Very rarely will injection of the supraorbital notch require an anaesthetic. I have injected this nerve in eighteen patients altogether, seven of whom were cases of tic douloureux, and in only one was an anaesthetic necessary.

This treatment of injection of the nerve trunks with strong alcohol is, I am absolutely convinced, a sure cure for the pain in tic douloureux; not a permanent cure as with excision of the Gasserian ganglion, but giving complete relief from the pain for periods varying from two to five months, when the injection has been only perineuritic, and has produced no anaesthesia, to twelve or eighteen months, or even longer, in the more successful cases in which the injection has properly punctured the nerve at the deep foramen, producing complete anaesthesia of the anatomical distribution of the nerve. When the pain returns, as it is likely to do ultimately, the same process can be repeated, giving generally a longer period of immunity from pain than on the first occasion, and so on apparently indefinitely. With the needles I use, no scar is produced which can be detected after the lapse of ten days to a fortnight, even though as many as three injections may have been given at about the same spot within a few days. With proper precautions and strict attention to asepsis, there is absolutely no risk to life, and the only troubles I have met with were in three patients, two of whom had slight transient diplopia, one partial diminution of the colour sense on the one side, and in one case a certain degree of Eustachian deafness. Slight haematoma may occasionally develop after an injection, especially after injection of the foramen ovale, or of the infraorbital foramen, causing a bruised appearance lasting for a few days. Swelling of the cheek or eyelid always follows a superficial injection of the infraorbital foramen or supraorbital notch, closing the eye in the latter case for a day or two, the swelling not entirely disappearing for four or five days. Injection of the foramen rotundum is said to cause sometimes considerable swelling of the lower eyelid and chemosis of the conjunctiva, but I have not met with this in my own practice.

Dangers to be Guarded Against.

1. In injecting to the foramen rotundum, never inject at a greater depth than 5 cm. for an average-sized skull, or, a better guide, be careful not to sink the needle more than 7 mm. past the anterior edge of the external pterygoid plate. This precaution will prevent the optic nerve being injured. If the injection be made too horizontally, it will pass beneath the superior maxillary nerve and reach the sphenopalatine foramen, and will be felt in the nose. If directed too high, the sphenoidal fissure may be reached and the branches of the third nerve may be damaged, causing diplopia and dilatation of the pupil.

2. In making the injection for the foramen ovale, for the third division of the fifth nerve, if the needle is directed too low and too deeply, more than 4½ cm., the pharynx wall or the Eustachian tube may be punctured; if too far back, the middle meningeal artery may be injured, and it is conceivable that if directed much too far back by a person with no experience, even the internal carotid artery or jugular vein might be injured.

As an instance of the boldness sometimes met with in the use of new treatments, I have known a doctor give a patient suffering from tic douloureux of the third division a hypodermic injection of alcohol deeply behind the angle of the lower jaw, because, as he said, "all the nerves ran there"! It is essential that any one wishing to use this method must first practise with a long needle upon a complete articulated skull, and then on the dead body in the post-mortem room, not once only, but many times.

REFERENCES.

- ¹ Finkelnburg, *Verhand. des Congress f. Inn. Med.*, Wiesbaden, 1907.
² Harris, *Proc. Roy. Soc. Med., Neurol. Sect.*, 1909, vol. ii, p. 77.
³ Harris, *loc. cit.*, p. 81. ⁴ Schlösser, *Klin. Monatsbl. f. Augenheilk.*, Stuttg., 1903, xii, p. 244. ⁵ Schlösser, *Verhand. des Congress f. Inn. Med.*, Wiesbaden, 1907, xxiv, p. 49. ⁶ Sicard, *Rev. Neurologique*, 1907, p. 1157.

The American and Colonial Clubs, composed of Rhodes scholars at Oxford, have passed resolutions strongly approving the aims and objects of the Association for the International Interchange of Students. The first touring party is leaving Liverpool on June 21st for Canada and the United States.

ON CIRCULAR OR END-TO-END SUTURING OF ARTERIES:

BEING A MODIFICATION OF AN ALREADY
PUBLISHED METHOD.

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THE following description of a method of end-to-end suture of arteries is an evolution of the method set forth in the book on blood-vessel surgery recently published for the author¹ by the Oxford Medical Press.

