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ACCOUNT

OF THE

DISSECTION OF A PATIENT

IN WHOM

THE SUBCLAVIAN ARTERY HAD BEEN TIED
FOR AXILLARY ANEURISM;

WITH PRACTICAL REMARKS.

By WILLIAM FERGUSSON, F.R.S.E.,

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(Extracted from the *London and Edinburgh Monthly Journal of Medical Science*,
September 1841.)



ACCOUNT OF THE DISSECTION OF A PATIENT IN WHOM THE SUBCLAVIAN ARTERY HAD BEEN TIED FOR AXILLARY ANEURISM; WITH PRACTICAL REMARKS.

IN number 109 of the Edinburgh Medical and Surgical Journal, I published an account of a case of axillary aneurism, which had been successfully treated by ligature of the subclavian artery.¹ Ten years ago, when the case occurred, such histories

¹ The following is a condensed abstract of the original history of the case:—
“Mark Robson, aged 60, from Kelso.—In the right axilla there is a large pulsating tumor, extending under the pectoral muscles as high as the clavicle; a portion as large as an orange projects into the axilla; and on being handled, its contents appear very fluid. The skin over the whole tumor is of a natural colour, but the veins appear considerably enlarged and somewhat tortuous.

“The patient thinks that the disease has existed for more than two years, although for many months it was scarcely perceptible. It has only been within these six weeks that it has increased rapidly to its present state, which is, as near as I can guess, about the size of a large fist. The pulsation in both arms is alike,—about 80. The heart and arterial system elsewhere appear perfectly healthy. No cause can be assigned for the original appearance of the disease; but the patient is inclined to think that he might have got a *rack* in the arm, during some of his fits of drunkenness,—a vice to which he has been strongly addicted throughout the last forty years of his life.

“At a consultation with Sir George Ballingall, Dr Simson, Mr Miller, and Mr Purves, surgeon, from Kelso, the operation of tying the subclavian artery was decided on, and in every respect, with the exception of the man's advanced age and his previous habits, the operation appeared to them to afford a fair chance for the patient's life.

“May 12, 1831.—I accordingly performed the operation in the presence of fourteen of my professional friends. I had no difficulty in introducing an aneurism needle, provided with a ligature, under the artery; and then by compressing it over the needle, all present were at once convinced that it was the vessel, as the tumor fell flaccid in an instant, and all pulsation ceased in it, as well as in the arteries at the wrist. I tied the ligature with my fingers alone, having no necessity for using any of the various instruments recommended in cases where the artery lies deep; and as the thread was very thin, (common purse-silk,) I left both ends hanging out of the wound.

“I several times, during a long-continued expiration, observed the internal jugular swelling over the surface of the anterior scalenus muscle. I saw also a large artery, which I took to be the deep cervical, coming off from the subclavian, between the scaleni muscles, and was careful, in tying the ligature, to keep it as far from that vessel as possible.

“From the day of operation up to the 13th of June, nothing very remarkable occurred in the case. Pulsation never returned in the tumor; but from the evening of the day on which the operation was performed, it could occasionally be felt at the wrist.

“On the 13th June, the ligature came away after a smart tug, and a portion of the artery, half an inch long, and about half its circumference, came along with it. I have no doubt, from the direction in which it came as I pulled it out, that it had been nearer the heart than the ligature, and from its length it must have come off near to the large artery, which I observed arising from the subclavian during the operation. When the ligature was removed, it appeared that that part of it which lay in the wound was $2\frac{1}{4}$ inches long,—showing how deep the vessel must have been

were of more interest to the profession than at the present date, for similar operations having now been so frequently performed with success, in all parts of the world where surgery is cultivated, individual examples are no longer required to enhance the character of an operation considered, by modern surgeons, one

