ON
A CASE
OF
ABDOMINAL ANEURISM
CURED BY
COMPRESSION OF THE AORTA.

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Received April 2nd—Read April 9th, 1872.

THERE are comparatively few maladies recognisable during life which are less amenable to treatment, and more certainly fatal in result, than aneurisms of the aorta, and its primary or visceral branches.

We therefore venture to think that the following details of a case in which we have recently succeeded in curing an abdominal aneurism by compression of the aorta are sufficiently interesting and important to merit the attention of the Fellows of the Royal Medical and Chirurgical Society; and the more so because, so far as we have been able to ascertain, this is the second case only of the kind in which a similar method of treatment has been followed by similarly successful results.

The first case occurred in the practice of Dr. Murray of Newcastle-upon-Tyne, to whom is due all the credit of having initiated the method of treatment we have adopted. The particulars of Dr. Murray's case were communicated to this Society by the late Mr. Charles Moore on the 24th May, 1864. Six years subsequently to the cure of the aneurism the patient died; and the case was rendered complete by a careful post-mortem examination, the details of which have been published by Dr. Murray in an interesting and able, though brief essay on 'The Rapid Cure of Aneurism by Pressure.'¹

The patient whose history we have now to narrate presented himself among Mr. Durham's out-patients at Guy's Hospital on the 2nd August, 1871. He was a comparatively healthy-looking young man, twenty-seven years of age, single, and a plasterer by trade. He had been accustomed to drink hard, but so far as could be ascertained had never suffered from syphilis. In his daily work he had been in the habit of frequently stooping and raising himself more or less suddenly, and sometimes under considerable strain. Six months previously he had begun to suffer from aching pains about the lower dorsal region occasionally extending round the abdomen. Pains were also felt down the front of the left thigh and leg. These pains gradually increased in severity, and becoming more or less constant prevented him from sleeping at night. After a time he noticed a "pulsation" in his abdomen.

On examination, the existence of an abdominal aneurism of considerable size was at once recognised. The pulsation and swelling were manifest to the eye as well as to the touch.

The patient was recommended for immediate admission to the hospital, and was placed under the care of Dr. Moxon in the Clinical Ward.

On subsequent and more careful examination it was found that the aneurism could be distinctly felt over a space extending from rather less than an inch below the cartilages of

¹ 'The Rapid Cure of Aneurism by Pressure,' illustrated by the case of Mark Wilson, who was cured of Aneurism of the Abdominal Aorta in the year 1864. By William Murray, M.D. J. & A. Churchill, London, 1871.

the false ribs to the level of the umbilicus, and from the right of the median line to about midway between the median line and the left border of the abdomen, or rather further. The aneurism pulsated strongly, but the pulsation could be controlled and even entirely arrested by deep digital pressure. There was no tenderness of the surrounding parts; but much manipulative examination gave rise to considerable pain.

The patient was kept in bed and perfectly at rest for eleven days. Very sparing diet only was allowed; and pills of acetate of lead and opium were administered every six hours with the view of diminishing the desire for food.

On the morning of the 14th August, the patient having fasted since the previous evening, chloroform was administered, and Mr. Durham proceeded to compress the aorta above the aneurism by means of what is known as Lister's abdominal tourniquet.¹

By positioning the body of the patient just sufficient space was afforded for the introduction of the pad of the tourniquet between the cartilages of the ribs and the aneurism. The tourniquet was adjusted and screwed down *very slowly* until the pulsation of the aneurism was completely arrested; but the greatest care was taken to exert no more pressure than was absolutely requisite. The pulsation of both femoral arteries was of course also entirely arrested. In order to guard as far as possible against any ill effects from the suspension of the supply of blood, the lower extremities were enveloped in cotton wool and flannel, and hot water bottles were placed in the bed.

The patient was kept under the influence of chloroform, and the pressure was absolutely maintained, for ten hours and a half. At the end of that period the general condition, as indicated by the pulse and respiration, was such as seemed to render it desirable to discontinue the treatment.

On removing the tourniquet it was found that the aneurism no longer pulsated. It was manifestly smaller and harder than before the application of the pressure. The

¹ The merit of inventing and first applying this instrument is due to the American surgeon Pancoast.

surface of the skin upon which the pad of the tourniquet had pressed was of a bright red colour. No pulsation of either femoral artery could be detected. The lower extremities when uncovered and exposed for examination were found to be cold and clammy to the touch, and presented here and there irregular livid or palish purple patches of discoloration. It is worthy of note, however, that at the end of the treatment the extremities appeared less cold, and the patches of discoloration were fewer and smaller than they had been found to be when examined during the progress of the compression at a comparatively early period.

In the course of a short time pulsation of the aneurism was again distinctly recognised. But it was very much feebler and altogether different in character to the strong full pulsation which was so manifest before the commencement of the treatment.

