greater part in the treatment of these conditions than hitherto. But the demand for psychotherapy is likely to grow in proportion to the number of its practitioners and the quality of their results. Freud's work has led to an increased interest in the neuroses, and their enormous frequency in our civilization has been revealed. The serious social repercussions of neurotic morbidity have been recognized: it is responsible for more sickness and unhappiness than any other type of illness, and neurotic parents are likely to cause neuroses in their children. It is only natural that many psychiatrists pin their hopes on prevention. But the foundations of mental hygiene are still very much in need of strengthening by basic research. This is where the psycho-analyst can make his unique contribution and where sociology and anthropology are expected to come to the aid of psychiatry.

Freud never intended to revolutionize psychiatry. He never practised short methods of psychotherapy which are indispensable to the psychiatrist. He viewed the dilution of his method with concern. But once its basic principles had found acceptance in a growing number of psychiatric centres their application was dictated by the psychiatrists' requirements. Psychological treatment is being subjected to careful scrutiny and new ways of teaching it are being explored. Recording machines are being employed for studying the psychotherapeutic interview in detail, and the one-way screen and the microphone have broken the seclusion of the psychiatrist's consulting-room. Whether these new techniques, which have been difficult to reconcile with some accepted principles of psycho-analytic treatment, will bring new knowledge it is too early to say. They prove, at any rate, that modern psychiatry is not unduly conservative, but boldly experimental. It has its own momentum, and it is difficult to predict in what directions the application of Freud's work is going to develop.

Freud summarized the basic principles of psycho-analysis from time to time, but he left behind no textbook for psycho-analysts and psychiatrists to consult. He was aware of the unfinished character of his researches and never ceased to be a field worker in search of new knowledge. Looking back over his life's work, he said that he had made many beginnings and thrown out many suggestions. Their fruitfulness is far from exhausted. Freud's influence in psychiatry is likely to grow rather than to wane.

MECHANICAL AND HAND SUTURE OF BLOOD VESSELS

BY

V. V. KOVANOV, M.D.

*Director of the School of Operational Surgery and
Topographical Anatomy of the First Moscow Order of
Lenin Medical Institute*

In recent years the surgery of the cardiovascular system has made great progress, and reports of successful operations on different parts of the heart and large vessels are being published all over the world. These operations have been made possible by the use of new instruments, apparatus, and other devices enabling the activity of organs and systems of vital importance to be controlled. The recent introduction of the method of hypothermia offers further facilities for the development of this branch of surgery.

As operations on the cardiovascular system are inseparable from the need to open the vascular trunks, the suturing of vessels and its technique have for long attracted the attention of surgeons. The first attempt to place a lateral suture on a vessel goes back to 1759, when an English surgeon—Hallowell—succeeded in suturing a

brachial artery which he had accidentally injured. His success led him to carry out experiments to verify his method of suturing vessels. Nevertheless this bold idea could not be put into practice because of the low level of medical and surgical science in those days, particularly as there were then no antiseptics. But the introduction of the antiseptic method at the end of the nineteenth century opened up new paths in surgery and made possible a return to the problem of vascular suture. The researches of Yassinovsky, published in 1889, played an important part in the development of this procedure. He proved experimentally that lateral suture of a vessel was a practical possibility, having failed to accomplish this in only four experiments out of a total of 26. He later suggested a new method of suturing in which knot sutures were passed through only the outer coats of the vascular wall. These studies of Yassinovsky were followed by the publication of a number of experimental and clinical reports on the suturing of vessels, and thus a new physiological operation was introduced into surgery.

Methods of Uniting Blood Vessels

In this brief report it is not possible to discuss all the methods of uniting vessels that have been devised, more than 60 different modifications of the original procedure having been suggested. Many of them are only of historical interest, but others are of definite value as marking certain stages in the development of surgical thought. The methods of uniting vessels proposed may be divided into three groups: (1) those in which a hand-made ligature suture is used, including anastomosis by invagination, various methods of turning the suture, and eversion of the vessel walls; (2) the prosthetic method, either alone or combined with a manual method; and (3) mechanical suture by means of an apparatus which approximates the cut ends and joins them with tantalum clips.

