

# **Anus and anal canal**

# Surgical anatomy

- The anal canal commences at the level where the rectum passes through the pelvic diaphragm and ends at the anal verge.
- The anorectal ring marks the junction between the rectum and the anal canal.

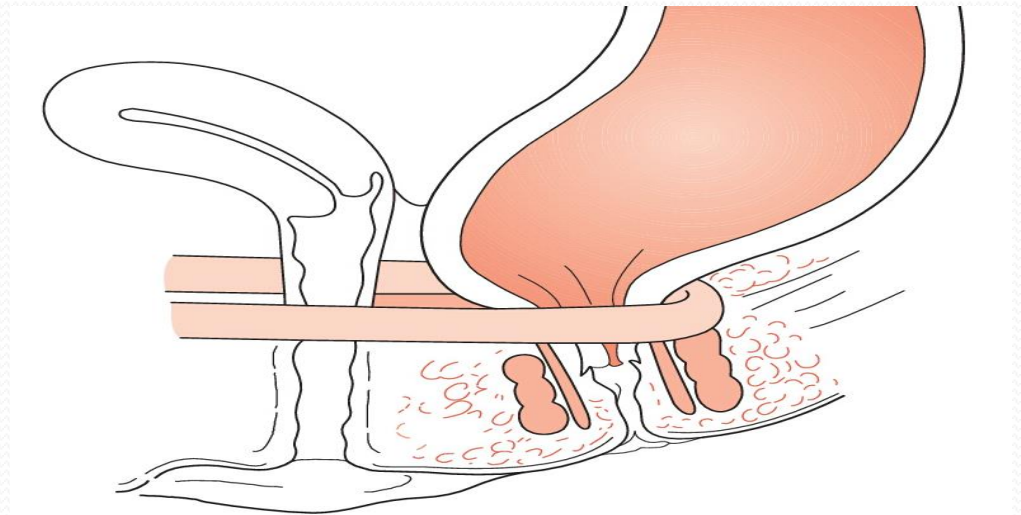
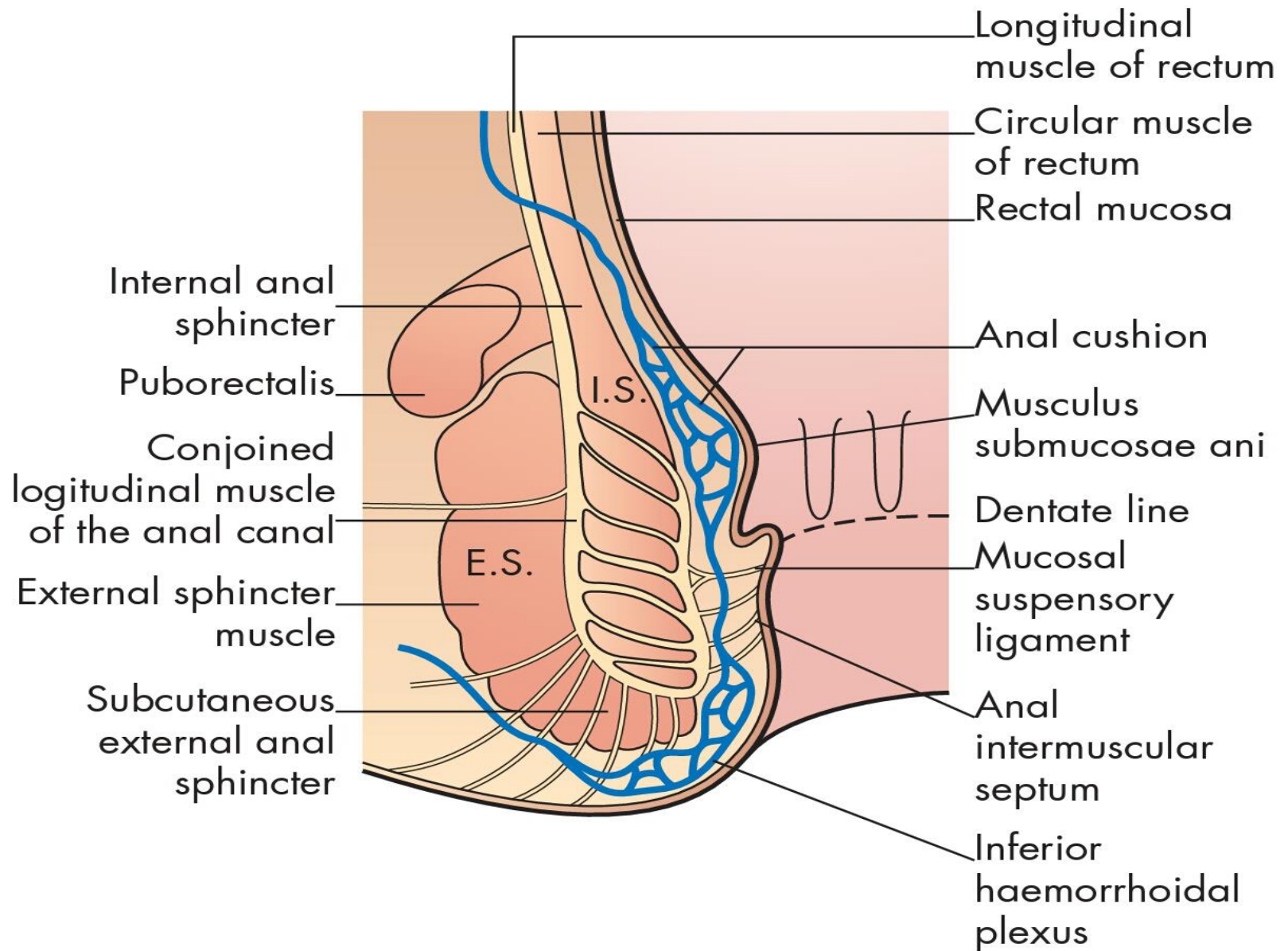



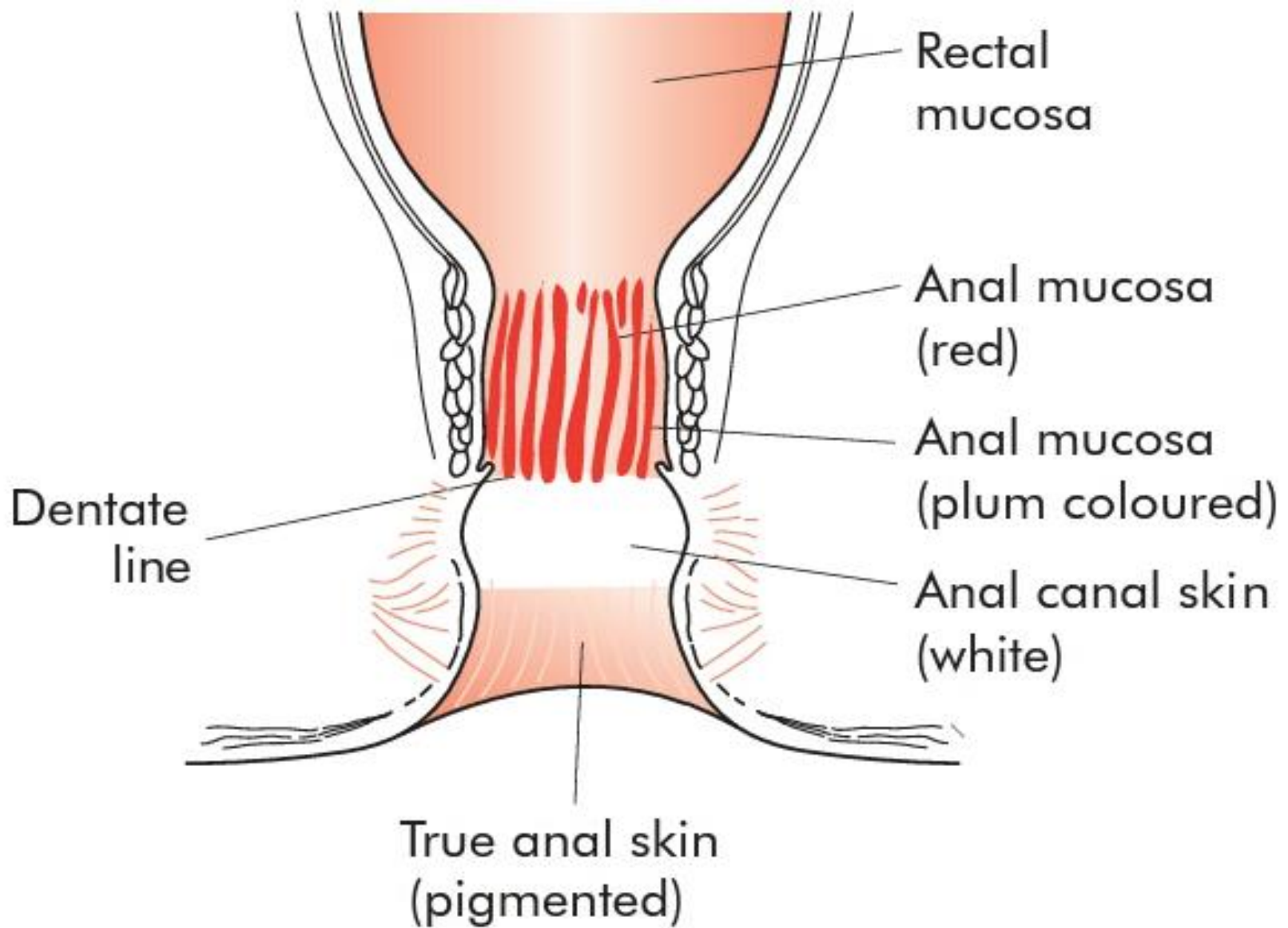
Figure 73.2 The disposition of the puborectalis muscle. Note how it maintains the rectoanal angle.