A little nourishment and stimulus and a full dose of opium were administered. After this the patient slept, and passed a comfortable night.

The next day the aneurism was smaller, much harder, and less compressible than it had been. But it still pulsated in a marked degree. Pulsation of the femorals was scarcely if at all perceptible. The right foot was cold, the left of almost normal temperature. Sensations of tingling and slight numbness were experienced by the patient; but sensibility to touch was almost re-established. The portion of skin which had been immediately in contact with the pad of the tourniquet presented a bruised appearance. It was of a deep livid red colour, and was exquisitely tender to the touch. The patient suffered from no *internal* pain or tenderness whatever, nor could any indication be detected of visceral disturbance or mischief as the result of the long-continued and severe pressure. During the early part of the night there had been some slight retching and vomiting; but these symptoms ceased altogether before morning and did not recur. The only obvious ill effects of the prolonged administration of chloroform that remained was some slight degree of inflammation of the conjunctivæ. This probably was accidental;

at any rate it very soon subsided. During the day the patient continued in every respect far more comfortable than might have been expected. Indeed it seemed somewhat strange that such severe treatment should have been followed by such marked absence alike of local suffering and general constitutional disturbance. The patient was disposed to sleep. This, however, was doubtless owing to the effects of opium which was administered at intervals in small doses. The pulse was weak, and varied in frequency from 100 to 110.

The day following the local and general conditions remained much the same. But it was especially noted that though the pulsation of the right femoral artery had become more distinctly perceptible than that of the left, yet the right foot was manifestly colder than the left, and the patient experienced a much more marked sense of tingling and numbness in the right than in the left foot.

Tincture of the perchloride of iron and tincture of digitalis, of each ten minims, were ordered to be taken every three hours.

It would be tedious, and is altogether unnecessary, to continue the daily report of the case. No bad symptom of any kind arose; but the pulsation of the femorals which had returned to some slight extent soon ceased altogether to be perceptible. The condition of the aneurism varied somewhat from day to day. The pulsation was sometimes more, sometimes less distinctly felt; but it was manifest that good and certain progress was being made.

At the end of a fortnight the aneurism was not only much smaller, and harder, and feebler in pulsation, but such pulsation as remained could be arrested with great ease by digital pressure upon the aorta. This being the case the question was raised as to whether it would not be well to apply the tourniquet again, or to keep up digital pressure for some short time, in order to complete the cure with as little delay as possible. On consideration, however, we decided that it would be better to avoid incurring the risk (slight though it might be) involved in any repetition of severe measures, and

to wait, at any rate, until more time had been allowed for the setting and organisation of the clot in the interior of the aneurismal sac, and the induration and contraction of the surrounding tissues. It cannot be doubted that these are essential elements in the process of cure of an aneurism, nor that they require a more or less considerable period of time for their full development and working.

The result justified our decision in favour of delay. The aneurism became more and more consolidated, and gradually diminished in size. The pulsation became less and less easily recognisable, until rather more than a month after the application of the pressure, when it ceased altogether to be perceptible. During the whole of this period and for some weeks subsequently the patient was kept absolutely in bed. His only complaint was of tingling and sensations of coldness and numbness about the lower extremities, and especially about the right foot. These symptoms varied greatly in intensity from time to time, but they gradually became less and less troublesome. There still remains, however, some degree of discomfort about the right foot. The limbs were kept well wrapped up, and manual friction was regularly employed to favour the restoration of the circulation.

During the last three or four months the patient has been up and walking about and freely taking moderate exercise. He has not yet been permitted to return to work, nor would it appear desirable that he should resume for some time to come his former laborious occupation. His general health has been good throughout, far better indeed than it had been for many months previous to his admission to the hospital.

He is presented for examination to-night.

It will be found that the remains of the aneurismal tumour can be distinctly felt. So far as we are able to judge this tumour does not pulsate at all; but a certain impulse is communicated to it by the portion of the aorta which remains pervious.

Occasionally of late we have thought we could detect slight pulsation of one or other femoral artery, but at other times no trace of such pulsation has been perceived.

The anastomosing vessels by which the collateral circulation is carried on cannot at present be distinctly made out. It is probable therefore that the deeper vessels are still principally employed; and that those superficial branches which commonly play so important a part in maintaining the circulation after obstruction of the main trunks of the lower part of the body, have not as yet become fully enlarged.

Slight traces of the effects of the pressure on the skin may still be seen. They serve to mark the spot upon which the pad of the tourniquet was applied.

Remarks.—The case thus recorded, especially if considered in conjunction with the similar case already alluded to as published by Dr. Murray, appears to us to prove beyond probability of dispute—

First, that in some instances, at any rate, it is practicable to apply mechanical pressure to the upper part of the abdominal aorta to such an extent as to completely arrest the onward flow of blood, and at the same time in such a manner as to inflict no serious injury whatever on the visceral or other structures.

