C A S E
OF
SUBCLAVIAN ANEURISM
IN WHICH
TEMPORARY COMPRESSION OF THE INNOMINATE WAS
TRIED, FOLLOWED BY LIGATURE OF THAT VESSEL.

BY
E. R. BICKERSTETH, F.R.C.S.E.,
SURGEON TO THE LIVERPOOL ROYAL INFIRMARY.

Received October 17th—Read November 26th, 1872.

JAMES J—, æt. 40, was admitted under my care into the Liverpool Royal Infirmary on the 15th of April, 1868, suffering from an aneurism of the third part of the right subclavian artery. He was a vigorous, muscular, healthy looking man, occupied as a dock porter. He described his condition as arising from a strain while lifting a bale of cotton three weeks previously, immediately after which he felt ill-defined pains and uneasiness at the root of the neck with stiffness of the right arm, and in a few days a pulsating swelling above the collar-bone appeared. The tumour was well marked, about the size of a hen's egg, its inner margin reaching to the outer edge of the sterno-mastoid. It had an aneurismal thrill, pulsated vigorously, and admitted of being partially emptied by compression, but no distinct bruit could be detected. In short, no doubt could be entertained re-

garding the character of the tumour, and as it was increasing rapidly, while in all other respects the man appeared to be thoroughly sound, it seemed desirable to attempt some operation for his relief.

The various plans tried and suggested by surgical authorities were anxiously considered, but all appeared to be equally hopeless. Ligature on the distal side of the aneurism offered no hope of success on account of the large branches arising immediately below, which would still continue to be fed even after the trunk was tied. Ligature in the first part of the subclavian has never been attended with success, and the second portion (that between the scaleni) was in this case probably so closely involved in the sac of the aneurism that deligation there could not be attempted. On the other hand, ligature of the innominate afforded but little better hope, for of the thirteen cases collated by Mr. Erichsen, twelve proved fatal, and in the solitary instance of recovery, although the carotid was tied at the same time as the innominate, hæmorrhage occurred on the fifteenth, thirty-third day, and fifty-first days, and then, as a last resource, on the fifty-fourth day the vertebral artery was also tied, after which no more bleeding took place, and the patient, we may almost say "miraculously," recovered.

Ligature, then, as ordinarily practised, appeared hopeless; compression was obviously impossible, and in galvano-puncture I had no better hope. The success attending the complete, temporary arrest of the current of blood through an aneurism, proved in very many cases, and more especially in the notable instance of cure of a large abdominal aneurism recorded by Dr. Murray, of Newcastle-upon-Tyne, who, after effectually compressing the abdominal aorta for a few hours, found such complete coagulation in the sac had occurred as to lead to its permanent obliteration, led me to hope that if any means could be contrived by which the current of blood, flowing through the aneurism, could be temporarily yet completely arrested for a few hours in the present case, a similar result might reasonably be hoped for. The difficulty to be encountered was how to apply temporary compression

effectually, and, as the anatomical position of the vessel rendered any other means impossible, I proposed a modification of the plan adopted with the acupressure needle. Although I have long ceased to employ acupressure, there is no doubt about the fact (which I have by dissection corroborated for myself), that if a needle be passed under an artery at some distance above its cut extremity, it does not necessarily leave any trace of its presence at this point, although it has effectually and permanently controlled all hæmorrhage. I hoped, then, that by passing a wire under the artery, and making temporary compression with a metallic bar upon it, I should gain the end sought without injury to the vessel. Mr. Porter, of Dublin, recorded in the 'Dublin Quarterly Journal,' for November, 1867, a case in which he compressed the innominate by an instrument not unlike a miniature lithotrite, the blades of which, after including the artery, were screwed down so as completely to compress the vessel. Fatal hæmorrhage resulted owing to a slough having formed from the pressure. I hoped that by employing elastic instead of unyielding pressure a better result might be obtained, and accordingly the accompanying cut, which shows the instrument, was devised. The screw arrangement in the shaft of the instrument enabled me to modify the amount of pressure at any time without disturbing the artery, and I trusted to being able to control the circulation by the gentle and yielding pressure afforded by the minute india-rubber "accumulators," without inflicting serious injury

