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ANA 212 Assignment

THE ANAL CANAL

The anal canal is the final segment of the gastrointestinal tract. It is about 3 to 4cm long and lies completely extraperitoneally. It begins at the anorectal junction distally from the perineal flexure and ends at the anus. It has an important role in defecation and maintaining faecal continence.

Anatomical Position

The anal canal is located within the anal triangle of the perineum between the right and left ischioanal fossae. It is the right segment of the rectum and passes inferoposteriorly to terminate at the anus.

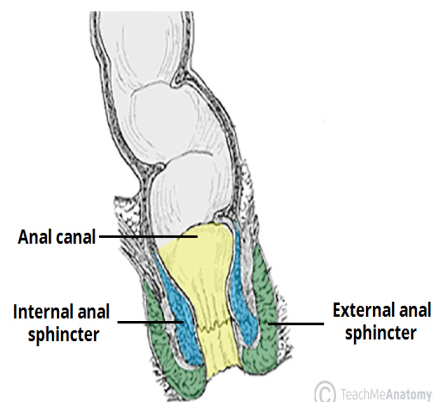
Anatomical Structure

Except during defecation, the anal canal is collapsed by the internal and external anal sphincters to prevent the passage of faecal material. The anal canal is surrounded by internal and external anal sphincters, which play a crucial role in the maintenance of faecal continence:

internal anal sphincter - surrounds the upper 2/3 of the anal canal. It is formed from a thickening of the involuntary circular smooth muscle in the bowel wall.

external anal sphincter - voluntary muscle that surrounds the lower 2/3 of the anal canal (and so overlaps with the internal sphincter). It blends superiorly with the puborectalis muscle of the pelvic floor.

At the junction of the rectum and the anal canal, there is a muscular ring - known as the anorectal ring. It is formed by the fusion of the internal anal sphincter, external anal sphincter and puborectalis muscle, and is palpable on digital rectal examination.



Internal Structure

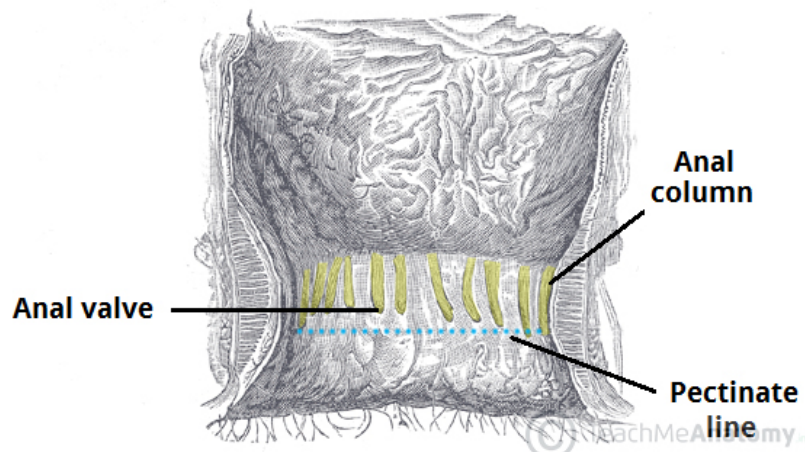
The superior aspect of the anal canal has the same epithelial lining as the rectum (columnar epithelium). However, in the anal canal, the mucosa is organised into longitudinal folds, known as anal columns. These are joined together at the inferior ends by anal valves. Above the anal valves are small pouches which are referred to as anal sinuses - these contain glands that secrete mucus.

The anal valves collectively form an irregular circle - known as pectinate or dentate line. This line divides the anal canal into upper and lower parts, which differ in both structure and neurovascular supply. This is a result of their different embryological origins:

above the pectinate line derived from the embryonic hindgut

below the pectinate line derived from the ectoderm of the proctodeum

Inferior to the pectinate line, the anal canal is lined by non-keratinized stratified squamous epithelium (known as the anal pecten). It is a pale and smooth surface, which transitions at the level of the upper inter-sphincteric groove to true skin (keratinized stratified squamous).



Zones

The anal canal may be subdivided into the columnar, intermediate and cutaneous zone:

Columnar zone: the lumen has folds of mucous membrane (anal columns) produced by arterial cavernous bodies (anal cushions) in the submucosa. These columns are connected to each other at their distal ends by transverse folds (anal valves). Behind the anal valves lie the crypts of Morgagni into which the excretory ducts of the anal glands open. All anal valves together form the dentate or pectinate line, a serrated line where the intestinal mucosa merges with the squamous epithelium of the anal canal and is also responsible for influencing the blood supply, innervation and lymphatic drainage to and from the anal canal.

