

COMPLETE OBLITERATION OF THE CÆLIAC AND MESENTERIC ARTERIES: THE VISCERA RECEIVING THEIR BLOOD-SUPPLY THROUGH THE EXTRA-PERITONEAL SYSTEM OF VESSELS. By JOHN CHIENE, M.D., F.R.C.S.E., *Demonstrator of Anatomy, University of Edinburgh.* (Read at the Oxford Meeting of the British Medical Association. August, 1868.)

THE body of a female, aged sixty-five, which had been injected with lard and vermilion from the femoral artery, was dissected in the Practical Anatomy Rooms of the University of Edinburgh, in the month of May of the present year. The cause of death, as stated in the certificate accompanying the body, was paralysis. During the dissection required for displaying the vessels supplying the abdominal viscera it was observed that, although the branches of the cœliac and mesenteric arteries were fully injected, the main trunks were completely obliterated at their origins, the obliteration in each case extending to the first branch.

The ABDOMINAL AORTA was extensively diseased. A large pear-shaped aneurism extended from its bifurcation upwards to the crossing of the left renal vein, in length  $4\frac{1}{2}$  inches, in breadth, inferiorly where its transverse diameter was greatest,  $2\frac{1}{2}$  inches. The inferior mesenteric artery arose from the lower part of the aneurism. Above the renal vein the aorta was enlarged. Atheromatous plates were scattered here and there throughout its whole extent. The iliac vessels were perfectly healthy.

The CÆLIAC AXIS arose in the usual position; it was a fibrous cord for the first half inch of its extent; past that point it was of the normal size, dividing almost immediately into the hepatic, splenic, gastric, and left phrenic arteries; they and their branches were fully injected. The gastro-duodenal branch of the hepatic gave off three large pancreatico-duodenal arteries to the pancreas and duodenum. A well-marked branch from the splenic supplied the splenic flexure of the colon ana-

stomosing with the arterial loop formed by the colica media and colica sinistra. This junction was uninjected. No other anastomosis with the mesenteric system could be found. The left phrenic, equal in size to the radial, ramified in the left half of the diaphragm, there inosculating with branches from the lower intercostals. These inosculations were filled with injection. A plexus of tortuous well-injected arteries, situated on the left side of the aorta above the renal artery, connected the left phrenic and pancreatico-duodenal with the renal and supra-renal arteries. As these anastomosing vessels were filled with injection presumably the blood had entered the cœliac system through them. No other injected communication could be discovered; it is quite possible, however, that such may have existed, escaping notice owing to the fluidity of the injection, due to the very warm weather at the time of the dissection.

**MESENTERIC VESSELS.** Both these arteries were obliterated at their origin; their branches were filled with injection from the pelvis through the superior hæmorrhoidal, which equalled in size the femoral at Poupart's ligament. The blood reached the superior mesenteric through the left and middle colic arteries, which were more than double their ordinary size; the ileo-colic and right colic were of normal calibre. The last dorsal artery on the right side gave off opposite the apex of the last rib a branch, equal in size to the anterior temporal, which helped to supply the caput cæcum and the commencement of the large intestine, inosculating with the ileo-colic; this inosculation was not injected. The lumbar arteries were large, inosculating freely with each other, and with the ileo-lumbar and circumflex-iliac arteries. The supra-renal arteries were enlarged, sending branches to the fat around the kidneys. On each side a well-marked artery pierced the capsule of the kidney at the upper part, supplying the fat around the organ. These enlarged vessels communicated freely with the lumbar arteries. The right phrenic was absent, its place being taken by branches from the supra-renal on the same side. The epigastric and circumflex-iliac arteries were increased in size.

The AORTA was carefully removed; it was adherent to the anterior surface of the body of the 4th lumbar vertebra; the

pressure of the aneurism had caused absorption of the bone at that point. The walls of the artery were thickened and atheromatous, studded with calcareous plates of various sizes. It was laid open from behind: anteriorly its canal was filled throughout the whole length with laminar clots, evidently of long standing. A channel for the passage of the blood to the iliacs remained patent behind this fibrinous layer, which, in the lower part of the cavity of the aneurism, was nearly an inch in thickness. A careful dissection of the origins of the cœliac axis and mesenteric vessels showed organized clots firmly adherent to the edges of their openings, completely obliterating them. The closure of these arteries was not of recent date.

The superior hæmorrhoidal artery was traced into the pelvis, and its inosculation with the internal iliacs were dissected with care. The presence of a large abscess, filled with fœtid pus, surrounding the lower end of the rectum, and the resulting induration of the tissues around, rendered the dissection difficult. The uterus was fixed, and the rectum adherent to the anterior surface of the sacrum.

