A CASE
OF
ANEURISM OF THE ABDOMINAL AORTA

TREATED BY
LAPAROTOMY AND THE INTRODUCTION OF
STEEL WIRE INTO THE SAC.

BY
J. J. PRINGLE, M.B., M.R.C.P.,
ASSISTANT PHYSICIAN TO THE MIDDLESEX HOSPITAL; PHYSICIAN TO THE
ROYAL HOSPITAL FOR DISEASES OF THE CHEST.

Received December 14th, 1886—Read April 13th, 1887.

J. K—, æt. 46, a German, by occupation a tailor, was admitted to the Middlesex Hospital under the care of Dr. Finlay on September 9th, 1886, and subsequently came under my care in Dr. Finlay's absence during the autumn vacation.

The patient stated that he had contracted syphilis in Geneva in 1864, and that about the year 1880 he had several "spots" or "sores" scattered over his body, some being as large as a sixpenny-piece. He had been twice married. His first wife died in her first confinement; his second wife had given birth to five healthy children, and had had no miscarriages. He had never

suffered from gout or rheumatism, and denied habitual alcoholic excesses. In 1884 he first complained of pain in his left leg and thigh without ascertainable cause, which he was told was "sciatica;" a year later the pain had become most severe in the left hip and loin, and for about four months previous to admission he had experienced a throbbing sensation below the margin of the ribs on the left side, accompanied by intense, constant, fixed pain, referred to the back and diminished by bending the body forwards.

State on admission.—An emaciated foreigner with demonstrative manner, expressing himself in an almost incomprehensible "patois;" temperature normal, respiration tranquil, radial pulse beating 88 to the minute, feeble and rather incompressible. The cardiac dulness was obliterated by hyper-resonant lung note; the apex-beat was localisable only by the stethoscope at the fifth rib within the mammary line; the sounds were feeble and free from bruit, but the second sound was comparatively accentuated over the aortic base. The breathing was everywhere weak with prolonged expiration; there were no adventitious pulmonary sounds. Micturition was not abnormally frequent; the urine was of good specific gravity (1020—1025), free from deposit, and contained neither albumen, sugar nor casts. There was no evidence of skin, lymphatic, or throat syphilis. The abdominal walls were thin, lax, and sunken; some prominence and visible systolic pulsation in the epigastrium, especially to the left of the middle line, were noted; on palpation the pulsation was recognised as distinctly expansile in character, and its limits could be accurately determined as extending vertically from one inch below the xiphoid cartilage to the umbilicus, and laterally, from the middle line to three and a half inches to the left; percussion over the area thus demarcated was dull. The tumour appeared to be fixed posteriorly and its pulsation could not be felt by the hand on the abdomen when the patient was placed in the knee-elbow position. A loud, blowing, systolic

bruit was heard over the area of pulsation without exerting pressure with the stethoscope. There was also a tender region in the back to the left of the three upper lumbar vertebræ, over which the heart-sounds were plainly audible. Pulsation in the femoral arteries was forcible, equal, and synchronous on the two sides, and tracings, subsequently taken, presented characteristically aneurismal oblique line of ascent and loss of summit wave.

The *diagnosis* of aneurism arising from the abdominal aorta, probably sacculated with narrow aperture and eroding the vertebræ, was made; absolute rest was enjoined; the diet was regulated on Tufnell's principles, applied as rigorously as the fractiousness of the patient would permit; iodide and bromide of potassium were administered four times daily, the former in gradually augmented doses of fifteen to sixty grains, and hypodermic injections of morphia were given at night or according as pain or restlessness indicated.

Progress.—On October 1st pulsation was plainly felt and systolic murmur heard in the left ilio-lumbar region. On October 4th the advisability of surgical treatment was discussed in consultation with Mr. Morris, who considered that proximal compression of the aorta was feasible only if a well-made cone-shaped pad were fitted to the abdominal tourniquet, and as the pulsation extended so low it was very doubtful if distal compression would do more than control one of the primary branches immediately beyond the bifurcation of the aorta.

Laparotomy and the introduction of steel wire was, on the whole, thought to be the operation best suited to the

case and it was decided to adopt this treatment. The patient, after due explanation, gave his consent.

