CASE
OF
DOUBLE SIMULTANEOUS DISTAL
LIGATURE
FOR
INNOMINATE ANEURYSM.

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LAURA H—, æt. 48, married, was admitted under my care into Charing Cross Hospital, Golding Ward, 16th February, 1884.

Both parents died when patient was too young to know of their diseases. She has had two sisters; one died of "cholera," the other is healthy and strong. Her relatives on the mother's side have suffered from heart affections. Patient's health has until lately been uninterruptedly good. She has had six children born living and healthy; two born dead at full term; four miscarriages.

Eighteen months previous to her admission she fell forwards upon her chest on the floor of an omnibus. No

bruising or other immediate ill-effects were noticed. A month after this she spat up one morning about a table-spoonful of inspissated blood, but had at that time no further trouble.

A year ago, that is six months after the accident, she noticed an uncomfortable sense of throbbing on the right side, below the collar-bone; soon after a pain about the elbow, which shortly extended up the arm to the shoulder and became very severe; movement and power of the arm rapidly diminished. Two months ago she had what she terms rheumatic fever; it was confined to the upper extremity, particularly to the hands, especially of the right side.

State on admission.—Patient looks older than her stated years; is pale, thin, and anæmic, has a dry skin and a temperature of 102·6°. She has some dyspnœa (very shallow breathing with evident effort), also a dry brassy cough, considerable loss of vocal power, the voice being toneless and low.¹

The veins of the upper part of the chest are full and congested, so also are those of the arms, equally so on both sides. The right half of the sternum, the inner part of the clavicle, and the two upper costal cartilages of the same side with their interspaces are involved in a distinct fulness or protrusion, circular in form, and a little more than three inches in diameter, and over all this space pulsation is distinct both to sight and touch, the throb is most evident in a semicircle below and outside the sterno-clavicular joint; the clavicle and the two upper costal cartilages participate in the pulsation. In the outer half of the episternal notch, and also behind the inner part of the sterno-mastoid muscle, a pulsatile tumour can be felt; its outer border reaches as far as, but not beyond, the interspace between the two heads of the muscle. When the sterno-mastoid and the fasciæ in front of the neck are relaxed by bending the head forward, deeper palpa-

¹ This condition has come on, she says, only during the last week. Some of her friends noticed it earlier.

tion shows that the tumour, merging out of the chest, does not merely cover but actually involves the carotid.

All that part of the chest, which I have described as protruding, is absolutely dull on percussion, and relative dulness extends beyond the limit of tumefaction and of pulsation. The dull area is separated from the cardiac dulness by a line of resonance. Only a small quantity of air enters the lungs, with râles and blowing murmurs throughout; in places also, markedly at the left base, there is bronchophony. The left posterior base is more especially dull, and less air enters that part of the lung than elsewhere; here, too, the râles are most marked. The apex-beat of the heart is not displaced; the organ is healthy, but the second sound is exaggerated; this exaggeration is very distinctly marked over the site of the tumour and to a less degree over a great part of the chest. Patient has much palpitation and præcordial pain even on slight exertion. The right radial pulse is very small and faint, the left one is regular and full, 96. The pulse of the right temporal artery is markedly larger and fuller than that of the left, also the beat of the right carotid on a level with the cricoid cartilage is stronger and bigger.

She keeps the right arm very motionless and close to her side; the elbow is semiflexed. The limb is markedly atrophied; the muscles are flabby and flaccid.

	Right.	Left.
Middle of upper arm . . .	8½ in.	9½ in.
Forearm three inches below elbow	8¼ in.	9 in.

Extension of the elbow, abduction, and rotation of the shoulder produce considerable pain, but movement of the wrist and fingers is painless. The power of the grasp is diminished; tested by the dynamometer it stands as 6½ right against 12 left.

There is a good deal of neurotic pain in the arm, running up in the course of the nerves with formication and numbness of the hands and fingers.

The patient's appetite is very bad. Tongue rather

brown but moist ; some thirst. She complains of a severe pain on swallowing, which she refers to a spot on a level with the sixth cervical vertebra, about three inches to the right of the spine. Although she has pain in various parts, as in the arm and chest, this appears to be the most-severe and least bearable of her troubles. On applying the stethoscope to the last cervical vertebræ while she swallows the act is heard to be prolonged, only occasionally reduplicated.

