Notes on the surgical treatment of aortic aneurism : being in part a reprint of some papers in the Lancet on the same subject published in the years 1869 and 1872 / by John Cockle.

NOTES

ON THE

SURGICAL TREATMENT

OF

AORTIC ANEURISM:

BEING

IN PART A REPRINT OF SOME PAPERS IN THE "LANCET" ON THE SAME SUBJECT, PUBLISHED IN THE YEARS 1869 AND 1872.

BY

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TO

CHRISTOPHER HEATH, F.R.C.S.,

Surgeon to University College Hospital, Holme Professor of Clinical Surgery, etc., etc.

DEAR HEATH,

I know not to whom I could with greater propriety inscribe this brief Memoir, than to yourself. To your operative skill and foresight it was mainly owing that a marked amount of success attended the first operation ever performed of ligature of the left carotid artery, with the direct intent of arresting the progress of pure aortic aneurism.

May I express the hope that the success achieved may lead to a still more extended trial of this method of treatment in the particular class of cases for which it was proposed?

Faithfully your's,

JOHN COCKLE.

PREFACE.

THE first systematic attempt to arrest the progress of pure aortic aneurism by the aid of surgery, antedates but a very few years. Even now, it admits of question whether the facts on which operative interference is based have received much general consideration. Indeed, but little interest could be supposed to attach to any enquiry into the principle of what might have been regarded as a hazardous proposal, or, at best, as an innovation on ordinary practice, unsupported, it might be urged, by any precedent. But, success more or less decided, once fairly achieved, would now permit the detail of the historical *data* which suggested the measure to be fairly weighed.

In a communication made to the Clinical Society in the Session of 1872, detailing the history of a case of aortic aneurism in which the operation of tying the left carotid artery was performed, the following passage occurs :—"To submit the case as one of cured aortic aneurism would be assuredly a premature, possibly a false, position to assume. A wider experience is required to determine whether, in a case of aortic

aneurism rapidly increasing and uninfluenced by medicine, such a procedure as ligature of the carotid artery is destined to find a place among the resources of our art."

Since that communication, the addition to our knowledge in relation to this matter, it must be owned, has not been great. But, at a recent meeting of the Clinical Society, Feb. 9th, the subject of the surgical treatment of aortic aneurism was again brought forward for discussion, and created, it would seem, much interest. A full detail was given by Mr. Heath of the sequel of the case before referred to, in which the operation apparently not only prolonged the patient's life for several years, but furthermore permitted for a time a return to his ordinary laborious occupation.

A second most interesting case was shown by Mr. Holmes, himself one of the highest authorities on the subject of aneurism. He stated (*Lancet* report, Feb. 17th) that the case was one of the worst he ever saw, and thought that death must occur within a month. The left carotid artery was ligatured Oct. 21st, 1875. Immediate marked benefit followed the operation, and the tumour subsided considerably; dyspnœa diminished, and hæmoptysis nearly ceased. This patient is now (1877) in comparative comfort, though still in a state in which any exertion might easily cause death. The particulars of a most instructive, though speedily

fatal case in which the right carotid was tied, were next related by Mr. Bryant. This case, however, by no means tells against the operation. It was, unless I am in error, one of simple though great and general dilatation and degeneration of the ascending aorta and its transverse portion (*arteritis deformans*).[1] No evidence of true sacculation was adduced. It was stated that no coagulation whatever existed in the diseased portion. In cases of dilatation and coexisting degeneration, but little laminated clot is ever to be found; the conditions for its formation in any quantity do not exist. It is to the sacculate type of aneurism that the operation alone applies. It may, therefore, be affirmed that the operation will, in certain cases, "rank among the available resources of our art."

But, whenever any new method of treatment is formally proposed, it is of paramount importance that the class of cases which such method is intended to

[1] I never remember to have seen any large amount of laminated clot in cases of simple dilatation and degeneration of the aorta. The only marked exception to the rule that I can call to mind, is the remarkable case (xxxvi) of *Bertin*. Here, it existed to a very great extent; but it admits of doubt whether the large dilated pouch behind the heart were not truly sacculate; although the three arterial coats were described as being intact. Not one of the pouches had given way. In this case it is interesting to observe that the swollen state of the inner membrane had extended to the middle of both right and left carotid arteries.

benefit should be first clearly defined ; next, that the facts suggesting and justifying its adoption should be as clearly set forth. For all the reasoning will partake of an *a posteriori* character.

It may be stated at the outset, that the method proposed for the treatment of aneurism involving the upper portion and arch of the aorta with cervical extension, stands last on the list of therapeutic means so far as regards mere chronological sequence, since it neither interferes with, nor displaces any present means. Its adoption is only urged when these means, fairly and sufficiently tried, are powerless to control the fatally tending progress of the affection. In conclusion, let me add that I have no theory to propound as to the "how", *i.e.*, the proximate cause of the formation of laminated clot in the aneurismal sac consequent on obturation of the left carotid artery—whether from "diversion" of the blood-current—from an influence transmitted to the living membrane of the sac—or from an extension of the clot from the end of the tied vessel (*sic* Holmes). These are still to be regarded as *postulata*. My more immediate concern is with the evidence tending to support the view of a causal relation between such obturation and the actual occurrence of laminated clot ; and by this latter agency the attainment, if not of radical cure of the aneurism (for that, probably, must be the exception rather than the

rule), at least of a palpable retrogression of its physical signs—a decided amelioration of its symptoms—and, comparatively, a very considerable prolongation of life. These two latter considerations should, I submit, operate as sufficiently strong incentives to resort to the operation in suitable cases.

