

COLORECTAL SURGERY

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Churchill Livingstone 

Colorectal Surgery

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Preface

Not so long ago most surgeons were able to embrace all branches of surgery. Surgeons of those times were true generalists and proud of their status. Their operating list would range from a goitre to haemorrhoids, from a fractured femur to a prostate.

Soon after World War II, the general surgeons found that expanding knowledge necessitated a change of practice. Instead of having a broad interest, surgeons concentrated on special areas. The urologist laid claim to prostates and other urinary tract problems. The orthopaedist took over bones and joints. Paediatric surgery, neurosurgery, cardiothoracic surgery, otolaryngology, ophthalmology and plastic and reconstructive surgery were all identified as specialist groups, with their own training programmes and their own examinations.

Despite these developments, general surgery has continued to attract the largest number of trainees. It has a vital role in multiple road trauma injuries and most Chairs in Surgery have general surgeons as incumbents. These various changes have proved beneficial to the community and, indeed, have been inevitable as knowledge, techniques, new equipment and remarkable anaesthesia have appeared on the surgical scene.

Most colonic, rectal and anal canal disorders are treated by general surgeons, but in the United States of America the speciality of colonic and rectal surgery has become recognized by the American Boards. Throughout the rest of the world there is no formal certification in colon and rectal surgery, but in Australia the trend towards specialization is developing, with some teaching hospital appointments being made in this discipline.

The authors of this book, who were trained as general surgeons, have set out their views on colorectal surgery, which are based on substantial, experience in this field. All the contributors have been closely associated with one or more of the authors. The emphasis has been on symptoms and signs, modes of presentation, investigations and differential diagnosis. Surgical procedures are outlined, but minute detail has been omitted, to avoid producing a book too large to handle. The book is designed for general surgeons, surgical trainees and senior students, but general practitioners may find some sections of use.

The chapters on carcinoma of the large bowel are based on a unique series collected by Sir Edward Hughes over more than 30 years. Follow-up has been virtually complete and has been the responsibility of Mrs E. Debney. Miss Bridget Moynihan has been chief theatre sister for most of the operations in the series.

The authors wish to thank Mr W. Owen, who was responsible for the art work. A special appreciation is extended to Mrs Marianne Monks, whose dynamic approach assured that all targets were reached on schedule. The final manuscript was carefully prepared by Mrs Anne-Marie King and Miss Margaret Lohan. Mrs Jo Marshall proved a wonderful help in checking references.

Finally, our publishers have been very tolerant and have been most helpful to us throughout the joint venture.

Sydney and Melbourne, 1983

E.S.R.H
A.M.C.
M.K.K.

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Surgical anatomy of the anal canal, rectum and colon

Some aspects of the anatomy of the anal canal, rectum and colon are studied more readily in the living. It is a region in which the anatomist must obtain help from the surgeon, who has the advantage of both endoscopic examinations and surgical dissections.

THE ANUS, ANAL ORIFICE AND ANAL VERGE

The anus is set in the diamond shaped perineum, on or just behind the transverse line which joins the ischial tuberosities—the interschial line (Fig. 1.1). The anus has an anteroposterior direction and lies at the distal end of the natal cleft which may be deep or quite shallow. The anus may project beyond the level of the perineal skin. The skin around the anus is pigmented and is arranged in radiating folds (Fig. 1.2).

Normally the anus is closed, even when the patient is anaesthetized deeply. Sometimes lateral

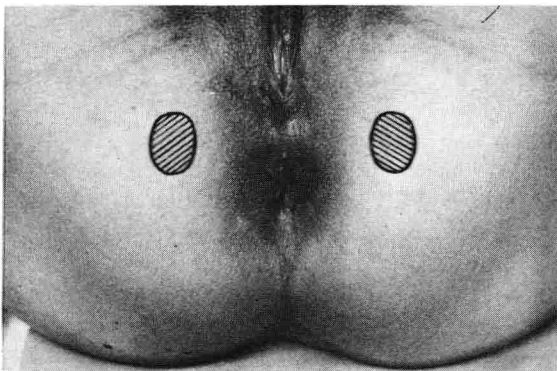


Fig. 1.1 Anus is situated on or just behind transverse line which joins ischial tuberosities.

