Results of the treatment of aneurysm by wiring / by D'Arcy Power and G.H. Colt.

RESULTS OF THE TREATMENT OF ANEURYSM BY WIRING

BY

D'ARCY POWER, F.R.C.S.Eng.

Surgeon to and Lecturer on Surgery at St. Bartholomew's Hospital

AND

G. H. COLT, F.R.C.S.Eng.

Assistant Surgeon to the Royal Infirmary, Aberdeen, and Assistant to the Regius Professor of Surgery, Aberdeen University

(Remarks made at a Discussion on Aneurysm at the Surgical Section of the Royal Society of Medicine, London, May 14, 1912)

[*Reprinted from the* Proceedings of the Royal Society of Medicine, *1912, Vol. V (Surgical Section), pp. 169—178*]

London

JOHN BALE, SONS & DANIELSSON, LTD.

OXFORD HOUSE

83-91, GREAT TITCHFIELD STREET, OXFORD STREET, W.

1912

RESULTS OF THE TREATMENT OF ANEURYSM BY WIRING

BY

D'ARCY POWER, F.R.C.S.Eng.

Surgeon to and Lecturer on Surgery at St. Bartholomew's Hospital

AND

G. H. COLT, F.R.C.S.Eng.

Assistant Surgeon to the Royal Infirmary, Aberdeen, and Assistant to the Regius Professor of Surgery, Aberdeen University

---

(Remarks made at a Discussion on Aneurysm at the Surgical Section of the Royal Society of Medicine, London, May 14, 1912.)

Mr. D'Arcy Power, speaking for himself and Mr. G. H. Colt, said: The subject of aneurysm is of perennial interest, and the Section of Surgery in the Royal Society of Medicine has done well to review the progress made in it during the last few years. We do not see many cases of aneurysm in the surgical wards of our general hospitals. They are either treated in the various smaller hospitals, they remain untreated by surgical methods, or they are less numerous now than they used to be when more alcohol was drunk, and syphilis was less systematically treated. But in spite of the scarcity of cases much has been done of late years in the treatment of aneurysm, and the work of Matas and other distinguished surgeons has shown how much the advance of surgery has enabled aneurysms to be cured by the most radical methods. It is clear, however, that it is impossible to treat every case of aneurysm surgically by these obliterative methods without undue risk to the patient. There will always remain some abdominal and, more rarely, thoracic aneurysms which from the accident of their position or anatomical relationships cannot

be excised or sutured. For these aneurysms some method of introducing wire into the sac, with or without electrolysis, remains as the simplest and least dangerous method of treatment.

Until the year 1903 the method of wiring was unscientific, and was carried out with comparative disregard of aseptic principles. The aneurysm was exposed, a trocar and cannula were thrust into its wall, the trocar was withdrawn, and as much wire as seemed enough was passed into the sac by pushing it through the cannula. This method involved a good deal of handling both of the sac and the wire, the wire often kinked and became unmanageable, the hæmorrhage was severe though controllable, and the introduction of the wire occupied a considerable time.

(*a*) The results of wiring without electrolysis and performed by the older method are as follows:—

Between 1864 and 1900, 14 cases were treated, of which 8 were thoracic and 6 abdominal. In the 8 thoracic cases all the patients were in a desperate condition and died from various causes from four days to one month after operation. In the 6 abdominal cases, one patient (Langton's) lived eleven years and ten months, and died at Acton on February 9, 1910, probably from rupture of the sac. No post-mortem examination was made. The patient was a woman, aged 37 at the time of the operation, and the aneurysm was noticed shortly after delivery. Five feet of silver wire had been used. There was some doubt as to whether or not the patient was syphilitic, but when she was again admitted into St. Bartholomew's Hospital under Mr. Bruce Clarke in 1907, it was noticed that she had irregular and dead white scars on the forehead and behind the left knee, and she then gave a history of miscarriages. This is the only case on record in which the presence of coils of wire was demonstrated in the sac during life by an X-ray examination. They appeared as oval loops. One patient (Morse's) lived four years, and died after receiving a kick on the abdomen. Five and a half feet of silvered copper wire had been used. One patient (Loreta's) died thirteen weeks after operation of rupture of the aorta at the origin of the sac, which was completely filled with laminated clot and wire. Six and a half feet of silvered copper wire had been used. Two patients were in a desperate condition, and death occurred soon after the operation. In one case (Stevenson's) death was probably hastened. Since 1900 one patient had his abdominal aneurysm wired by Mr. Harrison Cripps, and lived eighteen months, after which time he could not be traced. (This

case is unreported.) One patient, in whom Colt's instrument No. 1 was used, died fifty hours after operation.