before the operation. No blood followed the removal of the ligature, and the portion of the artery which came along with it must have been separated from the other parts for many days, as it was quite putrid, and had a very offensive smell. During the whole of this day he felt remarkably well. On the 14th he was very uneasy, complained of pain in the situation of the sac, which was increased on pressure, and the tumor appeared larger than usual under the clavicle, but in the axilla it was of its former size; cold wet cloths were applied over the wound and tumor. On the 16th and 17th, a little blood was discharged from the wound, but it soon stopped. The swelling had increased very much, and I was inclined to think that blood was getting down in front of the tumor, but where it came from, was a matter not easily decided on. On the 18th, it appeared that an abscess was forming in front of the tumor. On the 20th, fluctuation appeared so distinct that I was induced to open the abscess, which I accordingly did, and squeezed out a considerable quantity of very fetid brown-coloured fluid. I afterwards extended the incision to allow a more free passage for the matter, which was daily discharged in considerable abundance. Poultices were applied for a very few days at first, and when these were discontinued, compresses were placed over the tumor, and kept there by a roller passed round the body. He had a bottle of ale and a glass of port wine every day, and whatever food he wished for. Under this treatment the discharge from the wound gradually assumed a better appearance, and diminished in quantity. A communication which existed between the wound above the clavicle, and that below, closed up, and the patient speedily recovered in health and strength, so as to be able to take exercise in the open air. On the 3th of July, the opening above the clavicle, which was very small, suddenly began to ulcerate, and in twenty-four hours a cavity was formed, sufficient to admit the end of the thumb. I touched the whole surface with lunar caustic, which had the desired effect of checking the ulceration. After this the cavity was gradually filled up, and on the 15th of July it was nearly healed.

"The above case appears to me interesting in many points. It shows that in advanced age, for the patient, although certain that he is sixty, thinks himself several years older, and even when the constitution has been much shattered by previous dissipation, we are justified in recommending an operation, and holding out a tolerable chance of success. Only a few weeks previous to his coming under my charge, he had occasion to travel a distance of forty miles,—a journey to which he took nearly a month, having scarcely been sober during the whole of that period.

"Although the ligature remained on the artery much longer than usual,—from the 12th of May till the 13th of June,—still I think that this circumstance contributed greatly to the patient's safety; for had the portion of the artery which came along with it separated sooner, there can be little doubt that hemorrhage, probably to a fatal extent, would have been the consequence.

"The inflammation and suppuration of the aneurismal tumor is always an unpleasant occurrence in the treatment of this disease; but although under such circumstances many cases have terminated fatally, I am nevertheless inclined to think the danger in some instances more imaginary than real; for in several of the cases on record, where the subclavian has been tied for axillary aneurism, the tumor has afterwards supplicated and burst, and still the result has been favourable. Indeed, in the very first instance in which the operation proved successful,—that operated on by Dr Post of New York, the tumor burst in a few days after the ligature had been applied, and yet the cure went on rapidly.

"In the report of the case of Mark Robson, I have said that matter appeared to be forming in front of the tumor; but I have no doubt that the tumor itself was affected at last, from the circumstance of clots of fibrin occasionally passing out with the pus, and from its consequent rapid diminution in size."

of the most legitimate and valuable in the treatment of axillary aneurism. In 1831, however, only two successful operations of the same kind had been published by Scotch surgeons, one by Mr Liston, the other by Mr Wishart of Edinburgh; and, as I had every reason for supposing that this case was the third of the kind which had occurred in Scotland, I naturally felt anxious to lay the case before the profession, more especially as I was then a very youthful aspirant to be considered one of the Edinburgh school of surgery.

In the course of years, though the Hunterian operation came to be more frequently performed, and more extensively and boldly applied, the surgeon was still slow and cautious, in putting trust in the anastomosing arteries of a limb being equal to carry on a sufficiently vigorous circulation, to save the part from mortification; but in modern times he no longer dreads such an unfortunate result, for, though aware that such an event does occasionally occur, he has the oft-repeated proof before him, that the current of blood may be arrested by ligature, through the iliacs, carotid, subclavian, and innominate itself, with the fullest assurance that this casualty is the least likely to happen, in the chapter of accidents incidental to such operations. We know that even the aorta may become obstructed, and yet the blood will find its way to the lower part of the body; such obstructions, however, have probably been of slow occurrence, thus allowing time for the gradual increase in size of the collateral branches, and the cases in which the abdominal aorta has been tied, have survived too short a time, to allow them to be taken as proof, that this vessel may be closed by ligature with the same immunity. From what we know of the vast capabilities of the collateral branches, we would be justified in anticipating such a result, and we would be further encouraged in hopes of safety, by what we know of such obstructions in dogs. I have seen a puppy, within a few hours after I had applied a ligature to its abdominal aorta, frisk about as if no such cruelty had been perpetrated; but though such experiments have a certain degree of value, I do not deem it consistent with sound discretion, to draw any close analogy between such operations on the arteries of dogs, either young or old, and on the corresponding vessels of man beyond the meridian of life, the period when aneurism is of most frequent occurrence.