And, secondly, that in certain cases, under favorable conditions and circumstances, mechanical compression of the abdominal aorta may be safely continued during a period sufficiently long to permit such changes to take place in the contents of an aneurismal sac, and in the course of the circulation generally, as may lead to the speedy or ultimate cure of the malady, even though some part of the aorta itself, or one or other of its large primary branches, may have been affected.

We therefore have no hesitation in expressing our opinion that in cases of abdominal aneurism, in which the application of the method appears practicable, careful attempts should be made to compress the aorta on the proximal side of the aneurism.

It must be at once admitted that cases in which this method is applicable are comparatively rare. Nevertheless they do occur from time to time; and indeed we have at the present time under our care in Guy's Hospital a second

case in which we intend to carry out the same line of treatment we have found so successful in our first.

By far the largest proportion of abdominal aneurisms occur at or about the origin of the cœliac axis, or in connection with this trunk or one of its branches.¹ Now in any such case it would in all probability be absolutely impossible to apply pressure on the proximal side of the aneurism.

But, although of much less frequent occurrence, aneurisms of the aorta about the origin of the inferior mesenteric artery as well as of the inferior mesenteric itself are occasionally met with. In the case published by Dr. Murray the aneurism which had been cured was proved on post-mortem examination to have occupied the lower part of the aorta and to have involved the origin of the inferior mesenteric; and in the case which forms the subject of our present communication there appears reason to believe that the aneurism was similarly situated and connected.

In any such case, provided it is undertaken before the aneurism has attained too large a size, it is probable that room may be found for the application of the pad of the tourniquet between the cartilages of the ribs and the aneurism. As the tourniquet is screwed down the pad will pass to some extent, as it were, under cover of the rib cartilages, and even apparently round the border of the aneurism.

With regard to aneurisms occurring about the middle of the abdominal aorta, or in connection with the origin or trunk of the superior mesenteric artery, it is difficult to form any *à priori* opinion as to the probability of their admitting of the method of treatment under discussion. We may say, however, that we believe that in the case to which we have referred as being at present under our care, the aneurism is connected with the superior mesenteric artery. Though not so large, it is decidedly higher up in the abdomen than the aneurism in our first case; and further, it is capable of being moved bodily across from the left to the right side of the

¹ Such is stated by Dr. Sibson to have been the case in no fewer than 131 out of 177 instances of abdominal aneurism analysed by him. 'Medical Anatomy,' by F. Sibson, M.D., F.R.S., pp. 57, 58.

median line. In this case Mr. Durham succeeded on two occasions last week in experimentally arresting all pulsation of the aneurism by digital compression of the aorta. Yesterday, however, he found it impossible to apply the tourniquet in such way as to stop the pulsation of the aneurism without employing more force than he deemed safe. Pulsation of the femorals was arrested without difficulty, but that of the aneurism, although considerably reduced, continued in spite of all efforts, too strong to encourage any hope of a successful result. The attempt, therefore, was for the time being abandoned, but only to be renewed on an early future occasion. It may be considered worthy of note that three several times when the tourniquet was being screwed down the aneurism slipped across the median line to the right side. It was, however, each time easily replaced on relaxing the pressure. During the progress of the attempts that were made a number of sphygmographic tracings of the pulse at the wrist were taken by Mr. Mahomed (see Plate II). These afford striking and interesting illustrations of some of the effects upon the general circulation produced by compression of the upper part of the abdominal aorta, or the parts in immediate relation with it. Every time the tourniquet was screwed down to such an extent as to arrest the pulsation of the femorals the character and frequency of the pulse at the wrist was affected in a very remarkable manner; and every time the pressure was relaxed the pulse very speedily retained its previous condition. These changes in the character and frequency of the pulse at the wrist followed the application and relaxation of the pressure almost instantaneously, and with the utmost constancy. It may be an interesting question to determine how far the effects alluded to and illustrated by the sphygmograms were dependent simply upon the mechanical disarrangement of the circulation, and the consequent increased strain upon the aorta valves, and how far on the other hand they may be considered to have been due to physiological disorder of the heart's action, resulting from some possible, and not improbable pressure upon the great sympathetic nervous centres of the abdomen.

In conclusion, we would only add that we have refrained from offering any opinion or entering upon any discussion as to the practicability and prospects of success of any attempts to cure abdominal aneurisms by compression of the aorta on the distal side. We have thus refrained because it appears to us scarcely likely that any question of comparison between the two methods can be raised in reference to any particular case. As a general if not invariable rule it will be found that those cases in which proximal pressure is applicable, present such conditions as must render distal pressure difficult or impossible; and the converse is probably almost equally true. We may, however, remark that if the theory of the process of cure by distal pressure be correct, then it would appear obvious on anatomical grounds that the cases of abdominal aneurism in which this method is likely to prove successful must be very rare indeed. The branches of the abdominal aorta are so numerous, so large, and come off so close together, as to leave little chance of compressing the main trunk below any possible aneurism in such manner as to fulfil the conditions supposed on theoretic grounds to be requisite.