The SUPERIOR HÆMORRHOIDAL, as large as the femoral at Poupart's ligament, passed into the pelvis a little to the left of the middle line, and, opposite the 2nd sacral vertebra, divided into two primary branches. 1. The smaller or left division, equal in size to the brachial, coursed down the side of the rectum, and there bifurcated; its anterior branch, anastomosed with a branch from the ischiatic, and with the lateral sacral of the gluteal; while its posterior branch joined a plexus around the rectum, and anastomosed with the middle and inferior hæmorrhoidal arteries. 2. The larger or right division, as large as the axillary, also bifurcated. The anterior branch anastomosed by numerous branches with the right pudic and right middle hæmorrhoidal, forming a dense plexus of tortuous vessels resembling closely an "aneurism by anastomosis." This plexus lay to the right side of the rectum, opposite the third sacral vertebra. The arteries forming it were twisted and tortuous, similar to the curling arteries of the gravid uterus. After sending branches to this plexus, it divided into two vessels, which ended in the plexus round the rectum. The posterior branch, a very tor-

tuous vessel, after giving off a branch to each plexus, anastomosed with a large branch from the right pudic. This was the principal channel by which the blood passed from the parietal to the visceral arteries, a direct communication existing between the two systems equal in size to the brachial. The main branches of the right division were connected by a transverse vessel. From this description, and from a reference to the diagram, it will be seen that the blood was conveyed from the in-

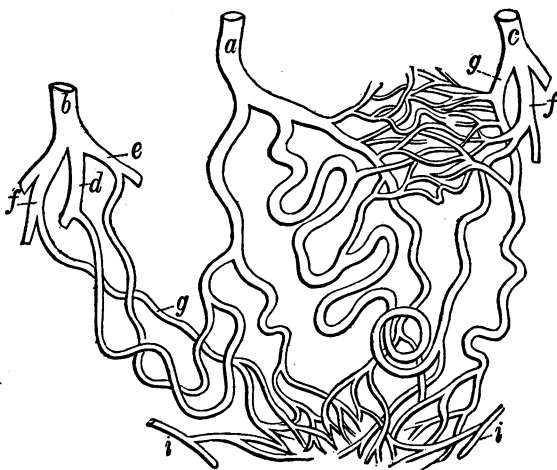


Diagram of Pelvic Plexus, seen from behind, the sacrum having been removed.

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|--|--------------------------------|--------------------|
| <i>a.</i> Superior hæmorrhoidal.                           | <i>b.</i> Left internal iliac. |                    |
| <i>c.</i> Right internal iliac.                            | <i>d.</i> Ischiatic.           | <i>e.</i> Gluteal. |
| <i>f.</i> Pudic.   | <i>g.</i> Middle hæmorrhoidal. |                    |
| <i>i.</i> Pudic in perineum, giving off sup. hæmorrhoidal. |                                |                    |

ternal iliacs to the mesenteric vessels; first, through two large plexuses, one situated round the lower end of the rectum, the other at a higher level and to the right; secondly, by three large anastomosing vessels: the whole forming a dense mass of tortuous arteries closely aggregated together on the posterior aspect and sides of the rectum. I could trace no anastomosis in front of the gut. The remaining branches of the internal iliacs were normal. The viscera were normal.

*Remarks.* This case is probably the only recorded example of an obliteration of the three anterior visceral branches of the abdominal aorta at their origin, and of a consequent enlargement of the secondary anastomoses for the supply of the viscera: the stomach, liver, spleen, pancreas and duodenum being supplied from the left lower intercostals, and from the left renal and supra-renal arteries which inosculated with the lumbar arteries on the same side; the remainder of the intestines receiving its supply from the internal iliacs through a large plexus surrounding the rectum, except the cæcum and ascending colon, which received blood from the last dorsal artery on the right side.

This case presents several interesting practical aspects.

1. It confirms the statement that, between the visceral and parietal branches of the abdominal aorta, a free communication exists through the sub- or extra-peritoneal system of arteries, first systematically described by Prof. Turner, in the *Brit. and For. Med. Ch. Rev.* for July, 1863.

2. Enlargement of this system of arteries, not only in the abdomen proper but in the pelvis, may take place to such an extent as to become the channel of blood supply to the abdominal viscera when their main arterial trunks are obliterated.

3. It establishes the important practical point that a direct arterial channel exists by which the blood can be drawn directly from the abdominal viscera by the employment of depletory measures to the walls of the abdomen. Thus, in inflammation of the cæcum, the arterial anastomosis between the last dorsal artery and the ileo-colic branch of the superior mesenteric, enlarged in this instance but always present, enables the physician, if he considers it advisable, to draw blood directly from the inflamed viscus: and in inflammation of the kidneys the anastomoses between the renal and lumbar arteries (specially those branches of the renal which, passing through the substance of the organ, pierce the capsule and supply the surrounding fat), explain easily and satisfactorily why cupping over the loins in inflammation of the kidneys is of such undoubted benefit.

4. It is evident that the anastomoses in the pelvis between the internal iliac and mesenteric vessels, enlarged in this instance for the supply of the viscera, would be one of the principal channels of blood-supply to the lower limbs in occlusion of the lower part of the aorta from disease, or as the result of ligature. Here the current of blood was reversed, the blood flowing from the pelvis to the viscera, while in occlusion of the aorta the blood would pass through the mesenterics into the pelvis, and thence into the internal iliacs to the lower limbs. In ligature of the common iliac, this anastomosis between the mesenterics and internal iliacs would probably be enlarged.