- The internal sphincter is composed of circular, non-striated involuntary muscle supplied by autonomic nerves.
- The external sphincter is composed of striated voluntary muscle supplied by the pudendal nerve.
- The space between sphincters is known as the
- intersphincteric plane



- The pink columnar epithelium lining the rectum extends through the anorectal ring into the surgical anal canal.
- Passing downwards, the mucous membrane becomes cuboidal and redder in colour .
- above the anal valves it is plum coloured.
- Just below the level of the anal valves there is an abrupt, albeit wavy, transition to stratified squamous epithelium, which is the colour of parchment. This wavy junction constitutes the dentate line.

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- dentate line is a most important landmark both morphologically and surgically, representing the site of fusion of the proctodaeum and postallantoic gut, and being the site of the crypts of Morgagni.



**Figure 73.3** The lining membrane of the anal canal (after Sir Clifford Naunton Morgan, London).



The mucosa and submucosa above the dentate line is uneven and thrown into folds, the so-called anal cushions. There are variations in the numbers and positions of these cushions, but there are usually three,

## ANAL CUSHIONS

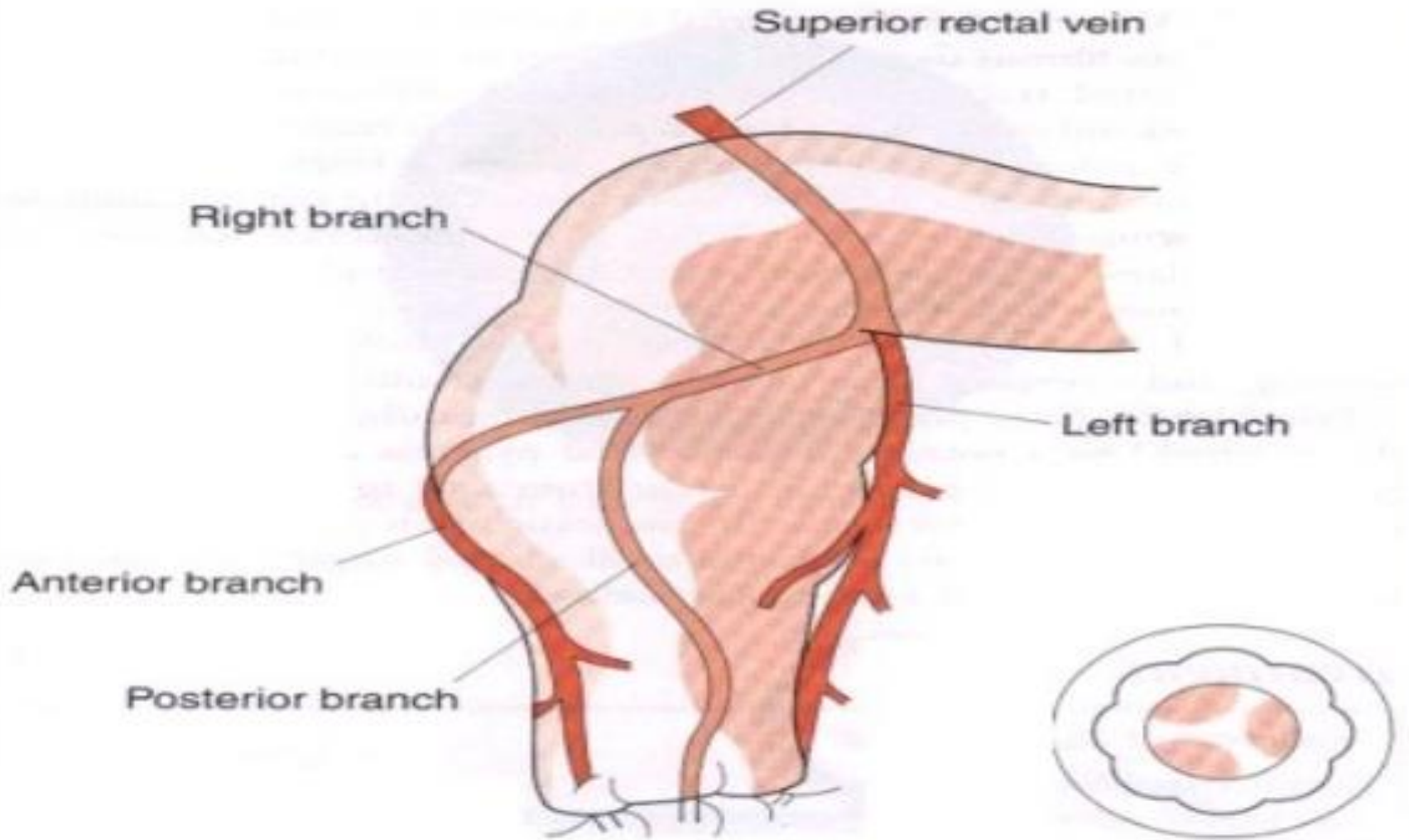
- Uneven folds of mucosa & submucosa just above the dentate line
- Left lateral
- Right posterior
- Right anterior
- Contains sub epithelial meshwork of supporting tissues
- Site of dense arterio venous plexus






# Blood supply

- superior rectal artery into right and left branches and with subsequent division of the former into anterior and posterior divisions .
- The anal veins are distributed in a similar fashion to the arterial supply.
- The upper half of the anal canal is drained by the superior rectal veins, tributaries of the inferior mesenteric vein and the middle rectal veins, which drain into the internal iliac veins. The inferior rectal veins drain the lower half of the anal canal and the subcutaneous perianal plexus of veins: they eventually join the internal iliac vein on each side.



**Fig. 61.25** Disposition of anal vasculature illustrating why haemorrhoids are classically sited at 3, 7 and 11 o'clock.

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- Lymph from the upper half of the anal canal flows upwards to drain into the postrectal lymph nodes and from there goes to the para-aortic nodes via the inferior mesenteric chain.
  - Lymph from the lower half of the anal canal drains on each side first into the superficial and then into the deep inguinal group of lymph glands.