On October 5th the pulsation had extended in an upward direction almost as high as the xiphoid cartilage, and laterally, two inches to the right of the middle line; a loud, musical, diastolic bruit was superadded to the systolic over the point of maximum intensity of the pulsation, and there was a trace of albumen in the urine. The pain in the back was daily becoming more and more excruciating, necessitating the employment of morphia injections every two or three hours day and night, and the patient's strength was obviously diminishing. As it was considered that there was evidence of rapid increase of the aneurism—now absolutely precluding the applicability of proximal compression—and imminent risk of its rupture, recourse was had to the procedure about to be described.

Operation.—The patient having been fed for two days exclusively by the rectum, and the bowels having been cleared out with a dose of castor-oil, an incision was made on Friday, October 8th, at 9.30 a.m., by Mr. Morris from the xiphoid cartilage to the umbilicus along the middle line. The abdomen having been opened, the surface of the aneurism was first exposed by teasing an opening in the great omentum between the transverse colon and the stomach. This was found not to give sufficient room for manipulation, and some difficulty was experienced in keeping back the viscera—considerably distended by flatus—with flat sponges and the fingers of an assistant, to sufficiently expose the sac for the introduction of the cannula. The sac was therefore sought, and easily exposed, above the upper edge of the stomach, and by dragging that viscus downwards and the left lobe of the liver and edge of the thorax upwards an ample view of the sac was acquired and maintained. The trocar and cannula were introduced and the cannula held between the forefinger and thumb of the left hand in such a direction as to pay in the wire downwards and to the left, *i.e.* in the course of the blood current. A sharp spurt of blood followed the

withdrawal of the trocar but ceased as soon as a few inches of the wire were introduced. Now was found the extreme difficulty of the operation owing to the coiling of the wire and the depth of the cannula. The wire, which was of fine steel, similar to that used in Dr. Cayley's case¹ reported last year and similarly purified, was coiled upon a roller which, being too large to enter the abdominal wound, was necessarily held at some distance from the cannula; thus, several inches of wire had to be unwound before it could reach the cannula, and there was, of course, a strong tendency for it to coil into the same circles as upon the roller. It was both a tedious and difficult task to straighten the wire as it was being paid through the cannula. Another difficulty was caused by the depth at which the cannula had to be held by the left hand of the operator and the tendency to lift the cannula which the force of the pulsation exerted, so that it was not always easy to be sure how much pressure was required to adjust the cannula between the outward force of the pulsation and the inward force of pressing the wire into the sac. The result was that the cannula slipped out of the sac, and after about eight inches of wire had been paid through, it was found that the greater part of this wire had passed simply into the abdominal cavity. The wire was therefore severed close to the sac, and the cannula was again introduced at a point near to the first puncture and more wire was paid into the aneurism. At length, after—as it was believed—about a foot of wire had been introduced, an insurmountable kink stopped its further progress. The cannula was withdrawn, and the wire was cut off close to the surface of the sac. By this time the aneurism was felt to be very appreciably harder than at the beginning of the operation. There was no hæmorrhage throughout excepting the free flow from the aneurism each time the cannula was introduced, but this ceased as soon as a short length of wire had been fairly introduced into the sac. The withdrawal of the cannula was not followed by hæmorrhage.

¹ 'Med.-Chir. Transactions,' vol. lxix, p. 267.

The abdominal wound was closed in the usual manner, and covered with a dressing of boracic lint, cotton wool and a roller.

The patient rallied well after the operation and for two days his progress continued satisfactory; the circulation in his lower extremities was unimpeded; he stated decidedly that the pain in his back had disappeared; the wound caused him little or no discomfort, and he retained nutrient suppositories and peptonised enemata containing brandy, under which his pulse improved, as well as small quantities of beef-tea and milk given by the mouth. It was, however, necessary to continue the free employment of morphia in order to control his restlessness. On October 11th he refused food, returned his enemata, developed hallucinations from which he had suffered previous to the operation, became almost uncontrollable in his attempts to get out of bed, and finally began to sink gradually. He died of asthenia on October 13th, five days after the operation, during which time his temperature had never exceeded 100·6° F.