I have been induced to reprint my original papers on this subject, not only with the view to clear any existing obscurity as to the "why" of the selection of the left carotid artery for ligation, but also to establish my claim as having been the first formally to propose this particular method of treatment.[1]

Even at the present time, however, I should find but little to add to the main argument. More careful search might possibly have brought to light other instances of natural occlusion of the left carotid, and the existence of a large amount of laminated clot in the

[1] It is quite true that *Velpeau*, commenting on these remarkable cases of Tillanus and Rigen, observed that ligature of the carotid artery not only arrested aneurisms of the innominate, but also those of the arch of the aorta. And so they really seemed to do. But this great surgeon lived nearly thirty years after the publication of his work, "*Elémens de Médicine Opératoire*", yet never again reverted to the subject, much less formally proposed operative interference in such cases. He missed the generalisation. Broca, writing only a few years ago on aneurism, also alludes to these cases, and, as I have pointed out, regards the occurrence as a "pure coincidence".

sac of an aortic aneurism, which might have lent additional force to the foregoing inference, but nothing more.[1] It would certainly weaken the argument for the selection of the left carotid artery for ligation, if cases could be cited in which arrest of aortic aneurism co-existed either with obturation of the innominate alone or of the left subclavian alone, the left carotid artery being patent. But, if the left carotid were also closed, looking to the cases detailed, it must still be regarded as the prime factor in the result. Even should it be found hereafter that the ligation of other arteries than the one selected should be equally successful, it would not alter the main position, viz.—*that pure aortic aneurism is, within certain limits, amenable to surgical treatment, which, after all, is the real issue involved.*.

Since the publication of these papers it is right to refer to the great improvements that have taken place in the treatment by galvano-puncture of such cases. A very successful future may possibly be in store for this powerful agent, and the necessity for recourse to surgery thereby rendered still more rare.

[1] A case greatly in point was brought before the Clinical Society during the session of last year.

FURTHER CONTRIBUTIONS TO THE PATHOLOGY AND TREATMENT OF ANEURISMAL TUMOURS OF THE NECK AND CHEST.[1]

If we examine the hollow of the neck in a sufficiently large number of individuals of both sexes, we shall occasionally find, especially among women, instances where the innominate artery is readily seen, and felt pulsating along the lower and tracheal border of the right sterno-mastoid muscle, and traceable below the sterno-clavicular articulation. This peculiarity of the artery depends either upon its being longer than ordinary, or upon the sternum being shorter, with flattening of the upper portion of the chest, or even upon the aortic arch reaching somewhat higher. The artery may gradually become the seat of circumscribed dilatation, constituting the "cylindroid aneurism" of Breschet, now more commonly designated simply "arterial dilatation." Its more common occurrence in females may probably result from the greater delicacy of their structure, and their greater liability to vascular excitement. This dilatation has been well-nigh

[1] Read before the Medical Society of London, March 1st, 1869.

mistaken for ordinary aneurism by men so experienced in the pathology of aneurismal disease as Dubreuil[1] and Broca ;[2] and Dr. Hayden, of Dublin, has recently published a case in which so marked a state of erethism of this artery existed as to simulate for a time aneurismal impulse ; nay, more than this, operations have even been performed under such a supposition. I am by no means sure that the second case detailed by a distinguished authority, the late Dr. Wardrop, in his work "On Aneurism," was not one of this description ; one recorded by Porta,[3] of Milan, most assuredly was, for death followed forty hours after the operation, and *post mortem* examination revealed simple dilatation of the innominate artery and its terminal divisions. In another case, mentioned by Hope,[4] the operation of tying the carotid was recommended ; but, on *post mortem* examination, it was found to be one of simple dilatation of the aorta and innominate artery. These examples may suffice to show the importance of a sound discrimination of this class of cases. So far as I have observed, they will be found generally associated with a greater or less degree of dilatation of the ascending aorta and its arch. Some amount of dulness over the course of the vessel is occasionally met with, and always a double murmur of greater or less intensity along the vessel, and most marked above the aortic valves. Collapse of the vessels is sometimes

[1] *Anomalies Artérielles*, p. 48.

[2] *Des Anévrysmes*, p. 87.

[3] *Delle Alterazioni Patologiche delle Arterie*, p. 35. Milano, 1845.

[4] *Diseases of the Heart*, p. 440.

seen (not from incompetence of the valves, though eventually, from the progress of disease, secondary insufficiency may occur), but it results from the loss of resiliency of the aorta, and the regurgitation of blood in the vessels springing from the arch to obviate the tendency to vacuum. This dilatation and loss of elasticity of the aorta, without any necessary valvular incompetence, may be at times attended with severe and even dangerous symptoms. This latter point is briefly referred to as worthy our serious consideration, and not as possessing any degree of novelty. It is a condition with which the cardiac pathologists of the last century were familiar, and in our own time has been specially referred to by Dubreuil and the late Dr. Bellingham, of Dublin.[1]

From time to time a few cases of this form of disease have been published by me, and quite lately another case has come under my notice, which I shall briefly relate.

Mary P——, aged forty-eight, married, and mother of a large family, was admitted under my care at the Royal Free Hospital, on September 29th, 1868. With the exception of occasional attacks resembling those of rheumatic gout (to which complaint she inherits a disposition), she had tolerably good health up to the period of the complaint she now suffers from. The only commemoratives of importance are the sudden death of both mother and grandfather from disease of the heart. About six or seven years ago she first felt a sensation of throbbing in the hollow of the throat,

[1] *Diseases of the Heart*, Part II, p. 573.

and shortly after a swelling arose, which has remained up to the present time without any very decided increase.

A pulsating tumour now occupies the episternal hollow, and is traceable downwards behind the right sterno-clavicular articulation ; it also ascends the neck in a slightly oblique direction behind the inner head of the right sterno-mastoid muscle, the tendon of which bisects the tumour, giving somewhat the appearance of a double sac, the outer portion of which extends to the clavicular attachment of the muscle. During arterial diastole the tumour (about the size of a pullet's egg) is circumscribed, prominent, tense, with very expansive and liquid impulse, but without any marked fremitus ; during arterial systole there is perfect collapse. A double murmur, of soft character, is audible over the tumour, but of greatest intensity under the sterno - clavicular junction ; it occasionally ascends faintly the vessels of the neck. Below the maximum site, the double murmur is audible down the aorta, at the apex of the heart, and in the left axillary region. The apex of the heart, however, is not lowered, nor apparently does any marked hypertrophy of the left chamber exist. No great amount of collapse of the vessels is observed. The superficial mammary veins clearly are more prominent upon the left superior portion of the chest. The right is invariably stronger than the left radial pulse ; pressure either upon the right carotid or subclavian arteries has no effect upon the tumour. The right pupil is, for the most part, considerably larger than the left, but occasionally both are of equal size.

