

Fig. 2.6 Morgagni columns

Fig. 2.7 Diagram showing anal valves

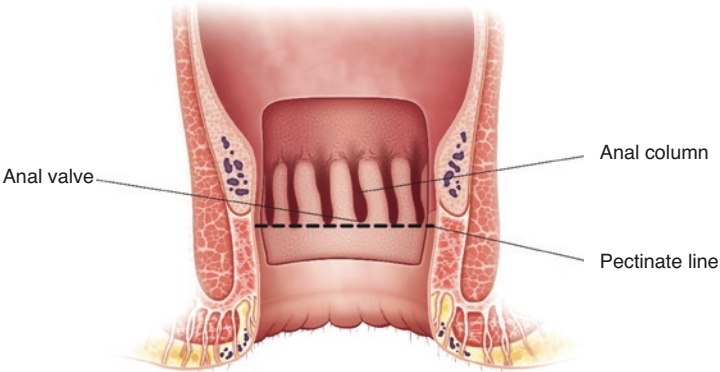


Table 2.3 Dentate line summarized

	Below the dentate	Above the dentate
	artery	line
Arterial blood supply	Inferior rectal artery	Superior and middle rectal artery
Venous drainage	Inferior rectal vein (systemic)	Superior rectal vein (portal)
Lymphatic drainage	Superficial inguinal nodes	Internal iliac nodes
Innervations	Somatic (Pudendal nerve)	Autonomic

2.5.5 Anal Papillae

These are remnants of the embryonic anal membrane and represent the junction of the proctodeum with the hindgut. These are present as small epithelial projections at the dentate line. In 60% of cases, 1–3 papillae are present, and in 40%, the number is from 4 to 6. The usual length of papillae is 1.0–5.0 mm. Due to their hyperplastic tendency, constant irritation, injury, or infection can cause enlargement, a condition known as “Hypertrophic Anal papillae” (Fig. 2.9) [12].

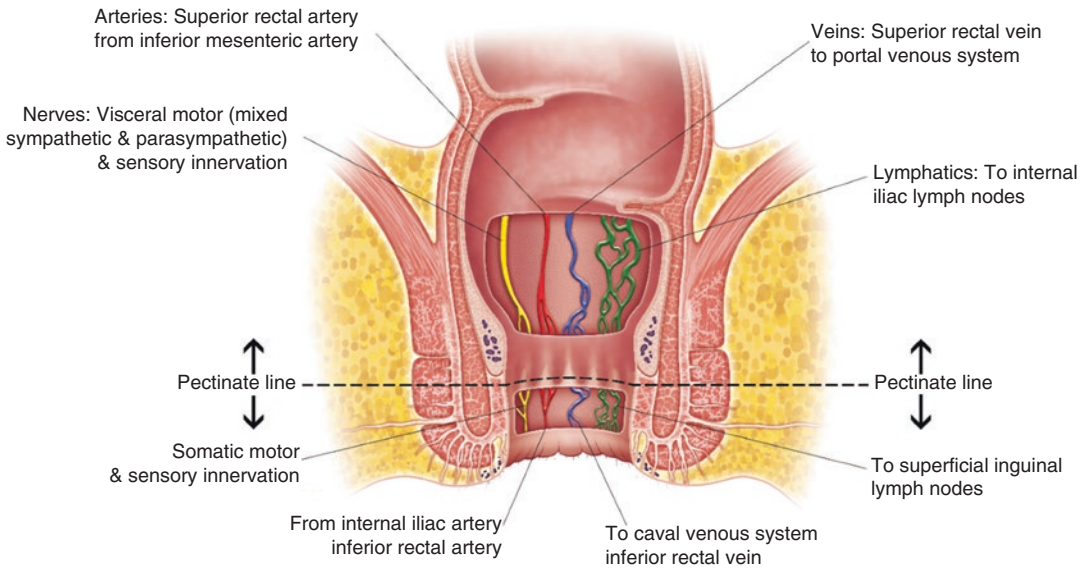


Fig. 2.8 Dentate line

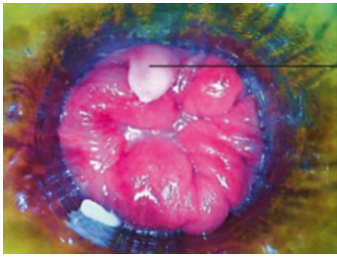


Fig. 2.9 Hypertrophic anal papillae

2.5.6 Anal Cushions

The term “anal cushions” was described by Thomson in 1975 [13, 14]. According to Thomson, the submucosa inside the anal canal forms a discontinuous series of cushions instead of a continuous ring.