Further experience, partly in human surgery, partly in the course of research work in which blood-vessel surgery forms part of the procedure, has led to a greater perfection of the method. One or two instruments for the purpose must first be described.*

1. The "frame" (Fig. 1) takes the place of a very simple appliance termed a "measure" in the original

Fig. 1.—The "frame." Half size.

publication of the method. In a steel frame slides a flat plate of steel engraved on one side with two scales, the upper one being 1½ cm., graduated in millimetres, the lower being the same length graduated in 1½ mm. Any number read off on the larger scale is equal to one and a half times the same number on the smaller scale. The use for this will appear hereafter. At one end of the instrument is a handle, and at each end of the fenestrated portion is riveted a small spring clip,

Fig. 2.—The needle. Actual size.

under each side of which can be fixed and held a suture.

2. A curved needle in a handle (Fig. 2). The eye is not far from the point; the needle is removable from the handle, and, if damaged, or if it becomes unthreaded during the operation, it can readily be replaced by a new one, or by one previously threaded.

3. Clamps required for the temporary control of the blood stream may readily be made by covering both blades of a small spring clamp with rubber tubing; the tubing should be reflected over itself at the heel end of one blade, and the point of the other, making those parts of the blades double covered (Fig. 3). The middle portion of

Fig. 3.—The clamp for temporary control of the blood stream.
Actual size.

the blades is used to clamp the vessel; the extra layer of rubber at the ends serves to prevent injurious pressure on its wall. These clamps are better if the blades outside the rubber are thinly covered with gauze, which prevents the divided vessel from retracting through the blades. (The gauze on the blades is not shown in the drawing.)

The suture material used is silk, for a vessel as large as the human femoral artery, No. 0000; for one the size of the radial about half that thickness. In addition, some fine chromicized catgut, No. 1 or No. 2, according to the size of the vessel, is required. The silk is used from the reel, and it is essential to thread the needle from the convexity of its curve towards the concavity. The catgut should for convenience be in straight lengths, that is,

* These two instruments have been made for me by Mr. C. F. Palmer, 6, Upper Tulse Hill, London.

never have been wound on a reel. I use an apparatus for sterilizing silk or catgut by superheated alcohol vapour, designed by Förlér, and made by Kutill of Vienna. The material is thus efficiently sterilized, and owing to the volatility of the alcohol, is dry when required for use, and free from any foreign substance.

The suture method is an adaptation of the quill suture, the quill being represented by the chromic gut. The desideratum is to bring two endothelial surfaces together, yet to have a suture that penetrates every coat of the vessel but causes a minimum of bare suture material to impinge on the lumen.

The following detailed description applies to the simple experimental operation of division, and end-to-end union of an artery.

Every preparation being made, and the operator completely equipped for aseptic operating, the vessel concerned is exposed freely, and separated from its surrounding tissues for a length of 3 to 4 cm. The frame is then slipped beneath the vessel and its diameter under the arterial pressure noted on the smaller scale. The vessel is then cleanly divided, after having been temporarily clamped above and below the proposed point of union. If it retracts within its adventitia the superfluous amount of the latter should be cut away even with the divided end of the vessel.

The first suture is then inserted as follows, and attention must be given as to the direction in which the needle should be passed. The needle is passed from without inwards on the deep aspect of one of the divided ends about 1 mm. from its edge, and from within outwards at a corresponding point on the other; the loop in the concavity of the needle is seized with fine dissecting forceps, and the needle withdrawn; through the loop is then drawn a thread of the chromic gut, and a thread of silk; the loop is then drawn tight, and the two ends tied over another thread of chromic gut. The end attached to the needle must be above, the loose end below the gut. The ends are left long, the needle having been previously slid along the silk towards the reel, and being thus left still threaded. The long ends of the tied suture, and the thread of silk through its loop on the other side form two traction

Fig. 4.—The vessels fixed in the "frame," stretched by traction threads, and partly sutured on one side. For the sake of clearness, only two sutures are shown, one of them tied, where three ought to be inserted for a vessel of this size. (Half size.) A, a, First traction threads. B, b, Second traction threads. G, G', j, j', "Quills" of chromicized catgut. D, Upper end of the last suture inserted, but not tied. d, Lower end of the last suture inserted, but not tied.

threads A and a (Fig. 4) on the deep aspect, one for each piece of the divided vessel.

The needle is passed for the second time in an exactly similar manner to the first, but on the superficial aspect of the vessel, that is, diametrically opposite to the first, but the loop of silk is drawn far through the vessel walls, and the suture is not tied for the present; the loop of this suture on the one hand, and the long ends on the other form the two traction threads, B and b, for the superficial aspect of the vessel, which is now ready to be fixed in the frame.

