ON THE
EFFECT UPON THE FEMORAL ARTERY OF
ITS LIGATURE
FOR THE
CURE OF POPLITEAL ANEURISM.

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WHEN the femoral artery is tied at the apex of Scarpa's triangle for the cure of popliteal aneurism, what effect is produced on the vessel between the point of ligature and the sac? In what state is the artery found at a subsequent period? Is it pervious or impervious? With the view of obtaining a satisfactory answer to this question I have examined all the preparations of popliteal aneurism in which the artery had been tied that I could find in the museums of the London hospitals, and the result is set forth in the following table.¹

¹ I am greatly indebted to Mr. D'Arcy Power for the important help he has given me in examining and describing these cases, and I am glad to have this opportunity of acknowledging it.

Table of Cases in the Museums of the London Hospitals in which the Femoral Artery has been tied in Scarpa's triangle for the cure of Popliteal Aneurism.

Hospital.	Duration of life after operation.	State of artery between ligature and sac.	State of aneurism.
St. Bartholomew's	6½ years	Pervious from ligature to anastomotica magna; from anastomotica to sac plugged by dark-coloured, imperfectly laminated clot	A firm, dense mass of fibrous tissue.
"	6 years	Pervious from just below ligature to aneurism	A solid mass of fibrous tissue.
"	11 years	Obliterated for two inches below ligature; then pervious, but much contracted	The aneurism is cured.
"	18 months	Pervious, but lined with a thin clot of blood of variable consistence, as if in process of absorption	Filled with firm clot.
"	A long while	Obliterated at seat of ligature; only two inches of artery shown below; this is pervious	Not shown.
St. George's	2 months	Only one and a half inches of artery left above the sac; this is quite pervious	The sac is full of laminated clot.
"	No history	The artery is quite pervious throughout from the point of ligature to the sac	The sac contains a small amount of discoloured clot.
"	4 years	Artery between point of ligature and sac pervious and injected	The sac is now quite empty; the aneurism was not cured; pulsation reappeared.
"	7 days	Artery pervious throughout	The sac is full of dark-coloured laminated clot.
Guy's	12 days	Pervious	Not shown.
"	11 days	Upper half filled with firm clot, tapering below; lower half contracted, but pervious	Lined with laminated clot.
St. Thomas's	Some days only	Upper portion only of the artery is preserved, which is pervious, except where a very small clot lies below ligature	Not shown.
"	Some days only	Pervious; the ligature was placed above the profunda femoris	Partially filled with laminated clot.

Hospital.	Duration of life after operation.	State of artery between ligature and sac.	State of aneurism.
University College	6 days	The femoral artery bifurcated half an inch below profunda, and the divisions reunited seven inches lower down; a clot extended from the ligature on one of the divisions to the point of their reunion	Completely filled with clot.
"	Some days	Only a portion of the artery in connection with the sac is preserved; this is pervious	Almost empty; only a thin layer of laminated clot.
"	3 months	Obliterated at seat of ligature; pervious below	A solid mass of dense fibrous tissue.
"	43 days	Pervious, but very much contracted	Filled with firm coagulum.
King's College	18 days	Occupied by clot for three inches from sac; the only portion preserved	It contains some fibrous coagulum.
London	A few days only	Pervious, except a plug for one and three quarter inches below ligature	Not shown.
"	7 years	Occluded for two and a half inches below ligature; then patent to origin of anastomotic magna; below this again occluded	A mass of fibrous tissue.
St. Mary's	2½ years	Pervious; injected throughout	Aneurism controlled for some time; but recurred after many months.
"	Some days	Artery patent throughout; even pervious through aneurism	Sac filled with stratified clot.
"	2 or 3 years	Solid for an inch below ligature; the rest of it pervious throughout	Aneurism much shrunken. Cured.
"	Several years	Clot for an inch below ligature; artery then pervious for three inches; then clot again for three inches	Aneurism shrunken. Cured.
"	Many years	Pervious throughout	Cured. Shrunken.
Middlesex	12 years, then amputation	Pervious	A mass of dense fibrous tissue.