There are three columns of these cushions along the anal canal—right anterior, right posterior, and left lateral, popularly known as 3, 7, and 11 o’clock positions (Fig. 2.10) [13]. These cushions represent well-shaped, deep purple, hemi-

spherical masses that protrude towards the anal canal lumen. Each cushion has a submucosa containing loose connective tissue, elastic muscle fiber, and anorectal vascular plexus consisting of arterioles and venules. The vascular plexus inside the cushions gives the surgical anal canal a purple color. The vertical mucosal folds of Morgagni superimpose the cushions.

The anal cushions are held in their normal position by the muscle fibers of ligament of Treitz. These fibers originate from conjoined longitudinal muscle (CLM), pierce the internal sphincter, and play a vital role in anchoring anal cushions (Fig. 2.11).

Histology of Mucosa Covering Anal Cushions

The anal canal mucosa has three layers—muscularis mucosae, lamina propria, and endothelium. The vessels cross muscularis mucosae to enter lamina propria. Due to momentary displacement during defecation, the mucosa may become lax

Fig. 2.10 Positions of anal cushions

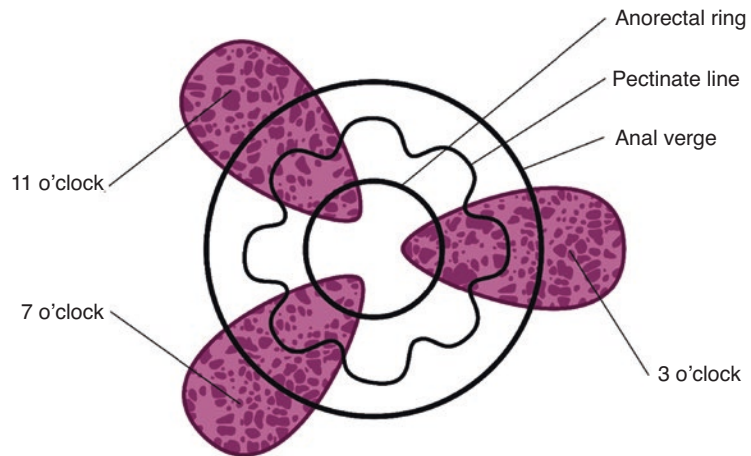
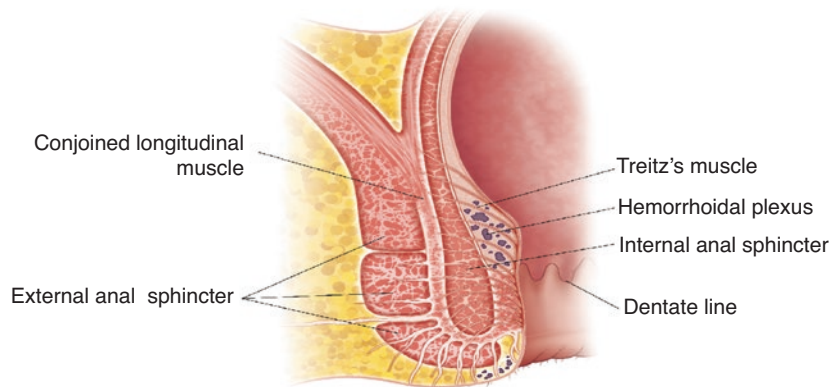


Fig. 2.11 Muscles of Treitz



and friable. A portion of this lax mucosal moiety might get pinched between the pectinate line and the passing stool. Trauma due to straining or passing hard stool may cause damage to the capillaries present in the lamina propria leading to bleeding [15] (Fig. 2.12).

2.5.7 Anal Transitional Zone (ATZ)

ATZ is a mucosal strip above the dentate line 0.5 to 1.0 cm long. The epithelium transforms to a single layer of columnar cells cephalad to this region and macroscopically develops the rectal mucosa's typical pink color [16] (Fig. 2.13).

