ANEURISM OF THE ARCH OF THE AORTA;

LIGATURE OF THE RIGHT SUBCLAVIAN AND CAROTID ARTERIES.

DEATH BY RUPTURE OF THE SAC ON THE FIFTY-FIRST
DAY AFTER THE OPERATION.

BY

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F. B—, æt. 30, a shopman, was admitted into St. Bartholomew's Hospital, under my care on January 17th, 1881.

History.—Patient has always believed himself healthy. Has never had syphilis. In March, 1880, he had neuralgia extending from the right side of the top of his head downwards behind the right ear, and along the posterior edge of the sterno-mastoid muscle to the shoulder, and thence on the inner side of the arm to the elbow. A month later (April, 1880) his voice changed to a hoarse whisper. The pain and the aphonia have persisted with varying amount to the present date. Seven weeks before admission he first noticed at the root of his neck a swelling about as large as a bantam's egg. This he says pulsated, and was at first firm, but it gradually became soft and tender on pressure.

On examination a pulsating tumour of the size of a large chestnut was seen, the centre of which was an eighth of an inch above the right sterno-clavicular joint, and about the same distance to the inner side of that landmark. It extended three quarters of an inch upwards, and bulged half way across the supra-sternal notch. Dulness on percussion extended for one inch below the clavicle, but not beyond the middle line. The sternal end of the clavicle and the adjacent part of the manubrium sterni were undergoing absorption, and the clavicle was pushed a little forward. The skin over the swelling was normal. On auscultation Dr. Church could detect no evidence that the tumour extended beyond the limits disclosed by external examination, or any signs of pressure on the trachea or on either bronchus. No bruit could be heard in the swelling. The heart sounds were normal and the heart was not displaced. The pupils were equal. The pulse in the right radial artery was slightly less firm than in the left, and a sphygmographic tracing, taken by Mr. D'Arcy Power, showed the short and sloping up-stroke and the waving down-stroke usually present in aneurism. The right carotid and the superficial temporal pulses beat very feebly compared with those of the left side. He complained of pain in the situations already noticed, and of constant aching extending through the chest from the right nipple to the inferior angle of the scapula. Nothing abnormal could be detected in the venous circulation. The urine was healthy. The situation of the tumour close behind the right sterno-clavicular joint, its apparently limited extent, and the absence of pressure signs within the thorax, suggested an innominate aneurism. Keeping in view the well-known difficulty of distinguishing aneurism of the innominate from aneurism of the arch of the aorta, the tendency of the swelling to extend towards the left convinced those who saw the case with me that the tumour was aortic.

The patient was kept as far as possible at complete rest in the horizontal position, and ordered a spare diet.

In the next few days he complained much of pain in

the tumour, and also in the right side of the neck and shoulder; and the swelling, which was very tender, became more prominent, extending towards the left, until its left border reached nearly to the middle line.

On January 31st, after consultation with Sir James Paget, Mr. Savory, Dr. Church, and others, I placed a ligature on the third part of the right subclavian, and on the right carotid at the level of the cricoid cartilage, using the carbolic spray. The ligature was chromicised catgut kindly sent by Dr. MacEwen of Glasgow. The ligature I passed round the subclavian broke as I tied the knot, but I ought at once to say that Dr. MacEwen, when he furnished the specimen, was not aware it was for so large a vessel as the subclavian, and therefore sent me a medium instead of a full-sized ligature. To make the vessel secure I passed another ligature round it in a line with the first.

Short decalcified bone drainage-tubes were inserted, and the wounds dressed with carbolic gauze. Pulsation in the carotid, when this vessel was exposed, was found to be scarcely stronger than that of a radial artery. No change was observed in the tumour when the vessels were tied.

February 1st.—The pain felt before the operation in the head, neck, and shoulder has almost ceased. But pulsation in the aneurism seems unaltered.

2nd.—Has severe pain in the right side of the neck when he swallows. He looks rather dusky and sweats profusely.

3rd.—Pain still severe in the side of the neck, especially on deglutition. He is still a little dusky. No pulsation in the vessels beyond the ligature.

4th.—On changing the dressings to-day there is found considerable brawny œdema of the right side of the neck, and marked duskiness of the integuments. The aneurism pulsates much less on its anterior aspect than it did before the operation, and the swelling is less prominent in this direction, but it has increased markedly towards the left side, and pulsation now extends considerably beyond the middle line and also higher in the neck in the supra-

sternal notch. Thus the operation appears to have had a beneficial effect on the original dilatation, but it has been followed by rapid extension of the swelling towards the left, and by evidence of obstruction to the return of venous blood towards the heart.

