

ON THREE CASES
OF
DISTAL LIGATURE OF THE CAROTID
AND SUBCLAVIAN ARTERIES
FOR
ANEURISMS INVOLVING THE INNOMINATE
ARTERY.

BY
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ON the 13th November, 1877, I read before this Society a paper on a case of large aneurism of the innominate, subclavian, and carotid arteries, for which I had performed distal deligation of the two latter vessels.¹ The man afterwards died of broncho-pneumonia, and in a subsequent communication, the parts were exhibited, showing complete obliteration of the vessels and almost complete obliteration of the sac. It will, perhaps, be remembered by those interested in such cases, that the part of the cavity still unoccupied by active clot had no channel through it, and therefore that its entire obliteration was a mere question of probably a very short

¹ 'Medico-Chirurgical Trans.,' vol. lxi, p. 13.

time, which, however, the man, with almost inconceivable folly, did not give himself. For the better elucidation of that matter, I have again placed on the table that preparation, and also because it may serve for the illustration of some points in the remarks that I have to make on three other cases of double distal ligature.

One of these cases, a man, æt. 48, sent to me by my friend, Dr. Cole, of Bath, underwent the operation on the 6th December, 1877. He died in about thirty hours, the thoracic portion of the aneurism being so large, and the power of respiration so restricted that he never recovered the anæsthetic (ether), but remained cyanosed and epileptoid to the end. The preparation from that man is on the table, but the case does not appear to contain material of such interest as to warrant me in taking up the time of the Society with its details. The operation on the subclavian was most difficult, for the vessel lay behind a clavicle so raised at both acromial and sternal ends, that I could do little more than reach it with the finger, and to get an aneurism needle round it was quite impossible. I managed, however, to pass the ligature by feeling behind the vessel for the eye of the needle, which could not be got beyond its lower edge, and then picking the catgut out with my fingernail. The man, however, lost hardly any blood.

On the same day I tied the carotid artery and the third part of the subclavian of Laura G—, and I beg here to thank my late colleague, Mr. Canton, for ceding to me that case, whose history is subjoined.

Laura G—, æt. 37, was admitted into Charing Cross Hospital on the 20th November, 1877, with an aneurism at the upper part of the right side of the chest.

Past history.—She is the only child of a mother who died in her twenty-fourth year, of phthisis. The father died, aged thirty-one, of an unknown cause. She, after having been a housemaid for three years, married at the age of twenty. Has had six children; two were stillborn, three died in early infancy (two of convulsions, one of bronchitis), the surviving girl is delicate, and has been under my care

with necrosis of the tibia. Laura G—'s husband died five years ago. She then took a coffee shop, where she found the task of putting up and taking down heavy shutters and other work try her so severely that she gave up the occupation in nine months. Two years ago, therefore two years after ceasing this sort of exertion, she first found her breathing easily disturbed, and about September, 1876, she first had indefinite, but sharp, shooting pains about the upper part of the chest. About eight months ago she first noticed a swelling "above the right breast." The indefinite chest pains then became localised in the right side and upper part of the chest, shooting also down the right arm, which was often numb; her breathing became embarrassed, sometimes even painful; she had a harsh, irritating cough (especially when she lay down) without expectoration, either of blood or mucus. During the last two months the swelling has markedly increased. She feels very faint when standing; she cannot lie without being much propped up by pillows, and sleeps only in snatches, being constantly awake by cough and a sense of suffocation.

State on admission.—Patient is a spare woman of cheerful disposition, but of highly nervous temperament, therefore, probably, some deductions have to be made in the account of her past sensations, especially as, though looking worn, she seems, save for the aneurism, in fair health.

A projecting tumour, with broad base and rounded apex, occupies the part of the chest lying between the lower edge of the second right costal cartilage and the sterno-clavicular joint; it protrudes above the episternal notch, and presses forward the right sterno-mastoid muscle. Its inner or left margin covers the right part of the sternum to the extent of one third of its breadth. It measures transversely one inch and three quarters; its lower edge lies two inches and a half below the sterno-clavicular joint, but just below this articulation a small portion of the chest-wall seems free of tumefaction. This tumour pulsates visibly; to the touch the pulsation is markedly expansile, and for a certain distance round the apex the impulse seems very near the surface.