The retina of the right eye presented nothing abnormal. The vocal cords looked a little relaxed, equally so on both sides.

During the twelve days ensuing she was carefully watched and frequently examined. She had during this time a good deal of pain in the abdomen and some diarrhoea. She appeared to be losing strength, while the lungs were becoming more impervious, less air entering them, the dulness of the bases extending higher. Her voice became more and more feeble. Her temperature was often below the normal, notably on the 19th and 20th it was 97° ; on the 21st 97.4° .

The most noteworthy phenomenon, however, was entire cessation of the right radial pulse—this occurred on the 20th—four days after her admission. The pulselessness extended throughout the brachial and all accessible parts of the axillary, also, I believe, to the subclavian, the third part of which could not be felt to beat.

The symptoms just described clearly indicated that I had in this case to do with a high innominate aneurysm, but certain occurrences are worthy of remark, namely, the very feeble state of the right radial pulse on her first admission and its subsequent total extinction. If together with these symptoms we collate the fact that almost simultaneously with the first sense of throbbing, that is to say, almost simultaneously with the first sign of disease—severe pain in the arm was felt, we can only come to one conclusion, namely, that the aneurysm which affected the upper part of the innominate and its offshoots had at

first inclined chiefly to the right and had more especially involved the subclavian branch; and that afterwards this part was obliterated, while remaining empty or nearly so, by compression of the carotid portion of the tumour. It is of course also possible that the obliteration was caused by detachment and subsequent impaction of a piece of clot. On this point I would not dogmatise; but must point out that spontaneous cure by impaction of clot leads to solidification with the sac full; and one should under such circumstances be able to feel a tumour behind the clavicular part of the sterno-mastoid muscle. Such tumour was entirely absent in this case.

Compression of an artery by an aneurysm situated upon it is by no means an unheard-of occurrence, though by some authors its possibility has been doubted.¹

In this case the mechanism of such compression would be as follows:—I have elsewhere pointed out² that the usual idea of the mode in which the innominate bifurcates is incorrect; it is described and depicted as though the two branches arose side by side and almost at right angles to each other. In reality the subclavian springs from its parent trunk almost directly behind the carotid and runs up some distance close, almost parallel and posterior to that vessel. If this position of parts be borne in mind, there will be no difficulty in perceiving how an aneurysm involving the root of the carotid would very easily compress against the vertebræ, the commencement of the subclavian, more especially if that branch were also aneurysmal. It will also be seen how under such circumstances that artery and its dilatation would be empty or nearly empty.

The aphonia noted in this case was due to compression

¹ This idea was due originally to Sir E. Home; see Astley Cooper, 'Med.-Chir. Trans.,' vol. i, p. 12. I watched a case of aorto-innominate aneurysm, in which the large sac, curling over and compressing distal parts of the subclavian, induced considerable consolidation of the outer part of the tumour.

² 'Encyclopædia of Surgery,' vol. iii, p. 514.

of the trachea as also was the condition of the lungs. This latter was a most interesting example of the mode of disintegration caused by such pressure. It is produced, as the late Dr. Pearson Irvine¹ and I showed, by obstruction, not to inspiration, but to expectoration, whence accumulation of secreta, &c., in the larger then in the smaller bronchi and air-cells, necessarily inducing consolidation, parenchymatous pneumonia, and breaking down of lung tissue. The first part of this process I had in this case the opportunity of watching from day to day.

Having watched the case for ten days, waiting to see if such process has had occurred in the subclavian would extend to other parts of the sac, I came to the conclusion that the advancing morbid condition of the lungs was the principal cause of the patient's debility and the chief source of her danger. Indeed, although anæmia is not a condition favorable to the success of deligation, I foresaw clearly that postponement would still more jeopardise the lungs and would render their condition fatal, if even some weeks hence the aneurysm could be cured. Still, before proposing any operation it was necessary, since the subclavian artery was occluded, to ascertain whether the cerebral functions would be carried on without the supply of blood derived from the right carotid. I therefore compressed this vessel with my thumb; no result followed. Simultaneous compression of both carotids produced, in about five seconds, pallor of the face, a sense of swimming in the head, and a distinct depression in the power of the pulse. The two first symptoms were doubtless due to loss of circulation through the carotids, the last to interference with the functions of the vagus nerve.

