (eight layers) for six weeks commencing 12th August 1865.
23. Upper: Horace Wells inhaled nitrous oxide and allowed Dr. John M. Riggs (left) to extract one of his teeth (18th December 1844).
    Lower: Cartoon by George Cruickshank showing one use of laughing gas—to subdue nagging wives.
24. Dr. Morton (left) holds his ether inhaler while Dr. J. C. Warren excises a congenital tumour from the neck of the anaesthetised Gilbert Abbott.
25. Dental extraction, 18th century. "The Dentist" by Francesco Maggiotto. Dentists were not yet accepted into the medical fraternity and travelled about the country like quacks.
26. Ovariotomy, performed by Dr. McDowell (in apron, right) at Danville, Kentucky, in December 1809. The patient was strapped to the kitchen table and sang hymns to counteract pain. The operation took 30 minutes and was a complete success.
27. Professor Charles McBurney (1845-1913) operating in the Roosevelt Hospital, New York.
28. Original bulletin posted at noon on 24th June 1902 at the gate of Buckingham Palace, announcing the postponement of the coronation of King Edward VII on account of an appendix abscess.
29. Dr. Halsted operating at Johns Hopkins Hospital around 1904. Drs. Finney, Cushing and Bloodgood, assistants. Miss Hampton, operating nurse. All are gloved.

LEGENDS TO FIGURES

30. Operation in a ward at Bellevue Hospital in the 1870's.
Note the "everyday" attire, except for the surgeon's protective apron, and the other patient in bed in the background.

31. A 17th century work showing:
Left: Intravenous injections, allegedly for anaesthetic purposes.
Right: Blood transfusion. Above: sheep to man. Below: man to man.
Clearly there is considerable artistic licence here, otherwise one could scarcely expect the man at the bottom right to benefit much from his transfusion.

32. Direct blood transfusion for haemorrhage following childbirth. After J. H. Aveling, 1873.

33. Above: Early "iron lung."
Below: Barnet respirator used today.

34. Modern respirator. Blease intermittent positive pressure ventilator.

35. Above: Early artificial kidney machine.
Below: Early heart-lung machine (Melrose) developed at the Hammersmith Hospital, London, and still in use today.

36. Modern heart-lung machine. Sarns modular pump console.

37. A heart-transplant operation. Groote Schuur Hospital, Cape Town. Professor Barnard, 1968.

38. Artificial kidney machine (Lucas Minicoil) in action. Artificial kidney unit, Harari Hospital, Salisbury, 1968. The unit opened in 1964 with the Kolff machine (on right).

39. Lower picture: Hypothermia.
Upper picture shows an anaesthetic being administered through an oro-tracheal tube.

40. "Operation" using Proton beam. Swedish surgeons destroying less than half a cubic centimetre of brain within seconds. The patient, a man of 54, was conscious all the time and felt no pain.

41. Operation in Harari Hospital, 1968.
Note the modern electronic equipment, including the cardiac monitor and defibrillator in the foreground.

42. Modern operating theatre, Edinburgh. It has an aluminium pressurised dome containing batteries of lights, ventilation grilles and observation windows. There are wall fittings for X-rays, electricity, gases and nitrogen for compression tools.
Note the absence of clutter on the floor space.

43. Operation at the College of Physicians at the beginning of the 18th century.
Note the surgeon operating under the eye of the physician—at the behest of and under the control of the physician, the qualified doctor.

44. The operation of the future. The electronic mechanism sitting in the seat of the adviser, as it were.