# Anorectal Anatomy and Physiology

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**Abstract**

The anorectal canal has the important function of regulating defecation and the role of controlling fecal continence. To fulfill its function, it is necessary to integrate muscular and sensory components. Continence in normal conditions is maintained by the acute angle that the contraction of the pubo-rectal muscle creates at the recto-anal junction, the rectal compliance, and the area of high pressure 2 cm from the anal verge. The resting pressure of the channel is attributed by 80 % to the tonic contraction of the internal anal sphincter, and the remaining 20 % is due to the action of the external anal sphincter and a small part of the hemorrhoidal cushions. During the filling of bulb, the distension of the rectum evokes the reflex inhibition of anal canal, with relaxation of the internal sphincter and contraction of the external sphincter. During defecation the external anal sphincter is voluntarily inhibited, the pubo-rectal muscle is relaxed with the aid of the abdominal muscles, and the fecal material is pushed out of the intestine.

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## Anatomy of the Anorectal Canal

The rectum and anal canal are the terminal parts of the large bowel. The rectum has a length of 15 cm and follows the pelvic colon, from the rectal-sigmoid junction, at the third sacral level, until the recto-anal verge.

Anatomically the rectum is composed of two portions separated by the insertion of the levator ani muscle into the rectal wall: the rectal ampulla placed in the small pelvis and the anal canal located in the rear perineum [1, 2].

On its way, the rectum shows two curvatures: the first is the sacral curvature situated in front of the anterior sacrum and coccyx, in anterior concavity. The second curvature is the perineal curvature in anterior convexity, alongside prostate apex in men and middle part of vagina in women.

In addition to these curves, there are also two flexuosities on the coronal plane, one convex on the right side and one on the left side, varying depending on the rectal distention.

When the organ is distended, it shows four walls, front side, rear, and two lateral sides, which tend to droop in conditions of vacuity. The walls show on the surface a series of transverse grooves corresponding to internal folds.

This part of intestine is not completely covered by the visceral peritoneum; in fact, the front wall below the pouch of Douglas and a large part of the side walls and the posterior wall [3] are lacking serosal lining. Considering the peritoneum, the rectum can be divided into a peritoneal part and a subperitoneal part, with different relationships depending on the sex. In males, the portion above the peritoneal part corresponds to the rectovesical pouch and is related to intestinal loops, and the subperitoneal part is related to the bladder trigone, the prostate rear wall, the seminal vessel, and the seminal vesicles. In females, the supraperitoneal part walls toward the rectum-uterine pouch, and the peritoneal part is related to the posterior wall of the vagina by which is separated through the rectovaginal septum.

The posterior wall, in both sexes, is separated from the spine by the retrorectal space filled by fibro-adipose material, through which the middle sacral artery runs ending lower with the coccygeal glomus. Finally, the two side walls lean against the walls of the small pelvis [4]. The perineal portion of the rectum is related to nearby organs, according to sex: in men the rectum-urethral trigonum separates it from the prostate apex, urethra, and urethral bulb glands; in women the rectovaginal trigonum is interposed between rectum and rear wall of the vagina.

The inner surface of the organ presents transverse folds, corresponding to the grooves on the outer surface and longitudinal pleats disappearing in case of vacuity. Two inches above the anal orifice, the inner rectum surface lifts in columns that are 5–10 longitudinal pleats presenting an inferior flared base and ending thinner after about 1 cm distance. Among the bases of the anal columns, we find cross pleats called semilunar valves creating the pectineal line, irregular and with circular course. Each valve together with the wall of the rectum delimits the rectal sinus, a pocket irrigated by the anal glands that secrete mucous. Below the dentate line, we find an area rippled by radiated folds known as the hemorrhoidal ring [5].

The anal orifice is located approximately 3 cm in front of the coccyx, in the posterior perineum, and is the external outlet of the anal canal. At rest shows up a right and left lip that hold on anteriorly and posteriorly with two commissures; when it is expanded instead, it assumes a circular outline. The anal skin is pigmented and haired in the male. At rest the skin rises in radiated folds that disappear when the anus dilates. The perianal skin is rather rich in apocrine sweat glands called circumanal glands.

