Anatomy of the caecum, appendix and colon

Harold Ellis

Vishy Mahadevan

Abstract

The gross and microscopic anatomy of the caecum, appendix and colon is described. An embryological explanation of the adult form is included. There is also a note on cancer spread.

Keywords Anatomy; appendix; ascending colon; blood supply; caecum; descending colon; lymphatic drainage; sigmoid colon; transverse colon

The large bowel is subdivided for descriptive purposes into the caecum and appendix, the ascending colon, hepatic flexure, transverse colon, splenic flexure, descending and sigmoid colon and the rectum and anal canal (Figure 1). The last two are addressed elsewhere in this issue. The caecum (which means a blind-ended pouch) represents the outpouching of the large bowel below the level of the ileocaecal junction, where the terminal ileum enters the large intestine via the ileocaecal valve.

The large bowel varies considerably in its length in different subjects — the caecum, in particular, is highly variable in its size. On average the total length of the large bowel is about 1.5 m (5 ft). The colon and caecum, but not the appendix or rectum, are characterized by the presence of taeniae coli on their outer aspects. These are longitudinally disposed 1.5 cm wide bands, and represent condensations of the outer, longitudinal layer of the muscle wall of the bowel. Because the taeniae are shorter than the bowel to which they are attached, the colon presents its typical sacculated shape, as may be seen in a plain radiograph of the abdomen as haustrations when the large bowel is distended with gas. This is in contrast to the radiological appearance of distended small bowel, which presents complete transverse lines due to the transverse mucosal folds of the valvulae conniventes of the small intestine. Interestingly, the taeniae coli are absent in many species of lower animals.

The colon bears characteristic fatty peritoneal tags — the appendices epiploicae — scattered over the serosa. Their function is unknown. Appendices epiploicae are absent over the caecum, appendix and rectum. They are most abundant on the surface of the distal descending colon and sigmoid colon.

Embryology

The configuration of the colon is best understood in terms of its embryology. In the early embryo the gut develops as a midline structure. The midgut (fed by the superior mesenteric artery) adjoins the hindgut (fed by the inferior mesenteric artery); this junction being situated in the adult approximately at the junction between the proximal two-thirds and distal third of the transverse colon. The embryonic midgut may also be defined as that part of the gut that resides in the physiological umbilical hernia between the 6th and 10th weeks of intrauterine life. During its return to the abdominal cavity the midgut twists to the right (ascending colon) and then to the left (descending colon) so these parts become retroperitoneal. It drags its blood supply with it, which explains why the right colon is supplied by branches of the superior mesenteric artery and the left colon by the inferior mesenteric artery. Surgical mobilization of the colon follows these tissue planes to restore its midline position, thus the safe approach on each side is from lateral to medial. There is a natural vascular watershed in the transverse colon between the branches of the middle and left colic vessels, resulting in the splenic flexure being vulnerable to ischaemia.

Peritoneal attachments

The transverse and sigmoid colon are completely peritonealized, suspended by the transverse and sigmoid mesocolons, respectively. The transverse colon is readily identified by its attachment, along its free border, to the greater omentum. In contrast, the ascending and descending colons lie on the posterior abdominal wall and are covered on their fronts and sides by the parietal peritoneum of the posterior abdominal wall. The adherence of the ascending and descending colons to the posterior abdominal wall is relatively avascular, and enables the surgeon easily to mobilize these parts of the large bowel. The caecum is usually completely peritonealized, as may occasionally be the commencement of the ascending colon. The appendix usually hangs free on its own mesentery, although it may tuck itself extraperitoneally behind the ascending colon or adhere to the back of the caecum.

The appendix

The appendix arises from the lower posterior aspect of the caecum, about 2.5 cm inferior to the ileocaecal valve. Its length is highly variable — with a range of 1.2 to 20 cm. Its position is also highly variable (Figure 2); indeed, it has been said that the appendix is the only organ with no anatomy! Most commonly it lies behind the caecum (retrocaecal), but a long appendix may extend behind the ascending colon and even abut onto the right kidney or the duodenum. In other instances it dangles in the subcaecal position (abdominal), hangs down into the pelvis (pelvic), or tucks itself behind the terminal ileum (retroileal).