In any particular operation the choice of a suture method must depend on the structure and situation of the vessel or vessels concerned. It would obviously be impossible to devise a universal method which would be equally suitable for the thoracic aorta and the femoral vein, for vessels of different diameter, for limb vessels or those which are relatively inaccessible. The method of uniting severed vessels most commonly used is by means of a hand-made ligature suture. A number of modifications of the circular suture were devised by Carrel at the beginning of the present century. Of these, according to Shumacker and Lowenberg (1948), the uninterrupted mattress suture with knot ligatures has given the best results. In experiments with this suture only 20.3% of complications occurred. Soviet surgeons too are working on this type of circular suture. In 1946 Sapozhnikov suggested a modification of the circular mattress suture—the welted suture which is inserted with two needles through the ends of the vessel with the intima everted. To facilitate turning the cuffs he made incisions 2 mm. long. I myself have successfully employed this method in my clinical practice. Another modification of the circular suture technique was suggested by Polyantsev (1948). This is carried out in three stages: (1) three inverted-U knot sutures are tied at equal distances from one another; (2) an uninterrupted twisted suture is inserted between them; and (3) in order more effectively to seal the anastomosis the site of suture is enclosed in a "muff" of tissue taken from a nearby muscle, this "muff" being either separated from the muscle or left attached by a pedicle.

Experimenting with the thoracic aorta of a dog, Medvedjev (1954) evolved a modification of an uninterrupted inverted-U suture in the form of a zigzag, which differs from an ordinary mattress suture in that each insertion of the needle into the everted edges of the vessel is made in the reverse direction to that of the suture itself, and the needle is withdrawn near or through the preceding stitch-hole. This

type of suture provides a good hermetic anastomosis. It should, however, be noted that the various modifications of the turned-out suture procedure are technically complicated and take a long time to perform.

The method of uniting vessels by invagination first suggested by Murphy (1897) has long been abandoned, as permeability was rarely secured. However, it is a desirable principle that a suture should be rendered hermetic while the vessel ends are being invaginated. At the present time the invaginating suture of vessels is being investigated under my direction at the School of Operational Surgery in Moscow.

The Prosthetic Method

As is well known, the prosthetic method of uniting vessels was introduced by Payr in 1900. This is technically simple, takes little time, and gives a good and immediate result. It does not, however, ensure natural physiological conditions, since the vascular prosthesis and ligatures impair the nutrition of the vessel walls and lead to pressure sores, thrombosis, and haemorrhage. In addition the materials employed for the prosthesis (vitallium, tantalum) give rise to reaction in the surrounding tissues. Soviet surgeons (Demikhov, Donetsk, Sinitsyn) have proposed several types of vascular prosthesis, but at present they use the method only for experimental purposes. To evaluate this technique the Soviet investigator Demikhov is conducting experiments on dogs, transplanting the heart and lungs and anastomosing the internal mammary artery to the descending branch of the left coronary artery.

A New Mechanical Device

In the U.S.S.R. during the period 1945-50 a group of medical men and engineers have designed an apparatus with which blood vessels can be quickly sutured end to end by means of fine clips made of tantalum, the cut ends having previously been fixed to the apparatus. The procedure is based on the principle of a knot suture turning the vessel inside out, in which, provided the intimal coats of the two portions are in close contact, the suture material remains outside the lumen of the vessel. Moreover, this suture provides contact of the intima over a large area, thus ensuring better inosculation of the vessel ends. Accurate adaptation of the parts to be sutured and the use of fine metal clips prevent constriction of the lumen at the site of suture, and the automatic suturing in one stage reduces trauma. The apparatus includes special clamps, and is supplied with removable bushes from 1.3 to 15 mm. in diameter to suit various sizes of vessel.

The technique of suturing with this instrument is as follows. The vessel ends are drawn out of the surrounding tissues and the clamps applied. The latter have rubber-tipped jaws and can be regulated so that they exert the necessary pressure to control bleeding. In applying the clamps a sufficient length of the free vessel ends is left for the apparatus to be applied and for "cuffs" to be turned. Then the two halves of the apparatus—the "uniting" and "supporting" parts, which are separate—are placed respectively on the distal and proximal ends of the vessel. Clips for suturing have already been threaded through holes in the uniting part of the instrument. Now comes the most important part of the operation: straightening out the cuffs of the vascular edges on the bushes. This is done by means of two pairs of anatomical forceps. In order to facilitate the procedure and avoid damaging the vessel it is necessary to use bushes 1-1.5 mm. smaller than the outer diameter of the vessel. The straightened-out vessel ends are fixed to the apparatus either by means of special cuff clamps or with corresponding parts of the apparatus, depending on the model used. Then the two halves of the apparatus are approximated and the vessel is ready for suturing.

The suturing itself is performed by pressing a lever which operates the "pusher," driving the clips forward to the supporting part of the instrument. On its way each clip punctures both ends of the vessel, its points entering corre-

sponding holes in the bush of the supporting part of the instrument, where they are turned over, providing a close union of the vessel ends. The devices supporting the vessel ends are then removed, and after them the remaining part of the apparatus. The distal and proximal clamps are removed consecutively.