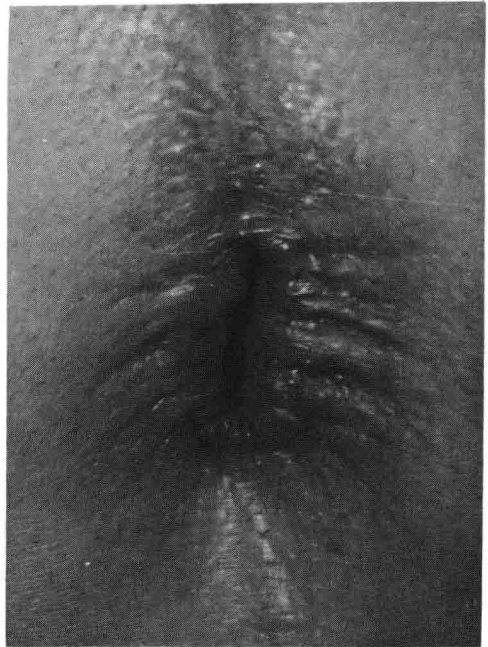


Fig. 1.2 Normal anus showing orifice, anal verge and radiating folds of skin.

traction at the anal margin will open the anus to reveal the anal orifice leading into the anal canal. The edge of the anal orifice is known as the anal verge or margin and it is from this relatively constant level that sigmoidoscopic measurements are made, rather than the variable level presented by the buttock. Some surgeons find that even the anal verge is an irregular landmark and prefer to evert the anus and measure from the dentate line (see overleaf). The difference in measurements from anal verge to dentate line is about 1 cm.

THE ANAL CANAL

The surgical anal canal extends from the anal verge to the anorectal ring and is 3–4 cm long (shorter anteriorly than posteriorly). The strong, muscular anorectal ring is the upper end of the sphincter muscle mass around the anal canal. The anorectal ring is not an embryological boundary, but it is recognized easily on clinical examination and is a landmark with considerable practical significance.

The dentate line represents the upper limit of the anatomical anal canal, and the anorectal ring the upper level of the surgical anal canal (Fig. 1.3).

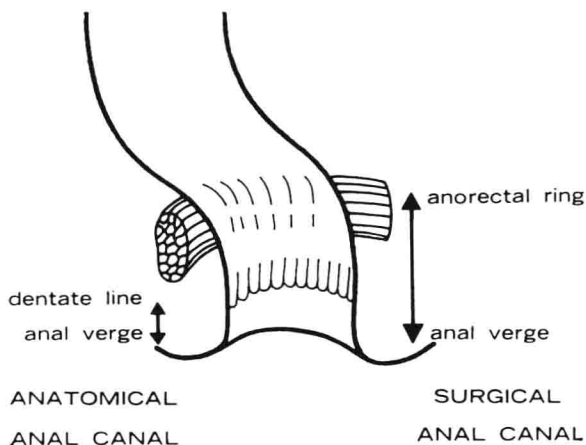


Fig. 1.3 The anatomical and surgical anal canal.

THE INTERIOR OF THE ANAL CANAL

Inside the anal canal, one centimetre above the anal verge, is a visible groove which has been called the interhaemorrhoidal depression or groove, but which is now known as the *dentate line*. This groove was believed to be caused by an anal intermuscular septum and was depicted as level with the lower border of the internal sphincter muscle, but further study of the anatomy showed this visible depression to be, in fact, 5–10 mm above the lower edge of the internal sphincter. The lower border of the internal sphincter can be felt on digital examination; the groove between it and the external sphincter has been termed the *palpable intersphincteric groove* (Morgan & Thompson 1956) (Fig. 1.4).