The blood supply of the appendix (Figure 3) derives from the appendicular artery, which arises from the ileocolic artery. It passes behind the terminal ileum to reach the appendix via the appendicular mesentery. Note that this is an end-artery and represents the entire blood supply of that organ. Acute infection of the appendix may result in thrombosis of this vessel, with inevitable gangrene and then perforation. This is in contrast to acute cholecystitis, where the rich collateral blood supply to the gall bladder, via vessels passing from the right hepatic artery in the gall bladder bed, ensures the rarity of gangrene of the gall bladder even if the cystic artery has thrombosed in the inflammatory process.

Harold Ellis *CBE FRCS FRCOG is Emeritus Professor of Surgery, University of London (Charing Cross and Westminster Medical School). He is Clinical Anatomist in the Division of Anatomy at King's College (Guy's Campus), London, UK. Conflicts of interest: none.*

Vishy Mahadevan *MBBS PhD FRCS is the Barbers' Company Professor of Anatomy and Professor of Surgical Anatomy at the Royal College of Surgeons of England, London, UK. Conflicts of interest: none.*

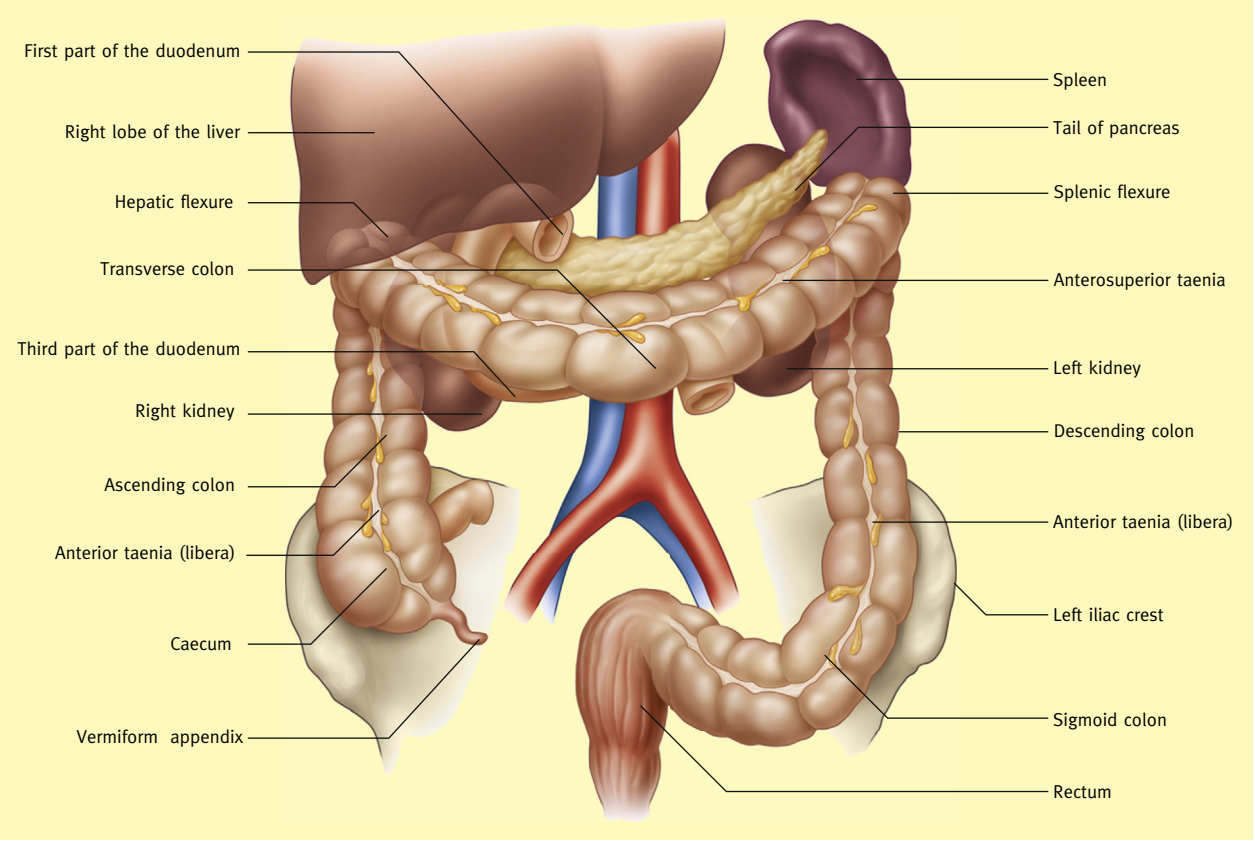

Figure 1 The large bowel

Vascular supply

The large bowel, from the caecum to roughly the splenic flexure, receives its arterial supply from the superior mesenteric artery. Beyond this, it is supplied by branches of the inferior mesenteric artery (Figure 4). Arising from the superior mesenteric artery, the ileocolic artery, in addition to supplying