The rectal tunica mucosa in its upper side is cylindrical and tends to become cuboidal at the bottom; this epithelium continues until the upper third of the anal canal and at the level of the dentate line changes irregularly, becoming stratified squamous epithelium and covering all structures of the anal canal. It is wrong to define the dentate line as "mucocutaneous junction" because this epithelial passage isn't definite; indeed sometimes the squamous epithelium can thrust above the dentate line [6]. The squamous stratified epithelium, beneath the hemorrhoidal ring, shows signs of keratinized layer together with hairs, sebaceous glands, and circumanal glands. The submucosa tunica placed in the ring hemorrhoidal area hosts the hemorrhoidal plexus (Fig. 2.1).

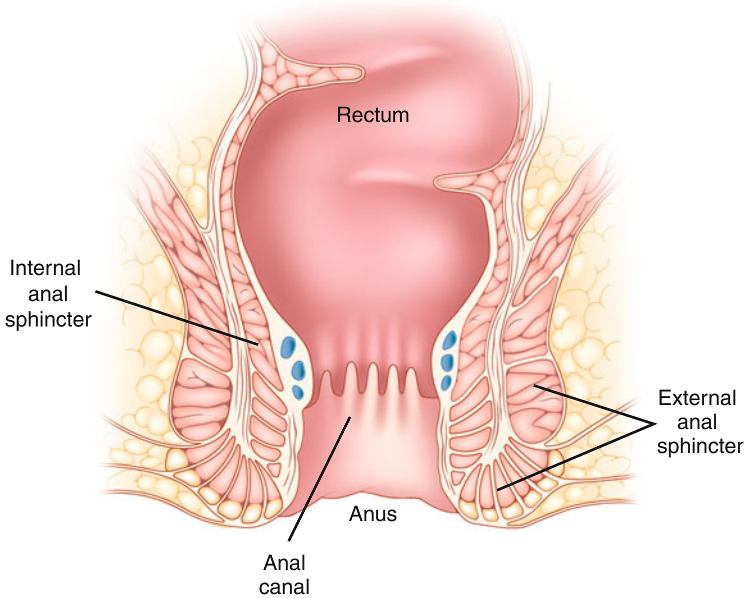


**Fig. 2.1** Rectum

## Anorectal Muscles

The rectal tunica muscularis, such as in the colon, is composed by one inner circular layer and one external longitudinal layer. The latter is an expansion of colon taenia, which, at the junction of sigmoid-rectal, creates a continuous muscular layer. Concerning rectal reservoir, there are links between the two kinds of musculature, since the longitudinal one opens like a fan within the circular muscle; this particular structure is easy to find at the level of the rectal valves. At the lower part of the rectum, the longitudinal muscular layer merges with the striated muscle of the levator ani muscle and with the fibroelastic tissue from the pelvic fascia overlying the pelvic diaphragm, in order to form the joint longitudinal muscle of the anal canal. In turn, at the level of the anal sinuses, the circular muscle thickening forms the internal sphincter muscle of the anus. This muscle is made by smooth muscle cells, innervated by the autonomic nerves of the intrinsic nervus plexuses (myenteric and submucosal), and terminates with an inferior boundary rounded at the intersphincteric line.

The longitudinal muscle joint (LMJ) broadens inferiorly surrounding the internal sphincter muscle of the anus and, in its turn, is surrounded by the external sphincter muscle of the anus. During its downward course, the LMJ emits a series of fibroelastic and muscular fascicles, which penetrate the internal sphincter muscle of the anus; some of these are joined to the muscularis mucosae of the anal canal composing the muscle of the anus submucosa (or "sustentator mucosae of Kohlrausch"), whose fibers anchor the anoderm of the dentate line to the underlying tissues and to the lower third of the internal sphincter muscle of the anus. Fixed in this way, the dentate line prevents the eversion of the anal canal and supports the overlying internal hemorrhoidal venous plexus during defecation [7]. The LMJ in its lower part before joining with the muscularis mucosa of the anal canal issues a series of fan-shaped fibro-muscular septa, which pass through the submucosal portion of the external sphincter muscle of the anus and are combined with perianal skin forming the corrugator muscle of the skin of the anus. A series of bundles in the opposite side is directed outward, passing through the superficial subcutaneous portion of the external sphincter muscle of the anus, lasting as transverse septum of the ischiorectal fossa. The importance of the LMJ consists in the fact that, along with the levator ani muscle, it exerts an action of lift on the sphincter and anal canal, preventing the spread of any anorectal infections.