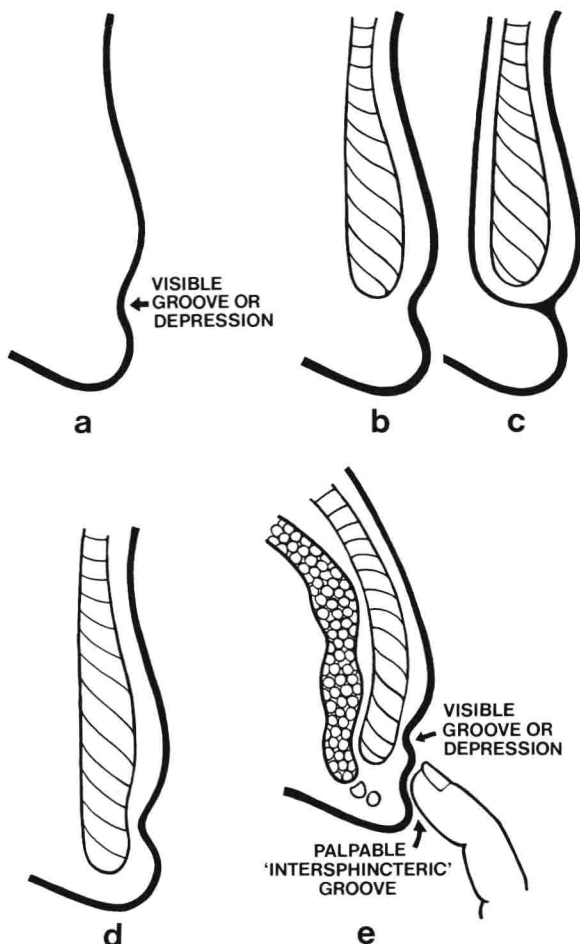


Fig. 1.4 a) Visible groove or depression. b) This depression was thought to be at lower border of internal sphincter and c) caused by an anal intermuscular septum, d) but visible depression is above lower edge of internal sphincter e) and therefore above the intersphincteric groove.

The mucous membrane of the upper half of the anal canal has a pink colour; lower, just above the dentate line, it is bluish purple. For a variable distance, up to 1 cm above the dentate line the covering epithelium is opaque. The degree of opacity varies from a barely visible film to a skin-like integument. This zone lies between mucous membrane above and modified skin below, and can be called the zone of modified mucosa. It commences below at the dentate line and ends above in an irregular line. When this zone of modified mucosa has a very thick epithelial covering, the upper line of transition forms almost a

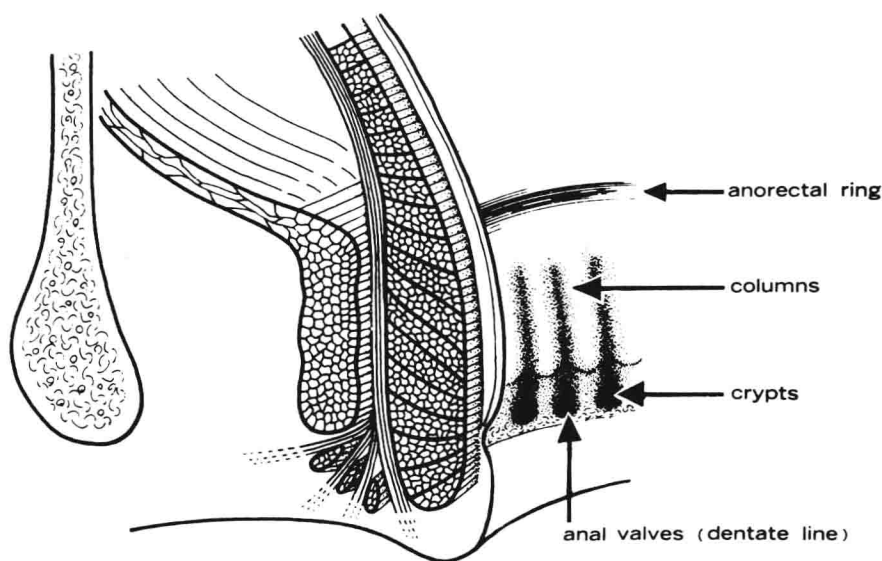


Fig. 1.5 Anatomical structures in anal canal.

ledge, but there are no valves at this level. This wavy line has been called the pectinate line, but most surgeons use this term as synonymous with the dentate line.