Pulsation can also be felt through the chest-walls for a considerable distance round the tumour, viz. on the left clavicle for about an inch, on the right for an inch and a half from its inner end. If from these points two curved lines (convexity outwards) be drawn to the upper part of the third right costo-sternal articulation a very fair map of the pulsation-limit on the chest will have been obtained (see diagram,

FIG. 1.

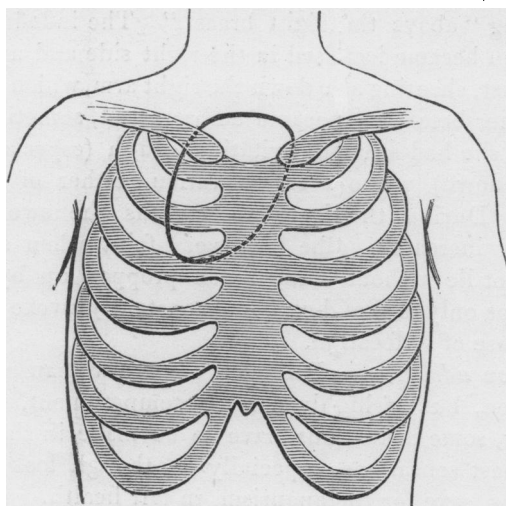


Fig. 1), but to this must be added the cervical pulsation, rising one inch and a quarter above the edge of the sternum, reaching under the inner edge of the left, and to the outer side of the right sternal portion of the sterno-mastoid muscle. Dulness to percussion mingled, on the left side of this space, with the cardiac dulness, but on the right was less extensive than the pulsation, as though the lung covered that portion of the aneurism. Over the whole area of this space the heart-sounds are loud, with a metallic ring, but the second sound is more especially remarkable as being even louder than the first, and having a peculiar, dull, yet metallic note.

Sphygmographic tracings of the left and right radial pulse were carefully taken by Mr. Wickers (figs. 2 and 3).

FIG. 2.

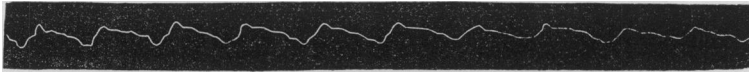
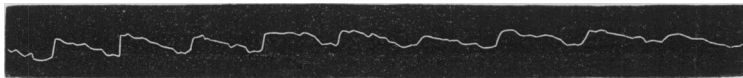


FIG. 3.



The patient was treated by diet and rest, but the tumour increased slightly, and the pulsation at its apex seemed approaching still nearer to the surface ; therefore, on

December 6th, 1877, I tied antiseptically, and with cat-gut, the right common carotid artery close to its bifurcation, and the third part of the subclavian artery.

7th.—Patient passed a good night, but is somewhat sick from the ether, and complains of severe headache *not* limited to the right side. Her diet, which, on account of sickness, she takes in small quantities at a time, is No. 2.¹

8th.—Headache disappearing. The pulsation in the tumour itself appears more distant.

10th.—The wounds are almost healed. There is some diminution in the area and force of pulsation. She complains of a sense of numbness in the right arm.

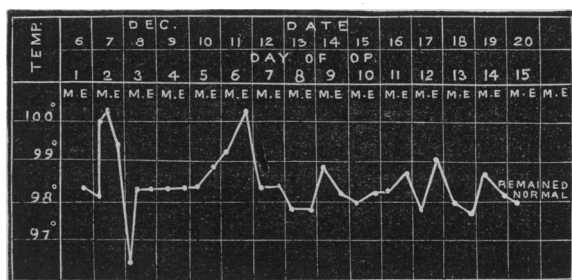
14th.—The carotid wound has healed. The upper part of the pulsatile tumour appears solid, as also does that above the sternum. The size of that on the chest has diminished, it is now an inch and an eighth in transverse, and two inches in perpendicular, measurement. Her cough has almost ceased.