The external musculature of the anal canal is formed by the external sphincter muscle of the anus (EAS), arranged in the shape of sleeve so as to surround 2–3 cm the terminal portion of the rectum and the anal canal. The EAS is composed by three parts: a subcutaneous, a superficial, and a deep part. The subcutaneous part about 3–5 mm in diameter surrounds the anal orifice directly above the edge of the anus, below, and slightly to the side to the internal sphincter muscle of the anus; in women, this part of the external sphincter muscle of the anus is more developed, especially anteriorly, where it forms a prominent annular bandage, which is sometimes engraved in the course of an episiotomy.

The subcutaneous part is functionally integrated with the levator ani, through expansions of the longitudinal muscle; they go through it like a fan and they terminate as fibers of corrugator muscle of skin and anus. The superficial part of the external sphincter muscle of the anus has an elliptical shape and is placed deeply and laterally to the subcutaneous part of the EAS. It is the most robust of the three parts of the EAS and originates independently from the rear face and from the tip of the coccyx, so it is sometimes called “coccygeal portion”; in the male it is connected at the front on the tendinous center of the perineum and on the median fascial raphe of bulbocavernosus muscles. In the female, muscle fibers are connected in lower part to the tendinous center; for the most part, however, they connect with the bulbocavernosus muscles. Posteriorly, the fibers form the anococcygeal raphe.

The deep part of the external anal sphincter muscle is for the most part an annular muscle bundle, not joined to the coccyx; posteriorly it is intimately fused with the pubo-rectal muscle since the fibers of this muscle, with a course in sling, pass around the terminal part of the rectum. Prior to the rectum, muscular fibers intersect with those of the opposite side mingling in part with the fibers of the superficial transverse perineal muscles; also in back fibers are mixed to fit in the anococcygeal raphe.

The essential supports that hold in position the recto-anal canal are derived from the muscles that form the pelvic floor: the levator ani muscle, consisting of three parts—the pubococcygeus muscle, the pubo-rectal muscle, and iliococcygeus. These three muscles together are located at the diaphragmatic and subdiaphragmatic floor; their organization is such that, when viewed from above, they appear as a funnel whose point is more declivous and corresponds to the gap of the rectal canal. The levator ani gives stability to the pelvic floor and acts as a fulcrum against the increased abdominal pressure, which is provoked by cough and defecation.

The pubococcygeal and the pubo-rectal part, forming a sling, becomes part of the anorectal muscular ring that surrounds part of the rectal reservoir and in part the upper portion of the anal canal. This ring is composed of the following: on its posterior half it is composed by fibers of the pubo-rectal ring; on the anterior part, by the internal sphincter muscle of the anus and fibers coming from the pubococcygeus muscle (pre-rectal or fibers of Luschka); and by the longitudinal muscle, surrounded by the deep part of the external sphincter muscle of the anus. The posterior half of that ring, along with the pubo-rectal sling, brings the rectum near to the pubic bone and increases anorectal torsion, shortens and narrows the pelvic opening, raises the anus, and collaborates to the closure of the anal canal (Fig. 2.2).

## Innervation

The sympathetic and parasympathetic fibers innervate rectum, anal canal, and genitourinary system. The sympathetic innervation is derived from the first three lumbar segments that form the preaortic plexus from which fibers arise that extend below the aortic bifurcation forming the superior hypogastric plexus or presacral nerve. The fibers of the superior hypogastric plexus will lead to the sides of the pelvis

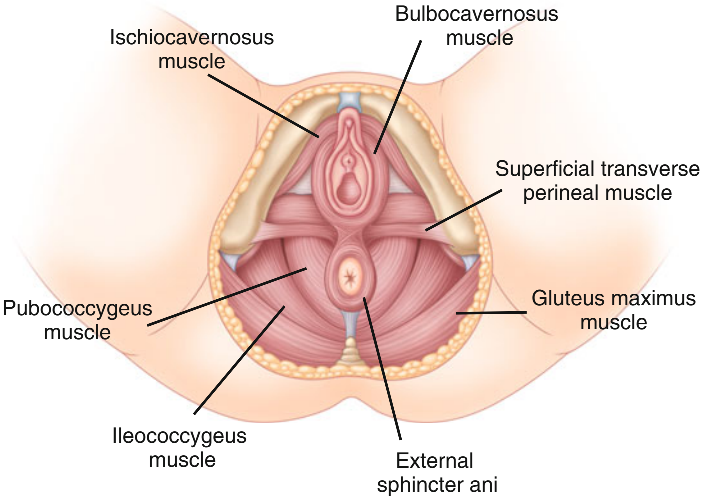


**Fig. 2.2** Pelvic floor anatomy, inferior view

where they join with the branches of the parasympathetic nerves to form the inferior hypogastric plexus, or pelvic plexus, in close contact with the rectum [8].

