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**PHYSIOLOGY**

**The Anal Canal.**

The anal canal is the last part of the gastrointestinal tract. It is about 3 to 4 cm long and lies completely extraperitoneally. It begins at the anorectal junction distally from the perineal flexure and ends at the anus.

It is divided into three anatomical zones; columnar, intermediate and cutaneous. The dentate (pectinate) line divides the anal anal into upper (two-thirds) and lower (one-third) parts, each one being supplied by completely different neurovascular structures. The functions of the anal canal include the maintenance of fecal continence and defecation. This is achieved with the help of the anal sphincters and the neighbouring puborectalis muscle.

This article will describe the anatomy and function of the anal canal.

Key facts about the anal canal

Location

Extraperitoneal, between the anorectal junction and anus

Zones

Columnar zone - anal columns, anal cushoins, anal valves, crypts of Morgagni, dentate (pectinate) line

Intermediate zone - anoderm

Cutaneous zone - perianal skin

Blood supply

Above dentate line.(superior 2/3) - superior rectal artery

Below dentate line (inferior 1/3) - middle and inferior rectal arteries

Venous drainage

Above dentate line.(superior 2/3) - superior rectal vein followed by hepatic portal circulation

Below dentate line (inferior 1/3) - middle and inferior rectal veins followed by the vena cava circulation

Innervation

Above dentate line.(superior 2/3) - inferior mesenteric plexus, pelvic splanchnic nerves, inferior hypogastric plexus

Below dentate line (inferior 1/3) - pudendal nerve

Histology

Colorectal zone - simple columnar epithelium

Transitional zone - simple columnar and stratified squamous epithelium

Anoderm - stratified squamous non-keratinized epithelium

Cutaneous zone - stratified squamous keratinized epithelium

Functions

Fecal continence and defecation

Macroscopic anatomy

**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 crypts (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.

Intermediate zone - Distally from the dentate line lies a 1 cm 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.

Rectum and anal canal

**Blood supply and innervation**

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

The arterial blood is supplied by the superior rectal artery (branch of the inferior mesenteric artery). The venous blood flows through the internal hemorrhoidal plexus into the superior rectal vein (→hepatic portal system). The lymph drains into the lumbar (paraaortic) lymph nodes. The sympathetic innervation is carried by the inferior mesenteric plexus, while the parasympathetic innervation by the pelvic splanchnic nerves and the inferior hypogastric plexus.

Below the 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 (→body circulation). The lymph flows into the inguinal lymph nodes. The pudendal nerve is responsible for the sensory innervation.

**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 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 canal is only one component of the gastrointestinal tract. Is your knowledge of the rest of the digestive system up to scratch? Find out with our free digestive system quizzes and learning tools.

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 hemorrhoids.

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