19th.—Clavicular wound has healed. No radial pulse.

22nd.—There is barely any pulsation in the episternal notch. She was put on a dry diet, namely, breakfast and supper, 1 egg, 4 oz. bread, 3 oz. milk, $\frac{1}{2}$ oz. butter ; dinner,

¹ Breakfast and supper—milk, 1 pint ; bread, 4 oz. ; butter, $\frac{1}{2}$ oz. Dinner—broth, 1 pint ; bread, 4 oz.

Fig. 4.



4 oz. meat, 4 oz. bread, $\frac{1}{2}$ lb. potatoes, and as little fluid as possible.

30th.—The tumour on the chest is becoming flatter and the pulsation less near the surface.

January 10th, 1878.—The pulsation has increased, and the tumour a little more projecting. She is menstruating. Ice-bags were ordered to be applied in alternate six hours. No right radial pulse can be detected.

March 2nd.—Since the last report until this date there has been nothing to remark further than diminution of the tumour and signs of progressive solidification, always interrupted for a day or two at the occurrence of each menstrual period. But in the night of the 1st March a woman, whose husband had thrown a paraffin lamp at her, was brought into the ward so severely burnt that she died in a few hours. Laura G— was greatly excited and agitated, and on the following day the tumour was found to be increased, and its pulsation more forcible.

5th.—The swelling is to-day as large as a pigeon's egg, and pulsation is well marked, appearing nearer the surface than a week ago.

9th.—Patient had this morning a severe fainting fit without apparent cause; she was quite unconscious for about ten minutes; during the rest of the day she had severe headache, sense of prostration, and pain at the seat of the tumour, or at least she thought she had. There was no sign of paralysis, no change in the pupils, in fact, no cerebral sym-

ptom save the comatose condition. The tumour is in the same state as on the 5th.

11th.—The patient has had no return of fainting, indeed, has recovered her usual condition.

18th.—During the last week the tumour has decreased in size, and the pulsation is less marked.

23rd.—The tumour has been steadily decreasing, and is now on a level with the chest-wall; the pulsation is less distinct. Slight radial pulse.

May 20th.—Nothing worthy of report save almost entire disappearance of pulsation has occurred. Some domestic trouble has greatly excited her, and again the tumour projects slightly, but the pulsation has not increased in a like ratio as it previously did, in fact, the sensation gives rather the idea of a solid tumour with communicated pulsation. On each occasion of increase ice-bags, in alternate six hours, were applied, and on each occasion as the excited condition of nervous system disappeared the tumour and increased pulsation also vanished. On June 13th was another but very slight exacerbation due to the advent of menses.

July 22nd.—Patient allowed to get up and move about a little, this has not increased the pulsation, and there is now no tumour.

August 15th.—Patient out for about three hours yesterday, and underwent an examination at one of the offices of convalescent homes. She came back very tired, but without increase of pulsation or appearance of tumefaction; nor at this date, the following day, can I detect any difference.

26th.—Patient left the hospital.

There is a part of the chest-wall roughly corresponding to the dimensions given in the first description of the case, which although it looks normal, or nearly normal, may be felt to be, beneath the skin, more protuberant than the same part on the other side. Here a distant communicated pulsation, not expansile, can be felt. A little below the sternoclavicular joint a small part about an inch in perpendicular, and two thirds of an inch in transverse direction, is dull to percussion. The rest is fairly clear.

On this case I would remark (further observations are to be found in the sequel) that the radial pulse was entirely absent for nearly four months—then occasionally a flicker was perceptible; afterwards a more uninterrupted pulse set in, and by the time she left the hospital, a weak, small, but constant right pulse was established.

The patient was in attendance to be examined by the Fellows of the Society. In the middle of February, 1879, she was married.