The mucous membrane of the anal canal is arranged in longitudinal folds, the *columns of Morgagni*, which become prominent just before they end at the dentate line. The groove between individual folds is therefore more obvious at the lower end and may appear as a deep sinus or crypt (*crypt of Morgagni*). The lower edge of the crypt, which has a definite lip, especially when stretched with a speculum, is called an *anal valve*. These valves give the characteristic appearance to the dentate line (Fig. 1.5).

Below the dentate line the lining of the anal canal is smooth modified skin, without hair, sweat and sebaceous glands. True skin appears at the anal verge.

MICROSCOPIC EXAMINATION OF ANAL CANAL (Figs. 1.6 and 1.7)

Microscopic examination of the anal canal reveals certain differences in the mucosa and submucosa of

the macroscopic subdivisions. The lining membrane of the upper part of the anal canal has the typical appearance of colonic mucosa. The glands of Lieberkühn are well-developed, and are lined by goblet cells, although both glands and cells become fewer near the zone of modified mucosa. A fine lamina propria is separated by the muscularis mucosae from the submucosa.

At the upper edge of the opaque zone of modified mucosa the intestinal mucosa is replaced abruptly by stratified epithelium composed of cuboid or squamous cells. The stratified epithelium may contain areas of columnar epithelium which serial sections show are not necessarily continuous with the intestinal columnar mucosa above. Mucous glands may be visible. The underlying connective tissue shows the same differentiation into lamina propria, muscularis mucosae and submucosa. The surface of this subepithelial connective tissue is even, with occasional papillary projections. There are no sweat or sebaceous glands or hair follicles.

At the dentate line it is common to see islands of columnar epithelium. At this level anal glands extend outwards and distally into the subepithelial tissues. Sections cut through an obliquely directed gland duct may show a delicate fold lined by