Results Obtained

Up to the present the vessel-suturing machine has been tested experimentally in about 400 cases by my assistant U. P. Petrova, who has obtained good results with it. In a series of 80 circular sutures of vessels tested in 76 extended experiments the permeability of the vessel was preserved. The vascular wall healed with only a slight scar and the intima was fully restored without the formation of a parietal thrombosis. The tantalum clip remaining in the vessel did not cause any reaction in the surrounding tissues. Microscopical studies have shown that inosculation occurs by the ninth or tenth day. The suturing itself takes only four or five minutes.

The great advantages of mechanical suture have been demonstrated by Petrova, who has used the method in transplanting vessels and autotransplanting extremities and kidneys in dogs. In 13 out of 15 animals the autotransplanted extremities healed rapidly. Some of these dogs have been observed for about three years, and one of those with an autotransplanted kidney has been under observation for five years.

The vessel-suturing apparatus has been employed by Androssov in 23 operations for aneurysm, with 18 good and 5 satisfactory results. In these cases a splint was applied to the operated extremity and worn for four or five days. Patients were allowed to walk on the ninth day. Mechanical suturing has also been employed in repairing freshly inflicted wounds of vessels and in transplanting a vein into an arterial defect.

In addition to the instrument above described, with which vessels are united end to end, there also exists an apparatus for applying a lateral suture and another for end-to-side anastomosis. With all three machines the suturing is achieved by means of fine tantalum clips.

The best immediate results of suturing arteries have been obtained when 6-8 ml. of a 2% solution of procaine hydrochloride has been introduced into the bed of the vessel before operation; this prevents spasm of the vessel, while at the same time the collaterals remain patent.

A Modified Circular Invaginating Suture

Experimental work in connexion with the control of mechanical suturing of vessels in different conditions is being carried out under my guidance at the School of Operational Surgery and Topographical Anatomy in Moscow. We are also engaged in elaborating manual methods of suturing vessels. One of my assistants, G. M. Soloviev, has worked out a new modification of the circular invaginating suture. This is a simplified method, and has shown good results both experimentally and clinically. The suture is based on the principle of isolating the lumen of the vessel from the lesions of the vascular wall and the suturing material. The operation has three main stages, the whole procedure from applying the clamps to restoration of the blood circulation taking eight to ten minutes. The first stage consists in placing four sutures at equal distances from each other on the circumference of the vessel; these are inserted as follows. At the proximal end of the artery, $1\frac{1}{2}$ times the diameter from its edge, only the outer coat is sutured; the thread is fixed by inserting a second row in the adventitia at the same place; then by placing a row inwards through all three coats of the artery the wall of the proximal end is sutured at the margin; and finally the edge of the distal portion is sutured outwards. In the second stage, the four sutures being placed, the wall of the proximal end of the artery is turned inside out by means of threads, with the intima outside forming a cuff. In the third stage the ends are

joined together and the sutures tied consecutively. The proximal end of the artery, forming a cuff with the intima outside, is invaginated into the distal portion. (In suturing a vein the cuff is formed at the peripheral end of the vessel.)

At the end of the operation the proximal clamp is first of all removed and then the distal one. The pressure of the blood passing through the cuff at the proximal end presses the latter closely against the intima of the distal end, thus ensuring a hermetic suture. The injured parts of the vascular wall, the suture material, and even the stitch-holes remain outside the lumen and are separated from it by a band of intact intima in close adhesion. All factors contributing to the formation of thrombosis are thus excluded, the force of the blood pressure now blocking and isolating the lumen of the vessel instead of causing haemorrhage.

Out of a total of 52 experiments with the circular suture only two were followed by thrombosis at the site of operation. Vasographical and histological examination has shown that the slight constriction of lumen which occurs at the site of anastomosis completely disappears in a week or two, this process being due to atrophy of the media in those parts of the vascular wall which are isolated from the lumen of the vessel. Examination of the vascular nerves at the site of suture has shown that they grow through the outer adventitial coats across the line of anastomosis.

This modification of the circular suture has been successfully used in uniting not only vessels of equal diameter but those of different diameters as well. In a number of experiments on dogs end-to-end anastomosis between the left subclavian and pulmonary arteries has also been successfully performed. It should be noted that in such cases one to three additional adventitial interrupted sutures are usually needed, but even then the operation takes no longer than eight to ten minutes.