The *autopsy* was made thirty-four hours after death; post-mortem rigidity had passed off, and there were evidences of commencing putrefaction in the abdomen, which was moderately distended. The edges of a linear wound extending from the xiphoid cartilage to the umbilicus were maintained in accurate apposition by five deep sutures and were healthy in appearance. The costal cartilages were ossified; on the anterior aspect of the right ventricle was a "milk-patch" the size of half-a-crown; both sides of the heart contained a large amount of mixed clot, a considerable proportion of which was pale, firm, and adherent to the endocardium, especially of the valve-cusps. From the right side a fibrinous clot extended up the pulmonary artery as far as its bifurcation. All the valves, as well as the myocardium, were normal, the heart weighing 10½ oz. The ascending and transverse aorta and the arteries arising from them were healthy in appearance, but considerable atheromatous change was present in the

descending thoracic aorta, increasing in amount and intensity from above downwards. There was marked emphysema of the anterior portions of the upper lobe of both lungs and of the anterior edge of both lower lobes with congestion, œdema, and subpleural ecchymoses in their posterior portion.

On opening the abdomen there was found to be strictly localised, recent, adhesive peritonitis connecting the parietal peritoneum corresponding to the operative wound with the left lobe of the liver, the small omentum, the anterior surface of the stomach and transverse colon, and the great omentum, which latter was very short. The stomach was somewhat dragged downwards by these adhesions, and a mass, considered to be an aneurismal sac containing clot, could be felt above its lesser curvature, but the seats of puncture could not be distinguished. The sac was more easily reached by turning up the transverse colon with its mesentery and was found to lie chiefly to the left of the middle line, extending as far as, and displacing the left kidney outwards, on the inner aspect of the upper portion of which it made a deep indentation. The pancreas lay across, and was arched forwards by, the aneurism, but neither it nor any other of the viscera were firmly adherent to the sac. The left renal artery, however, coursed for nearly an inch at its origin in the thickness of the retro-peritoneal tissue reinforcing the sac and the corresponding vein, which ran transversely across the sac near its centre, seemed slightly compressed from behind forwards. The absence of firm adhesion between the sac and the viscera was considered as evidence in favour of its rapid extension.

The stomach was dilated and contained about an imperial pint of thick fluid; it and the intestines, which were empty, showed no sign of disease. The liver, spleen, and kidneys were healthy. These and the hollow viscera having been removed, the more intimate relations of the aneurism were investigated. The fibres of the left crus of the diaphragm above, and of the psoas muscle on

the left side and below, overlay, and were incorporated with, the sac. Seen from the front, the aneurism was trilobate in form, the central portion being the most prominent, and the aorta lying between it and the right lobe. Its diameter, both vertically and transversely, measured four inches. At its most prominent part, immediately to the left of the origin of the superior mesenteric artery, there was localised thickening and induration of the sac, which probably corresponded to the seat of the punctures; and extending vertically downwards from this to the lower boundary of the sac, some dark clot infiltrated the matted tissues reinforcing the sac, due presumably to oozing from the punctures during the operation. The aorta having been opened along its anterior aspect the opening of the aneurism was perceived to be situated entirely on its posterior wall, directed slightly towards the left side and behind the origin of the coeliac axis and superior mesenteric artery; it was oval in form, measuring one inch vertically by five eighths of an inch transversely, and was occluded by dark clot.

The aneurism was then removed along with the last dorsal and three upper lumbar vertebræ, to which it was firmly adherent, and the mass immersed in alcohol for three weeks. A vertical, antero-posterior section having then been made from the centre of the vertebral canal to the most prominent portion of the sac, the progress of extension of the aneurism from its point of origin could be observed (*a*) backwards, to erode deeply the last dorsal and two upper lumbar vertebræ whilst sparing, to a comparative degree only, the intervertebral discs; (*b*) to the right of the aorta for three quarters of an inch, displacing the inferior vena cava; (*c*) upwards for an inch to the upper border of the last dorsal vertebra; (*d*) downwards for nearly three inches, to within half an inch of the level of the aortic bifurcation; and (*e*) to the left for a distance of two inches and three quarters. The result of the pressure around the aorta was a marked diminu-

tion in calibre of that vessel for a distance of two inches, best seen at the level of the renal arteries, where the bulging forwards of the posterior wall was very notable.