Having, however, proved that occlusion of the right carotid produced no cerebral disturbance, I determined first to tie that vessel and to be guided by the immediate result as to any further action.

February 28th.—I tied the common carotid artery with

¹ 'Pathological Transactions,' vol. xxviii, p. 67, and my book on 'Aneurysm, especially of the Thorax and Root of the Neck,' p. 101.

an ox aorta ligature about one inch below its point of bifurcation. I begged that the right pupil might be watched at the moment of tightening the ligature. One observer thought he perceived a very slight contraction of the pupil, the other believed that no change took place.

After this deligation the clavicle and the protruded part of the chest pulsated more violently than before. I tried to make out if the third part of the subclavian pulsated, but the powerful throb of the clavicle rendered it impossible to ascertain this point. Fearing, however, that occlusion of the stream in the carotid might divert blood into the subclavian and thus reopen that part of the aneurysm, my colleagues also, on rapid consultation, coming to the same conclusion, I laid bare the third part of the subclavian. It was empty, and there was not the slightest pulsation in it, nevertheless having exposed it, I, with a view to future possibilities, tied it.

In the evening of the same day the pulsation had very much diminished. On the next day she began to expectorate the muco-pus that had for some time past been accumulating in her lungs. On the fourth day she lost the pain on swallowing, the voice began to improve and the protrusion of the upper part of the right chest to flatten.

March 20th.—All these signs of diminution in the bulk of the aneurysm continued to increase. On the twenty-first day she sat up and was pleased to find that she could painlessly feed herself with the right hand.

28th.—The cervical part of the tumour had apparently become nearly solid; the pulsation that remained had in great degree lost its expansile quality and had assumed more nearly the character of a communicated heave from the aorta. But at this date that enlargement appeared to increase, and although she was kept very still and quiet the hitherto solidifying tumour became softer, the pulsation resumed its expansile character, and although the thoracic protuberance did not at the same time increase, the clavicle again began to pulsate. The patient averred

that she again felt the throbbing, but none other of the subjective symptoms recurred.

April 4th.—The cervical portion of the aneurysm had become almost as large and nearly as pulsatile as it was before the operation, the thoracic portion continuing meanwhile to become flatter, and the resonance of this part to increase. With a bandage of elastic webbing I bound upon the tumour a pad of cotton-wool, for which in two days I substituted a round, hollow, elastic ball, according to a method successfully employed by Mr. Holmes in a case of subclavian aneurysm.¹ This treatment produced a good deal of pain and considerable restlessness, therefore, as at the end of a week no benefit had resulted, it was discontinued. I was considering the desirability of employing needles, with or without the galvanic current, when on the 15th the tumour was found to be smaller and more solid.

20th.—Solidification and decrease in size of the cervical portion of the tumour has been progressing regularly since the last report. To-day she was allowed to get up.

May 6th.—The cervical part of the aneurysm appears as a small solid tumour behind the inner head of the sterno-mastoid muscle; it is lifted by each beat of the aorta, but has no inherent pulsation. The voice is natural, she has no cough, suffers, however, a good deal from muscular rheumatism, and is feeble. She left the hospital desirous of remaining at home for some time before going to a convalescent institution.

June 4th.—The patient showed herself at the hospital. There is no protrusion of the right upper half of the chest nor any tumour to be felt in the neck. Over the late site of the aneurysm percussion notes all clear, and respiratory murmurs are to be heard where previously only exaggerated heart-sounds were audible. The lungs are clear down to their lowest bases.

No pulse could be felt in any branch of the right carotid, nor of the subclavian. The right arm, which has

¹ 'Lancet,' Feb. 12th, 1876.

hitherto been always rather cooler than the left, is now rather warmer, but the temperature of the face is lower on the right side. It is hoped that the patient will attend. She was last seen at the end of August, well, as far as aneurysm is concerned.

Remarks.—As I have already made some remarks concerning the diagnosis of this case, the few observations I would offer now shall be very brief.

The disease was distinctly an example of high innominate aneurysm, eminently fitted as far as situation is concerned for the double distal ligature.