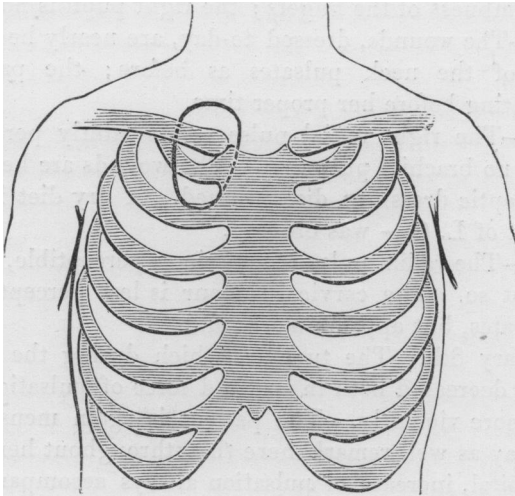
CASE 4.—Catherine H—, æt. 27, was placed under my care by my friend Dr. Julius Pollock on 10th January, 1878.

History.—She comes of a healthy family, but she, though not suffering from any disease, has never been strong, more especially since a severe attack of acute rheumatism fourteen years ago, which kept her in bed more than four, and in the house nearly six months. Since then, until disabled by her present malady, she has been a nurse, her hardest work being carrying children. A little before Christmas, 1876, she suffered from palpitation, breathlessness, and sickness, with pain at the upper part of the right chest; occasionally these troubles would be alleviated, but only for a short time. About March of last year a medical man noticed pulsation above the clavicle; she was taken into a cottage hospital and kept at perfect rest and on strict diet for two months; she was better and returned to her employment. In three weeks the pulsation returned worse than before, accompanied by breathlessness and cough, and she has been able to do nothing since.

Present state.—Patient is a slightly-built, spare, young-looking woman, whose general functions are well performed, except that she menstruates too frequently and too abundantly. She gets out of breath on very slight exertion, and has a constant teasing cough, worse when she lies down. On looking at her neck one is at once struck by a peculiar wide and distinct separation of the sternal and clavicular portions of the sterno-mastoid muscles, leaving above the clavicles two rather wide triangular intervals, in which

probably no muscular fibres exist. In the right interval a pulsating tumour, looking about the size of a cobnut, is visible. To the touch this tumour seems larger; its pulsation can be felt inside the sternal portion of the muscle, as also under the clavicular part, for a considerable distance. By turning the head so as to relax this muscle one can grasp the tumour between the finger and thumb, when its pulsation is felt to be remarkably expansile and its walls appear very thin. The pulsation limit just above the clavicle is an inch and three quarters broad and nearly an inch high; pulsation may also be felt beneath the clavicle, and after any slight exertion in the first intercostal space down to the upper border of the second rib. Percussion notes are dull on the inner two inches of the clavicle, and in a semi-circle beneath this part extending down to the second rib (Fig. 5). On all

FIG. 5.



this part the second sound of the heart is markedly loud, with a dull but somewhat ringing thud. Sphygmographic tracings of the two radial pulses were taken by Mr. Wickers (figs. 6 and 7).

FIG. 6.

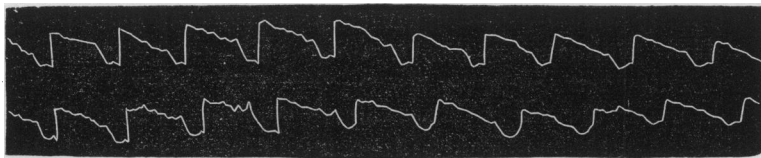
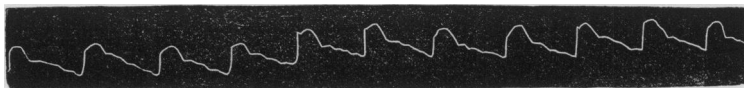


FIG. 7.



January 17th.—I tied the common carotid a little below the bifurcation and the third part of the subclavian.

18th.—The patient complains of intense headache, chiefly referred to the vertex. The temperature of the right side of neck, of the right shoulder and arm, is normal; there is slight numbness of the fingers; the right pupil is normal.

21st.—The wounds, dressed to-day, are nearly healed, the tumour of the neck pulsates as before; the patient is menstruating before her proper time.