The section described divided the aneurism into two unequal parts, the left being the greater; both parts were filled with clot of which more than one third, lining the interior of the sac throughout the section, was considered to be of ante-mortem formation (see Woodcut, p. 275). It may probably be fairly assumed that in the part on the left side of the section the proportion of ante-mortem clot was even greater. In order, however, not to destroy the specimen the clot was not removed in searching for the wire; but its presence was easily detected by the introduction of two steel needles connected with the poles of a galvanic battery—of which only two cells were in action—and with a very delicate galvanometer which at once indicated when a complete circuit was established by contact with the wire, by a marked deflection of the needle. The wire had obviously fallen from its point of introduction and lay embedded in the middle of the left portion of the aneurism at a distance of about an inch from the centre of the section described. It was, unfortunately, impossible by this method to verify the amount of wire introduced.

Remarks.—I have been emboldened to bring this case before the Royal Medical and Chirurgical Society by the fact that many of the most important contributions to our knowledge of the treatment of abdominal aneurism are contained in the Transactions of the Society, and because I am convinced that the Fellows whose criticisms will, I trust, follow will discuss the principles of the treatment adopted in a philosophical spirit rather than decry the operation on the mere ground of its want of success in the present instance.

From a medical point of view the case presented no features of novelty and but few of special interest, the confirmation post mortem of almost all the surmises of the physician only demonstrating the facility of diagnosis of certain conditions by physical examination. The presence

of a loud, musical diastolic, in addition to the more usual systolic bruit, was considered as evidence of narrowness of the aperture of the sac, and as it developed along with other signs indicative of its rapid extension, as confirmatory of these. It is universally admitted that a diastolic bruit over an aneurism is of exceptional occurrence, but this case, as well as one narrated by Dr. Wickham Legg¹ and one by Mr. Bryant,² invalidates the absolute truth of the dictum of Quincke³ and differs from the experience of Dr. Walshe⁴ and Dr. George Balfour⁵ that such a diastolic bruit is never present.⁶ Nor can the presence of a to-and-fro bruit afford occasion for wonderment, if free to-and-fro circulation take place between a large artery and a large aneurismal sac containing little or no coagulum, separated one from the other by a narrow and hard-edged aperture.

The main importance of the case, however, lies in the treatment resorted to. I admit that I am somewhat sceptical as to the value of drugs in such cases, and am inclined to consider the benefit attributed to them in many cases published as successful, as due mainly to the absolute rest and dietary restrictions with which they have been invariably combined. Da Costa's⁷ six consecutive cases treated by iodide of potassium in full doses are certainly, however, more convincing than the solitary triumphs ascribed to acetate of lead,⁸ sulphate of iron,⁹ aconite,¹⁰ or ergotine¹¹ (employed subcutaneously by Wolff in a case of

¹ 'St. Barthol. Hosp. Rep.,' vol. xvi, p. 258.

² 'Med.-Chir. Trans.,' vol. lv, p. 225.

³ 'Ziemssen's Encyclopædia,' vol. vi, p. 419.

⁴ 'A Practical Treatise on Diseases of the Heart, &c.,' London, 1862, 3rd edition, p. 494.

⁵ 'Clinical Lectures on Diseases of the Heart and Aorta,' London, 1876, p. 351.

⁶ Dr. Balfour, however, cites an instance of diastolic murmur in abdominal aneurism in his second edition, 1882.

⁷ 'Boston Medical and Surgical Journal,' vol. xcix, p. 813.

⁸ Daly, in 'London Hosp. Rep.,' vol. iii, p. 179.

⁹ Bone, in 'Lancet,' 1864, vol. ii, p. 207.

¹⁰ Grimshaw, in 'Med. Press and Circ.,' 1876, vol. i, p. 406.

¹¹ 'Berliner klinische Wochenschrift,' 1873, p. 314.

more than dubious diagnosis), whilst the utility of atropia and digitalis as recommended by Mr. Barwell,¹ receives no support from recorded experience. Moreover, the undoubted value of the iodide of potassium in some thoracic aneurisms renders it probable that abdominal aneurisms may to some degree be amenable to its influence, however exerted, and it will probably not be contested that surgical interference ought to be invoked in the treatment of all internal aneurisms only when that drug along with absolute rest and restricted diet have proved futile after prolonged trial.

Such, unfortunately, was the case in this instance; indeed I cannot but believe that had surgical measures been employed earlier, before the patient's strength was at such a low ebb, his life might have been materially prolonged, and its burden of pain lightened.