Surgical Significance of Anal Transitional Zone

Sensory nerves in the anal canal were described by Dutheil and Gairns in 1960. This showed a high level of sensitivity to touch, temperature, and pain. Sensation and innervation are lacking in the mucosa [17, 18].

- The external anal sphincter contraction and internal anal sphincter relaxation are related to rectum's distention. Rectal contents may be sampled by the anal mucosa in ATZ which differentiates between gas, liquid, and solid stools.

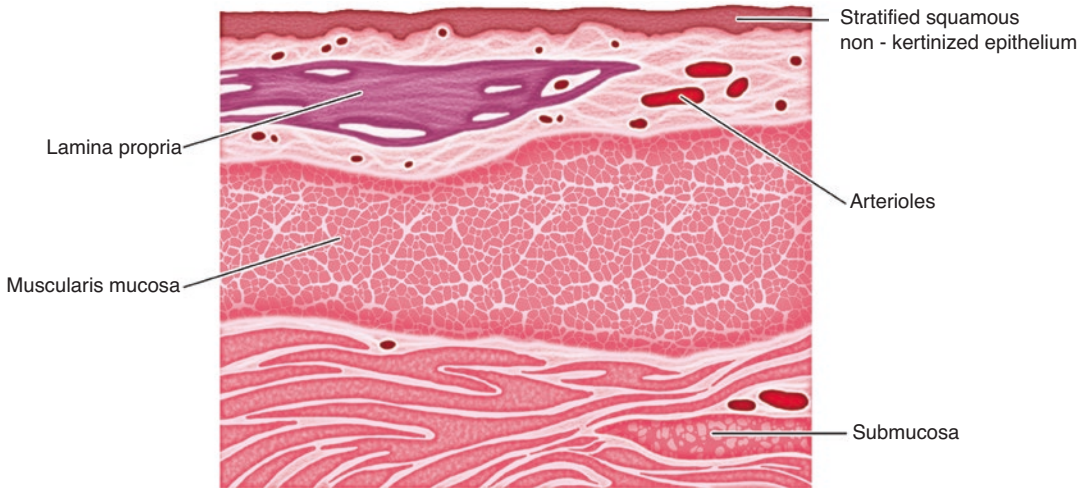
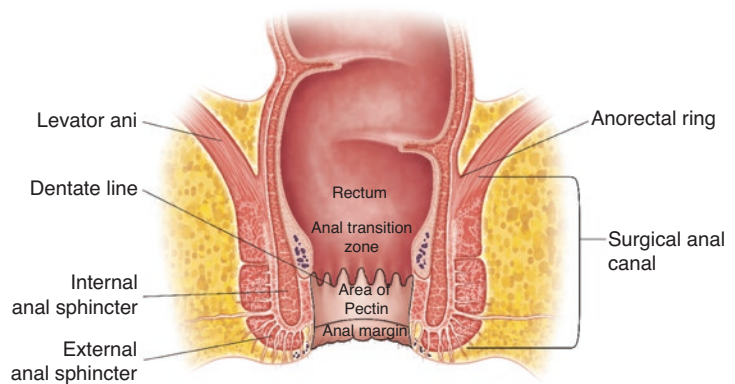


Fig. 2.12 Histology of anal cushions

Fig. 2.13 Anal transition zone (ATZ)



2.6 Intermediate Zone

Between the dentate line and the white line of Hilton is the intermediate zone. The intermediate zone is separated from the lower zone by a line known as the “White line of Hilton” [19]. It is approximately 1–1.5 cm long and lined with anal mucosa (anoderm). The mucosa over here is less mobile than in the upper zone. This area is known as the “area of pectin.” This area of pectin is lined by stratified squamous nonkeratinized epithelium [20] (Fig. 2.14).

Surgical Significance of White Line of Hilton

- Because of its white color, the bottom limit of the pecten is known as the “White line of Hilton” [19].
- This is seen at the intersphincteric groove.
- The stratified squamous epithelium that lines it is pale, thin, glossy, lacks sweat glands, and indicates the lower limit of pecten.
- Internal anal sphincter in pecten region is spastic according to Goligher et al. [21]. Anal fissures usually extend between the anal verge and the dentate line for this reason.