However fully convinced of the powers of nature to keep alive and nourish a limb under the circumstances alluded to, the surgeon nevertheless looked with great interest on the state of the anastomosing vessels; and every dissection, whether in the lower animals, or in his own species, which could throw light on the subject, was examined with eagerness. There are few museums now-a-days in which such specimens in the lower animals

do not appear; in my own collection, I have had many examples from the dog and monkey; in the Anatomical Museum in the University of Edinburgh, there are some beautiful examples, prepared by my friend Mr Spence; there are some excellent specimens in Guy's Hospital museum; and who can forget those in the collection of the late Sir Astley Cooper, who has ever had the honour and good fortune of witnessing the enthusiasm with which he displayed these amongst his other scientific treasures. Even specimens from the human subject are now becoming common; yet it must be confessed, that for beauty (if I may use the term,) and perfection, these, in general, fall far short of those from the inferior animals. That such is the case need be no wonder; the unfortunate and simple Pompey, as he takes his evening stroll, unconscious of the "Evil Eye" that hovers watchfully near him, becomes the ready victim of the scientific enthusiast; but we cannot "catch" a man, tie his aorta, or some other large vessel, and then keep him *in petto*, until such time as he may be considered in good condition for a preparation; we must trust to chance for a favourable opportunity of examining the remains of an individual in whom some large artery has been tied, months or years before, and such opportunities are of rare occurrence, in proportion to the frequency of operations for aneurism. Patients are lost sight of by those who know their history, and even when a case is carefully followed, the necropsy being effected in private, the anatomist has not the opportunity of carrying out the different steps requisite to make the examination complete, at least in so far as regards the display of the collateral circulation. Such favourable circumstances have occasionally occurred, however, and upwards of thirty years ago, Sir Astley Cooper read, before the Medical and Chirurgical Society of London, the description of a "dissection of a limb on which the operation for popliteal aneurism had been performed;" the paper was afterwards published in the second volume of the Transactions of the Society (p. 251), with two very beautiful drawings of the preparation, and I well remember the delight with which, in my early professional studies, I used to trace out, in these drawings, the numerous and admirably-displayed tortuous anastomosing branches. I have since seen some valuable preparations of this kind in the magnificent collection at Guy's Hospital, and much as I admire them, I cannot forget that of surpassing worth, in the Barclayan collection in the Museum of the Royal College of Surgeons of Edinburgh, which I have always thought has never had a sufficiently prominent place allotted to it, but has been kept, as my old and esteemed preceptor, the former conservator, would say, too much "under a bushel." In my inspections of museums, I have met with no specimen of the kind I now refer to, equal to this one, and it is a gem, even amidst the

wonderful dissections of arteries among which it is placed. In the museum at Guy's, there is a splendid preparation, illustrative of the collateral circulation, in a case in which Mr Key tied the subclavian for aneurism, twelve years before, an account and drawing of which have been published in the first volume of Guy's Hospital Reports.