Even at the time of the first consultation with my surgical colleague, Mr. Morris, I was dubious as to the applicability of proximal pressure, not sanguine as to its results, and fearful of the risks of direct pressure on the sac, whilst a subsequent study of the literature of the subject has convinced me of the dangers of any compression applied to the aorta above the level of the duodenum. Below that level pressure upon the intestine or other viscera may be avoided by careful application of the compressor. The fact that five successful cases of proximal pressure have been recorded by Murray,² Greenhow,³ Moxon and Durham,⁴ Heath,⁵ and Philipson,⁶ shows that such treatment *may* be successful despite the occurrence of hæmatemesis, albuminuria, jaundice and threatened gangrene of the lower extremities during, or as the direct results of, the operation; whilst in one case, included in five

¹ 'Ashhurst's Encyclopædia of Surgery,' vol. iii, p. 476, *et seq.*

² 'Med.-Chir. Trans.,' vol. xlvii, p. 187.

³ *Ibid.*, vol. lvi, p. 385.

⁴ *Ibid.*, vol. lv, p. 213.

⁵ 'British Medical Journal,' 1867, vol. ii, p. 287.

⁶ *Ibid.*, 1877, vol. ii, p. 247.

unsuccessful cases collected by Mr. Barwell, gangrene resulted, the external iliac was tied and amputation performed; the remaining four cases died from peritonitis and bruising of the abdominal contents. One cannot but agree with the author when he writes,¹ "Doubtless more (cases) have failed than are made available by publication, but we may conclude with almost complete certainty that all successful instances are known." I am inclined, on the whole, to limit the applicability of proximal pressure to those aneurisms in the abdomen which arise below the aortic bifurcation.

It is, however, to be borne in mind that the great majority of abdominal aneurisms arise from the aorta or its branches about the level of the coeliac axis, that is, at a point above which compression of the aorta is impracticable. Dr. Sibson's² experience that 133 out of 177 cases occupy this position remains unchallenged; thus the principles of treatment of the present case are those of a great preponderance of abdominal aneurisms.

What alternatives, then, to the operation performed presented themselves, and with what prospect of success comparable to that obtained by similar treatment by Loreta, of Bologna,³ in his memorable and in many respects similar case? The records of distal pressure employed in five cases are far from encouraging. Mr. Bryant's case⁴ died eleven hours after the second application of the tourniquet from peritonitis and obstruction of the bowel; Mr. Lunn and Dr. Benham's case⁵ died eleven days after the operation from gangrene of the intestine and blocking of the superior mesenteric artery, the aneurismal sac being nearly filled with clot; Dr. Markham Skerritt's⁶ case died seven weeks after the operation from diffusion of the

¹ Loc. cit.

² 'Medical Anatomy,' p. 57.

³ 'Memoire dell' Accademia delle Scienze dell' Istituto di Bologna,' vol. vi, 1885, p. 215.

⁴ 'Med.-Chir. Trans.,' vol. lv, p. 225, *et seq.*

⁵ *Ibid.*, vol. lxxiii, p. 191, *et seq.*

⁶ 'British Medical Journal,' 1878, vol. i, p. 405.

aneurism ; in a case under Sir James Paget in St. Bartholomew's Hospital in 1865, the facts of which have been kindly communicated to me by Mr. Astley Bloxam, then house surgeon, the results of the compression comprised peritonitis, gangrene of the gut and the reduction of the pancreas to a pulp ; whilst in an unrecorded case under the care of Mr. Barwell, to whose courtesy I am indebted for permission to cite it, distal compression was applied continuously for six days without either temporary or permanent benefit. Not only does the treatment by distal pressure appear to me to be fraught with danger from pressure upon the abdominal contents involving, it may be, their obstruction, laceration, rupture, inflammation or gangrene, but also to be theoretically faulty, as the branches arising from the upper portion of the abdominal aorta are too numerous and too large to afford any reasonable prospect of sufficient arrest of the circulation above the point of compression to determine coagulation.

Another danger, common to all measures of pressure, whether proximal or distal, less obvious than the above, but probably none the less real, lies in the increased tension in the aorta and its branches above the seat of pressure and the consequent risk of rupture of diseased vessels. This increase of tension, transitory though it may be, has been graphically represented in Dr. Mahomed's tracings from the radial pulse in the paper by Dr. Moxon and Mr. Durham.¹ Without specially investigating the point, I have incidentally come across a narrative of three instances, and have myself seen one instance of coexistent thoracic aneurism, whilst in four others a second, unsuspected abdominal aneurism was found to exist on post-mortem examination.