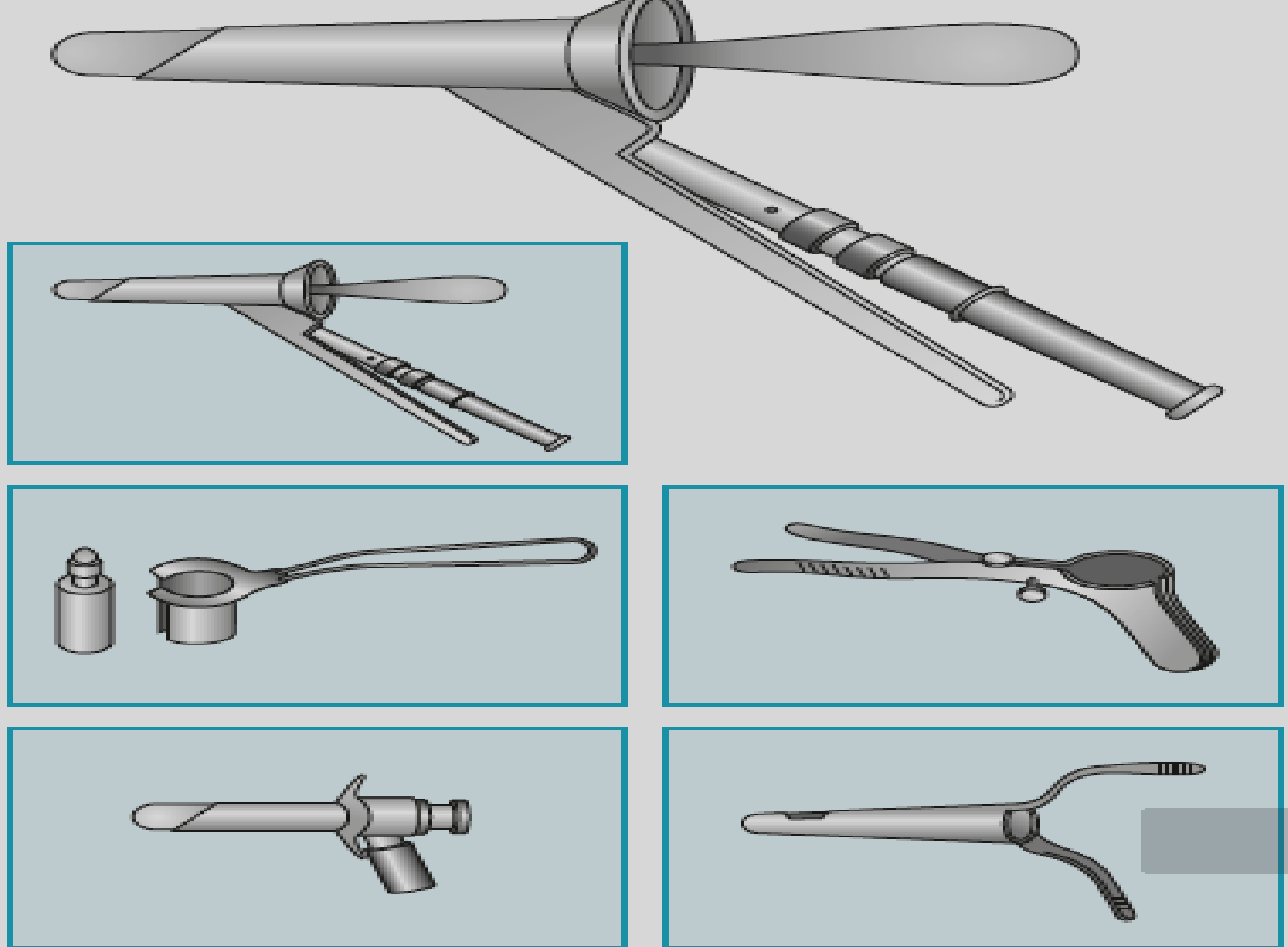
# Anal canal anatomy

- The internal sphincter is composed of circular, non-striated involuntary muscle supplied by autonomic nerves
- The external sphincter is composed of striated voluntary muscle supplied by the pudendal nerve
- Extensions from the longitudinal muscle layer support the sphincter complex
- The space between sphincters is known as the intersphincteric plane
- The superior part of the external sphincter fuses with the puborectalis muscle, which is essential for maintaining the anorectal angle, necessary for continence
- The lower part of the anal canal is lined by sensitive squamous epithelium
- Blood supply to the anal canal is via superior, middle and inferior rectal vessels
- Lymphatic drainage of the lower half of the anal canal goes to inguinal lymph nodes

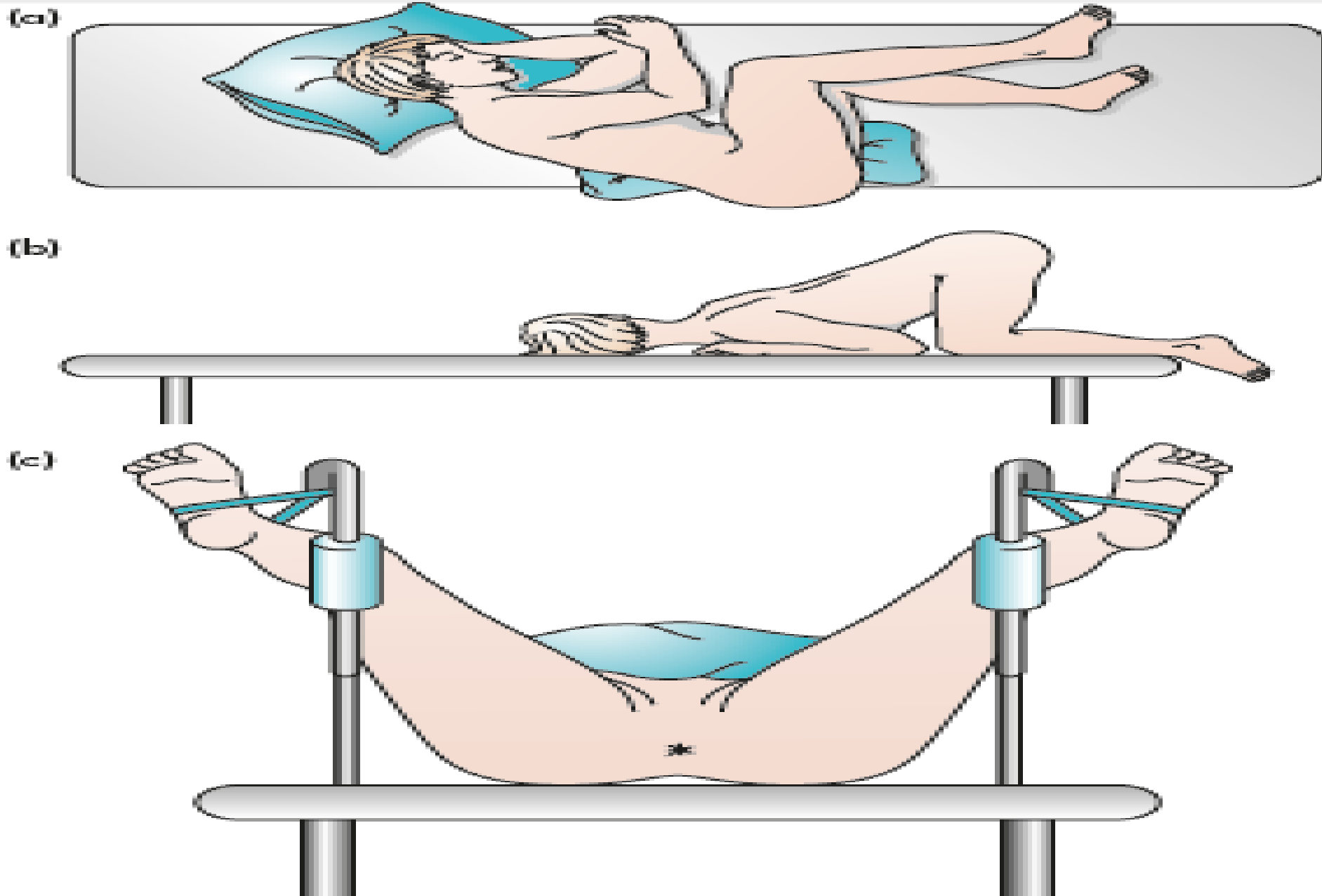
# investigations

## Proctoscopy

- allows a detailed inspection of the distal rectum and anal canal. Minor procedures can also be carried out through this instrument, e.g. treatment of haemorrhoids by injection or banding



**Figure 73.6** Various types of proctoscope. Redrawn with permission from Mann CV. *Surgical treatment of haemorrhoids*. London: Springer, 2002.



**Figure 73.5** The left lateral (a), knee–elbow (b) and lithotomy (c) positions for examination. Redrawn with permission from Mann CV. *Surgical treatment of haemorrhoids*. London: Springer, 2002.






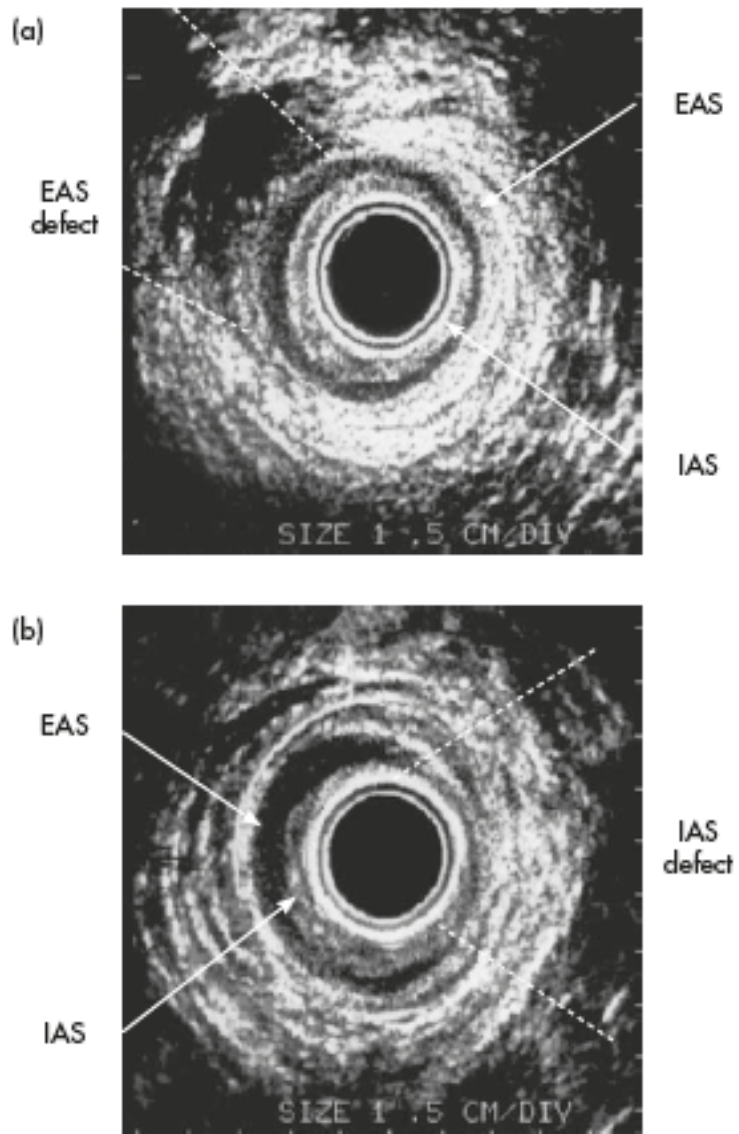
- **Sigmoidoscopy**

- Although sigmoidoscopy is strictly an examination of the rectum, it should always be carried out even when an anal lesion has been confirmed.