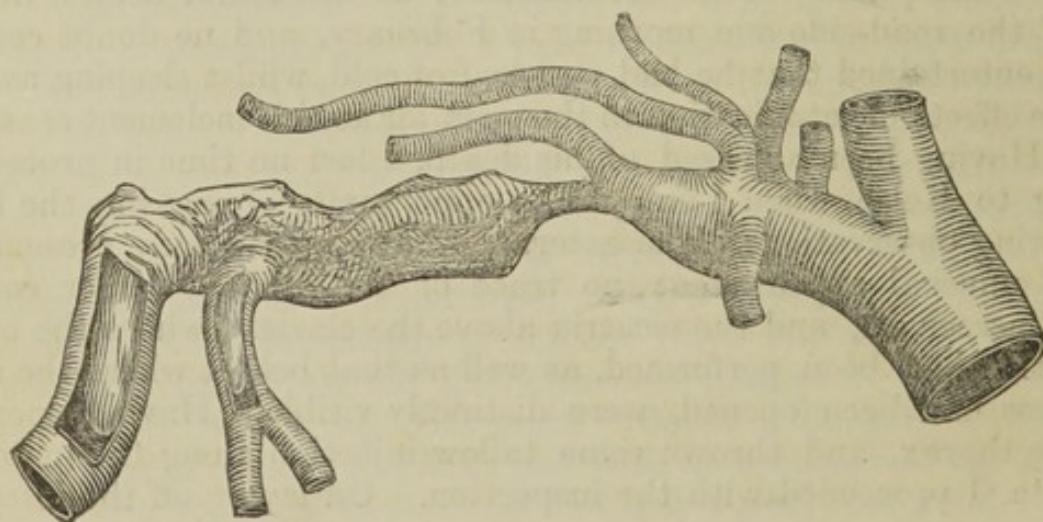
By far the greater number of preparations of parts illustrative of appearances after operations for aneurism, are either of so recent date after the operation, or have been, of necessity, so hurriedly and imperfectly "snatched" away, that arterial displays, similar to the preparations referred to, cannot be looked for often; yet even in their mutilated condition they are well worthy of preservation; and though it has always been a subject of regret with me, that in the preparation I am now about to describe, the collateral circulation has been so imperfectly displayed, I have ever looked upon it as a valuable teaching preparation, both to myself and my pupils; and though it did cost me an eighty-mile trip to secure it, I have always deemed my time and trouble well bestowed.

The history of Mark Robson, subsequent to his return to his native place, may be briefly told. The fresh and invigorating air of the country soon restored him to the enjoyment of excellent health; and it was the remark of all who were wont to be amused with his eccentricities, that he had become a graver and a "better man." The old leaven was still, however, deep within him; the keen edge of the surgeon's knife had produced no permanent effect here; Mark gradually returned to his old habits; there was no Mathew in these parts; and the only "pledge" he was ever known to take, was to the prosperity of those, who good-naturedly gave him the means of indulging in his favourite propensities. He considered himself more than ever the lion of the district; and up to the date of his death, led a careless good-for-nothing kind of life. In the severe part of the winter of 1835, however, nearly four years after the operation, he suffered the penalty of his recklessness; he was found dead a little off the road-side one morning in February, and no doubt could be entertained that he had perished of cold, whilst sleeping away the effects of intoxication in the open air at this inclement season.

Having been apprised of his death, I lost no time in proceeding to Kelso, when I enjoyed an opportunity of making the following observations. The external surface of the body presented no unusual appearance; no trace of the axillary tumor could be perceived; and the cicatrix above the clavicle, where the operation had been performed, as well as that below, where the abscess had been opened, were distinctly visible. Having opened the thorax, and thrown some tallow injection along the innominate, I proceeded with the inspection. On laying off the integu-

ments, and exposing the supra-clavicular region, I observed two large vessels in the ordinary situation of the supra-scapular and transversalis colli arteries; on the surface of the first rib I observed a branch of considerable size passing outwards, and slightly upwards and backwards, which I considered to be the deep cervical, arising from the subclavian, behind the anterior scalenus muscle; below this branch a firm cord of cellular texture, condensed by lymph, was readily recognised as the remains of the subclavian artery, at the seat of ligation. On tracing this cord downwards, the artery was found flattened, with its opposed serous surfaces in a state of adhesion to each other; two inches farther down the remains of the artery were lost in a hardened mass, which on being unravelled a little, presented the axillary plexus of nerves, each branch being surrounded on all sides with a dense and firm covering of organized lymph; the parts presented many of the appearances of a large cicatrix, and no other trace of the original tumor could be observed. Opposite the upper margin of the latissimus dorsi, a knuckle-like projection appeared, which I found to be the artery, larger than its natural diameter, filled with a dense clot of fibrin; a little farther down, the vessel assumed its usual size, and, where it becomes the humeral, was quite pervious, and of a natural appearance. A vessel of the magnitude of the subscapular artery was attached to the agglutinated mass, a little higher than the projection above described; in this situation it was filled with fibrin, but lower down it was quite patent, and had a branch of considerable size, also patent, running into it. Several large veins were found in front of these parts, but none corresponding or bearing any resemblance to the subclavian, which I therefore concluded was obliterated.