Feb. 7th.—The general condition is satisfactory. But he is still dusky and the brawny state of the side of the neck remains. The aneurism continues to enlarge on the left side, and the whole swelling pulsates more than it did two days ago.

9th.—The subclavian wound is very nearly healed. The carotid incision is suppurating very slightly.

14th.—The general condition is good. Temp. 98.8° , pulse 96. He complains of pain in the right side of the head and neck. He is still dusky. The aneurism is slowly extending higher in the neck and further to the left. The inner third of the right clavicle and a considerable portion of the first rib and of the manubrium have been absorbed. The skin over the aneurism is tense, dark coloured, and thin. No pulsation in the right carotid. Slight pulse in the right radial.

27th.—The aneurism is now very large and prominent. Pulsation is forcible and expansile.

28th.—Last night a slight discharge of dark blood and serum, apparently derived from the aneurism, escaped from the subclavian wound, which, however, had long been closed by a thin scar.

March 22nd.—On the 20th there was a sudden gush of about ten ounces of bright blood through the subclavian incision, and a further hæmorrhage last night. This morning another bleeding occurred from both wounds, to the amount of upwards of a pint, and he died at 5 a.m.

A post-mortem examination was absolutely refused by the patient's relatives, and all that could be made out by enlarging the operation wounds was that the aneurism was of very large size within the thorax, and extended, apparently after partial rupture, nearly as high as the thyroid cartilage.

Remarks.—As no post-mortem could be obtained, the cause of the greatly diminished pulsation of the right carotid cannot be stated with certainty. The presence of this symptom, however, led to some doubt whether the case was suitable for distal ligature ; for, as the aneurism was increasing in spite of the occlusion of the carotid, and, as occlusion of the carotid has probably a more powerful influence in checking the growth of aneurism than occlusion of the third part of the subclavian, the gain to be anticipated from distal ligature of the latter vessel was somewhat uncertain. The distal ligature of both vessels, nevertheless, was held to afford the patient a better chance of recovery than any other means of treatment that could be adopted.

Some may be inclined to ask why the carotid was tied, as its pulsation was already hardly to be felt ? This step was necessary, because it was uncertain whether the artery was obliterated or merely obstructed by the pressure of an overlying portion of the sac. If the latter condition was present and the artery were not tied, blood might again flow through the vessel, should any diminution in the size of the aneurism take place. Under these circumstances the principle of the distal ligature would have been imperfectly carried out. It will be remembered that in the classical case of Mrs. Denmark who had innominate aneurism, Mr. Wardrop, finding no pulsation in the carotid, tied the third part of the subclavian. The tumour subsided, but pulsation in the carotid speedily returned.

This case incomplete from the absence of post-mortem examination, is offered to the Society as one of a series of examples from which, when sufficiently numerous and varied, a just estimate may be formed of the value of the distal ligature in treating aortic aneurism. For this purpose the present instance is a clear illustration of what other cases have foreshadowed, namely, that the distal ligature may not only sometimes fail to do good, but may also do positive harm by suddenly altering the distribution of the blood pressure ; and by throwing it on

some unsound portion of the arch, too weak to bear it, may lead to extension of the aneurismal disease in some new direction. When the patient was admitted, the tumour was placed well to the right of the middle line of the neck, and was most prominent just above the right sterno-clavicular joint, and like many examples of aortic aneurism already on record, bore a close resemblance to aneurism of the innominate. But, although the ligature of the vessels was followed at once by cessation of pain, and during the first few days by marked diminution in both the size and the pulsation of the original swelling, the aneurism was found to grow so rapidly towards the left, that ten days after the operation it had nearly doubled its extent. The patient's face also had become distinctly dusky from obstruction to the return of venous blood, and there was for the first time some dysphagia.