Intermediate zone: distally from the dentate line lies a 1cm long zone with anal mucosa (anoderm).

Cutaneous zone: this zone below the anal verge (anocutaneous line) is a hollow between the internal and external anal sphincter and has regular perianal skin. The tension of the corrugator cutis Ani muscle gives it its fan-like look.

Anatomical Relations

It lies in close proximity to several other important structures in the pelvis and perineum:

Anteriorly	Posteriorly
Male: perineal body, urogenital diaphragm, urethra, bulb of the penis	For both male and female - anococcygeal ligament, coccyx and sacrum
Female: perineal body, urogenital diaphragm, vagina	

Neurovascular Supply and Lymphatics

The columnar zone derives from the endoderm whereas both the intermediate and cutaneous zone develop from the proctoderm (cloaca). As a result of the different embryologic origins, the zones have separate supplying structures. Hereby the dentate line serves as an important marker.

above dentate line: the arterial blood is supplied by the superior rectal artery (branch of the inferior mesenteric artery) anastomosing branches from the middle rectal artery. The venous blood flows through superior rectal vein which empties into the inferior mesenteric vein (portal venous system). The lymphatic drainage is into the lumbar paraaortic (internal iliac) lymph nodes. The sympathetic innervation is carried by the inferior mesenteric plexus while the parasympathetic innervation is by the pelvic splanchnic nerves at the inferior hypogastric plexus.

below dentate line: the blood supply comes from the middle (branch of the internal iliac artery) and inferior rectal arteries (branch of the pudendal artery from the internal iliac artery). The venous blood drains via the external hemorrhoidal plexus into the middle and inferior rectal veins. The lymphatic drainage is into the superficial internal iliac lymph nodes.

Function

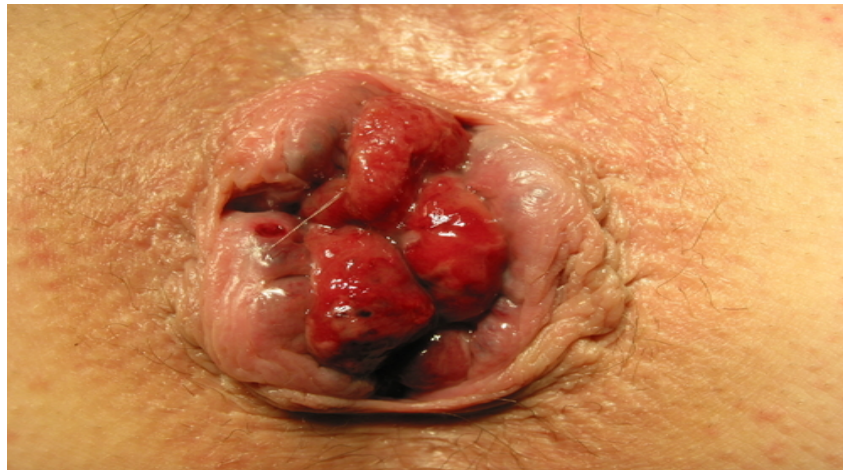
The anal canal is an important part of the continence organ. It is surrounded by a muscular sphincter system which tightly closes the lumen. The internal anal sphincter is permanently contracted through the sympathetic tonus and relaxes under parasympathetic influence. The external anal sphincter surrounds the anal canal like a clamp. It is in close relationship to the

puborectalis muscle (part of the levator Ani muscle) which encircles the rectum from behind (puborectal sling) and thus forms a bending closure. Both the external anal sphincter and the puborectalis muscle are voluntarily controlled.

The anal cushions play an important role in the fine control. Physiologically they are filled with arterial blood. During defecation, the internal anal sphincter relaxes so that the blood in the cushions drains away, allowing a smooth passage of the stool through the anal canal. A pathological enlargement of the anal cushions leads to pathological haemorrhoids.

The human anal glands are rudimentary. Their secreted scent does not play role for humans any more. For many animals the scent still fulfills important functions, eg. territory marking or sexual stimulation.

Clinical Relevance - Haemorrhoids



Haemorrhoids are vascular cushions found within the anal canal of healthy individuals, which help with the maintenance of faecal continence. If they become swollen and distended, they are referred to as pathological haemorrhoids.

Pathological haemorrhoids are observed in people who suffer from constipation, prolonged straining when defecating, or raised intra-abdominal pressure (eg. pregnancy, ascites). Upon examination of the anal canal (with the patient in the lithotomy position), the haemorrhoids are typically located at the 3, 7 and 11 o'clock positions.

They can cause bleeding and itchiness, and depending on the severity, can be managed conservatively or surgically.