This case is therefore interesting to the surgeon in reference to ligature of the aorta. It does not, I apprehend, bear directly on the important question: Is there any rational hope of recovery after this operation? The arterial changes consequent on disease are gradual, and they therefore do not give us much assistance in estimating the effect that would be produced by the sudden stoppage of the current of blood, as in ligature. It will, however, help to solve the as yet unsettled point—By what channel does the blood reach the pelvis and lower limbs after obliteration of the aorta? That it does so cannot be doubted. There are four cases on record which place this fact beyond dispute. 1. In the *Dublin Hosp. Reports*, II. 1818, Dr Goodisson of Wicklow describes a case in which, as a consequence of disease, the lower part of the aorta and the common iliacs were obliterated. The obliteration was of long standing. The intercostal arteries, and “in particular that one which takes its course along the last rib,” were “much increased in size,” the spermatic arteries were “immensely increased,” the mammary, lumbar, and circumflex ilii were “much enlarged.” The inferior mesenteric was occluded, but the viscera had been removed before the diseased condition was noticed, so that no description of their arterial supply could be obtained. 2. In a pamphlet on *Aneurism of the Abdominal Aorta*, Ed. 1827, Dr A. Monro relates a case of closure of that vessel at the bifurcation in consequence of an aneurism. The patient died of phthisis, and there were no symptoms referable during life to the abdominal lesion. Dr Monro distinctly says that the

coeliac axis, mesenteric, renal and lumbar arteries were of normal size; and adds that probably the blood reached the limbs by anastomoses between the phrenic, lumbar, ileo-lumbar and circumflex-ili arteries, between the gluteal and lumbar, and lastly, between the internal mammary and epigastric arteries. In neither of these cases, owing to the vessels being uninjected during the *post mortem* examination, have we a complete or satisfactory account of the enlarged anastomoses which must have been present. 3. The abdominal aorta has been ligatured five times in man, by Sir Astley Cooper in 1817<sup>1</sup>, by James in 1829<sup>2</sup>, by Murray in 1834<sup>3</sup>, by Monteiro in 1842<sup>4</sup>, by South in 1856<sup>5</sup>. There has not yet been a successful case; but Dr Monteiro's patient lived for ten days after the operation; we may therefore conclude that the blood must have reached and nourished the lower limbs. A *post mortem* examination was made, but special attention does not seem to have been paid to, and no attempt made to discover, the new channels through which the blood reached the extremities. 4. A description will be found in the *Med. Chir. Trans.* XXIX, of a case in which Dr William Murray of Newcastle cured, by pressure with a tourniquet on the aorta above the tumour, an abdominal aneurism the size of a large orange. The aneurism was situated below the origin of the superior mesenteric artery, the pulsation being felt on a level with, and a little to the left of, the umbilicus. Two attempts were made, under chloroform—the first for two hours, the second for five; the latter was completely successful. Five months after the operation Dr Murray notes, "Patient looks well, works as engine-fitter from 6 a. m. to 8 p. m. Lives two miles from his work. No pulsation in the aorta below the tumour, which is now small and hard. Distinct pulsation in right femoral, none in left." The man is, as far as I am aware, still alive, and the condition of the abdominal vessels cannot be definitely settled; the present case will, I think, aid us in coming to a conclusion. Is it not highly probable that the extra-peritoneal vessels around the kidneys and in the pel-

<sup>1</sup> Cooper and Trayers, *Surg. Essays*, i. 1818, p. 101.

<sup>2</sup> *Med. Chir. Trans.* xvi. 1.

<sup>3</sup> *Lond. Med. Gazette*, xiv. 68.

<sup>4</sup> Schmidt's *Jahrbuch*, 1843.

<sup>5</sup> *Lancet*, 1856, p. 222.

vis are enlarged; and that through them the blood is conveyed to the pelvis and lower limbs? This view is strengthened by a note taken on the 4th day after the compression. "Running over the right border of the tumour a vessel can be felt pulsating, which, from its position and size, is probably the superior mesenteric artery." Eleven weeks after there is no pulsation to be felt in the iliacs or femorals. Pulsation is not noticed in the right femoral until five months have elapsed. Is not this significant fact explained by supposing that the anastomoses between the lumbar arteries and ascending branches of the gluteal are enlarged; also that the blood having reached the ischiatic and gluteal through the pelvic plexus, is thence poured into the circumflex and perforating branches of the profunda of the femoral; and that the pulsation in the right femoral, five months after the consolidation of the aneurism, is a regurgitant one?

To sum up: these four cases distinctly prove that the circulation can be carried on after the aorta is occluded. In none have we a satisfactory explanation by what channel it reaches the lower limbs. Does not the present case fill up the blank? Can it not now be said that it is through the anastomoses between the parietal and visceral branches of the aorta; in other words, through the extra-peritoneal system of vessels in the region of the kidneys, and more especially in the pelvis, that the blood, for the most part, finds its way to the lower extremities?