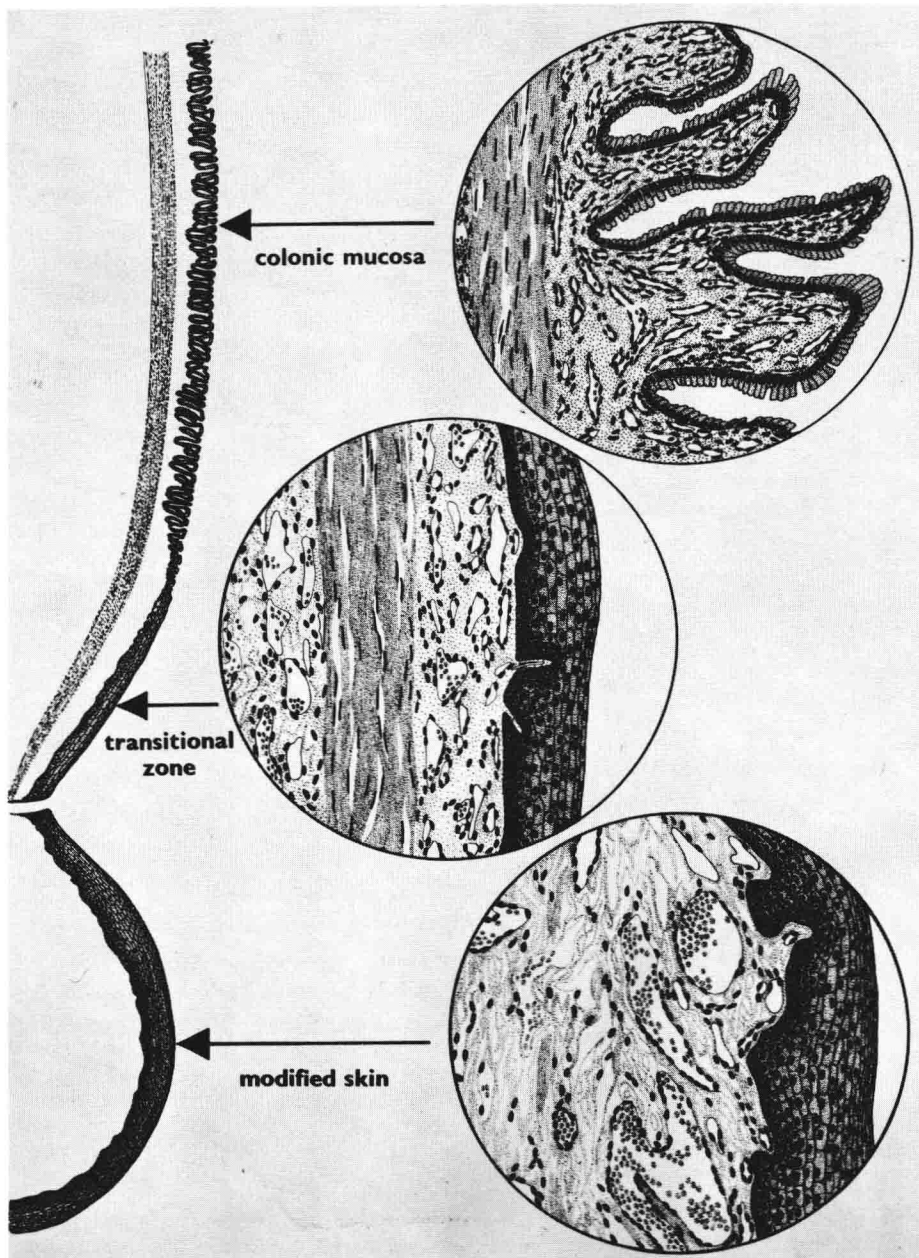


Fig. 1.6 Microscopic features of anal canal. Colonic mucosa in upper part of anal canal with underlying muscularis mucosae. Transitional layer immediately above dentate line showing stratified cuboidal or squamous epithelium and muscularis mucosae. Below dentate line stratified squamous epithelium rests on dense vascular connective tissue.

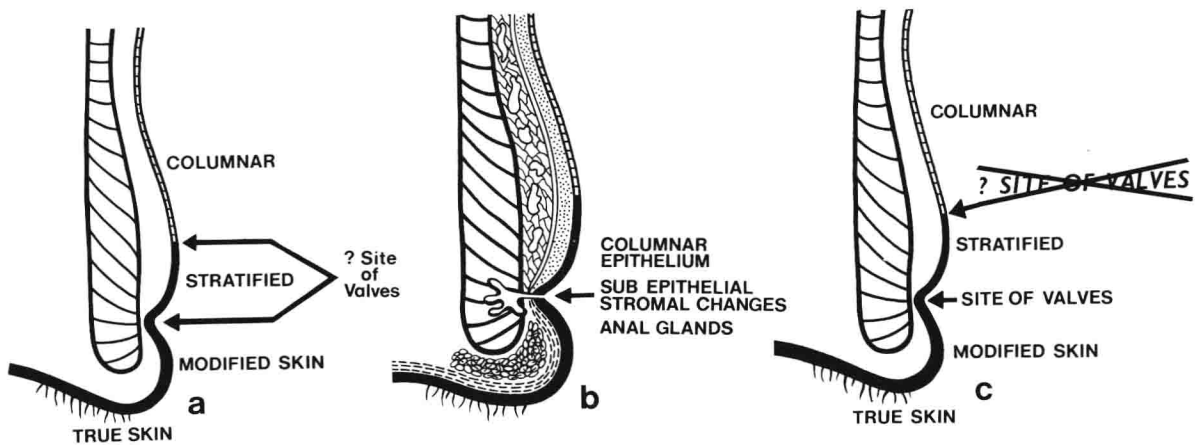


Fig. 1.7 Site of anal valves has been disputed. a) Do they occur at or above the visible depression? b) Important changes occur at the lower level c) Valves are sited at the interhaemorrhoidal depression or dentate line.

columnar epithelium above the stratified epithelium below. This may give the impression of a sharp edge to a valve.