the terminal ileum, also supplies the caecum and ascending colon and gives off the important appendicular branch. The right colic artery supplies the ascending colon, while the middle colic artery supplies the transverse colon. The inferior mesenteric artery now takes over; the left colic artery supplies the descending colon, while the sigmoid branches supply the sigmoid colon. Note that there are common variations in these vessels; for example, the ileocolic and right colic branches frequently have a common trunk of origin. What is important is the fact that there is an extremely effective anastomotic arcade, the marginal artery, linking these successive arteries around the margin of the bowel. In older patients with atheroma, this marginal artery may be compromised, which may lead to anastomotic ischaemia after bowel resection. Venous drainage takes place via the veins that accompany these vessels in their distal part (Figure 5). Only proximally does the arrangement differ, as the venous drainage forms part of the portal system of veins. The inferior mesenteric vein ascends above the point of origin of its accompanying inferior mesenteric artery to join the splenic vein behind the body of the pancreas, while the superior mesenteric vein joins the splenic vein behind the neck of the pancreas to become the portal vein.

Lymphatic drainage

Numerous small lymph nodes lie near or even on the large bowel. These drain to intermediately placed larger nodes along

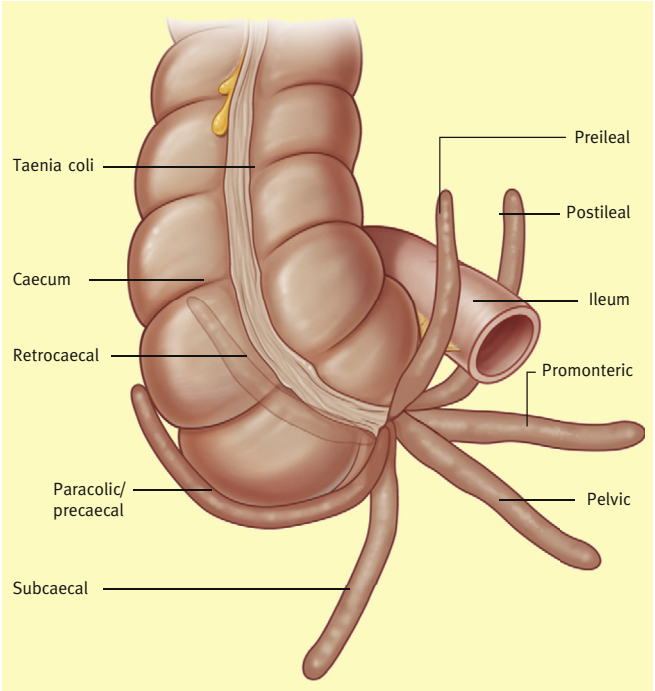

Figure 2 The appendix and its various positions