These cases may be thus arranged :

Total number of cases	.	.	.	26
Complete specimens	.	.	.	17
Incomplete specimens	.	.	.	9

In the complete specimens :

Artery pervious throughout . . . 13

Artery partially pervious . . . 4

Number of cures . . . 15

In these artery pervious . 11

In these artery partially closed 4

Number of failures . . . 2

In these artery pervious . 2

In these artery partially closed 0

Now, I think that most surgeons will hardly be prepared for these results. That in many cases after ligature of the femoral artery in Scarpa's triangle the trunk of the vessel below remains to a greater or less extent pervious is a fact well known to all of us ; but I think, also, most of us would have said that in many cases, perhaps in the majority, the canal becomes obliterated. But this table of twenty-six cases furnishes no single instance in which after the operation the artery was rendered impervious throughout. Of seventeen specimens which are perfect, in four instances it is to a greater or less extent pervious, and in thirteen instances it is patent throughout. Very probably, in almost all cases, it is diminished in size, but this point cannot be determined clearly in the preserved specimens, and the extent to which it remains patent is no doubt greatly influenced by the size, number, and arrangement of its branches. The specimens, however, hardly afford demonstration of this, but it is clear that while in some cases branches arise from the patent portions, in others they arise from a part that has become impervious.¹

¹ The obliteration of the trunk of an artery below a ligature has been, perhaps, generally regarded as a very gradual process. For instance, Sir Astley Cooper wrote—

“ When a ligature has been applied it is some time before the artery below becomes obliterated. Mr. Forster, surgeon of Guy's Hospital, has a drawing in his possession of a case of popliteal aneurism for which the femoral artery

But the fact is abundantly shown that obliteration of the artery is by no means necessary to the cure of the aneurism. Here in fifteen cases the aneurism is cured, and yet in all the artery is to a large extent pervious ; in eleven it is pervious throughout. It is clearly enough, as there is ample evidence to prove, that the pressure of the blood stream on the sac be reduced. This, indeed, may be said to be the principle of the operation which Hunter performed as distinguished from all previous ones ; that branches may be allowed to intervene between the site of the ligature and the sac, and so blood may still find its way freely though circuitously from above downward to the main trunk and thence to the aneurism, and yet nevertheless by thus breaking the force of the main stream a cure will follow. Not invariably, indeed, on this account, for occasionally, as is well known, although the artery as usual becomes obliterated at the seat of ligature, the supply remains too free and the pressure too strong on the aneurismal sac and so it continues to yield. In such instances the ligature of the main trunk does not from various causes—among the chief of which must be the freedom of the collateral current and the character and condition of the aneurism—suffice to restrain the circulation to a sufficient degree, and these instances throw a strong light on the principle of cure in the treatment by compression above and the frequent failure of this method.

The following case is of interest from this point of view,

was tied in August ; the man died in January following, and when the limb was injected, the femoral artery, below where the ligature had been applied, was found to have received a part of the injection by communicating vessels.

“ It is for this reason that the pulsation in some aneurisms where there are free communicating vessels, will remain for a considerable time after the operation. However, in twelve or fourteen months, when the femoral artery has been tied, it becomes obliterated, above the ligature to the *arteria profunda*, and below it, to the origin of the anterior tibial artery ; and sometimes the remnant of the vessel is not only converted into a cord, but is ossified ” (*Medico-Chirurgical Transactions*, vol. ii, 1811, p. 253).

But this table clearly shows that many years may elapse, 6, 7, 11, 12, and yet the artery may be either in part or throughout pervious.

but it is instructive chiefly in showing that while a ligature upon the artery far away from the aneurism may fail, a ligature lower down, nearer to the sac, may succeed.

J. J—, æt. 37, a hawker, was admitted into St. Bartholomew's Hospital on the 18th of January, 1883, with a popliteal aneurism in the left ham in the form of a well-defined globular tumour about two and a half inches in diameter. It was much reduced when the femoral was controlled and there was a distinct murmur over the sac. He had been conscious of something wrong behind the left knee for three months. There was no history of syphilis or evidence of intemperance or of disease in the arterial system elsewhere.

On February 13th the femoral artery was tied at the apex of Scarpa's triangle with a silk ligature. All pulsation in the sac at once ceased. The wound healed by the first intention throughout except where the ligature passed out. This, which was rather stout, did not separate till the thirty-first day. On the next day very slight pulsation could be detected on the inner side of the sac, but not elsewhere. The tumour had gradually diminished in size and become more solid. On the 24th of March he was discharged.