Below the level of the dentate line the epithelium has a stratified squamous structure, sometimes with keratinization. There is no great difference between the epithelial layer of this zone and the previous one, although it is thicker and there are no columnar cell inclusions. The most notable difference is in the subepithelial connective tissue. The lamina propria, muscularis mucosae and submucosal layers disappear at the dentate line, and are replaced by a vascular dense connective tissue containing a few muscle fibres. Sweat and sebaceous glands and hair follicles are absent, but connective tissue papillary projections become a noticeable feature.

Below this zone of modified skin the histological appearances are those of normal skin.

RELATION OF ANAL VALVES TO THE DENTATE LINE (Fig. 1.7)

The anal valves have been regarded as the remains of the septum which separates the embryological proctodaeal ingrowth from the postallantoic gut. Some anatomical descriptions have placed the

valves and consequently the embryological junction at and some above the dentate line. Walls (1958) has highlighted the difficulty by pointing out that it is unusual to find valves even after cutting hundreds of serial sections.

If attention is focused on the abrupt change from intestinal mucosa to stratified epithelium of the intermediate zone, the embryological boundary and the valves will be placed above the dentate line. However, studies in association with L.B.M. Joseph (Vellore, India) and J.A. Buntine (Melbourne) show that significant changes occur more distally at the dentate line.

1. It is common to see patches of intestinal columnar epithelium at the dentate line.
2. At this level the anal glands are found.
3. This dentate line marks the site of change from the lamina propria and submucosa to dense undifferentiated connective tissue.

In addition to these observations Ewing (1954) and Walls (1958) have noted the absence of melanin pigment in the epithelium above the dentate line.

Therefore the junction of the embryological proctodaeal ingrowth and the postallantoic gut appears to be at the dentate line. The lower lips of the depressions at the dentate line form the anal valves.

ANAL PAPILLAE (Fig. 1.8)

Anal papillae are projections from the lower ends of the anal columns. Arising from the side or from the anal aspect of the anal columns, they may involve a valve. They are usually pyramidal in shape, but larger ones are often thickened near the free end to appear club or pear shaped. Varying in size from several millimetres to 3 cm, anal papillae are found in 40% of persons. It has been suggested that they represent the embryological proctodaeal plate, but more likely they are caused by an exaggerated response to minor trauma.

PECTEN (Fig. 1.9)

The obsolete term 'pecten' was used by Stroud (1896) to describe the band of modified skin which lies below the dentate line and above Hilton's white line (Hilton 1877). Ewing (1954) recommended that this latter term be discarded but it is possible to demonstrate a white line around the anal orifice during inspection when the skin is stretched and blanched over the lower edge of the internal sphincter. Fowler (1957) places the lower level of the pecten band at the palpable intersphincteric groove which corresponds with the white line. The stratified squamous epithelium which covers this zone lacks hair follicles, sweat and sebaceous glands, and the underlying connective tissue stroma is compact.



Fig. 1.8 Hypertrophied anal papilla.

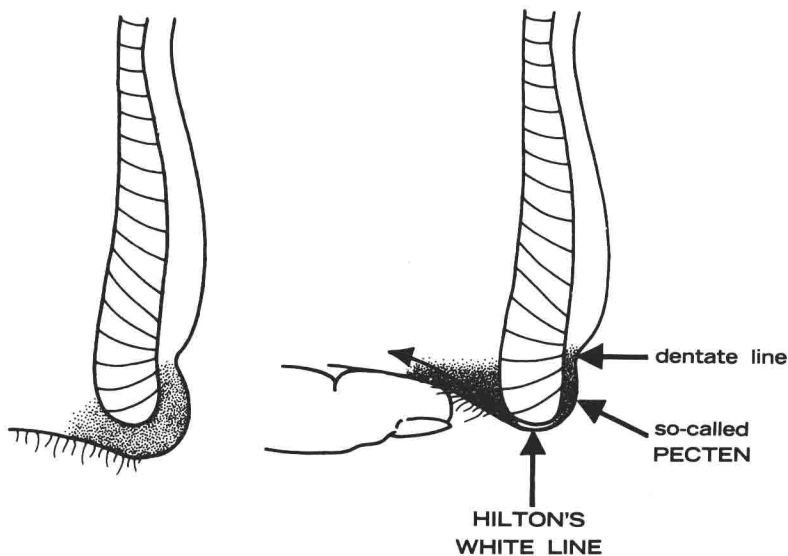


Fig. 1.9 Pecten and Hilton's white line.