(*b*) The results of wiring by the older method combined with electrolysis between 1864 and 1910 are as follows:—

Of 29 thoracic cases, 2 patients in whom the aneurysm involved the origin of the left subclavian died, one on the second day and one on the twentieth day. Two in whom the aneurysm involved the origin of the innominate artery died — one two months and one fourteen months after the operation. Of the rest, 1 died three and a half years after the operation, 1 was alive three years later at the time of the last report in October, 1910, and 20 others died at periods varying from two and a half days to ten months, the average duration of life being fourteen and a half weeks. One was alive three months after operation at the time the report was made. Many of these patients were in a desperate condition, and the relief of symptoms was well marked. Of 7 abdominal cases, 1 died five years after operation, 1 died eight months afterwards from dysentery, 1 died forty-seven days afterwards, 1 died twenty days later, and 3 died from five and a half to forty hours after operation.

In 1903 one of us (G. H. Colt) invented an instrument for the rapid introduction of a known quantity of sterilized wire into an aneurysm, with a minimum of disturbance. The method was described and the instrument was figured in the *Transactions of the Royal Medical and Chirurgical Society*[1] with an account of the case in which it was used. The ease with which the wire was introduced defeated the object of the operation, for, as is seen in the specimen (Museum of St. Bartholomew's Hospital, No. 1551D), a loop of wire left the sac and entered the aorta. Up to the present time six cases are recorded in which this accident has happened independently of the size of the opening of the sac, by the older method of wiring through a canpula. (1) In Ransohoff's case of aneurysm of the ascending arch, the opening of the sac was 1 in. in diameter and a loop of wire had passed towards the heart. (2) In Reeves's case of abdominal aneurysm the opening of the sac was 1 in. in diameter, and a loop of wire had passed 10 in. up the aorta, one loose end passing as far as the aortic valves. (3) In the case of aneurysm of the ascending arch recorded by White and Gould, the opening of the sac admitted four fingers, and a loop of wire had

[1] *Med. Chir. Trans.*, 1903, lxxxvi, pp. 363-76.

passed into the aorta. (4) In Griffith's case of abdominal aneurysm the mouth of the sac was 1½ in. long, and narrow, and a double loop of wire had passed 2½ in. up the aorta. (5) In Ballance's case of aneurysm of the ascending arch, the wire had been previously coiled into a cylinder 2½ in. in diameter, but the free end passed up to the middle of the left ventricle and loops of wire had also passed down the aorta for 2½ in. (6) In Power and Colt's case of abdominal aneurysm mentioned above, the opening of the sac measured 2⅛ in. and a loop of wire 7 in. long had travelled up the aorta. In this case Colt's instrument No. 1 was used; it delivered coils of snagged wire 1½ in. in diameter.

In view of this occurrence another instrument (No. 2) was arranged to sever the coils from time to time without removing the needle from the sac, but this instrument was never used, because the principle and design of instrument No. 3 proved to be so much better. This instrument was described and figured in the *Lancet*[1] and in the *Transactions of the Fifteenth International Congress of Medicine*, held at Lisbon in 1907. The instrument consists of a trocar and cannula with which the sac is pierced; an additional barrel can be attached to the cannula, and this barrel contains a light wire frame in the form of a cage, or a wisp which is pushed through the cannula by means of a piston until it reaches the sac, where it opens out like an umbrella. The cages and wisps are made in different sizes, of fine, lissom steel wire, dull gilt, and the surface area presented for clotting may be calculated with great accuracy. The following is a summary up to the present date (May, 1912) of the cases of abdominal aneurysm treated by means of Colt's apparatus (No. 3) without electrolysis:—

(1) A male patient who died four days after operation from a rupture of the sac into the peritoneal cavity. The rupture was not at the seat of puncture, as was shown post mortem. The case was under the care of Mr. D'Arcy Power and is mentioned in full later.

(2) A male patient died two days after operation from ether pneumonia. In this case the wires were found at the post-mortem examination to be evenly expanded inside the sac, and there was a firm and uniformly adherent clot—a point which is in favour of the dull gilt wire employed. The specimen was taken to St. Bartholomew's Hospital Museum, but was lost. It is recorded by Lieut.-Colonel M. P. Holt, D.S.O., R.A.M.C., in the *Journal of the Royal Army Medical Corps*.[2]

[1] *Lancet*, September 19, 1903, pp. 808-13.