It may be asked whether the ligature clearly accelerated the development of the aneurism, or whether it only failed to check the advance of the disease. There could be no doubt that the former was the case. This was a startling result, and it is necessary to inquire whether it was due, in this instance, to some combination of circumstances so rare as to have no bearing on these cases generally, or whether it was one of the dangers with which we always have to reckon in pursuing this method of treatment. The point is one upon which we have not adequate evidence. Yet the present is not the only case which seems to bear upon it. The carotid and subclavian have now been tied in nine published cases of aneurism of the aorta. These are arranged chronologically in the accompanying table.* One proved fatal in a few hours, and it therefore affords no evidence on the question. Of the remaining seven (my case being set aside), Mr. Maunder's, and Mr. Barwell's first case may be briefly noticed. In Mr. Maunder's case, on the day after the ligature, pulsation in—*i.e.* disturbance of the circulation through—the tumour was so great that venesection was performed for its relief,

* Vide, p. 91.

and on the fourth day also there was "strong pulsation" in the tumour. The patient became cyanosed and unconscious, and died on the fifth day. On inspection, a large clot filled the ascending part of the aorta. It is not improbable that the cyanosis depended on venous obstruction resulting from rapid enlargement of the aneurism, following the ligature. In Mr. Barwell's case the vessels were tied, as post-mortem examination proved, for aneurism of the back part of the ascending aorta, on February 15th, 1879, and on April 2nd Mr. Barwell found the patient moving his left arm freely as he played at draughts. "This discovery," he remarks, "accounted for some pulsation I had observed of late on the left side of the sternum." It is not stated how long the patient had indulged in this imprudence, but it is very material to observe that Mr. Barwell attributed the pulsation to "inherent weakness of the aorta which would not permit it to withstand the current increased in the parts beyond, by tying its two large derivations." On May 12th Mr. Barwell states that the patient was suffering from pressure symptoms, and that the aorta was evidently becoming dilated. At the patient's death, sixteen months after the operation, a large aneurism was found involving the transverse arch—the aneurism for which the vessels were tied being, as already mentioned, at the back of the ascending portion. The precise bearing of Mr. Barwell's case on the point under discussion, is rendered doubtful by the fact that the ligature placed on the carotid was tied so loosely that the vessel was not obliterated, and this circumstance must have tended to diminish the strain to which the arch beyond the origin of the innominate would have otherwise been subject. It is clear, notwithstanding, that within some five weeks of the operation, so large a dilatation of the arch had occurred that pulsation could be felt to the left of the sternum. When it is remembered that in cases of aneurism the whole aorta is frequently not only atheromatous, but already considerably dilated, while a second, or even a third aneurism may be present, the

existence of which it is impossible to ascertain, the effect of distal ligature would appear to be a matter of much uncertainty.

This, however, is by no means a conclusive argument against this method of treatment, for, on the other side, is the well-established fact, that in some of the cases the patients have received very marked relief, and have had their lives considerably prolonged. Dr. Lediard's patient, who was very nearly asphyxiated before the operation, lived for nine months, and for four months was actively about, and enjoying excellent health.

Mr. Barwell's patient lived for sixteen months, and the pressure signs within the thorax almost disappeared; while Mr. Heath's case survived for four years, and for two years was free from any increase of the disease, although she was a confirmed drunkard, and utterly reckless of her health. Thus, though no case has, so far as we know, yet been cured, some have been distinctly relieved, and have some prolongation of life secured to them by the operation.

The practice of tying the carotid and subclavian for aneurism of the aorta originated, one may almost say, fortuitously; for in the first three cases in which it was undertaken the operators believed they were dealing not with aortic but with innominate disease. Nevertheless it was from two of these cases—Heath's and Sand's—but especially from Heath's, that we learnt the fact that this operation may be followed by very favourable changes in the condition of the patient. It was after this preliminary demonstration that Mr. Barwell, in 1879, tied the vessels for what he was aware was an aneurism of the aorta. Since this case occurred those of Dr. Lediard, and Dr. Wyeth have been recorded, and in all the operation was, beyond question, followed by markedly beneficial results. Surgeons have thus been led on from case to case; but this course has been taken tentatively; and spite of pre-existing notions. Besides the accidental results of clinical experience there has been very little to guide the surgeon,

and no generally recognised principle to rest upon. We have certainly been carried far beyond the suggestion of Brasdor, and far beyond the practice of Wardrop. It thus behoves us to tread cautiously on this new ground. Of the cases in the table, Green's must be passed over, for full particulars have not been published. Barwell's second case proved fatal in thirty hours, and must also be set aside. Wyeth's patient was alive on December 25th, 1880, and no subsequent report has been made.