upon the arterial coats. The chief difficulty that presented itself was the finding of a wire sufficiently tough, and yet so pliable that, when drawn home through the rings at the extremities of the transverse bar intended to rest upon the artery, it would bend easily and compress equally every part of the artery. Gold, silver, platinum, and aluminium were all tried, but not found to answer. None of them admitted of being drawn sufficiently tightly to occlude the calibre of the vessel without injury to its coats. But lead wire appeared to answer in every respect—very pliable, comparatively soft, yet tough, I resolved to place it under the innominate, and then apply elastic compression.

During the period that elapsed while making the above trials the patient was kept very quiet with his arm supported in a sling, but the tumour obviously increased, and a bruit now became audible.

Operation.—On the 5th of May, I made an incision parallel with the anterior edge of the sterno-mastoid muscle down to the sterno-clavicular articulation, and another from this point outwards along the clavicle. The flap thus formed was raised and reflected, and the sternal attachment of the sterno-mastoid was divided close to the bone. Next, the sterno-hyoid and sterno-thyroid muscles were cut across and the lower portion of the common carotid and internal jugular became visible. Some little trouble was experienced with cross venous branches running between the anterior and external jugulars, but they were either held aside or cut across and tied. The sheath of the common carotid was there followed down to its junction with the subclavian, and innominate exposed. Its sheath was opened and an aneurism needle passed under it armed with a thread by which the lead wire was next pulled through. Then the ends of the wire were passed through the apertures in the transverse bar, and made fast to the “accumulators.” The bar was pushed down upon the artery, and the wire tightened by turning the screw in the shaft of the clamp till pulsation in the aneurism and radial artery ceased. Then the wound was closed by sutures except where the instrument projected.

The operation was accomplished with remarkable facility, and almost without the loss of blood. It was interesting to observe the movements of the clamp caused by the impulse of blood on the immense vessel which was thus being controlled. No sickness or pain occurred, the patient enjoyed his food the same evening, and the pulse remained as before the operation, about 60.

May 6th.—Patient slept frequently for a short time during the night, but complained of slight pain at the epigastrium. He had some toast and beef tea. To-day he looks well and cheerful, and his pulse is quiet. A shot bag was placed over the aneurism.

7th.—During the night the patient complained of pain in the head, and also in the epigastrium. About 10 a.m. pulsation was observed in the aneurism, and Mr. Puzey, the house surgeon, proceeded to tighten the wire by turning the screw in the clamps, but, finding this did not control the pulsation, he looked into the wound, and then observed that the lead wire had broken on one side at the point where it passed through the aperture in the transverse bar. The constant sawing movement, caused by the impulse of the artery had evidently worn it through. At 1 p.m. a consultation was held, and it was decided not to replace the clamp, as the leaden wire was obviously insufficient, and no other form appeared to possess the requisite suppleness. The wound was completely opened and found to be in a very healthy state. The artery, at the spot where the pressure had been, looked a little discoloured, but seemed healthy. A double silk ligature was passed beneath the vessel at the same part where the wire had been, and was tied firmly at two points very slightly apart from each other. The two threads were employed in order to tie above and below the points where the wire had been, as it was feared that the vessel might not be in a favorable condition at this part. This second operation was accomplished easily without any loss of blood, and, after it, pulsation in the tumour and in the radial artery ceased.

8th.—Passed a good night; pulse 70. Tumour decidedly

smaller. Patient looks well and is cheerful. It was noticed that the right pupil was slightly dilated, and the wound looked a little red at the edges.

9th.—Patient looks well and cheerful. Passed a good night. The tongue is clean, and pulse 76. The wound discharged a thin, dirty matter.

10th.—All going on well. There is less redness round the wound, which, however, still discharges the same kind of matter.

11th.—Patient slept irregularly. Pulse 88. Complains of frontal headache. Radial pulse perceptible on the affected side. Wound more inflamed.