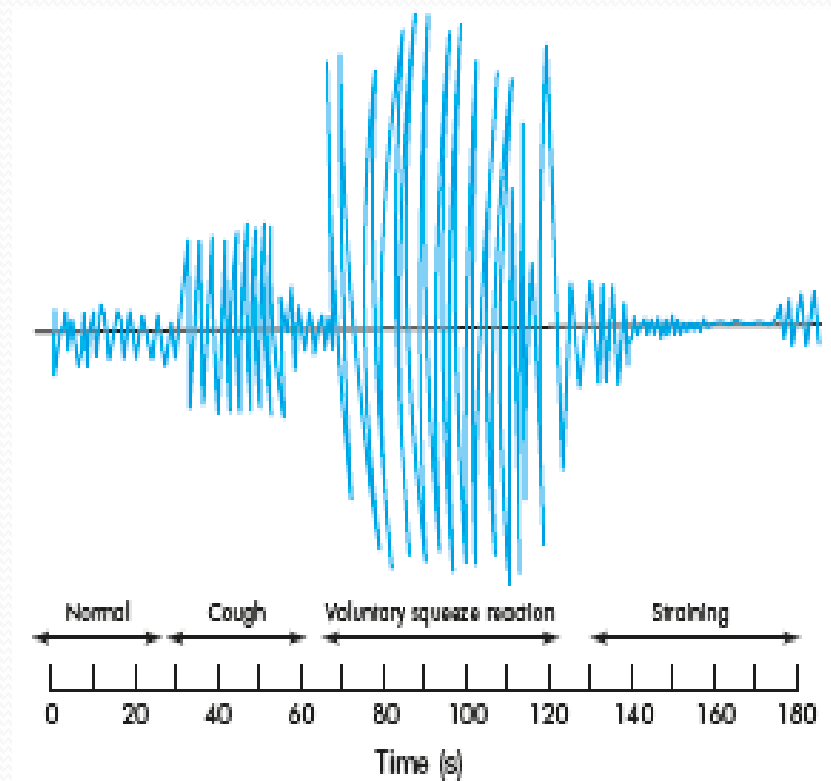
# SPECIAL INVESTIGATIONS

- Anal continence and defaecation are highly complex processes that necessitate the structural and functional integrity of the cerebral, autonomic and enteric nervous systems, the gastrointestinal tract (especially the rectum) and the pelvic floor and anal sphincter complex, any of which may be compromised and lead to disturbances of function of varying severity.


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- The structural integrity of the sphincters can be visualised with endoluminal ultrasound
  - neuromuscular function can be measured by assessment of conduction velocity along the pudendal nerve on each side, or, more painfully, by needle electromyogram (EMG) studies



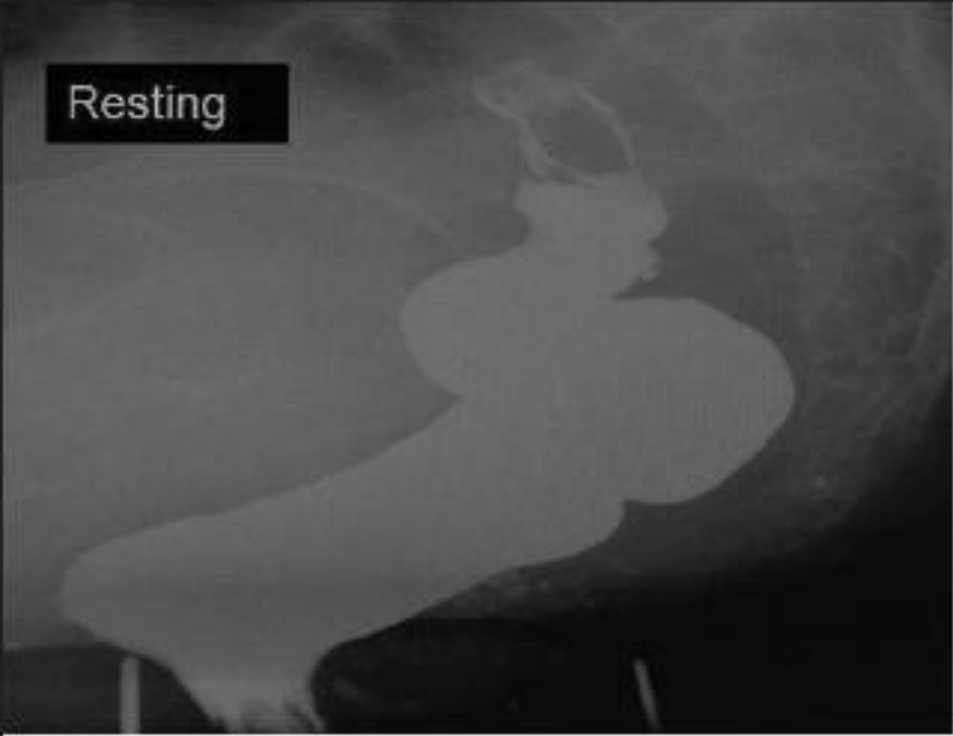
**Figure 73.8** Endoanal ultrasonography. (a) External anal sphincter (EAS) defect caused by obstetric injury. (b) Internal anal sphincter (IAS) defect post-sphincterotomy.



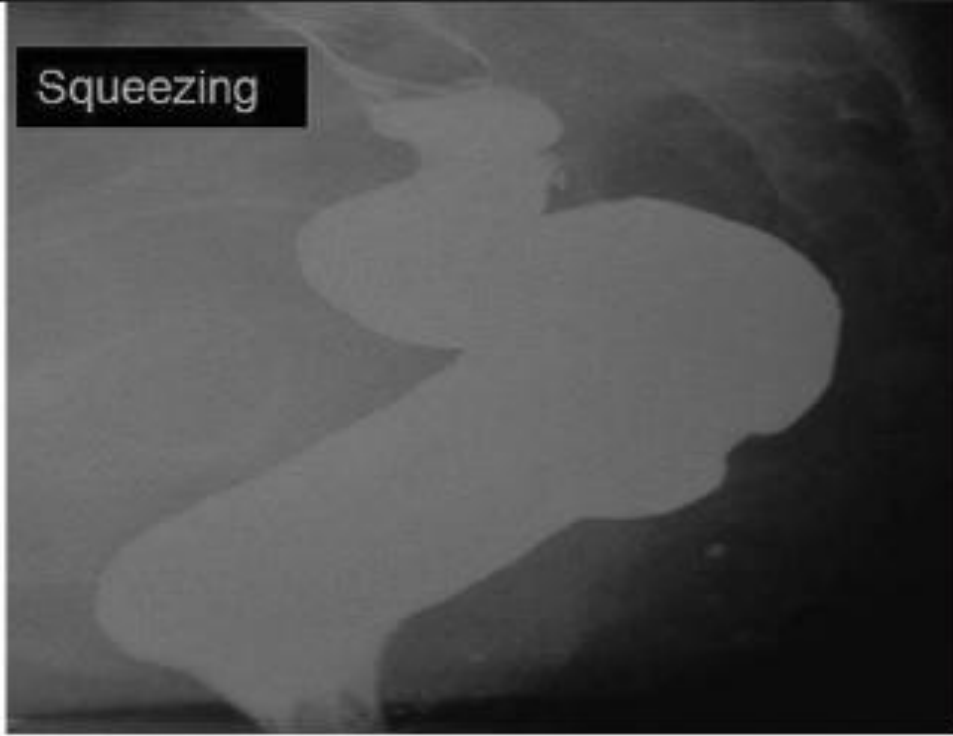
**Figure 73.9** A typical, normal electromyographic study of the external sphincter during various activities.