The symptoms complained of are somewhat variable, but in the main unchanged : sense of weight and throbbing in the hollow of the throat ; frequent pain at the upper part of the chest, and in the right shoulder ; transient giddiness and dimness of vision ; hoarse, barking cough whenever cold is taken ; and some embarrassment of breathing, especially upon exertion, or ascending stairs.

Prognosis.—My experience does not enable me to state with the necessary precision what may be the eventual destiny of such cases of arterial dilatation. I can only say that I have watched one or two for years without perceiving them to undergo any great amount of change ; and in this particular their history signally differs from that of ordinary aneurism. Still it is not unreasonable to suppose that under such dilatation the arterial coats may gradually undergo such transitional changes as eventually to lead to the more ordinary form of mixed aneurism ; and such contingency may justify a few remarks upon the differential diagnosis of aneurisms occupying the root of the neck, in their earliest phase.

Assuming for the moment the integrity of the aorta, —should an aneurismal tumour involve the distal end of the innominate artery, generally speaking, it first emerges from behind the right sterno-clavicular articulation (which it may displace), distends the episternal hollow, and passes behind the sternal portion of the sterno-cleido-mastoid muscle ; and from these points it may ascend the neck, to spread in various dierctions. Moderate percussion dulness will be found correspond-

ing to the articulation; and here a shock or murmur, single or double, is ordinarily heard, of maximum intensity, which may ascend the terminal vessels if pervious, but weakening below, and altogether diffused and lost about the arch of the aorta. The condition of the carotid and radial pulse is, at times, greatly modified, being either much weakened or quite suppressed in one or other vessel; but this of course must quite depend upon the amount and position of the clot within the sac, and upon the extent of pressure exercised by the latter upon the terminal branches. Severe neuralgic pain of the right side of the head, neck, and arm, is almost invariably present, and a marked amount of venous turgescence and œdema.

Oppolzer, in his lectures recently edited by Stoffella,[1] attaches very great importance to a retardation of the carotid and radial pulses upon the right, as compared with those of the left side; and to a distension of the left jugular veins, and those of the arm, as very characteristic of innominate aneurism. The signs referred to by this distinguished physician would be of the utmost value, provided we could eliminate aortic complication —a not unfrequent cause of the phenomena; but since the lower portion of the innominate artery is included in his description, and as under such circumstances an accurate diagnosis is impossible, I hesitate to admit their value. Nor do I think the differential point indicated by Gendrin—viz., a double concussion-sound in innominate, and a single concussion-sound in carotid or subclavian aneurism, reliable; a sac upon any large

[1] *Vorlesungen.* Erster Band, S. 300. 1866.

artery, permeable, and partly filled with fluid blood, may engender double concussion-sound.

The ordinary situation of aneurism of the distal end of the artery has been alone referred to ; but it is true that some exceptional cases have occurred in which a pulsating tumour first appeared near the acromial end of the clavicle. But here the disease commenced at the cardiac end of the vessel, was generally loculated, and involved the aortic arch to a greater or less extent.

Carotid aneurism perhaps most frequently occurs near the point of bifurcation of the artery, and here of course no difficulty occurs in diagnosis ; but there are several recorded cases in which the origin of the vessel was the part engaged; and now embarrassment begins. In such a case, however, the sac generally ascends the neck and side of the trachea in the direction of the current, so that its long diameter is vertical. I can find no instance in which carotid aneurism distended the episternal hollow, and, unless I am in error, this fact would constitute a capital point in diagnosis. The state of the circulation, again, would now furnish evidence of the highest value. If the carotid pulse, at a higher point than the tumour, were weakened or suppressed, with a more or less disturbed state of the cerebral functions, while the right radial pulse remained unchanged, such signs would afford presumptive proof of the malady in question. We must not, however, lose sight of the possibility of the radial pulse being modified, even in this form of carotid aneurism, from direct pressure of the sac upon the subclavian artery.

Aneurism of the subclavian artery outside the scaleni, in its early stage, could hardly be confounded with any other form of external aneurism. The position of the sac, its shape, its long diameter transverse, the state of the radial pulse, the pain and œdema of the arm, would be distinctive. In a later stage the sac might even wear itself into the chest, and become embedded in the upper portion of the lung, but would hardly cross to the tracheal border. Subclavian aneurism limited to the intra-scalenal portion of the artery, if it ever occur, must be of extraordinary rarity ; and, as it might pass through the scaleni, ascend the neck, or pass into the chest, and affect the circulation both of the carotid and innominate arteries, would be impossible to reach by diagnosis. With regard to the value of the sphygmograph in this class of aneurisms, I would defer to the opinion of Dr. Anstie, who, as is well known, is a master in the use of this instrument. He has been good enough to examine all my cases, and will state how far its use may subserve the purposes of diagnosis.

It is, however, of very little practical importance, so far as the available resources of art are concerned, whether an aneurism involve the upper portion of the innominate, root of the carotid, or subclavian arteries ; but it is of importance in a prognostic point of view, inasmuch as an aneurism limited to the root of the carotid is much more likely to be benefited by these resources.

In all such aneurisms, both medical and surgical measures essentially aiming at lessening the impetus of

the blood-wave passing through the diseased structure, either by slackening the general circulation by some modification of Valsalva's method, or, by an agency acting between the sac and the capillaries, and this with or without a solution of continuity of the parts—pressure or ligature.

I do not dwell upon the process of malaxation of Sir W. Fergusson, or upon the reputed efficacy of certain drugs, as iodide of potash : of the first I have no experience to offer ; of the second I *can* say that its alleged power has yet to be more satisfactorily demonstrated.

In Brasdor's method of treating these aneurisms, there is nothing theoretically wanting to prevent success ; but practically it is most hazardous at times to carry the knife where the method is to be adopted in all its purity ; and almost equally hazardous, in Wardrop's modification, to leave open vessels so near the sac. Still, we must bear in mind that these operations are never matters of choice, but imposed on us by the necessities of the case.