ANAL GLANDS (Fig. 1.10)

Anal glands arise mostly from the dentate line and open into the crypts of Morgagni. Rarely more than six to eight in number, they tend to be concentrated in the posterior segment. They have a narrow duct (30–40 μm) and, whilst usually simple, may possess up to six tubular branches which extend towards the anus (Walls 1958). They ramify in the submucosa but actually penetrate the internal sphincter in 15% (Fowler 1957) to 50% (Parks 1956) of dissections to reach the longitudinal muscle layer. Small, discrete cysts may be observed in the course of the ducts.

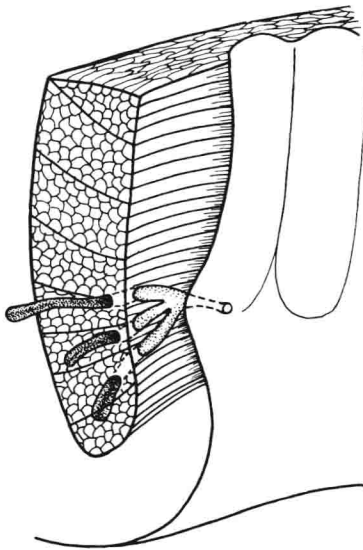


Fig. 1.10 Anal gland.

The ducts are lined by stratified mucus-secreting columnar epithelium with occasional patches of squamous epithelium. Lymphoid tissue is related to the ducts; indeed there is enough of such tissue to justify the term 'anal tonsil'.

The glands have been regarded as morphological rudiments, but it is likely they have a function. It is widely held that infection of these glands is responsible for anal infections and fistulas.

THE MUSCULATURE OF THE ANAL CANAL (Figs. 1.11 & 1.12)

The anal canal is surrounded by a complicated muscular sphincter, the structure of which has

often been investigated. The sphincter has voluntary and involuntary muscle components with smoothly coordinated function.

External sphincter muscle (voluntary, striated)

In 1889, Holl suggested a tripartite structure for the external sphincter muscle, and although subsequent investigations have failed to confirm any sharp subdivision, the concept has proved helpful.

1. Subcutaneous external sphincter muscle

This portion of the external sphincter muscle has the form of a flattened ribbon, varying in development from a few slender bundles to a muscle of substantial thickness. Fowler (1957) observed constant anterior attachments to the perineal body or to the superficial perineal muscles and nearly always a posterior attachment to the skin of the anococcygeal sulcus. The subcutaneous sphincter is split into bundles by prolongations of the longitudinal muscle passing towards the skin. This subcutaneous part of the external sphincter muscle is not an immediate relation to the anal canal as was once believed.

2. Superficial and 3. Deep parts of the external sphincter muscle

In earlier descriptions the superficial part of the external sphincter muscle was described as elliptical in shape, lying above and extending a little more laterally than the subcutaneous portion. Posteriorly it was said to be attached to the skin and the dorsal aspect of the coccyx (the only part of the external sphincter attached to the coccyx), whilst anteriorly the muscle gained insertion into the perineal body.

The deep external sphincter muscle was defined as the uppermost of the three subdivisions. As it had no attachment to the coccyx, it formed the anterior boundary of a potential space, pyramidal in shape, between the external sphincter muscle attached to the dorsum of the coccyx and the levator ani attached to the anterior aspect of coccyx and sacrum.