12th.—Patient slept well. Pulse 96. Tongue clean and appetite good. He still complains of the frontal pain and of numbness in the right arm. The sutures having given way were removed, and the edges of the wound brought together with adhesive plaster.

13th.—Slept well. Pulse 86. Feels comfortable. It was noticed that the carotid pulse was much more visible than before. At 7.45 p.m., during a fit of coughing some hæmorrhage took place from the wound, but was easily controlled by pressure.

14th.—At 8.45 a.m. there was another and more severe attack of hæmorrhage lasting a quarter of an hour. At 12.50 there was bleeding again lasting for eleven minutes, and at 7.45 p.m. a fearful gush of blood occurred, the patient became convulsed and died in about an hour. After the bleeding in the morning, the wound was opened and cleansed and its cavity filled up with loose shot, after which a bag containing shot was placed over it.

Post-mortem examination.—The heart, aorta, great veins and arteries, trachea and all the structures on the right side of the neck, including the aneurism were removed *en masse*, and carefully dissected out. The heart was found to be quite healthy, but the aorta exhibited considerable signs of atheromatous degeneration in its early stage. The innominate, from its origin from the aorta to the point of ligature, was filled with a firm closely-fitting plug of fibrin—was, in fact,

most satisfactorily occluded. Above the ligature to its bifurcation the vessel was quite empty, while the common carotid and the subclavian as far as the aneurism were also quite empty and did not contain a trace of clot. The aneurism had obviously diminished a good deal in size and was quite filled with firm laminated clot. Indeed it may be said to have been in fair progress of cure. The rest of the subclavian beyond the aneurism and first part of the axillary artery, were nearly, but not quite filled up with clot. So that from the aorta to the ligature and from the aneurism onwards clotting had occurred, while between the ligature and aneurism this had not taken place. The two ligatures were found close together and still *in situ*, and the hæmorrhage was seen to have proceeded from the distal side of the upper of the two ligatures, which had partially cut through the vessel. The wound, although not in a healthy state, did not present an unhealthy appearance. All the other viscera were quite normal.

The actual condition of the parts is shown in the drawing (see Plate II) from the preparation exhibited at the meeting.

In presenting this case to the Society I must claim its indulgence. I cannot feel satisfied that even the process of reasoning which led to my plan of operation was free from error. It was my intention to have removed the clamp and wire at the end of forty-eight hours, when I hoped that a fibrinous plug sufficiently firm to secure the subsequent obliteration of the aneurism would have formed, and I trusted to do this without injury to the coats of the innominate, but the return of vigorous pulsation in the tumour after forty-five hours of compression too clearly indicated that my expectations were miscalculated. Although I do not think that any injury had, up to this time, been inflicted on the innominate coats, it was evidently endangering their vitality to continue the compression any longer, and I was thus compelled, as it were, to resort to the ordinary process of deligation. Possibly, had I then desisted from further interference, the artery might have contracted and closed from adhesive inflammation.

But while deploring the result which I have thus thought it my duty to detail and while resolved not to attempt again a like procedure, I am by no means satisfied that deligation of the innominate will not become a justifiable and proper operation in cases of aneurism of the subclavian. At the time when the case narrated occurred, antiseptic surgery was yet in its infancy, and the marvellous results to be obtained by the catgut ligature properly prepared and the subsequent antiseptic treatment of the wound were unknown. From the experience and confidence I have obtained in this method of tying the iliac, carotid, and femoral arteries, I should feel justified in attempting again deligation of the innominate in a similarly otherwise hopeless case.

DESCRIPTION OF PLATE II.

A.—Aneurism laid open, showing laminated clot completely filling interior.

B.—Subclavian artery between innominate and aneurism quite empty.

C, D.—Lower portion of carotid and upper part of innominate laid open, showing absence of clot.

E.—Firm fibrinous clot filling up innominate from its origin to the point of ligature.

F, G.—Subclavian beyond aneurism and upper part of axillary artery nearly filled with clot.