I next proceeded to remove the whole parts from the aorta to the humeral artery, and after making a careful dissection, left them much in the condition represented in this figure.



The vertebral, internal mammary, and inferior thyroid arteries were of their usual size, in proportion to the subclavian, which, with the carotid and innominata, was somewhat larger than usual; the supra-scapular, transversalis colli, and deep cervical, were all considerably enlarged, and I have no doubt that these vessels formed the principal currents towards the humeral artery. Unfortunately, from the manner in which the dissection was, of necessity, conducted, a complete view of the anastomosing branches could not be obtained; but from the increased size of the subscapular artery, I concluded that this vessel had a large share in carrying on the blood in its novel course. The extremity of the pervious portion of the subclavian was adherent to the posterior surface of the anterior scalenus muscle, and the vessel seemed to taper away, until it was lost in the circumference of the deep cervical. The heart and lungs were in a natural condition; the aorta was somewhat dilated, its inner and middle tunics being slightly thickened; on laying it open, a patch of calcareous matter might be here and there observed, as was also the case with the innominata. Having no suspicion of any other cause of death than that already alluded to, I did not proceed farther with the examination.

The case and the preparation, (which is now placed, with the rest of my collection, in the museum of King's College, London,) have often served the purpose of illustrating my lectures on aneurism; and as some of my observations are, in my opinion, not unworthy of the notice of the practical surgeon, I hope I may be allowed the recapitulation of them here.

It will be observed in the history of the operation and its immediate results, published soon after the patient was dismissed from under my care, that, among others, these remarkable circumstances occurred, viz. the ligature remained in the wound for an extraordinary period; the aneurismal tumor suppurated; and, lastly, ulceration suddenly came on in the wound, at a time when cicatrization was nearly completed. The first of these I have referred to as a proof of the fact, that a ligature may remain on an artery of this magnitude for more than a month, though no other texture is included in the noose; but I have deemed it of more value, as illustrating the propriety of not fretting the artery and its surrounding textures, new and old, by frequently tugging at the ligature to bring it out of the wound. Had I been over-anxious on this score, I think there can scarcely be a doubt, taking into consideration the size of the dead portion of artery which came away with the ligature, as represented in the annexed cut, —the proximity of the thread to such a large vessel as the deep cervical is proved to be by the preparation, and also the somewhat enlarged condition of the subclavian itself, that hemorrhage must have been the result. It is always



satisfactory to find the ligature loose at an average date, in cases of this kind, yet it should ever be kept in mind, that the mere circumstance of the thread remaining firm, is one of the best proofs that nature has not completed the process of closing the artery, which, in favourable cases she invariably does, before the ligature is thrown off. Every surgeon of experience must be familiar with examples of the tardy separation of ligatures from large arteries. A case similar to my own has lately occurred here, in the practice of Mr Skey of St Bartholomew's; and I might cite many more in different parts of the body, from my own practice, as well as that of others, were further proof required on this score.

In regard to the second circumstance above referred to, further experience has not inclined me to alter the opinions expressed in my first paper, about the danger of inflammation and suppuration in the aneurismal tumor; but the more I see and hear of cases of this disease, the more am I impressed with the idea, that these untoward events are of more frequent occurrence than the young surgeon imagines.

The occurrence of ulceration in the wound, after the lapse of nearly two months from the time the operation was performed, and when it was almost healed up, I now contemplate with more interest than I did at the time, and for some years subsequently; though even then, as I well remember, I was fearful that some large vessel would suddenly give way, under the rapid ulceration of twenty-four hours. Every surgeon is familiar with the rapidity with which this process goes on in newly-formed cicatrices; and in the treatment of ordinary wounds—a stump, for example—it is not unusual to perceive, that a large cavity has formed in the deeper parts of the wound, whilst the union at the surface remains entire. The presence of such cavities, and the concomitant ulceration, are occasionally overlooked, or not to be detected by the surgeon; and the period is fraught with much danger to the patient; for the cicatrix, which may have already become tolerably firm in each end of the divided artery, may undergo the same process with equal rapidity; and the adhesive lymph being absorbed, the vessel may be suddenly thrown into the same condition as if divided with a knife. This may occur at one or both ends, and the aperture may be as large as the diameter of the vessel, or small and puckered; but the result is nearly the same in both cases—a sudden and fearful flow of blood, which may terminate fatally at once, or, after being stemmed, on some repeated recurrence. I believe it has been this stealthy form of ulceration, which has caused the unexpectedly fatal results, in some of the operations on the larger arteries at the root of the neck. In Dr Mott's case of ligature of the innominata, the wound had nearly healed on the surface, when