But of *three* conditions we have to consider, and which must be satisfied before any aneurism can undergo a process of cure, this slackening of the current, however effected, is the only one over which we have any immediate medical or surgical control. How important is our power in this particular may be best estimated by studying the natural process of repair. It is the incontestable merit of the late Mr. Hodgson that he was among the very first to recognise the importance of this means. His work ought still to be our text-book, for

it is the most practical up to the present day, inclusive. Very few amendments, in a pathological sense, would be required, and these of minor importance, such as the nature of cysto-genetic aneurism, and the inculcation of the almost absolute necessity for the formation of a pure fibrinous coagulum. Although we have since learnt that an ordinary coagulum (the passive clot of Broca) may undergo stratification,[1] still it is clear that such a process is often an unmitigated evil. The clot may, and often does, redissolve, and débris pass into the general circulation—at the least losing all value as a hæmostatic barrier ; or it may, if large, act as a direct irritant, and induce both inflammation and suppuration within the sac.

The second condition demands that the blood should possess a given constitution ; and this, if originally defective (so far as we at present know), either chemically or clinically, can be but very imperfectly corrected. This aplastic quality of the blood, if we investigate the cause of death in many cases, will be found to have been, apparently, the sole impediment to cure.

The third requirement consists in a certain physical peculiarity and arrangement, so far as relates to the state of the orifice of the sac and the condition of its inner walls. If the mouth of the sac be wide, as in the crateriform aneurism, and the walls comparatively smooth, the formation of coagulum is much impeded ; but if the neck be narrow, and the walls roughened by calcareous or atheromatous deposit, it constitutes a

[1] Richet, *Nouveau Dict. de Méd. et de Chirg.*, p. 286 (Paris, 1865).

veritable straining chamber ; and then, the other conditions being present, the plasmine divides, allowing fibrin to settle, molecule by molecule, with that singular mode of adhesion and formation of laminæ—the most internal hyaline, the external still fibrillary—so well investigated and described by Robin in his "Lectures on the Normal and Morbid Fluids of the Body" (p. 161).

With respect to our treatment of these cases, I think we ought, from the very first, to enforce, with severity and persistence, a modification of Valsalva's method : by this is meant the most perfect rest, the restricted use of fluids, the occasional exhibition of saline aperients, the guarded use of digitalis and iron, iodine, and the local application of ice where it can be borne ; and we should additionally employ pressure, indirect, intermittent, or alternating and partial, either digitally or instrumentally. While adopting these measures, we should, *daily*, most carefully examine the condition of the sac ; if the general expansion become less marked, and the impulse decidedly less liquid, we should be content with their continuance, as placing the patient in the best condition for what does (and not very unfrequently) happen—a natural arrest of the disease. Should such measures clearly fail, we have no alternative left but to employ the knife. I would advise that the carotid artery be first tied ; here the anatomical relations are most favourable, no collateral branch directly intervening ; but here, for a time, we should stop. Few surgeons would now venture to tie the subclavian artery *within* the scaleni, and it is with

me a doubt (though possibly an unreasonable one) whether better results would follow ligature *without* the scaleni than those from partial and indirect pressure. If the artery is tied, and the collateral branches remain pervious, by a natural law they actively enlarge, and might soon permit the passage of such a current as entirely to disturb the repose essential to the formation of fibrinous coagulum, and undo all the good at first obtained. Indeed the operation is tolerably parallel with that at the groin, which we all know is notoriously unsuccessful. I am, however, very far from asserting that the vessel should not be tied as the last resource.

Thus far these aneurisms have been simply considered as existing *per se*, but the coexistence of disease of some portion of the aortic arch in nearly all is, I fancy, rather the rule than the exception; *and I am now anxious to put a question over which I have long thought—namely, whether such complication should in any way restrict our measures, or prevent our carrying out, with premeditation, that which we have hitherto done in ignorance of the precise nature of the affection.* Let us first interrogate the facts, and see whether they are of sufficient number and importance to warrant the attempt to generalise and use them. They have been commented on again and again, regarded as singular, but still left without any application.

The first case, and certainly one of the most interesting of the series, is recorded by Haller in his "Opuscula Pathologica" (p. 40), an engraving being

attached to show the morbid appearances. The body of a woman about fifty years of age was brought for dissection into the anatomical theatre. The ascending aorta was found dilated, and the entire arch converted into a large sac. Beyond, the vessel was normal. Upon opening it, some recently coagulated blood occupied its centre, but the sac itself was densely filled with firm, white, laminated tissue resembling membrane; the innermost layer, six lines in thickness, adhered so firmly to the lining membrane that it might have been mistaken for part of the arterial coat. The same dense membrane extended continuously up the trunk of the left common carotid artery, completely obliterating it, and so firmly adherent as to be with difficulty detached by dissection; it also passed up the external carotid to the commencement of the labial artery. The internal carotid artery, smaller and contracted, was also filled by an extension of the membrane as far as the foramen of the petrous portion of the temporal bone. The right carotid artery and jugular were pervious, but a considerable extent of the left jugular vein was entirely plugged with the same substance.

The second case is from Pelletan,[1] whose experience in aortic aneurism was very considerable. A physician of the Faculty had an aneurismal tumour of the form and size of the smaller half of a hen's egg, situate above and behind the right clavicle, near the sterno-clavicular articulation; the impulse was enormous, and was supposed to be connected with the arch of the

[1] *Clinique*, tom. i, p. 82.

aorta. Pain, regarded as rheumatic, preceded the appearance of the swelling. Valsalva's method, and the application of ice, greatly reduced the size of the swelling, and abated the pain; but the patient refused to continue the treatment, and, some months later, died from pain and impeded respiration. The external tumour had increased by one-half. On dissection, the sac was found to arise from the summit of the arch involving the innominate and right carotid arteries. Pelletan adds,—"I know not why this situation of an aneurism appears to me more favourable to cure than any other; possibly the obliteration of the carotid might, by forming a cul de sac, have checked the progress of the aneurism."