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- The dynamics of defaecation can also be assessed radiologically by evacuation proctography.
  - Proctography can be combined with synchronous EMG and pressure studies

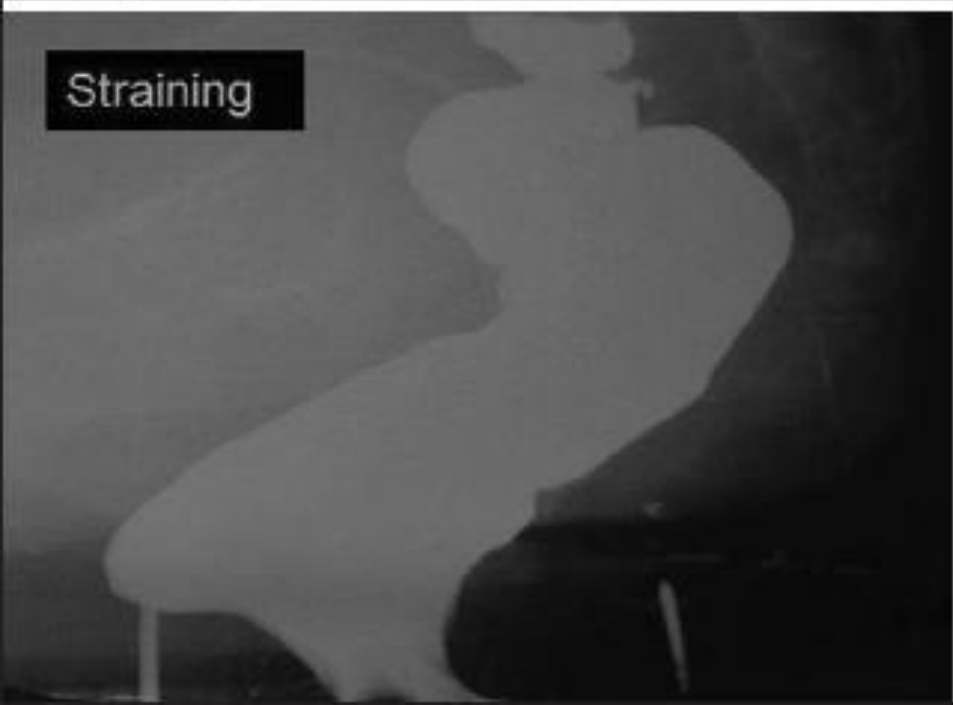
Resting



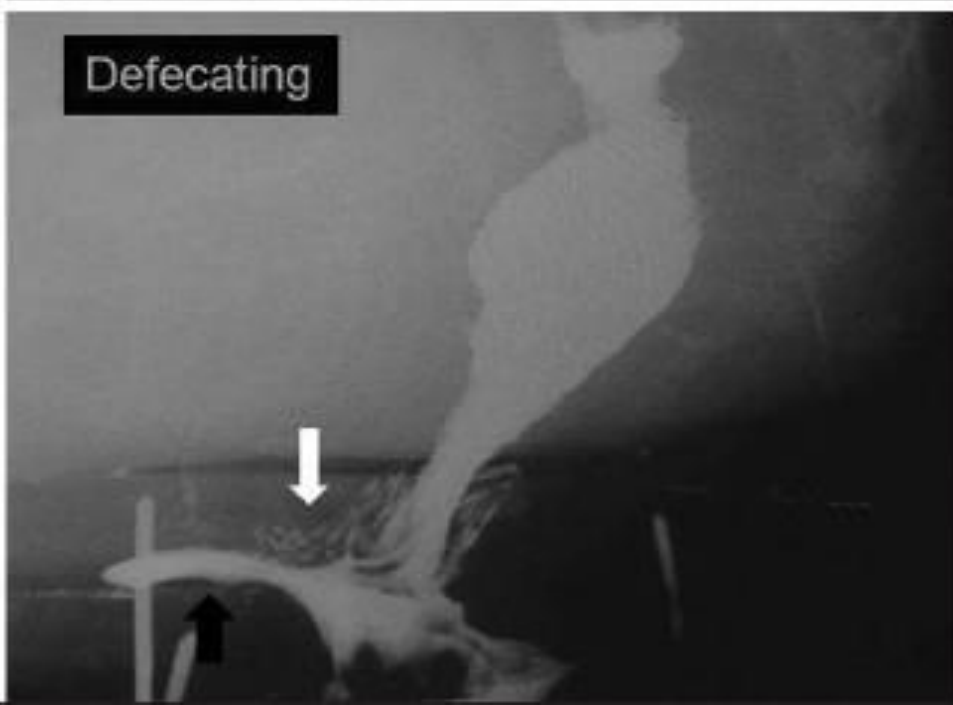
Squeezing



Straining



Defecating



# CONGENITAL ABNORMALITIES

- **Imperforate anus**
- A rare congenital disorder
- Classified as being high or low depending on the site of the rectal termination in relation to the pelvic floor
- Low defects: relatively easy to correct, but prone to
- constipation
- High defects: more difficult to correct and prone to faecal incontinence
- Low anomalies with a perineal fistula can be treated by an anoplasty.
- More complex malformations require early colostomy, with definitive repair performed several months later.



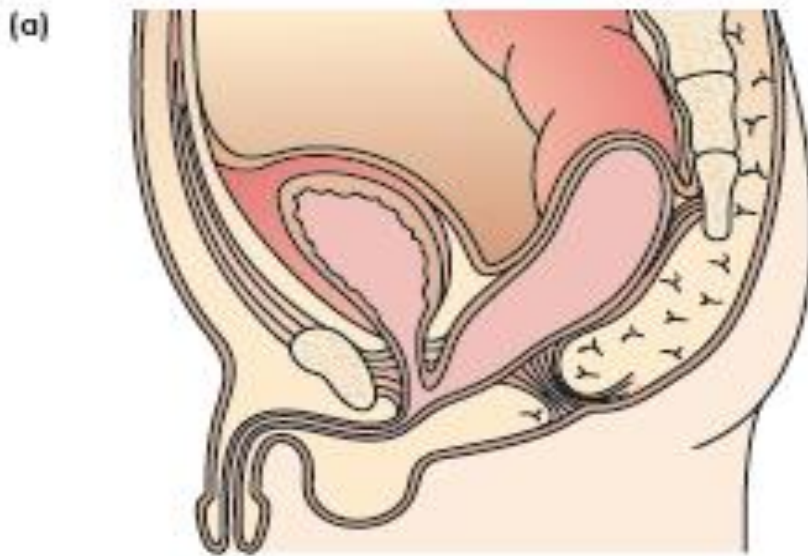
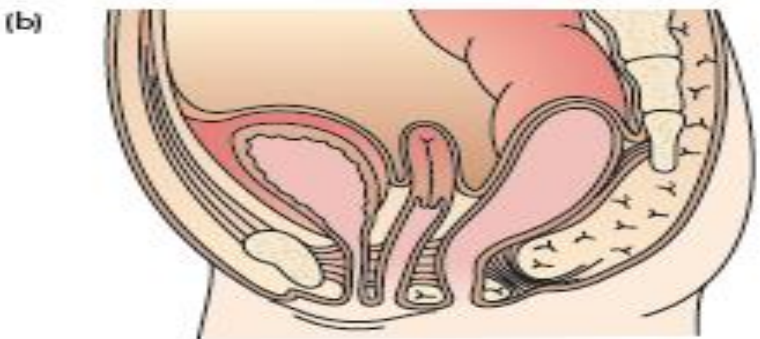
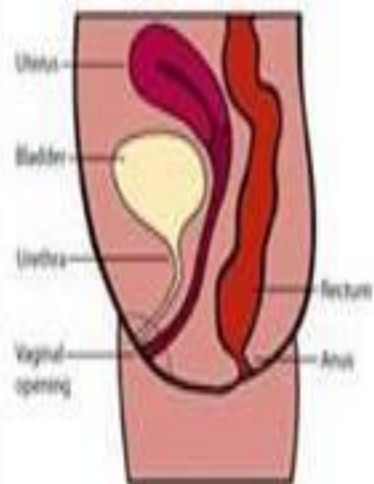


Figure 73.12 Low anorectal malformations. (a) Rectoperineal fistula in a boy; (b) rectoperineal fistula in a girl (anterior anus); (c) rectovestibular fistula. Courtesy of Alberto Pena and Springer-Verlag. From *Atlas of surgical management of anorectal malformations* by Alberto Pena, 1990. Copyright Springer-Verlag.

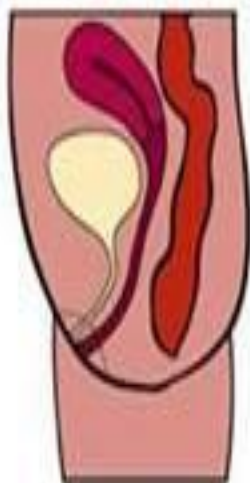
Figure 73.13 More complex anorectal malformations. (a) Rectobulbar fistula; (b) cloacal malformation. Courtesy of Alberto Pena and Springer-Verlag. From *Atlas of surgical management of anorectal malformations* by Alberto Pena, 1990. Copyright Springer-Verlag.