The results of galvano-puncture in the treatment of internal aneurism, in this country at all events, have been admittedly disappointing. As far as I have been able to ascertain, it has been employed in only two cases similar to the present. The more successful of these is reported

¹ Loc. cit.

by Keyes.¹ The patient, a woman, æt. 42, died about a month after galvano-puncture had been performed for the third time, probably of exhaustion from an unsuspected thoracic aneurism. The author honestly states his doubts whether the action of the current had anything to do with the presence of the stratified clot found in the sac, as it was not firmer about the seats of puncture than elsewhere, and did not differ from the clot of other aneurisms in the same person. The less successful galvano-puncture was performed by Felice dell' Acqua² upon an Italian nobleman, but "the patient quickly died."

The treatment of aneurism by the introduction of foreign bodies into the sac has been only recently discussed before the Society, and its principle has received general acceptance and approbation.³ Mr. Bryant's opinion "that it seems likely to be of use in certain aneurisms in which none of our ordinary methods are applicable, and in which under many circumstances we have only to stand by and wait for the end" represented, I think, the feeling of the Society at the discussion and stimulated me to hope for some measure of success in a case presenting so many points of resemblance to Loreta's, although the age and unsatisfactory *morale* of the patient materially reduced the chances.

The operation presented some unforeseen difficulties, upon which Mr. Morris will remark, but these were, on the whole, successfully encountered, and the patient's death was certainly not directly due to the operation, as in the majority of recorded cases of the most feasible alternative, *i.e.* distal compression. The amount of clotting produced by even so short a length of wire as it was found possible to introduce, the insignificant hæmorrhage from, and complete occlusion of the punctures, the absence of peritonitis or other abdominal complications, despite the unruly conduct of the patient, all to my mind justify the procedure

¹ 'New York Medical Journal,' vol. xiv, p. 569, *et seq.*

² 'Gazetta Medica Italiana Lombardia,' No. 28, 1870, p. 217.

³ 'Proceedings Roy. Med. and Chirurgical Soc.,' New Series, vol. ii, No. 2.

adopted and render the epithet "inaccessible," hitherto frequently employed with regard to aneurisms thus situated for the future an unjustifiable one.

Remarks by Mr. HENRY MORRIS.—There was no difficulty in exposing to view the aneurism sufficiently for the purpose of introducing the cannula. Whether in another case this would be accomplished better by drawing down the stomach or by drawing up the transverse colon and omentum will depend upon the precise situation of the aneurism and the nature of the adhesions round about it.

The great difficulty attending the operation was the management of the wire. We had thought it desirable to have the wire coiled upon a long and very slender rod so that there should be a strong disposition for it to regain its twist and so occupy but a small space within the aneurism. This difficulty could be greatly diminished or altogether removed by having the wire wound upon a reel which could be held in the right hand of the operator within the abdominal cavity, and thus the wire could be paid off the reel directly into the mouth of the cannula.

Another way of obviating it would be to substitute fishing-gut or horsehair for the wire, but the advantage which the wire has over either of these materials is twofold: it coils up within the aneurismal sac, and is therefore less likely to find its way through the opening between the aneurism and the artery, and it can be introduced in one continuous piece instead of presenting a number of ends to be pushed onwards into the sac.

There is no doubt that but for the kinking of the wire more of it would have been inserted in this case; but it had never been my intention to introduce more than two feet because I have long held the opinion that for the perfect cure of aneurism the contraction of the sac must follow the coagulation of blood within it. It seems to me therefore that one of the points in connection with this mode of treatment as to which it is important that we should obtain information is "what is the smallest quantity of the foreign body which need be introduced to excite the requisite formation of clot?" The smaller the quantity the greater the probability, *cæteris paribus*, of a cure, because the contraction of the walls of the aneurism is more likely to be safely and perfectly accomplished when one foot instead of many feet of wire forms part of the contents of the solidified tumour.

(For report of the discussion on this paper, see 'Proceedings of the Royal Medical and Chirurgical Society,' New Series, vol. ii, p. 241.)