[2] *Journ. Roy. Army Med. Corps*, 1904, iii, pp. 175-78.

(3) A male patient operated on in Dublin, who died two months after, apparently from leakage of the sac. The case is unpublished.

(4) One male patient, living at the time of the report.[1] Mr. de Courcy Wheeler writes: "The present condition may be summed up by saying that aneurysm may still be diagnosed, but it is better and not worse than it was two years ago. The patient was aged 38, with a good family history. He had served in the Army for sixteen years, during which time he contracted syphilis. For the last seven years he was employed in Guinness's brewery. His symptoms began eight months before he was admitted to the hospital, in August, 1910. Dyspepsia and pains in the back were the worst symptoms until July, when he noticed the abdominal pulsation. He was kept under rigid medical treatment for five weeks, but even in this short time the symptoms became more severe and the pulsation in the abdomen obviously increased. There was a loud systolic murmur below the tumour in the region of the bifurcation of the aorta, traceable downwards along the iliac vessels. There was no murmur over the tumour. Expansile pulsation was easily demonstrated. The diagnosis of aneurysm of the cœliac axis was made. On August 30, 1910, the aneurysm was easily isolated and appeared like a distended and thin-walled gall-bladder, somewhat larger and more oblong than an orange. The sac gave an uncomfortable feeling of thinness and friability on manipulation. The origin of the tumour was lost in the aorta in the region of the cœliac axis, and it was quite impossible to determine the exact vessel from which it sprang. Probably the aorta and all its branches in this region were involved. A trocar and cannula were plunged for about 2 in. into the sac, the point of the trocar aiming, as far as could be estimated, at the mouth of the vessel leading into the sac. When the trocar was removed the blood welled out without any expulsive force. A cartridge containing a cage of 150 in. of Colt's wire was applied to the mouth of the cannula, through which the wire was pushed into the aneurysm by means of the piston. There was no further bleeding, but the puncture point in the sac was strengthened by a few sutures passed through the wall of the sac. The operation was performed in a very short time. For the first five days the pulsations of the aneurysm were more tumultuous, and it was deemed advisable to give hypodermic injections of morphia to ensure absolute quietude on the part of the patient, who was restless and uneasy. After the fifth day the pulsations became less, the pain in the back

[1] Wheeler, *Brit. Med. Journ.*, 1911, ii, p. 1091; Case I.

disappeared, and the tumour—allowing for the resistance of the lines of buried suture in the abdominal wall—was harder and slightly reduced in size. Six weeks later the man was discharged from hospital after an intramuscular injection of '606.' A second intravenous injection was given recently owing to the presence of a positive Wassermann reaction. After another short interval he resumed light work at the brewery." Mr. Wheeler adds there is little doubt that the progress of the aneurysm towards disaster was checked by the operation. Time alone will show the exact part played by the wire in bringing about so satisfactory a result.

(5) A male patient was living at the time of the report,[1] one month after operation, and showed disappearance of the bruit and reduction in the size of the tumour. The man was aged 30, and presented symptoms so like the previous case that it was unnecessary to enumerate them. Pain in the back was again the prominent symptom, and it drove him to seek relief. He was given an intravenous injection of "606" and, a week later, an intramuscular injection of horse serum immediately before the operation. At the operation the pancreas was found to be firmly adherent to the front of the sac above. The liver did not appear and the stomach presented an anterior relationship below. The aneurysm was as large as a big orange. It appeared to spring from the aorta below the origin of the cœliac axis. The splenic vein, together with the gastro-hepatic omentum, impeded access to the front of the sac. There was no bleeding whatever in this case when the cannula was withdrawn after the wire had been introduced, nor on removal of the trocar before the cartridge was put into position. A wisp of 105 in. of wire with a surface area of 2½ in. was used in this case instead of a cage. In suturing the puncture the needle injured the splenic vein, but the oozing was easily controlled. In this case the pulsations were more tumultuous and intense for a few days after the operation, whilst the pain in the back was very severe. After the fifth day, however, all pain and discomfort had gone and there was no trace of the loud murmur which had been present before the operation. There was no doubt that the tumour was considerably reduced in size four weeks later, and the consistence had become hard and firm. Mr. Wheeler writes (May 8, 1912): "This patient was operated upon in July, 1911. I saw him two months ago, and there was no sign of the aneurysm beyond an increased resistance under the scar of the operation. He was perfectly

[1] Wheeler, *Brit. Med. Journ.*, 1911, ii, p. 1091.

cured, and he has passed, as sound, a medical examination in London for a Government post in the Naval Reserve."