## FORMS OF IMPERFORATE ANUS - SIDE VIEW

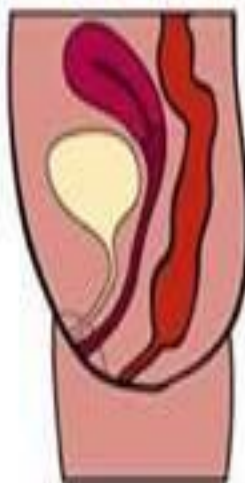
**Normal Anatomy Female**



**Anal opening missing or closed off**



**Opening in wrong place and too small**



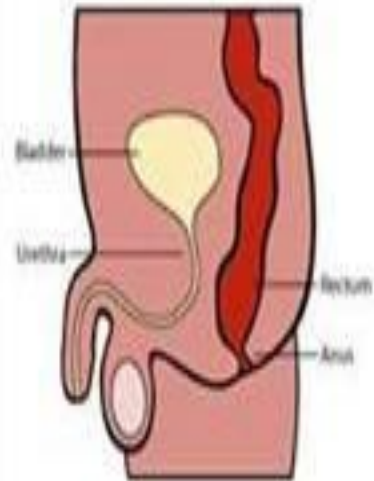
**Rectum connects to vagina**



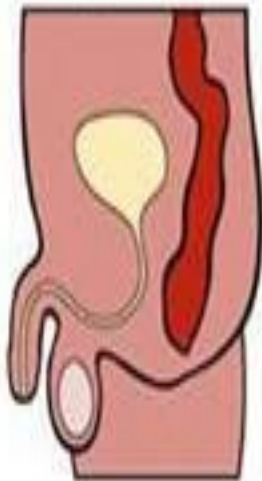
**Cloaca: all three form a single opening**



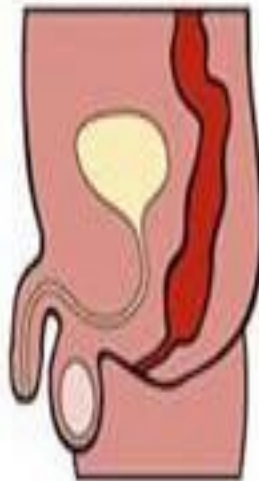
**Normal Anatomy Male**



**Anal opening missing or closed off**



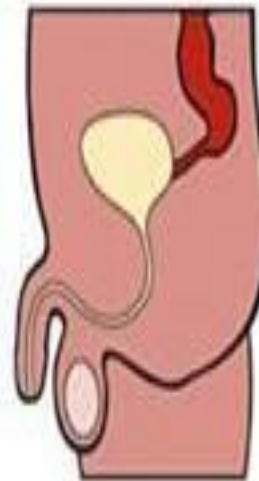
**Opening in wrong place and too small**



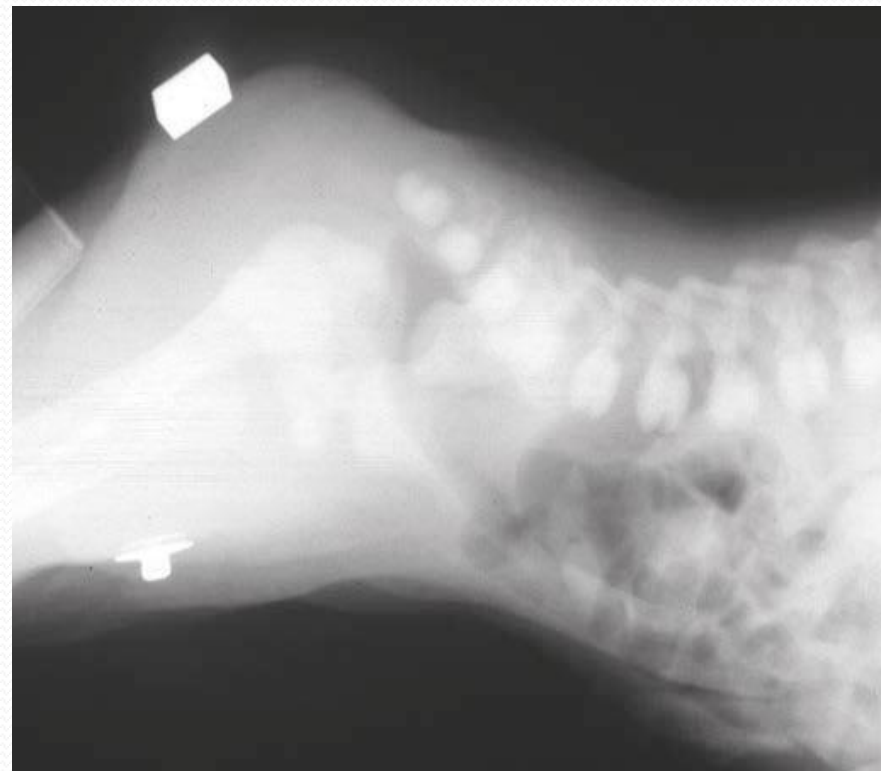
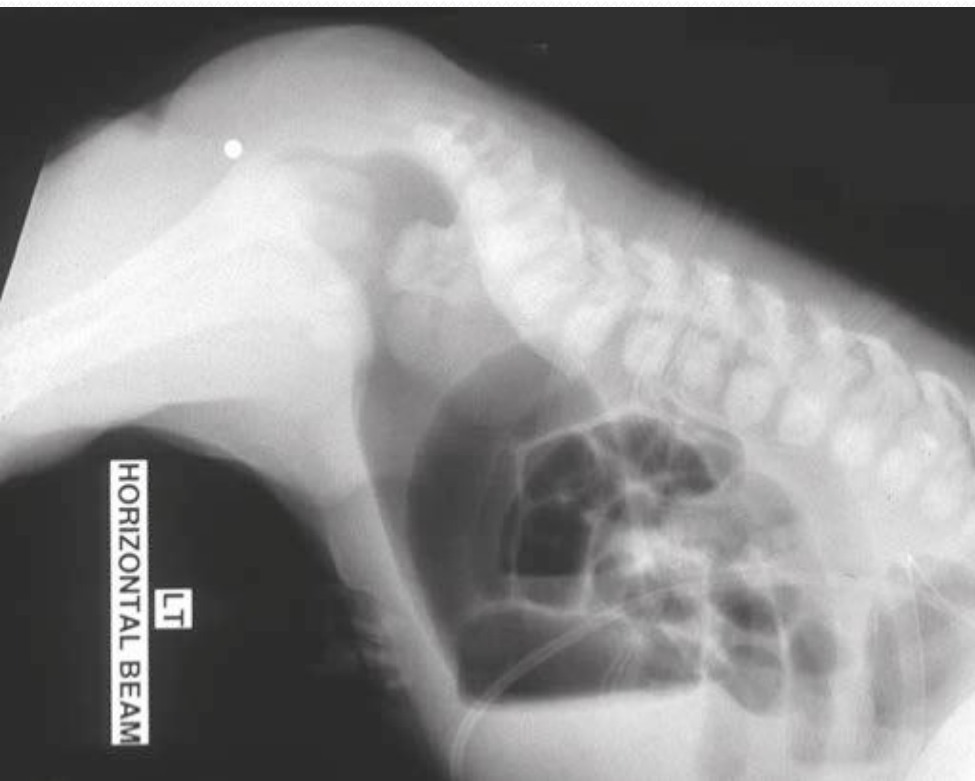
**Rectum connects to urethra or bladder**



**High rectum connects into bladder**



Lateral prone shoot-through radiograph of a neonate with (a) low and (b) high anorectal malformation. A radio-opaque marker has been placed on the anal dimple





# Pilonidal sinus

- The term 'pilonidal sinus' describes a condition found in the natal cleft overlying the coccyx, consisting of one or more, usually non-infected, midline openings, which communicate with a fibrous track lined by granulation tissue and containing hair lying loosely within the lumen.