In February, 1884, he was re-admitted with distinct pulsation in the tumour, which was then quite as large as before the operation. The pulsation was greatly reduced, but not entirely controlled by pressure on the femoral above the scar of the operation. Since his discharge he had been, for many hours of each day, on his feet following his business as a hawker. On one day in the previous November, after a walk of twenty miles, the tumour increased in size, and became painful.

By rest and the continual application of an elastic bandage the pulsation almost subsided, and he left the hospital in the end of May.

In February, 1885, he was again admitted with the aneurism in much the same state as when he came to us the year before. The tumour felt solid, but with distinct

pulsation, most plainly felt on the inner side. This was almost completely stopped by pressure on the femoral above. The man was kept at rest for some months with the limb bandaged and firm pressure over the tumour. On three occasions Esmarch's bandage was applied so as to control the circulation in the limb, for from half an hour to an hour. But no perceptible effect was thereby produced on the aneurism.

On August 6th I cut down on the popliteal artery between the opening in the adductor magnus and the tumour. The artery which was raised by the tumour and comparatively superficial, came readily into view. It appeared healthy, hardly diminished in size, and pulsating with almost normal force. It was tied about two inches above the point where it joined the surface of the sac, by a catgut ligature in two places, and divided between them. No other artery could be seen in relation to the sac. All pulsation in the tumour immediately ceased and never returned. The wound healed through-out by the first intention. The tumour rapidly subsided, and when the man left the hospital a month afterwards, it was greatly reduced. He has not been since seen.

Other cases similar to this can be produced, in which, while ligature of the artery at the distance of Scarpa's triangle failed to effect a cure by not sufficiently restraining the current through the sac, the aneurism was forthwith controlled and cured when the artery was subsequently tied much closer to it. And, in view of the patency of the artery below, after ligature in Scarpa's triangle, I would suggest that when this operation fails to cure a popliteal aneurism, in the absence of any special objection, the artery should be tied lower down; if practicable, in the upper part of the popliteal space, so as to be below the anastomotica magna. This may make all the difference, as in the following case:

A man, æt. 48, was admitted into St. Bartholomew's Hospital under the care of Mr. Smith in October, 1881, with a popliteal aneurism. Fifteen months previously he

noticed a swelling in the right ham for which, seven months later, the femoral artery was tied in Scarpa's triangle. This was followed for three months by a reduction of the tumour, but afterwards it steadily increased.

On admission the aneurism was as large as a common orange with considerable impulse. The femoral was occluded in the apex of Scarpa's triangle, but the popliteal pulsated strongly. Pressure on the common femoral stopped all pulsation in the limb. Bandaging and flexion having failed, the superficial femoral was exposed in Hunter's canal, and as it was found to be pervious though small, it was tied in two places and divided between the ligatures. This did not stop the pulsation in, or control the aneurism. In May, 1882, after another trial of pressure and flexion without avail, the popliteal artery was tied in two places and divided between the ligatures, an inch above the aneurism. Then all pulsation at once ceased and the sac rapidly diminished.

I would go even farther than this, and suggest that in some, perhaps in many, cases of popliteal aneurism it would be better to tie the popliteal artery in the first instance rather than the femoral. The one single objection of any weight to this operation is in the risk that the artery so near the aneurism may prove to be diseased. But is not the chance of this somewhat exaggerated? At least in many cases of popliteal aneurism it shows no signs of it, and the frequent occurrence of aneurism in the popliteal artery is perhaps more largely due to the position of the artery and the strain to which it is occasionally subjected than to any material deterioration of its structure. Moreover, let it be remarked that we are already accustomed, without much fear of the consequences in this respect, to place ligatures on other arteries for the cure of aneurism elsewhere at a very short distance from the sac, as in ligature of the subclavian for axillary aneurism and of the carotid in the neck below for aneurism above.

The increased difficulty of ligature of the popliteal over

the femoral need hardly be taken into account. And for the rest, with regard to the two operations, the advantage appears to me to be with ligature of the popliteal, mainly on the score of the greater certainty of its success in the cure of the aneurism. In view then of the number of cases known to us in which ligature of the femoral artery has failed I would ask whether we may not reconsider the question of ligature of the popliteal artery for the cure of popliteal aneurism ?

(For report of the discussion on this paper, see 'Proceedings of the Royal Medical and Chirurgical Society,' New Series, vol. ii, p. 162.)