However Fowler (1957) observed considerable variation between specimens, no two being alike. A plexiform arrangement was the rule with fibres

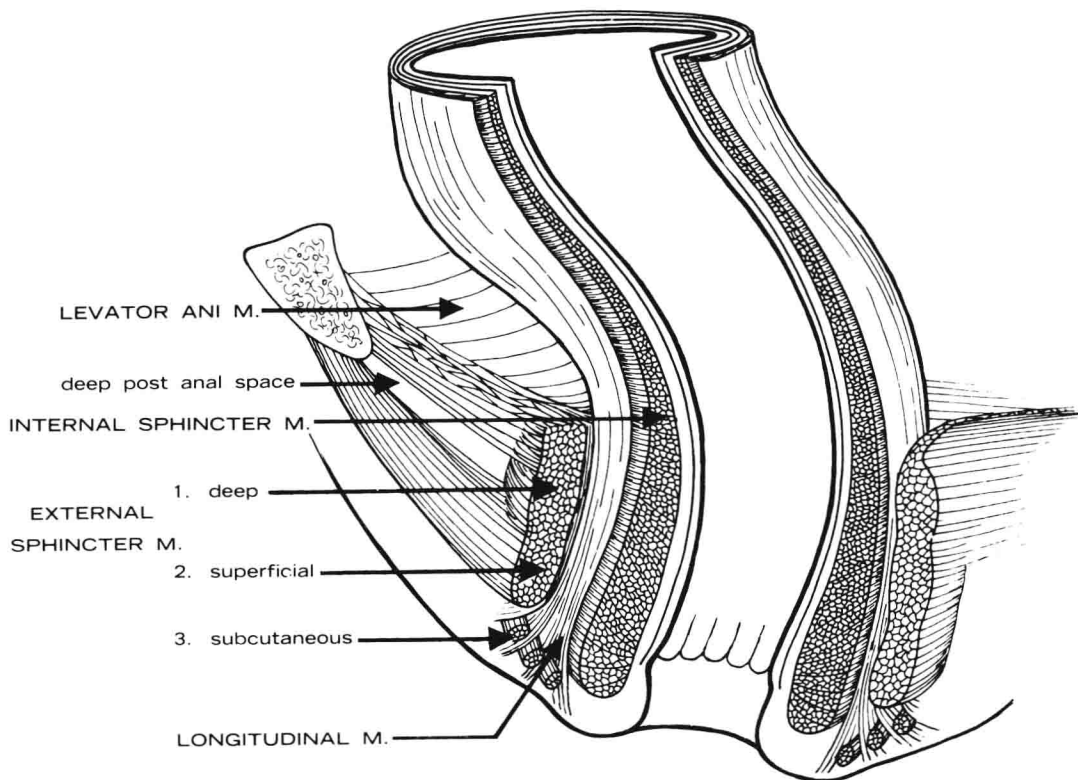


Fig. 1.11 Components of musculature of anal sphincter.

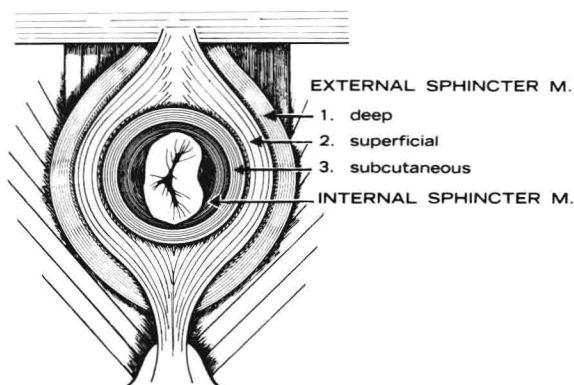


Fig. 1.12 Diagrammatic representation of anal sphincter from below.

spiralling between and binding together the various layers of the external sphincter. He found anterior and posterior attachments for both superficial and deep parts of the sphincter. Posteriorly the fibres were attached to the skin of the anococcygeal sulcus and to the dorsum of the coccyx. Anteriorly they were inserted into the perineal body and, merging with the transverse perineal muscles, gained insertion into the ischial tuberosities. Above, the pubococcygeus and puborectalis sent intertwining fibres into the external sphincter muscle mass.

Confused by the loose use of the term 'anococcygeal raphe', Courtney (1949) recommended that it refer only to the ligamentous tissue deep to the skin of the anococcygeal sulcus. It is not connected with the levator ani muscle.