It is possible that some of the Fellows may see a different mode from that above given of accounting for the singular occlusion, by the disease itself, of the subclavian artery and its branches. Yet I would point out that whatever view be taken of the occurrence it cannot be supposed to have taken place elsewhere, than at or near the commencement of the vessel, and proximal to the vertebral artery. With this fact in view, I tested, as above detailed, the effect of temporarily cutting off the blood-stream in the carotids. After deligation of the right common carotid artery no cerebral symptoms whatever supervened, although in all probability no blood found its way directly to the right side of the brain. I hold this fact to be highly important as aiding to prove a view, elsewhere expressed,¹ that occlusion of a carotid by ligature or otherwise has no injurious effect upon a sound and healthy brain.

Whether or not the subclavian artery should also be tied remained in doubt until after the operation on the carotid; I was influenced at that time by the increased pulsation of the aneurysm, and believe that I may congratulate myself on the course taken.

The lungs were, when I operated, becoming rapidly filled up with retained secretions. The cessation of pressure on the trachea had almost immediately the effect of permitting the elimination of large quantities of muco-

¹ 'On Aneurysm, especially of the Thorax and Root of the Neck,' p. 31.

pus, and subsequently of mucus, the lungs becoming by that process disburdened. To watch the gradual disappearance of the pulmonary symptoms, to hear the dullness clear away and the râles diminish, was a most interesting clinical experience.

One other point I would like to touch upon. The tumour, or rather that portion of it which was in the neck, had become by the 20th March (twenty-first day of operation) nearly solid, was tolerably hard, and had considerably diminished; about a week later it again began to soften and to increase until, though the thoracic portion did not yield in the same way, the cervical part was nearly as large as before the operation, the blood in it being evidently fluid. As is well known, recurrence of pulsation occasionally occurs after a certain consolidation of the aneurysm has followed treatment either by the elastic band, by pressure, or ligature, though I am not aware that ultimate success has previously been observed to follow such recurrence in the neck. But the questions which I would put to the Society are these:

What becomes of the clot (probably soft clot) already formed in the sac, and which quite disappears when the recurrent pulsation persists a certain time?

Since no sign of embolism or plugging of vessels accompanies these phenomena, it would appear that such clot must again become fluid. If so, what peculiar power has living and flowing blood that can enable it to dissolve and liquefy clots formed from its own substance?

The answers to these questions involve, I believe, some important points in physiology and in pathology.

It may be well to remind the Fellows of the Society that since I last had the honour of addressing it on this subject, two cases of aneurysm about the upper part of the thorax and the root of the neck have been laid before it, the one by Mr. Howard Marsh—he tied both vessels simultaneously but without success; another by Mr. Morris, who attempted, but failed, in the altered condition of the parts to tie the carotid—this patient also died.

I have to thank the Hon. James George Beaney, of Victoria, for sending me a copy of his 'Clinical Lectures.' One of them gives two cases of innominate aneurysm treated by consecutive ligature of the carotid and subclavian (third part); they were both eminently successful. In neither did the carotid ligature produce any marked benefit until the subclavian was tied, four and two weeks afterwards respectively.

I may be permitted also to recall the fact that this is the sixth case of simultaneous double distal ligature that I have reported to this Society. Of these, one was for a very large aorto-innominate aneurysm (*a*), two for smaller but still considerable aneurysms of the same description (*b*, *c*), two (including this case) for aneurysms purely innominate (*d*, *e*), one for aneurysm of the first part of the aorta (*f*).

The first was one of my earliest cases, such as with my present increased knowledge I should not subject to any operation. The other five have been all successful.

- a.* J. L—, from Bath; operated 6th December, 1877.
- b.* Robert W—; operated 14th August, 1877.
- c.* Laura G—; operated 6th December, 1877.
- d.* Catherine H—; 7th January, 1878.
- e.* Laura H— (this case); 28th March, 1884.
- f.* John S—; 15th February, 1879.

Note.—It was reported to me in May, 1885, that the patient was quite well, and going about her household duties with ease and comfort.

(For a report of the discussion on this paper, see 'Proceedings of the Royal Medical and Chirurgical Society,' New Series, vol. i, p. 332.)