Conclusion

The new modifications of the hand-made and mechanical sutures here described have been used to divert arteries in plastic operations on the large arterial trunks. By means of such an operation it is possible, for instance, to repair a defect of the femoral artery below the branching of the deep femoral artery in man over a distance of 7-10 cm. by anastomosing the intersected deep femoral artery to the distal portion of the femoral artery. Animal experiments have shown that the substitution of smaller arteries for arteries with a diameter $1\frac{1}{2}$ -2 times greater secures a renewal of the general blood circulation which is functionally adequate.

The value of the methods of vascular suture, both hand-made and mechanical, elaborated in my department of operative surgery at the Medical Institute in Moscow has been amply proved both experimentally and in clinical practice.

REFERENCES

- Carrel, A. (1902). *Lyon méd.*, **98**, 859.
 Murphy, J. B. (1897). *Med. Rec. (N.Y.)*, **51**, 73.
 Payr, E. (1900). *Arch. klin. Chir.*, **62**, 67.
 Polyantsev, A. A. (1948). *Gunshot Wounds of the Blood Vessels and their Treatment*.
 Sapozhnikov, E. S. (1946). *Khirurgiya*, No. 2, 61.
 Shumacker, H. B., and Lowenberg, R. I. (1948). *Surgery*, **24**, 79.
 Yassinovsky, A. (1889). *Inaug. Diss.*, Dorpat.

"Radiopage," a miniature personal radio-receiver using transistors instead of valves, was demonstrated recently in London. It is claimed to be "eminently suitable" for use in hospitals. The receiver fits into a pocket and the power is supplied by a battery with a life of 500 hours. Up to 50 calls can be effected with any one system, and each communication is received privately and separately. Messages can be heard without the need of putting the receiver to the ear. The makers are British Communications Corporation Ltd., Wembley, Middlesex.

RENAL PAPILLARY NECROSIS

OBSERVATIONS ON FIVE CASES

BY

J. E. CATES, M.D., F.R.C.P.

AND

T. F. HEWER, M.D., F.R.C.P.

From the Departments of Medicine and Pathology, University of Bristol and the United Bristol Hospitals

It has long been known that papillae may necrose and separate from the rest of the kidney. This lesion has been variously named necrosis of the renal papillae, papillary necrosis, necrotizing renal papillitis, and papillitis necroticans. It was first observed by a pathologist (von Friedreich, 1877) and for years remained a post-mortem finding; consequently it was held to be a fatal complication. However, clinicians are becoming more aware of the condition, especially since the report of Robbins *et al.* (1946) and the classical paper by Edmondson *et al.* (1947). Nowadays the presence of papillary necrosis may be recognized clinically. As a result it is found that papillary necrosis is not necessarily fatal, and that function of the kidney may recover after papillae have necrosed and sloughed.

The following cases exemplify some factors that predispose to necrosis of renal papillae and illustrate different symptoms that may result. In one patient there was good evidence of healing and repair.

Case 1

A man aged 62 was admitted to hospital with uraemia in March, 1952. For five weeks he had had difficulty in passing urine and there had been haematuria at times. There was no fever; the prostate was enlarged; the urine contained no sugar, a little albumin, and on microscopy red cells and a few white cells were seen. Culture was sterile. The blood urea was 503 mg. per 100 ml.; haemoglobin 42% (6.2 g./100 ml.). He died the next day.

Necropsy Summary.—Senile hypertrophy of the prostate obstructed the urethra; the bladder showed an acute cystitis; bilateral hydronephrosis and hydronephrosis were present. Both kidneys, though distended by hydronephrosis, were small (left 102 g., right 105 g.) with narrow granular cortex and adherent capsule. Almost all renal papillae were affected by papillitis necroticans in an advanced stage, some having sloughed away, but most were still in the process of separation, the necrotic piece being shrunken and dark in colour. The gall-bladder was full of pus and contained a stone; on culture *Proteus vulgaris* and coliform bacilli were isolated. Uraemic pericarditis and colitis were also found.

Sections of 15 papillae from both kidneys were examined. Three of these appeared in the gross to be unaffected by necrosis but histologically all had some degree of clear-cut necrosis of the tip. In the three that looked normal there was some acute pyelonephritis but only a few chronic lesions. The chronic pyelonephritis was accompanied by some intimal thickening of the intralobular arteries but there were no hypertensive arteriolar changes and nothing to suggest diabetic glomerulosclerosis. The papillae with extensive necrosis had an increased vascularity of the adjacent living papillary tissue but no granulation tissue formation. There was no necrosis of the tissue of the renal pelvis.

Comment.—Papillitis necroticans was associated with urinary obstruction and pyelonephritis. There was no evidence of diabetes. In retrospect the necrosis of renal papillae was evidently responsible for haematuria and must have contributed to renal failure.