Let us glance at the remainder. Heath's, Sand's, and Lediard's, were all examples of simultaneous occlusion of the carotid and subclavian; the patients were distinctly better after the operation, and they survived for a considerable period. In both Heath's and Lediard's the carotid was closed, but the first and second parts of the subclavian remained fully patent. These cases suggest, so far as they go, that it would be best to tie the carotid, and refrain from ligature of the subclavian; seeing that, as its first and second divisions remain patent, the ligature of its third part would, *primâ facie*, seem to have little effect. But, in the case just related, the carotid was very nearly closed before the ligature was applied; and therefore whatever influence the occlusion of this vessel was calculated to exert was already in action; consequently the case was one of ligature of the subclavian only. Yet, so far from this operation having no effect, the immediate result was rapid enlargement of the aneurism. In Mr. Barwell's first case (the preparation is in the museum of the College of Surgeons) the carotid was tied so loosely that it remained fully patent. While, as in the other cases, the first and second parts of the subclavian continued widely open. In other words, both these vessels continued to transmit very nearly, if not quite, their full arterial stream. We have thus three conditions under which the distal ligature has seemed to have a marked effect. 1. When the carotid, and the third part of the subclavian have been simultaneously occluded, the first and second parts of the subclavian, however, remaining patent. 2. When the third

part of the subclavian has been tied, the carotid being already practically closed. 3. When the third part of subclavian has been tied, the carotid though tied, remaining freely open. It may also be mentioned that, in the well known case, recorded in his very able pamphlet, by Dr. Cockle, Mr. Heath tied the left carotid, with very marked benefit to the patient, for what, as the post-mortem four and a half years later showed, was aneurism of the ascending part of the aorta. It is difficult to see how the effect observed in these various cases was produced. Many surgeons, bearing in mind the well-known fact that patients with aortic aneurism may survive for a considerable period, and may improve in a very unexpected manner even when their condition has become desperate, if they can be persuaded to maintain absolute rest, attribute the relief which has followed distal ligature, more to the quietude which the operation has been the means of enforcing, than to the direct effect of the operation itself. This view is not consonant with the facts of some of the cases. In some of the cases complete rest had been enforced and had failed; whereas the effect of the operation was immediate and unmistakable. Although it acted prejudicially in the case under consideration, the effect of the operation—though this was practically merely ligature of the subclavian—was perfectly distinct. While in Mr. Barwell's, though the carotid was not closed, the ligature of the subclavian was followed not only by improvement in the original aneurism but also, very quickly, by symptoms of dilatation of the arch towards the left. Again, in Mr. Maunder's case the operation was rapidly followed by cyanosis, and other signs of increased venous obstruction, as well as by strong pulsation in the sac (in this instance the aneurism was found to be seated on the arch beyond the origin of the innominate). The true explanation, perhaps, lies in another direction. All surgeons are aware by what slight mechanical interference aneurisms are sometimes cured, whether by pressure on the proximal, or even on the distal side, or by means of

flexion, or Esmarch's bandage. Possibly such temporary improvement as has been obtained in the cases under discussion may have been due to the fact, not hitherto fully recognised, and certainly not anticipated, that interference of even a limited character may have a powerful effect—though not always for good—on this form of aneurism. But without theorising upon the subject, the opinion may be expressed that the value of distal ligature for aneurisms of the aorta must be regarded as still *sub judice*, and that there are some cases in which it may be attended with very grave results.

No.	Operator and reference.	Date.	Age.	Sex.	Period of survival.	Cause of death.
1	Heath, 'Lancet,' Jan. 5, 1867, July 2, 1870	1865	30	F.	4 years	Bursting of sac.
2	Maunder, 'Surgery of the Arteries'	1867	37	M.	5 days	Occlusion of ascending aorta by clot? Patient became cyanosed and unconscious.
3	Sands, 'Bellevue Hosp. Reports,' 1868-69	1868	43	F.	13 months	Pressure of tumour.
4	Green, Wyeth's Pamphlet, New York, 1880	1874	45	M.	3 months	Bursting of sac.
5	Barwell, 'Med.- Chir. Trans.,' vol. lxii, p. 393	1879	36	M.	16½ months	Wearing out. (<i>Vide</i> Wyeth's Pamphlet.)
6	Lediard, 'Med.- Chir. Trans.,' vol. lxiv, p. 226	1880 March	42	M.	9 months	Bursting of sac.
7	Wyeth, Pamphlet	1880 Sept.	42	F.	Living Dec., 1880	—
8	Barwell, 'Med.- Chir. Trans.,' vol. lxiv, p. 226	1880 Oct.	37	M.	30 hours	Pneumonia.
9	Marsh	1881	30	M.	51 days	Bursting of sac.