The traction threads of the first suture are then fixed in the clips of the distal end of the "frame," which is slipped underneath the vessel at the point of union, those of the second suture being fixed in like manner in the clips at the proximal end, the vessel itself being as near the distal end as possible. (See Fig. 3.) Traction is then made on the vessel wall by means of these threads, so that the part between the points where the threads pierce it is stretched to the same number on the large scale as was read on the small scale before division. The vessel is now

ready to be sutured, and is not removed from the frame till the suture is practically completed. The stretching in the way indicated ensures the size of the vessel at the suture line being the same as it was before division, so that no narrowing should be present at the point of union. The sutures already inserted, after serving their purpose as traction threads, take their place also as permanent sutures when all is completed.

Sutures are now laid in succession on the exposed side of the vessel beginning $1\frac{1}{2}$ mm. from the first suture, and with a space of $1\frac{1}{2}$ mm. between each two sutures.

Fig. 5.—The "frame" reversed. The first suture on the reverse side inserted, its loop threaded on a probe and the loose ends distinguished into upper D, and lower d, in respect of the chromicized catgut j. Lettering as in Fig. 4. Half size.

The loops are successively threaded on a probe, and the untied ends are caught temporarily in two pairs of forceps, the unattached end (when passing the needle), being designated the lower d, the end attached to the reel the upper D. (See Fig. 5.) When the sutures for the one side are all laid, the proper piece of chromic gut G (Fig. 4), is threaded on the probe and drawn through the loops, being finally passed also between the two threads of the corresponding traction loop B (Fig. 4). The loops are then drawn tight, and tied over the second strand of chromic gut, j, in the same order in which they were laid, each suture being cut short when tied, and the chromic gut j being drawn between the two threads of its corresponding traction loop b. The sliding plate is then slid to the proximal end of the frame, which itself is turned over around the blood vessel as an axis, thus bringing the other side of the vessel upwards, and exposed for suturing.

It is in order to facilitate the reversal of the "frame" that the first traction threads A and a are fixed to the

Fig. 6.—The last suture on the reverse side, its loop enclosing both ends G G' of the one catgut "quill," and its ends tied over both ends j j' of the other. Lettering as in Figs. 4 and 5. Half size.

distal end of the frame, and that the vessel is fixed as near that end as possible.

By making the first traction thread on the deep aspect of the vessel the latter is only turned on its own axis to an extent of 90 degrees, first one way, then the other, an amount of torsion insufficient to injure the vessel wall.

The second row of sutures is now laid exactly as the first, and tied in the same way, except that the last one to be tied has both ends G G' of the one catgut strand through its loop, and both ends j j' of the other tied under it (Fig. 6).

The loop of the second traction suture *B b* is now loosened from its clip, drawn tight, the ends tied and cut away. The first traction threads are cut, and releasing the vessel thereby from the frame, the suture is complete.

On loosening the temporary clamps, there is sometimes a little oozing at the suture line, which stops in a minute or two under gentle pressure with gauze between the fingers. The reason for laying and tying the sutures in a definite order is that if one breaks in the tying it cannot be replaced if the sutures on both sides of it have been already tied.

This method of end-to-end union of a divided vessel differs in some small but important details from that previously published by me.

The "frame" is a greater convenience as compared with the "measure" of the original method, in that the vessel once fixed is not removed till the suture is complete, the other side being exposed by simply sliding back the plate, and reversing the frame as described.

The main difference is that, in the original directions, the second suture inserted, which forms the traction threads *B b* during the suturing of the two sides of the stretched vessel, is directed to be tied last of all, as in this method, but the ends of the chromic gut "quill" *G G' j j'* were originally directed to be tied in this suture after removal from the "measure" (which there takes the place of the "frame"), while now the two ends of the "quills" *G G' j j'* are tied in the last of the sutures on the reverse side of the "frame," and so the diameter of the supporting "quills," which determines that of the finished union, is fixed before the traction is released and the "frame" removed. The traction suture *B b* is then tied, the section of vessel wall concerned being already held stretched, whereas in the former method that section of wall was free to contract, the traction being released, and consequently the contraction led to a slight narrowing at the suture line.