(6) A male operated upon by Mr. Wheeler (hitherto unpublished). He died of intestinal obstruction owing to the performance of gastro-enterostomy for dilated stomach after the wire was introduced into the aneurysm. Mr. Wheeler says: "The loop of jejunum which I fixed to the posterior wall of the stomach got pressed upon by the aneurysm behind and the stomach and abdominal wall in front, a most unlooked-for complication. At a second operation, two days later, the obstruction was quickly relieved, but subsequent vomiting ruptured the aneurysm at a point remote from the position of puncture for the wire. The examination showed that the wire had entered the aneurysm between two layers of clot already formed—a point, I think, of practical importance, because it tells us that we must get a good flow of blood through the cannula before introducing the wire, so as to be sure that the instrument is in the lumen of the aneurysm and not burrowing between laminated clots."

(7) A male patient[1]; lived for several weeks and eventually died of pneumonia after leaving the hospital. There was no post-mortem examination. The case was under the care of Professor Conway Dwyer, who writes (May 10, 1912): "The pain which, before the operation, was severe and continuous, disappeared completely, and the pulsation had almost gone. I heard that some months afterwards he was admitted to another hospital suffering from pneumonia. He died there, but I have not been able to get particulars."

(8) Major C. B. Lawson, R.A.M.C., also sends us details of the following case: A man, aged about 33, whose previous occupation had been a boiler tube maker, was a private in the Lancashire Fusiliers. There was no history of syphilis, but there was a history of severe injury to the abdomen, as he was thrown from his horse on to an anthill during the South African War. He had an aneurysm as large as a tangerine orange between the cœliac axis and the superior mesenteric artery. It communicated with the left side of the aorta and extended in the direction of the left kidney. An epigastric laparotomy was performed on May 6, 1906; the tumour was exposed by incising the lesser omentum and drawing down the stomach and pancreas. The fundus of the sac was very thin. Wisp No. 2 was inserted, and three days afterwards the tumour was more distinct and very hard, but there was no expansile pulsation. Pulsation in the anterior and posterior

[1] Wheeler, *Brit. Med. Journ.*, 1911, ii, p. 1091.

tibial arteries was more marked than before the operation. The pulse-rate after the operation was greatly increased for about a week. The case was invalided to Woolwich, and the patient was alive and well four years and nine months after the operation, but we have no report after February, 1911.

(9) A male patient, probably suffering from an aneurysm of the ascending part of the arch of the aorta. The right carotid and subclavian arteries had been tied two years previously. The patient was in a desperate condition from thinning of the front of the sac. He died of external hæmorrhage seven days after the operation, but the bleeding did not occur at the site of the scar. (Unpublished.)

The first case mentioned in our summary was that of a male, E. S., aged 36, admitted into St. Bartholomew's Hospital on March 5, 1911. He began to have attacks of severe pain in the right hypochondrium in October, 1906. The pain doubled him up and made him lie down. The attacks came on without warning and could not be assigned to any cause. At first they lasted about ten minutes at intervals of a week, but they have gradually become more frequent, longer, and more generalized, though they are worst in the small of his back. He has been confined to his bed for the last month. Seven years ago he received a severe blow in the epigastric region from the handle of a winch. Examination showed that he had a pulsating globular swelling in the middle line of the abdomen, 2 in. below the xiphisternum. There was a bruit over the swelling. Enlarged and discrete glands were felt in the left axilla, and there was a small gland in the right axilla and in the right supraclavicular region. The patient was shown "at consultations," and the general opinion was expressed that he was suffering from malignant disease of the pylorus and that the enlargement of the glands was due to secondary deposits. The tumour was explored on March 18, and was found to be an aneurysm of the cœliac axis. A wire wisp was introduced by Colt's apparatus, but no blood escaped from the cannula when the trocar was withdrawn, so that it is probable that the wisp never entered the sac at all. The edges of the perforation were closed with two silk sutures and the abdominal wall was closed in layers. The operation took twenty-four minutes, including the anæsthetic and dressing. The patient went on well after the operation until 7 p.m. on March 22, when he died suddenly and without any warning. The post-mortem examination showed that he had a pathological aneurysm of the cœliac axis which had ruptured into the lesser and greater sacs of the peritoneal cavity. The wire lay between the layers of a previously formed clot. There was no leakage.