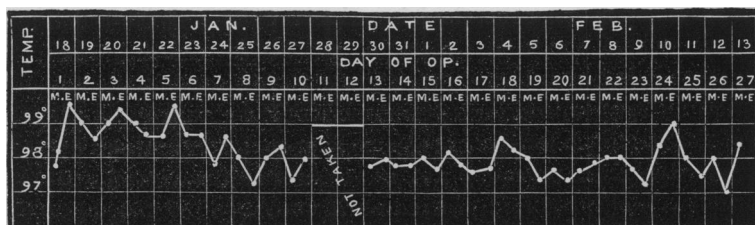
23rd.—The right radial pulse seems faintly perceptible. There is no brachial pulsation. The wounds are healed and the antiseptic dressings discontinued. A dry diet identical with that of L. G— was ordered.

29th.—The radial pulse is sometimes perceptible, at other times not so. The cervical tumour is less perceptible; it still pulsates, but appears more solid.

February 8th.—The tumour, which during the last six days has decreased both in size and force of pulsation, beats to day more violently. The patient is again menstruating and I may as well remark here that throughout her stay in the hospital, increase of pulsation always accompanied this function, which was both too frequent and too profuse. The cough has almost entirely disappeared.

16th.—The radial pulse is only occasionally perceptible; there is a good deal of pulsation at the proximal side of the carotid ligature.

FIG. 8.



20th.—Not very well, having some biliary derangement with sickness and headache. There is no cough nor other thoracic symptom; radial pulse faintly perceptible.

March 19th.—The patient has been going on very satisfactorily. The supraclavicular tumour considerably diminished in size, appears solid; it rises, however, with each pulsation, and its wedge-shaped bulk being forced up between the compressing fingers, gives a sensation as of expansile pulsation. I permitted her to go out to make arrangements about going into the country. She was absent about an hour. On her return she was much exhausted, and the pulsation below the seat of ligature was increased, and she complained of dragging pains from that place towards the heart. After resting in bed for an hour or two, all these sensations disappeared, and she regained her usual condition.¹

20th.—Pulsation of the tumour is still very marked; the right radial pulse is quite perceptible, but small. She is to keep her bed.

23rd.—The additional amount of pulsation has disappeared and she is now in the state reported in the early part of the month.

April 1st.—I examined this patient with very great care. All the pulsation about the chest wall has disappeared; percussion dulness reaches barely an inch outward from the sternal end of the clavicle and about half an inch below that bone. The heart sounds are too loud over a rather larger

¹ This description of the effects produced by her walk are *verbatim* from the registrar's notes.

space; the second sound is not especially well-marked. The tumour above the clavicle pulsates visibly and to touch; it is, when the sterno-mastoid muscle is relaxed, easily grasped between the finger and thumb and its pulsation feels, on a first impression, expansile; careful palpation of the part has however convinced me that the tumour does not expand on pulsation; it seems firm and solid and I feel the mass rise up from the chest at each beat of the heart. It is in fact a cone which being forced upward by each pulse between the finger and thumb acts like a wedge and gives a false sense of expansion. Although the tumour is greatly solidified, I doubt its being altogether solid.

July 22nd. The patient was virtually discharged at the end of May, but was kept in the hospital until a convalescent home could receive her. The tumour in the neck persisted and still pulsated in the manner above described. The heart sounds were more audible than they should be in the right upper chest. The ratio between first and second sounds was normal. She has no cough or other chest symptom, but she occasionally gets into a nervous or hysterical condition when she cries and says she has the same pain as before the operation; when not in this condition, she denies having any pain in the chest at all.

November 5th—C. H—, presented herself at the hospital and was carefully examined by Dr. Pollock and myself. She has no cough; no difficulty of breathing, but can run up and down stairs, or up hill with ease. The right upper chest and the clavicle are resonant on percussion; the heart sounds a little too plainly audible, are normal in their ratio and have no metallic ring nor thud which were prominent previous to operation. The radial pulse (right) is very small, there is no carotid pulse above the seat of ligature.

On looking at the root of the neck a rather wide pulsation is visible; the greater part of which is undoubtedly venous, but on feeling behind the sterno-mastoid a pulsatile tumour is perceptible, upon which I have no further remark to make than that in the report of 1st April, except that this tumour has not increased, but rather decreased in the interval. I

hope to be able to show her when this paper is read, and the fellows of the Society will be able to judge for themselves of the condition.