DESCRIPTION OF PLATE II.

[For the sphygmographic tracings copied in the accompanying Plate, as well as for the substance of the following explanatory notes and description, we are indebted to our friend, and recent pupil, Mr. F. A. Mahomed, at present Assistant Medical Officer to the Highgate Infirmary.]

Figs. 1 and 2 represent tracings produced by the right and left radial arteries respectively, when the patient was seen in his ordinary condition. Both were taken with the same degree of pressure (viz. 3 oz.) applied to the radials, but marked differences exist between them. The right (Fig. 1) presents all the appearances produced by an ordinary normal pulse. But the left (Fig. 2) shows a more marked "percussion wave," and the distension of the artery by the "tidal wave" is more prolonged than usual. These differences may possibly be due to the comparative proximity of the source of origin of the left radial to the aneurism, which may probably have somewhat obstructed the blood flow.

The following figures all represent tracings produced by the right radial at different periods during the progress of the attempts made to compress the abdominal aorta to such extent as to obstruct completely the flow of blood through it, and to arrest the pulsation of the aneurism; and all were taken under the same pressure to the radial (viz. 3 oz.) except Figs. 3 and 4, in which a pressure of 4 oz. was applied.

Fig. 3 represents the tracing obtained when the patient was fully under the influence of chloroform, but before any pressure was applied to the aorta. Its character corresponds with that shown in Fig. 1, the slight differences depending almost entirely upon the different pressure (a difference of 1 oz.) applied to the radial.

Fig. 4 shows the change in the character of the pulse at the wrist, which immediately followed the screwing down of the tourniquet so as to compress the abdominal aorta. The pulse, as thus represented, had become at once smaller, quicker, and dicrotic. The increased rapidity and the diminished fulness of the pulse may probably be attributed to the effect produced upon, and communicated through, the sympathetic nervous system either as the result of direct stimulation of the semilunar ganglia by the pressure, or as some reflex effort to overcome the obstruction to the circulation.

PLATE II (*continued*).

The dicrotism, however, which is the most striking and interesting feature presented, would appear to be the result of the increased strain upon the thoracic aorta. There being reason to believe that the dicrotic wave results from the contraction of the elastic coat of the aorta immediately after its distension by the ventricular systole, it is evident that under the conditions existing when this tracing was taken the distension of the thoracic aorta, and its corresponding contraction from elastic recoil, must have been very greatly and abnormally increased, and that, therefore, the "dicrotism" presented must be, as shown, most markedly increased.

Fig. 5 represents the tracing produced immediately after the tourniquet was unscrewed and the pressure relaxed. It shows a return of the pulse to a condition more or less closely resembling that which it presented before the application of the pressure as shown in Fig. 3, the excessive dicrotism having disappeared.

Fig. 6 represents the tracing obtained when digital pressure was applied to the aorta. The dicrotism is more marked than in Fig. 4, probably because the passage of blood through the aorta was more completely obstructed.

Pressure having been relaxed, the tracing from which Fig. 7 is taken was immediately obtained. The character of the pulse as thus shown differs somewhat from that presented before the application of the compression. The tidal wave is more sustained and fuller. This difference may, perhaps, be due to slower and more powerful contractions of the heart in effort, as it were, to overcome the obstacle presented.

Fig. 8 shows the effect produced by reapplication and partial screwing down of the tourniquet.

Fig. 9 represents the tracing obtained after the removal of the tourniquet and the abandonment for the time of the attempts made. The increased force of the heart's contraction and the sustained tidal wave are plainly indicated.

NOTE.—Many tracings besides those of which copies are here given were taken during the progress of the attempts made to compress the artery; and it is worthy of especial remark that so instantaneous and so constant was the change from the non-dicrotic to the dicrotic condition of the pulse that by watching the lever of the sphygmograph alone without any knowledge of the movements of the operator it was easy to say when compression was applied to the aorta and whether it was effectual or not.

Sphygmograms.

*Illustrating the Effect of Compression of the Abdominal Aorta
upon the Pulse at the Wrist,
in the Case of T.D. æt 30 Suffering from Abdominal Aneurism.*

*Ordinary Conditions,
Right Radial.*

*Ordinary Conditions,
Left Radial.*

*After Chloroform,
Before Compression.*

*Immediately after
Screwing down Tourniquet.*

*No Compression,
Tourniquet removed.*

Digital Compression.

No Compression.

*Tourniquet again applied,
& partial Compression.*

*No Compression,
Still under Chloroform.*