The next two cases are quoted by Velpeau.[1] A man was admitted into the hospital at Amsterdam with an aneurismal tumour extending above the sternum. Tillanus, supposing the case to be one of aneurism of the left carotid, tied this artery a little higher up. The patient recovered. Five months subsequently he died suddenly. The aneurism occupied the arch of the aorta, and was completely filled with fibrinous clot. The specimen is still in the anatomical museum. In the second case, the aneurism occupied a similar position, and was on the point of bursting. Taking the case to be one of aneurism of the left carotid, Rigen, of Amsterdam, tied the artery a few inches higher up, on the 21st of February, 1829. All the more serious symptoms disappeared, and the size of the tumour considerably diminished. It was necessary to operate for

[1] *Méd. Opératoire*, tome i, p. 307 (Bruxelles, 1840).

strangulated hernia on this man on the 9th of May following, but on the 13th of the month he died, with symptoms resembling those of asthma. *Post mortem* examination showed the sac to occupy the arch of the aorta between the innominate and left carotid arteries. It was filled with solid, fibrinous clot, and very considerably diminished in size.

The following case occurred in a patient under the care of Mr. Montgomery, of the Mauritius. A negro, about forty years of age, was admitted into hospital on Feb. 20th, 1829, for an aneurismal tumour the size of a pullet's egg, situated immediately above the sternal end of the left clavicle, and so close to that bone that it seemed to emerge from behind it, or rather from within the cavity of the chest. The tumour rapidly increased until the 9th March, when it had acquired an alarming size, the base occupying the space of two-thirds of the sternal end of the clavicle, and ascending nearly four inches upwards to the angle of the jaw. Under the impression that it was a case of aneurism of the left carotid artery, Mr. Montgomery tied the vessel above the sac, as recommended by Mr. Wardrop; and the tumour rapidly diminished in size. The patient died on July 11th. It was found on *post mortem* examination that a mistake in diagnosis had been made. An aneurism, the size of an orange, occupied the arch of the aorta between the innominate and left carotid arteries. The orifice of the sac was firmly closed by organised coagulable lymph, which completely prevented any blood passing from the aorta to the sac; the left carotid was plugged by the same

matter, and the right carotid much enlarged. Unluckily, inflammation and suppuration had occurred at the upper part of the sac, and ultimately extended to the pericardium.[1]

The last case I shall cite is extracted from Robert's essay "On Aneurisms of the Subclavian Region." A woman, sixty-three years of age, had a large aneurismal tumour occupying the site of the left sterno-clavicular articulation, and greatly embarrassing the breathing. Colson, of Noyon, diagnosed aneurism of the left carotid, and tied the artery above the sac; gradual diminution of size and pulsation of the tumour occurred, but these never completely disappeared. This patient recovered, and was alive some years after the operation. Now, I would say of this case, that there is no recorded evidence to show that it might not have been an aneurism of the aorta, especially when we find that an aortic sac so much more frequently ascends in the locality described.

Reference might also be made to the interesting cases of Dr. Davies and Mr. Maunder, but I will not trouble you with further citations. If those referred to do not establish my position, nothing further would enforce the argument.

Now, these results, so far as they go, cannot be said to contrast unfavourably when confronted with those obtained from operations for aneurisms of the innominate and root of the subclavian arteries; *and I again ask whether in a case of aneurism of doubtful origin, or even with the conviction that the tumour springs*

[1] Guthrie, *Diseases, etc., of Arteries*, p. 190.

from the upper wall of the aortic arch, we may not be justified in affording the patient a chance by the ligature of the common carotid artery? How such ligature acts — whether by causing some "diversion" difficult to explain, or by producing some further modification in the membrane of the already diseased sac, one or both,—the facts remain; and, although there may be risks—risks of undue inflammation of the sac, of suppuration, of disintegration of the clot, of hæmorrhage, or even of cerebral disturbance,—we must not balance contingent against a certain peril, for risks like these pertain to every case we have considered. Again, it may be urged that rupture of the sac may occur, despite the operation. But this objection applies to every case we treat. It is one which we cannot forestall, and for which the ligature is in no sense responsible.

In desperate cases like these a doubtful remedy is better than none; and, while painfully conscious of the doubt, for we never can very firmly rely upon any modification of Brasdor's method, *the practical question for us to determine is, whether by the employment of such a measure we have an equally reasonable hope, if not of saving, at least of prolonging, the life of the patient, as we should have in cases free from the aortic complication.*

ON THE CONNEXION BETWEEN

OCCLUSION OF THE LEFT COMMON CAROTID ARTERY & THE EXISTENCE OF LAMINATED CLOT IN THE SAC OF AORTIC ANEURISM.

To the Society[1] I have the honour of addressing, I feel that a communication on the worn subject of aortic aneurism would probably awaken a scarcely more than passing interest, were it not redeemed by an embodiment of the results of the impulse given of late in Italy (particularly), in Russia, and to some extent in this country, in matters of moment as regards its treatment. Indeed, with a pathology well-nigh exhausted, it is in the direction of treatment alone that the future road of promise lies.

It is an admitted truth, however rare and exceptional a one, that aortic aneurism does undergo spontaneous cure, and equally a truth that the process through which such cure results is known—and known as one not of restitution, but of substitution. The inquiry, therefore, whether any means other than those in common use to induce such process can, under given circumstances, be employed, is a perfectly legitimate one; and provided a reasonable probability of success can be thereby ob-

[1] Read before the Medical Society of London, on October 28th, 1872.

tained, our bounden duty is, I conceive, to try them. To support this proposition, no testimony, more authoritative or encouraging, could be adduced than that of the late Professor Porter, of Dublin. In his work on aneurism,[1] he remarks—"Still, the disease is of such a dreadful nature, and its results so fatal, that no chance should be rejected of discovering some means of arresting its progress; and perhaps by unwearied diligence and repeated trials we may arrive at some means of mitigating so serious an evil."