Remarks.—A very few words will suffice to say all that need be added to these histories. It appears that when women in the middle period of life are the subjects of aneurism, whether or not they undergo operation, many disturbing causes prevent such a fair and full estimate of progress or the reverse, as we can form if the subject be male. I had occasion to observe these peculiarities in the case of a lady with femoral aneurism some four years ago. I am not, however, aware that this so strongly marked excitement of the vaso-motor system during the menstrual period has been previously noted. The histories indeed of these cases show many fluctuations and vicissitudes, all of which, except when L. G. was frightened (and even then she was unwell), were connected with that function, and all of which were, I believe more apparent than real. That is to say, the increase of pulsation at certain times was due to increased action and motion of the whole vascular system, rather than to any increased size of the aneurism.

A few words must be said about organisable ligatures, for I think the advantages of being able to leave a ligature after metamorphosis, upon an artery have been hardly appreciated, nor has this ability had its due practical influence on our mode of deligation. Little or no advantage has been taken of the fact, that we can now occlude the tube without destroying the continuity of a blood vessel. Yet upon this characteristic of the organisable ligature, I believe its value and safety to depend. Ever since the final abandonment of the flat tape ligature, more especially since the classical work of Dr. Jones, "On the Suppression of Hæmorrhage," 1805, it has been the universal doctrine of surgery, that ligatures must be tied sufficiently tight, to divide both the inner and middle coats of the vessel. This is doubtless necessary when such ligatures as must come away, that is, such as must ulcerate through the vessel, are

used—partly because the retracted and corrugated inner coats adhering to the coagulum form one of the barriers to hæmorrhage, and partly because it is necessary to shorten the ulcerative process. But if an organisable ligature be used in this manner there will be, when the cord is dissolved or metamorphosed, nothing between the blood stream and the outer parts except the somewhat loosely constructed outer coat wrapped round with a narrow line of recently formed fibre tissue. Therefore, unless the sealing with coagulum have been rather more rapid and more firm than is usual with large vessels tied in continuity, there will be some risk of secondary hæmorrhage. I cannot but think that we must attribute to this cause such instances of that disaster as have been from time to time reported to sister-societies and in the medical journals. But if we so use the ligature that only the inner coat, or, better still, that no part of the artery be divided, the persistent ligature and the coagulum will keep the artery occluded, while the tough elastic middle coat, supported by the outer, will effectually prevent hæmorrhage.¹ In working out this idea I found by gradually increasing experiment that catgut ligatures were perfectly safe when tied comparatively loosely on the largest vessels divided in amputations. I also found that catgut (size E violin string) will cut through both inner coats of the carotid, subclavian and femoral arteries if tied with a pressure of 3 lbs., but either no coat or only the inner serous tunic if tied with a force equal to 2 lbs.² In all cases of deligation of vessels I have, judging only from the action of the hands, endeavoured to use less than this minimum force; applying the ligature with only sufficient power to check the blood-current in the parts beyond, thus avoiding division of the middle coat. Partly to this mode of using the ligature, partly to the use of antiseptic precautions, must be attributed my somewhat remarkable success in these operations.

¹ I must however, express a strong opinion that catgut is neither a reliable nor a well-chosen material.

² These experiments were made on a large number of fresh subjects, with a dynamometer in each hand.

Let me recapitulate the statistics given in my last paper. Six cases of simultaneous deligation of carotid and subclavian for innominate aneurism were quoted. The case I then recorded was the seventh, and was the only successful one. Since that paper was read Dr. Kelburne King, of Hull, has performed the same operation ; his case is most interesting and instructive, but the patient (drunken and insubordinate) died from suppuration of the sac and hæmorrhage on the eightieth day.

The three cases which I this evening add to these statistics make up the whole number of such operations for innominate aneurism to eleven ; of which four belong to me. Of the eleven cases three are successful ; all these are mine.

¹ 'Lancet,' 8th June, 1878.