# *Clinical features*

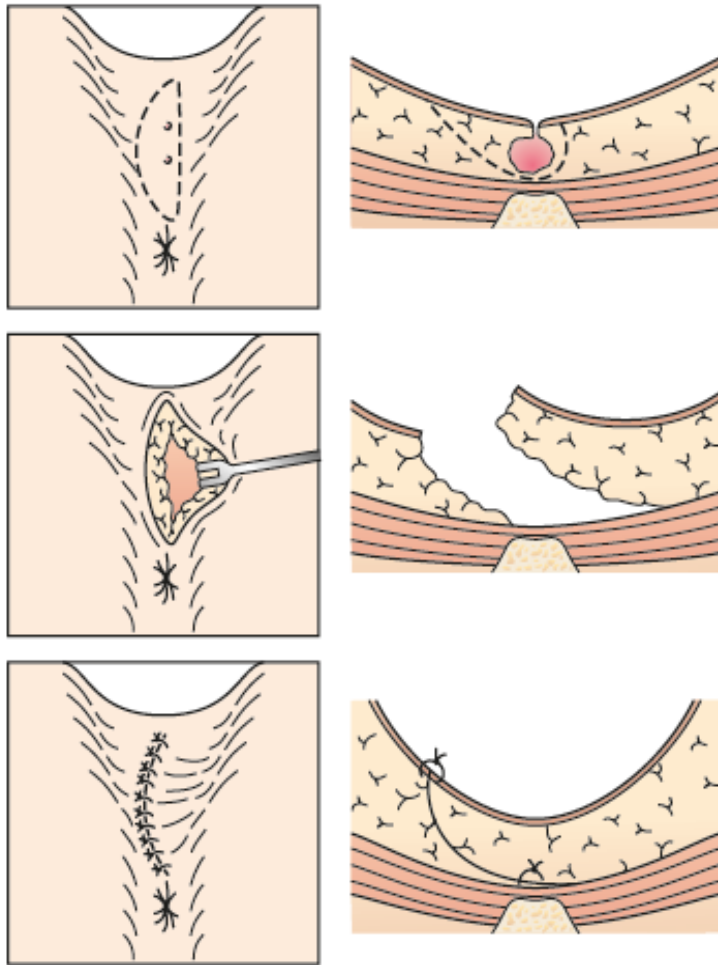
- The condition is seen much more frequently in men than in women
- usually after puberty and before the fourth decade of life, and is characteristically seen in dark-haired individuals rather than those with softer blond hair
- Patients complain of intermittent pain, swelling and discharge at the base of the spine,
- There is often a history of repeated abscesses that have burst spontaneously or which have been incised, usually away from the midline.

# *treatment*

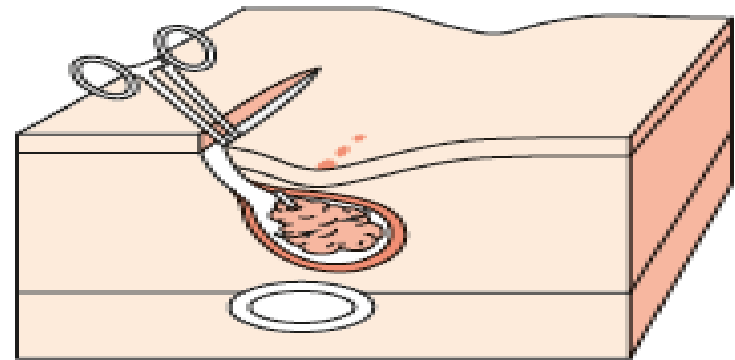
- *Conservative treatment*
- Simple cleaning out of the tracks and removal of all hair, with regular shaving of the area and strict hygiene, may be recommended.
- *Surgical treatment*
- laying open of all tracks with or without marsupialisation, the excision of all tracks with or without primary closure, and the excision of all tracks and then closure by some other means designed to avoid a midline wound

- (Z-plasty, Karydakis procedure (Figure 73.15)).  
Bascom's procedure involves an incision lateral to the midline to gain access to the sinus cavity,

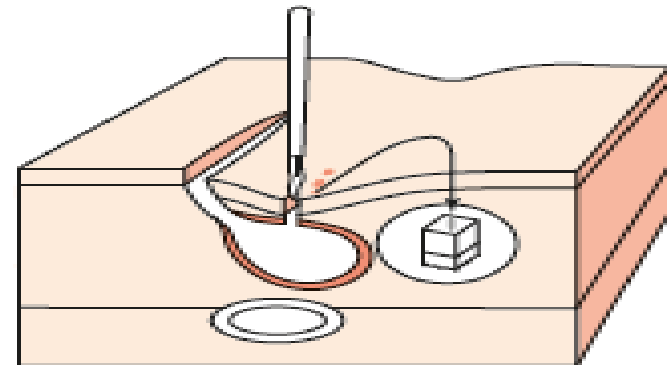




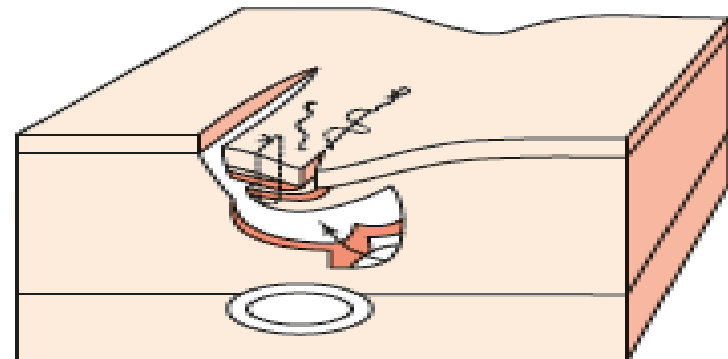
**Figure 73.15** Karydak's operation for pilonidal sinus. A semilateral incision is made around the sinus complex, the diseased component excised and the flap mobilised to allow tension-free closure of the wound off the midline. Reproduced with permission from Nicholls RJ, Dozois RR. *Surgery of the colon and rectum*. Edinburgh: Churchill Livingstone, 1997.



**3.16** Bascom's technique for pilonidal sinus: 1.



**3.17** Bascom's technique for pilonidal sinus: 2.



**3.18** Bascom's technique for pilonidal sinus: 3.

# ANAL INCONTINENCE

## Causes of anal incontinence

### Congenital/childhood

- Anorectal anomalies
- Spina bifida
- Hirschsprung's disease
- Behavioural


### Acquired/adulthood


- Diabetes mellitus
- Cerebrovascular accident
- Parkinson's disease
- Multiple sclerosis
- Spinal cord injury
- Other neurological conditions:
  - Myotonic dystrophy
  - Shy-Drager syndrome
  - Amyloid neuropathy
- Gastrointestinal infection
- Irritable bowel syndrome
- Metabolic bowel disease
- Inflammatory bowel disease
- Megacolon/megarectum
- Anal trauma
- Abdominal surgery:
  - Small bowel resection
  - Colonic resection

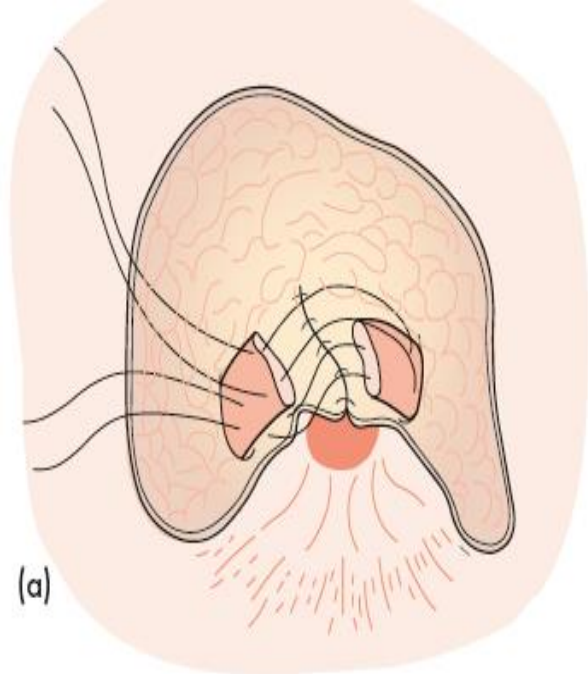
- Pelvic surgery:
  - Hysterectomy
  - Rectal excision
- Pelvic malignancy
- Pelvic radiotherapy
- Rectal prolapse
- Rectal evacuatory disorder:
  - Mechanical, e.g. rectocele, intussusception
  - Functional, i.e. pelvic floor dyssynergia
- Anal surgery:
  - Haemorrhoidectomy
  - Surgery for fistula
  - Surgery for fissure
  - Rectal disimpaction
- Obstetric events

### General

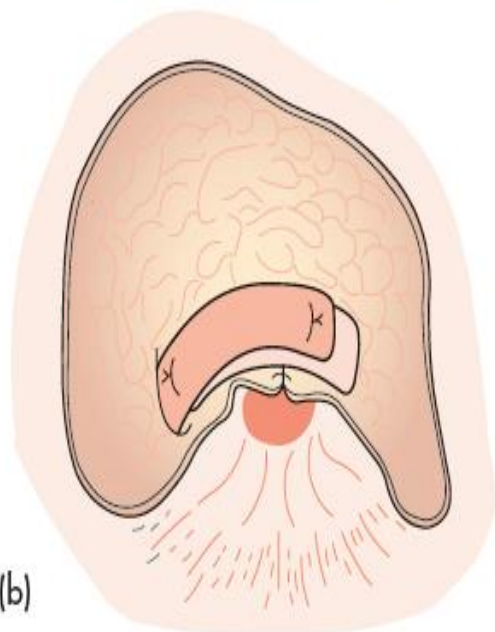
- Ageing
- Dependence of nursing care
- Obesity
- Psychobehavioural factors
- Intellectual incapacity
- Drugs:
  - Primary constipating and laxative agents
  - Secondary effects

- 
- In general, conservative measures to reduce symptoms are
  - employed initially. These may be in the form of stool bulking
  - or constipating agents, nurse-led bowel retraining including
  - specific biofeedback programmes, or anal plugs, which expand
  - within and thus seal the anal canal. Failure of such measures and
  - severity of symptoms may result in selection for surgery.