In a paper read before this Society on March 1, and published in the *Lancet* April 16, 1869, I believe that I was the first formally to propose the ligation of the left carotid artery as an extreme measure, with the direct intent of arresting the progress of pure aortic aneurism. I may further state that, conjointly with Mr. Heath, I was the first also to bring the proposal to the test. I say as an extreme measure, for if after failure of all the means supposed by art remedial—and this how often?—the sac should still increase and threaten to give way, must then our active duties merge into a mere passive watching the result, or dare no other means be tried? To desperate conditions desperate measures must apply; and if ever the *anceps remedium* found a justification, it is here. And this is why, from time to time, some daring efforts have been made to rescue these cases from the charge of utter hopelessness under which they labour. Such measures as the introduction of iron wire into the sac,

[1] *Observations on the Surgery, Pathology, and Treatment of Aneurism*, Part 1, page 85.

or the injection of perchloride of iron, are scarcely likely from their results to attract many imitators. The distal ligature of the left carotid artery is now on its trial—it may be to share a similar fate; but the verdict must rest in the hands of the future, for the actual results cannot be ignored.

The results obtained from the use of galvano-puncture by Ciniselli,[1] the distinguished physician of Modena, must not be passed by. His paper is far too long for me to attempt to analyse, but it deserves the most careful study. His recent experience is much more favourable than the earlier essays. Of these no permanent cure resulted. In the former, of fifteen cases five are stated to have been cured. He admits frankly that what he terms "unfavourable conditions" for the use of the agent are most frequently met with in practice. I fear that his "favourable conditions" are rare; but at the same time can well believe that a flagon-shaped false sacculate aneurism, in which a sluggish current circulates, may be consolidated by the process.

To my mind the principal drawbacks to galvano-puncture are these—The sac may rupture at its posterior face; it can be of no avail in secondary sacculation not advancing to the surface; the galvano-albuminous clot may redissolve, and give rise to embolism, with its train of ills; and, lastly, the sac may yield in the interval recommended—at times some weeks—between each application of the current (page 392). In stating these objections, however, I

[1] *Annal. Univer. de Medicina.* Griffini. December 1870.

must not be understood as wishing in any way to underrate the general value of the thoroughly good and able work of the Italian physician ; with more perfect instruments of precision, more satisfactory results may be yet obtained and other measures superseded. To return to my more immediate subject matter, if the plan I advocate is really to constitute an addition to our knowledge, it takes its root in the experience of the past, and it is from this experience that the material is to be selected to furnish the proof sought. The question is one of pure observation, and quite independent of any *a priori* reasoning. The great point to determine (considering the gravity of the issue involved) is whether the successive links in the chain of evidence are sufficiently strong to warrant the conclusion—in other terms, whether the facts are adequate. Such as they are, I now submit them. They are, however, weighted with the consciousness of the imperfect manner in which I have executed this portion of my task. This defect has arisen in part from the restriction of time, but mostly from the neglected mention of the condition of the artery in many of those recorded cases in which either a cure took place or the aortic sac was found unruptured and filled with laminated clot.

The cases may be divided into those in which the occlusion of the artery, coinciding with the formation of laminated clot, has been effected by a natural process, and into those in which such conjunction has been the result of an artificial process. A further subdivision may be made of the first class into cases where the

aneurism has been permanently cured, the subject dying of other disease, and into those in which death has resulted from tracheal or other pressure. The second class would embrace those cases in which clot has been formed in the aortic sac from the ligation of the carotid artery, though tied with indirect intention, and into those in which the artery has been tied with the direct intent of inviting its formation.

The first case of the first series I can adduce is the remarkable one recorded by Haller,[1] with a plate attached showing the morbid appearances. The body of a woman, about fifty years of age, was brought into the anatomical theatre for dissection. Upon opening the thorax an old and cured aneurism was found. The ascending aorta was dilated, and the entire arch converted into a large sac. Beyond, the vessel was normal. The centre of the vessel contained much coagulated blood, but the sac itself was densely filled with firm, white, laminated tissue, resembling membrane. The innermost layer, six lines in thickness, adhered so firmly to the lining membrane that it might have been mistaken for part of the arterial coat. But Haller writes—"We were much more surprised to find that this membrane was prolonged into the left carotid artery alone, and not into any other of the arterial trunks." It was white, soft, but tough, completely obliterating the canal of the vessel, and so firmly adherent to its walls as to be with difficulty detached by dissection. . . .

[1] *Opuscula Pathologica, Lausannæ.* 1755. Obs. xix, page 38.

A second case of old-cured aneurism is referred to by Dubreuil.[1] Treating of these cases he states—"But if the aneurismal sac is limited to a portion of the vessel without involving its totality, we cannot refuse to admit the possibility of spontaneous cure—that is to say, that the accumulation of fibrinous coagula in the sac may form a kind of artificial wall or barrier against the blood, and permit the main stream to course onwards in the aorta." We may be permitted to recall here the description of a preparation of which the history is recorded in the *Journal of Medical and Surgical Sciences* of Philadelphia for November 1826. The preparation shows the remains of an aneurism of the upper wall of the aortic arch, the inferior wall remaining sound. . . . The sac of the aneurism itself is filled with extremely dense laminated coagulum, consisting of numerous layers. The innominate artery emerges from the exuded fibrine lining the surface of the aneurism. This vessel is contracted to the point of obliteration of its canal. The left carotid artery, filled by a coagulum, gradually decreases in size to its division. The right and left inferior thyroid arteries, enlarged in volume, establish by their anastomoses communication with the right subclavian, thus compensating, during life, the defect of circulation in the innominate artery.

Sir Astley Cooper[2] mentions (briefly enough, it is true) a case of aneurism of the arch of the aorta in

[1] *Observations et Reflections sur les Aneurysmes de la Portion Ascendante et de la Crosse de l'Aorte.* 1841. P. 176.

[2] *Medical and Chirurgical Transactions.*

which death occurred with the sac unruptured. "The left carotid artery was found obliterated as far as its terminal division."

The following case, also in the second series, is narrated by Pelletan,[1] who, it is well known, carried out with great severity the plan of Valsalva :—A female, aged thirty-two, was attacked, in January 1801, with severe catarrh followed by pain in the left shoulder-joint, extending first to the clavicle and back of the ear ; subsequently to the entire left side of the chest, much embarrassing the respiration. In the following October, after great mental excitement, the symptoms increased, and shortly after she discovered a small pulsating tumour below the right clavicle. The treatment of Valsalva was now adopted, and apparently with signal benefit. After many changes in the character of the malady, and the appearance of a swelling below the left clavicle attended with slight impulse, and later by another, death occurred in August 1804 (three years and eight months after the advent of the symptoms), the apparent result of intractable diarrhœa, cough with excessive purulent expectoration, and emaciation progressing to the extremest degree.