fatal hemorrhage occurred. The wound was in a similar condition in Mr Lizars' case, when the like event occurred. In Mr Liston's case of ligature of the carotid and subclavian, on the tracheal side of the scaleni muscles, the latter vessel had also been opened by this process. In a case of ligature of the carotid, by Mr Lambert of Walworth, *five weeks after* the operation, when all danger was supposed to have passed away, the cicatrix ulcerated, and death from hemorrhage occurred within three weeks after—the distal end of the artery having been opened by this process. But I need not repeat examples of a well-established fact. I shall therefore confine myself to the statement, that I now look upon the occurrence of ulceration in *any* part of a wound, in cases similar to those under consideration, as a most alarming symptom; and I have frequently congratulated myself, that in my own case, in consequence of the surface having opened, as well as the deep part of the wound, I was enabled to perceive what was going on, and to apply such a remedy as was deemed (and as it also proved) sufficient to check the unhealthy and dangerous process.

The preparation has enabled me to illustrate an opinion which I have long entertained, that an internal coagulum is not essential to the permanent closure of an artery on which a ligature has been placed; and that there is less danger than has been imagined, in placing the thread near to any large branch, which may be given off from the artery, between the seat of ligature and the heart. I am strongly disposed to think that the internal coagulum, even when present, has but little to do with the process. In its formation, however, we have little influence, unless it be by placing the ligature at a considerable distance from any large branch, (and that we have it not always in our power to do,) and, even then, we cannot calculate with certainty on its presence. I am fully impressed with the soundness of the doctrine, that a ligature should, in an operation for aneurism, be placed as far from any large collateral branch, as may prevent the force of the current of blood bursting open the upper end of the artery. I deem it the duty of every teacher to insist on this point; but it is equally his duty, in my opinion, to show that an artery even of the magnitude of the subclavian, may close, though the ligature is placed in almost immediate contact with a larger branch. Nor ought he to overlook the fact, which every year's experience renders more apparent, that the hemorrhage *very* frequently comes from the distal end of the vessel, whilst that nearest the heart remains perfectly closed. I have stated in the report of the operation, that a large artery was seen at the bottom of the wound, which I took to be the deep cervical, and from which I kept the ligature as far as possible; the distance, however, was perhaps not more than half an inch at most, and it may be sup-

posed to have been diminished, by the sloughing of that part of the artery which came away with the ligature; yet the vessel closed permanently (for though a little blood came from the wound on the third and fourth day after the separation of the ligature, there is no proof that it was from the subclavian), and in the preparation, the artery is pervious, as far as the deep cervical, which now seems like a diminutive continuation of the main trunk. I have, for many years, pointed out to my pupils, that an internal clot cannot reasonably be supposed to exist in such cases as I am now alluding to; and I have often referred to the example of ligature of the internal iliac artery as a case in point. The ligature here, cannot be placed far from the great current of blood through the common and external iliacs, yet, compared with similar operations on other great arteries, this operation has been wonderfully successful.

In the museum at Guy's, there is a preparation of an internal iliac which had been recently tied, where the ligature is more than an inch from the common and external iliacs, and there is a firm clot both above and below; but it must be admitted, that an internal iliac of such a length, is rarely met with in the dissecting room.

I know that I am not singular in entertaining the opinions above expressed; and it gives me pleasure to perceive, that they coincide with those entertained by a surgeon of vast practical experience,—Mr Porter of Dublin,—who states in his excellent treatise on aneurism, lately published, that he has “tied the common carotid within one-eighth of an inch of its origin from the innominata, with the most complete success.”

I shall not occupy more of the pages of this Journal at present, with any farther remarks on this case and preparation; but may possibly, on some future occasion, again refer to them, and to other preparations of arteries now in my collection, to illustrate some additional observations on the interesting subject of hemorrhage.

8, DOVER STREET, PICCADILLY,
20th July 1841.