1. The course of the suture in its passage through the walls of the apposed ends of the vessel is to be noted. If the details above described as to threading the needle and as to the distinction of the ends of the suture before tying into upper *D* (Fig. 5) and lower *d*, with respect to the strand of catgut *j* over which they are tied, the suture will invariably take the form of the figure 8, the space in each

Fig. 7.—Shows diagrammatically the figure of 8 shape of the suture *in situ*.

half of the figure being occupied by the chromic catgut, while the cross in the centre is where the suture pierces the vessel walls (Fig. 7). There is thus no possibility of the suture cutting out on each side to the width of the thickness of the chromicized catgut, and the hole through which it passes in the vessel walls is minimal.

2. The catgut itself is a powerful aid against any tendency of the suture to cut out, by giving a more extended hold on the vessel wall. It acts also as a pair of splints, keeping the two endothelial surfaces in contact between the suture points.

3. Fewer sutures are required than under any other suture method, and so fewer needle punctures, and less consequent weakening of the wall of the vessel.

4. Nothing but an endothelial lining is exposed to the blood stream, even the sutures, though perforating all coats, being practically prevented from contact with blood.

Fig. 8.—Diagrammatic representation of the internal appearance of the suture line in an artery which has been united by the method described.

The inner aspect of the vessel after suture is shown diagrammatically in Fig. 8.

5. If the observations of measurements of the size of the vessel when full of blood, and when stretched in this

"frame," are correctly made, there is a mathematical certainty of having the size of the vessel at the suture line that of ordinary distension under the pressure of the blood.

6. As I have shown in the book referred to, when healing has occurred no suture material remains *in situ* in the vessel wall, the catgut being eventually absorbed, and the silk completely outside the vessel; in the scar itself new elastic and muscular fibres form, and there is a strong probability of a complete *restitutio ad integrum* being established.

I have repeatedly united by this method divided vessels of a diameter when distended with blood of not more than 3 mm. Rarely can any necessity arise in human surgery for suture of a smaller vessel.

The method is equally applicable to end-to-end suture of veins, though it is specially designed to furnish a safe suture under conditions of pressure such as exist in arteries.

A suture on the same principle is also applicable to the repair of wounds in the wall of a vessel not amounting to complete division. If the wound were longitudinal or slightly oblique the "frame" would not be required; if very oblique or transverse, it might be wiser to complete the division and make a union as above described.

It would then, of course, be necessary to observe the original diameter of the vessel under the arterial pressure by temporarily controlling its proximal end and laying it across the graduated plate of the "frame" when filled out with blood.

REFERENCE.

¹ *Suture of Arteries*. By E. Archibald Smith. Oxford Medical Press. 1909.

A NOTE UPON

THE MECHANICAL EFFECTS OF A MASSIVE RIGHT-SIDED PLEURAL EFFUSION.

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(From the Anatomical Laboratory of the College.)

THE observations here recorded were made on a dissecting room subject preserved by the double vascular injection method. The arteries were injected under low pressure with a corrosive-carbolic-glycerine preservative, the venae cavae and their tributaries to the first valves with 15 per cent. formalin.

This method of preservation secures that the majority of the tissues retain an almost lifelike consistency, whereas the heart, liver, and kidneys are firmly fixed and the lungs partially fixed.

The body upon which the observations were made was that of an old woman, whose age was returned as 67. Before dissection was commenced the right shoulder was seen to be considerably higher than the left. This elevation is shown in the photograph. When the thorax was opened, the right pleural cavity was found full of clear fluid. The condition of the (partially fixed) right lung is shown in the figure. It contained air, but was not completely expanded.

In connexion with the displacement of the thoracic viscera the most striking fact was that the inferior vena cava and the pericardial attachment of the diaphragm had moored the mediastinal structures as efficiently inferiorly to and through the diaphragm as the great vessels, trachea, and oesophagus moor them superiorly to the margins of the thoracic inlet. As a result the displacement of the mediastinal structures to the left was maximal at the level of the lung roots and minimal at the levels of the thoracic inlet and diaphragm.

The diaphragmatic pleural recesses were widely opened up, and the convexity of the right cupola of the diaphragm was in part reversed, so that it looked downward instead of upward. The posterior part of the mediastinal pleura was bulged somewhat to the left of the middle line, but not sufficiently to clear the vertebral bodies.

The heart was displaced, the apex having passed downwards and slightly inwards. The mechanism of this displacement was: the right margin of the inferior or diaphragmatic surface of the heart was held almost im-