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- **Operations to reunite divided sphincter muscles**
  - **Operations to reef the external sphincter and puborectalis muscle**
  - **Operations to augment the anal sphincters**

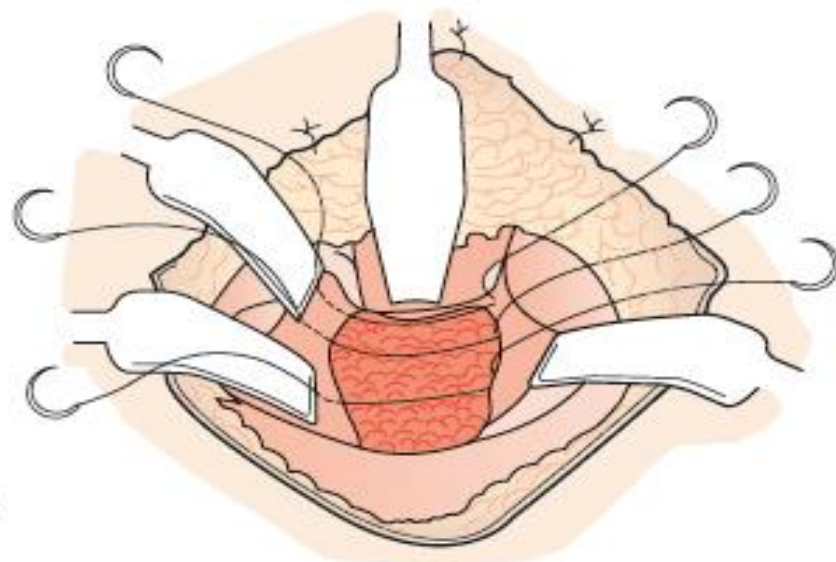


(a)

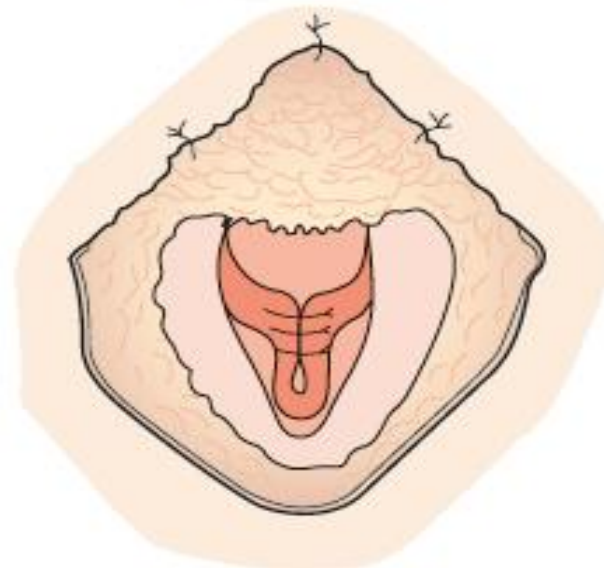


(b)

Figure 73.19 Direct sphincter repair in which (a) the sphincter defect is excised and (b) the remaining muscle is overlapped. Redrawn with



(a)



(b)

Figure 73.20 Post-anal repair in which (a) the sphincter muscle is plicated posterior to the anal canal, thus restoring the anorectal angle. (b) The completed repair. Redrawn with permission from Mann CV, Glass RE. *Surgical treatment of anal incontinence*. New York: Springer, 1991.



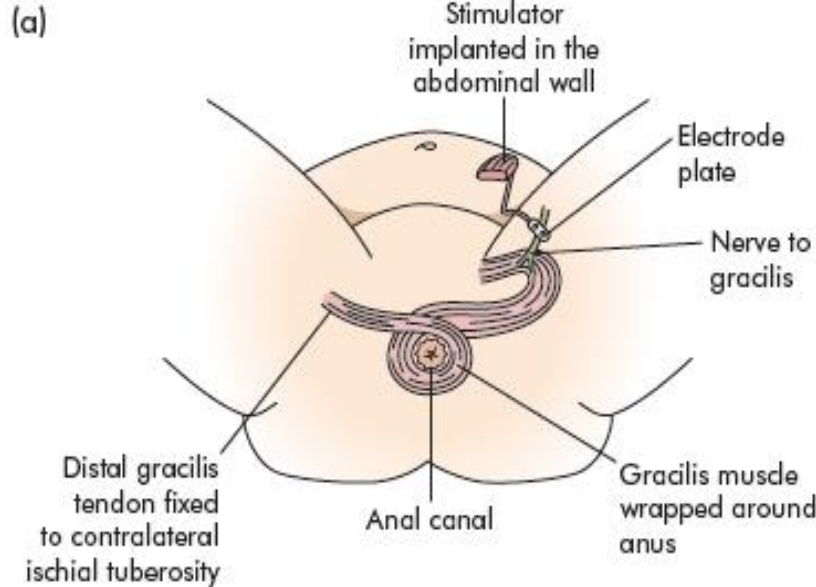


Figure 73.21 (a) The electrically stimulated gracilis neosphincter or dynamic graciloplasty. (b) Hand-held radiotelemetry controller, which allows the patient to turn the stimulator on and off.

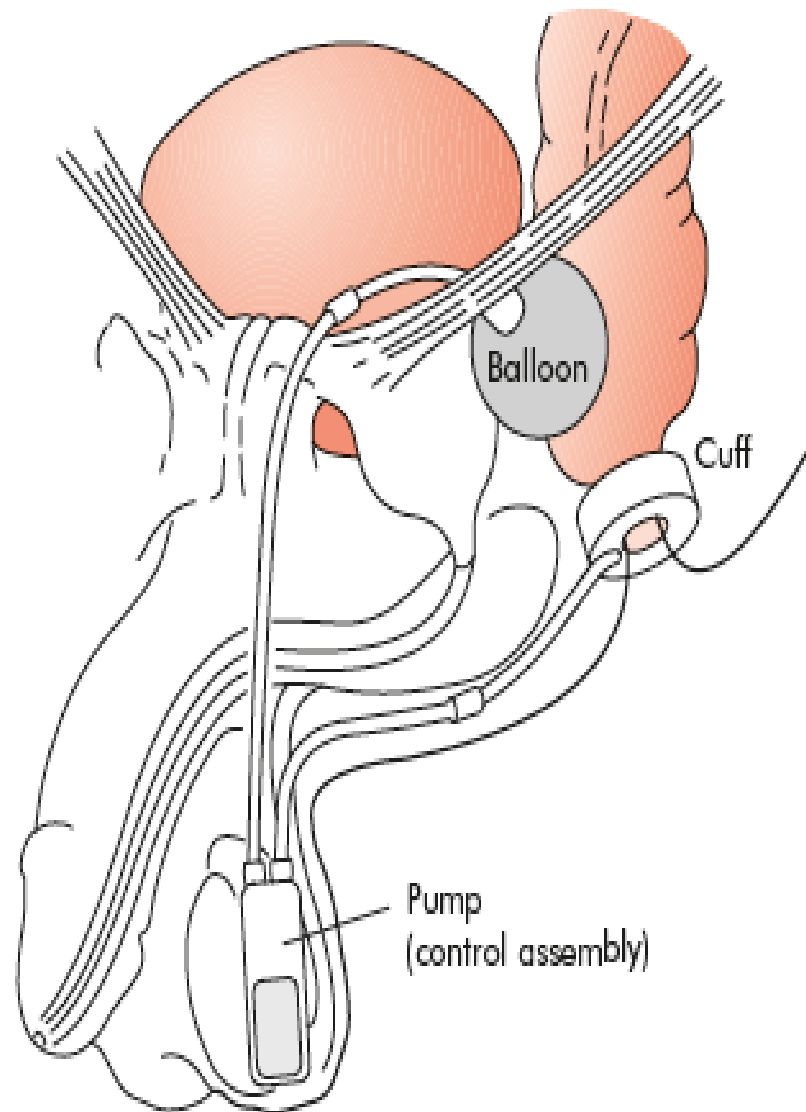


Figure 73.22 Artificial bowel sphincter. A cuff is placed around the anal canal. An inflatable pump control assembly is placed in the scrotum and the balloon reservoir is placed under the symphysis pubis.