The summary of these cases in tabular form reads as follows:—

Abdominal.—One patient alive and well four years and nine months after operation (last report, February, 1911); 1 patient alive and well one year and eight months after operation (last report, May, 1912); 1 patient alive and well nine months after operation (last report, May, 1912); 1 patient lived some months and died of pneumonia; 1 patient died two months later of leakage from sac; 1 patient died four days afterwards from rupture of sac, not at site of puncture; 1 patient died a few days after operation from acute dilatation of stomach; 1 patient died two days after operation of ether pneumonia. The 3 patients who are alive and well have been entirely relieved of their pain. Death was probably hastened by a few days in two of the cases which ended fatally.

Thoracic.—One patient died of rupture of the sac externally, but the rupture was not at the seat of puncture.

At the discussion held at the Royal Academy of Medicine in Ireland on December 16, 1910,[1] one of the speakers referred to the risk of embolism after the operation, and until the present time it has always been held to be a distinct risk. Taking all the cases recorded up to 1910 in which wire has been introduced into an aneurysm, there are 33 in which the lesion was situated on the cardiac side of the origin of the left common carotid artery, and in 22 of these the aneurysm lay between the heart and the origin of the innominate artery. In only one case were there any symptoms of cerebral embolism, and even in this case it was doubtful, yet altogether there were fifty-five large direct arterial channels open to receive a fragment of clot from the aneurysm and to carry it to the brain. No case of embolism of the vessels of the upper extremities has been recorded in aseptic cases. In no case has embolism of the arteries of the lower extremities been recorded when abdominal aneurysms have been wired. In cases treated by Macewen's method the evidence is entirely against emboli being detached by scratching the wall of the sac. We know of one patient in whom needling was performed on twenty-five occasions without embolism. In the post-mortem room puncture of the sac with a sharp trocar, whether performed slowly or quickly, obliquely or normally to the surface, causes no detachment of clot. The danger of embolism, therefore, may be disregarded until the contrary is shown. It is probably great when electrolysis is employed and the current reversed during the sitting.

[1] *Trans. Roy. Acad. Med. Irel.*, Dubl., 1911, xxix, p. 24.

The chief indications for the operation of wiring are: (1) An aneurysm of the ascending part of the arch of the aorta, especially if X-ray examination in two planes at right angles to each other indicates sacculation. (2) Abdominal aneurysm in the usual situation—namely, at the origin of the cœliac axis. Both these types of aneurysm are usually saccular, and the louder the bruit the greater is the chance of a case being a suitable one for wiring, because the aneurysm is probably saccular and the opening of the sac small. Medical treatment is of no avail.

The chief contra-indications are: (1) Rapid increase of pain or of pressure symptoms. These are probably indicative of an early and fatal termination. If these symptoms pass away under treatment the question of operation can be again considered. (2) The presence of a second aneurysm. (3) Sepsis. (4) Involvement of the transverse part of the arch. The cases recorded by Hodgson show clearly that the patient's discomfort is much increased by consolidation taking place in this situation.

As regards the instruments, Nos. 1 and 2 are now obsolete. The advantages claimed for instrument No. 3—the one here shown—are: First, that asepsis is absolutely secured; secondly, that there is a minimal risk of wire entering the aorta; thirdly, that the operation can be performed easily, quickly and gently. It is important to emphasize the latter point, because the idea has become prevalent that force is needed. The whole secret of avoiding shock in this part of the operation seems to lie in pushing home the piston very gently. The record of cases just given shows that it is absolutely essential to see blood spurting through the cannula before the cartridge is inserted, for there is otherwise no certainty that the wires will open out in the sac or that they will enter the blood-stream at all. It is also advisable to withdraw the cannula until the end only just projects into the blood-stream, because if the wires, on emerging from the cannula, are close to the opposite wall of the sac they may not open out properly. Much damage might be done in this way, especially if any force were used. Fourthly, the exact quantity of wire is known and its probable arrangement in the sac may be assumed with some degree of accuracy. Lastly, the dull gilding of the wire provides a granular surface, as proved by Holt's case, which is most efficient in collecting firmly adherent fibrin from the blood.

John Bale, Sons & Danielsson, Ltd., 83-91, Great Titchfield Street, London, W.