Post mortem examination revealed false sacculate aneurism of the arch of the aorta, which had occasioned some absorption of the superior portion of the sternum. It almost completely filled the left cavity of the thorax, crowding back the lung, which was condensed and tuberculous. In the substance of this latter organ a cavity existed, containing blood which apparently

[1] *Clinique Chirurgicale*, Paris, 1810, p. 60.

had simply oozed through the coagula of the largest sac. The coagulum in the sac was white and laminated, about an inch and a half in thickness at the anterior part of the sac, and weighed about a pound and a half. The left carotid artery was flattened and occluded. Above the occlusion the canal was filled by a coagulum extending to its terminal division.

The next case is from Cruveilhier.[1] It is too long to detail, but its more salient points are as follows :— A cooper by trade, aged sixty-eight, of vigorous constitution, but addicted to great excesses, felt a tumour at the upper part of the chest about two years before he came for advice. Prior to its appearance the health was good, without any symptoms either of oppression or palpitation. Duméril diagnosed aneurism of the arch of the aorta. In the two years which elapsed between the appearance of the tumour and his death he was examined many times while still continuing his irregular habits. He died eventually with symptoms resembling those of pernicious algide fever. The aorta was dilated from its origin ; a very large false sacculate aneurism of the arch existed, commencing at the left of the innominate artery ; another sac, much smaller, was found beyond the origin of the left subclavian artery. The aneurism of the arch was filled with fibrine, arranged in numerous concentric layers, and evidently formed at different periods, the most ancient so dense that they might have been confounded with the wall of the sac itself. The left common carotid artery sprung from the sac ; it was completely ob-

[1] *Atlas de l'Anatomie Pathol.*, liv. III, planche iv.

literated by a very dense semi-transparent plug intimately adherent to the arterial walls. A second case is recorded by Cruveilhier,[1] occurring in a dissecting-room subject, concerning whose antecedents no particulars were known. Death had evidently occurred from tracheal pressure. The aorta, after leaving the pericardium, was dilated into a spheroidal pouch, extending upwards, still enlarging and acquiring enormous dimensions in every direction. This vast tumour presented above two prolongations—one bearing to the right, formed by aneurismal dilatation of the entire innominate and origin of the right subclavian arteries; the other, a false sacculate pouch crossing the trachea to the left, the limit of the sac being the inner wall of the left subclavian artery, which, together with the carotid, was free from dilatation. The portion of the ascending aorta forming the spheroidal pouch was simply dilated; the coats of the vessel were intact, though thickened by numerous cretaceous and cartilaginous patches. This portion was free from coagulum, but the walls of that portion of the aneurism of secondary formation crossing to the left were thin and mottled in colour, as if about to yield. All this portion of the aneurism was filled with adherent and laminated coagulum. The right carotid artery was perfectly patent; the canal of the right subclavian was patent to its dilated mouth, which was completely closed. The left subclavian artery was perfectly normal; but the canal of the left carotid artery, which alone arose from the left portion of the sac containing laminated coagu-

[1] *Traité de l'Anat. Path.*, t. ii, p. 763.

lum, was completely obliterated and its origin contracted.

Dr. Holland, in his essay upon "Aneurism of the Innominate Artery", quotes the following case as occurring in the practice of the late Dr. Hughes :— "A man, aged forty, had suffered from cough for five years. Six months ago a pulsating tumour was detected above the right sterno-clavicular articulation. When seen by Dr. Hughes he presented all the signs of innominate aneurism, with consolidation of the upper lobe of the right lung. The tumour disappeared, and never again could be discovered. The patient lived four months after, and died from dysphagia and tracheal pressure. In the centre of the right lung an irregular cavity was found. One aneurism arose from the right side of the innominate artery; a second aneurism, about the size of a hen's egg, sprung partly from the left side of this vessel, and partly from the aorta pressing on the trachea; a third aneurism, about the size of a walnut, arose to the left of the subclavian artery. The ascending aorta was enlarged and diseased. The right subclavian artery was enlarged; the right carotid normal. The left carotid was very small, and its mouth completely closed. The origin of the left subclavian was recently but entirely closed by pressure of the third aneurism."

In the *Transactions of the Pathological Society*, 1870, a case is recorded by Mr. Sidney Jones, which, for present purposes, may be thus summarised :—A seafaring man, aged 32, had suffered from chest symp-

toms for two years. During the last year a swelling of the left clavicle appeared, and then shifted its position. No pulsation in the left axillary, brachial, or radial arteries could be felt. The left carotid artery seemed to have a diminished current passing through it. Considerable impulse existed behind the left sterno-clavicular articulation. *Post mortem* examination revealed an immense aneurism of the arch of the aorta, measuring five inches horizontally and vertically. It had partially absorbed both sternum and clavicle in front, and posteriorly extended to the vertebral column. The sac was completely filled with laminated coagulum. The innominate artery was patent, but the left carotid and subclavian arteries were compressed and filled with adherent clot. Treating of the aneurismal swelling, Mr. Jones observes—"The latter also became less evident, from less distension of the sac, and from the vessels taking origin from it being obstructed."

The second division includes those cases in which deposit of laminated clot has taken place in an aortic sac from ligature of the left carotid artery, although done with indirect intention.

For a record of the first two cases we are indebted to Velpeau.[1] A man was admitted into the Hospital at Amsterdam with an aneurismal tumour extending above the sternum. Tillanus, supposing the case to be one of carotid aneurism, tied this artery a little higher up. The patient recovered. Five months subsequently he died suddenly. The aneurism occupied the arch of the aorta, and was completely filled with

[1] *Méd. Opératoire*, tom. i, p. 307.

fibrinous clot. The specimen is still in the anatomical museum.

In the second case the aneurism occupied a similar position, and was on the point of bursting. Taking the case to be one of aneurism of the left carotid, Rigen, of Amsterdam, tied the artery a few inches higher up—February 21, 1829. All the more serious symptoms disappeared, and the size of the tumour considerably diminished. It was necessary to operate for strangulated hernia on this man on May 9 following, but on the 13th he died, with symptoms resembling those of asthma. *Post mortem* examination showed the sac to occupy the arch of the aorta, between the innominate and left carotid arteries. It was filled with solid fibrinous clot, and very considerably diminished in size.

The following case occurred in a patient under the care of Mr. Montgomery, of the Mauritius :—A negro, about 40 years of age, was admitted into the hospital February 20, 1829, for an aneurismal tumour the size of a pullet's egg, situate immediately above the sternal end of the left clavicle, and so close to the bone that it seemed to emerge from behind it, or rather from within the cavity of the chest. The tumour rapidly increased until March 29, when it had acquired an enormous size, the base occupying the space of two-thirds of the sternal end of the clavicle, and ascending nearly four inches upwards to the angle of the jaw. Under the impression that it was a case of aneurism of the left carotid artery, Mr. Montgomery tied the vessel above the sac, as recommended by Mr. Wardrop,

and the tumour rapidly diminished in size. The patient died July 11. It was found on *post mortem* that a mistake in diagnosis had been made. An aneurism the size of an orange occupied the arch of the aorta between the innominate and left carotid arteries. The orifice of the sac was firmly closed by organised coagulable lymph, which completely prevented any blood passing from the aorta to the sac; the left carotid artery was firmly plugged with the same matter, and the right carotid much enlarged. Unluckily, inflammation and suppuration had occurred at the upper part of the sac, and ultimately extended to the pericardium.

Robert[1] cites this case:—"A woman, aged 63, had a large aneurismal tumour occupying the site of the left sterno-clavicular articulation, and greatly embarrassing the respiration. Colson, of Noyan, diagnosed aneurism of the left carotid, and tied the artery above the sac; gradual diminution of the size and pulsation of the tumour occurred, but these never completely disappeared. The patient recovered, and was alive some years after the operation." Now, as I have hinted in a prior memoir, this case may fairly be considered to involve an element of doubt. The great dyspnœa, if not caused by external tracheal pressure (which is not mentioned), in all probability arose from pressure within. But aneurism of the intra-thoracic portion of the carotid (if such a case ever occurred) could by no possibility be diagnosed from aortic aneurism. Again, aneurism of the left is far less common

[1] *Essai sur les Anev. de la Région Subclav.*

than that of the right carotid, and far more common at its distal than its proximal end ; remembering, also, how very common it is for an aortic aneurism to ascend the neck in this locality, and warned by the error of diagnosis in all the preceding cases, it is possible that this was a case of aortic aneurism cured by ligature of the left carotid artery.

Pirogoff, the famed Russian surgeon (whose cases I am compelled to mention second-hand, having had no opportunity of consulting the originals), tied the left carotid artery in three cases of aneurism at the base of the neck, in all of which the arch of the aorta was known to be largely involved. Two of the cases were cured, although some pulsation still existed ; the third case proved fatal from cerebral embolic softening.

The last case to mention is the one in which the carotid artery was tied for pure aortic aneurism, diagnosed as such.

As it is published in the current volume of the *Transactions of the Clinical Society* it is unnecessary to refer to it here, unless to add that the man keeps fairly well and capable of doing work.

With respect to the cases of Tillanus and Rigen, Broca[1] regards the ligation of the artery and the deposition of fibrine in the aortic sac as a "pure coincidence" ; and Mr. Holmes, in his "Lectures on Aneurism,"[2] states that they prove nothing definite. In their isolation it might be so ; but, looking to the collocation of the facts, we seem to catch glimpses of a

[1] *Traité des Anevrysmes*, p. 652.

[2] Lecture III, p. 11.

truth that something bordering on law prevails. The cases offer, as it were, a crucial test. Looking to those of the first series, where Nature fills the sac, they indicate a way to Art ; while if Art seek a justification for her measures, she points to Nature as her guide.

Viewed, however, under a less obtrusive aspect, if it were conceded that some causal relation may exist between the occlusion of the artery and the clotting in the sac, we naturally seek the proximate causation. I do not undertake the difficulty of the solution. We do not see those agencies in action which are generally considered indispensable to the formation of fibrinous deposit. It can hardly be considered in such cases that any slackening of the blood-stream can be a direct result of the operation so as to be at all operative in determining the formation of the clot. I could not assert that in my case the earliest sign of consolidation was in the immediate vicinity of the carotid mouth. From the most careful observation I could make, the impulse seemed to lessen, so to speak, all along the line of the aneurism, and seemingly to commence at the cardiac end. What part "diversion" of the current may play in the matter is difficult to conceive. There would appear only left to consider some special affinity between a plastic state of the blood and a plastic state of the wall of the sac. Notwithstanding all that has been said of late,—notwithstanding the able advocacy of Richet[1] as to the fitness of ordinary coagulum to harden *masse*, and more or less gradually to laminate and

[1] *Nouveau Dict. de Méd. et Chir.*, p. 286.

adhere,—there still lurks a suspicion that such a clot wants the essential attribute—perdurability. It is, I believe, the teaching of the schools in these kingdoms that the "fibrinous coagulum" of Petit, Hodgson, Bellingham, Robin,—the "active clot" of Broca,—where the fibrine is deposited in a gradual and almost molecular condition from the blood, is still the most perfect mode of cure in these affections. In what the special condition of the sac-wall, other than its roughness, consists is yet matter of controversy. They who are specially interested in the inquiry should, if they have not, peruse the report of a very animated discussion on this matter at the Anatomical Society of Paris, and published in its bulletin for November 1865.

I will conclude with a passing allusion to the possible accidents from the operation. That from secondary hæmorrhage would probably be reduced to a minimum by the employment of the carbolised catgut ligature. Pyæmia from venous thrombosis does not appear. Perhaps the chief danger is from cerebral anæmia. This result occurred, as has been stated, in one of Pirogoff's cases, and is the only one recorded among those I have submitted. Here, as in every case in Surgery in which a ligature is applied in the continuity of an artery, immunity from anæmia and its results depends mainly upon the rapidity and sufficiency with which the collateral circulation is established. But this is a risk that must be chanced, and does not appear sufficiently serious to contraindicate the operation.

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