The parasympathetic innervation is derived from the erigentes nerves, or pelvic splachnic, which originate from the II, III, and VI sacral root. The pudendal nerve arises from the sacral plexus at levels S2–S4, which provides motor innervation of the external sphincter and sensory innervation to the perianal skin. The pudendal nerve at the end of its course, at the side wall of the ischiorectal fossa, is divided into three branches: inferior hemorrhoidal, perineal, and dorsal of the penis/clitoris.

The external anal sphincter has a threefold innervation: the perineal muscular branch of the pudendal nerve for the inner or ventral side of the muscle, the anal nerve on the lateral side of the sphincter, and the perineal branch of the fourth sacral nerve for the posterior or caudal area [9]. The arrangement of these fibers is radial, numerous connections are intersegmental, and this explains the functional recovery after nerve section.

The internal sphincter essentially works as a reflex and is constituted by autonomous smooth muscle fibers. Both sympathetic and parasympathetic systems contribute to its innervation [10].

The levator ani muscle, intimately linked to the external sphincter by its puborectal bundle, receives on its upper branches fibers of the levator ani. These nerves can come directly from the third and fourth sacral root or from internal pudendal nerve.

## Afferent Nerves

In the wall of the anal canal, there are numerous receptors, distributed all along the channel and also in the thickness of the wall layers.

Muscle receptors and polymodal nociceptive receptors exist in addition to specific mucosal receptors [11]. These muscular receptors are mechanoreceptors of two types: one for slow adaptation, in the internal sphincter, and the others for fast adaptation, in the external sphincter.

The sensory innervation of the anus is richer than the one of the rectum and especially at the mucosa level [12]. The sensitivity of the skin surface area of the anal canal, from the anorectal line, depends on isolated intraepithelial nerve fibers (region discriminative pain). Above this area, receptors with greatest diversity and density allow to analyze lots of information: genital corpuscles (friction), Golgi's corpuscles (pressure), Meissner's corpuscles (touch), Krause's corpuscles (cold), and Pacini's corpuscles (stretching). The sensory nerve fibers run in the hemorrhoidal side branches of the internal pudendal nerve but also with a parasympathetic group toward the hypogastric plexus and the sacral sympathetic trunk through the second and third sacral ganglion. The sensory role is particularly to discriminate accurately the quality of the content of the anal canal, of fundamental importance for continence and evacuation [13].

## Nerve Centers of Control

The processing of information takes place at three levels: the enteric nervous system, the paravertebral ganglia of the autonomic nervous system, and the cerebrospinal axis.

The enteric nervous system is the support of local muscle tone. This nervous system is localized in the submucosal plexus of Meissner and between the sphincter muscular layers of myenteric plexus of Auerbach, more voluminous than the last. Regardless of the extrinsic nervous system, a local reflex system, with the presence of interneurons, allows an adjustment control within the same wall. This local nerve plexus is characterized by a wide variety of chemical mediators; cholinergic neurons are present in spontaneous activity permanently, noradrenergic neurons are very common in sphincteric zone, and non-adrenergic and non-cholinergic (purinergic and serotonergic) neurons, as well as numerous neuropeptides, are present in large quantities in the anal canal [14].

Some neuropeptides have a relaxing effect on the internal sphincter, unlike opioid neuropeptides (enkephalinergic), which represent 25 % of the neuronal population and increase sphincter tone.

The autonomic nervous system (autonomic sympathetic and parasympathetic) guarantees a faster connection for the transmission of sensory information through the paravertebral ganglia and the hypogastric plexus.

The cerebrospinal axis receives afferent information from neurons of the ganglionar root placed in the back or in the plexiform ganglion of the vegetative system. At this point, the information can pass through the synapses of preganglionic sympathetic or parasympathetic origin of segmenting reflexes or continue its afference in tractus nervosi of posterior spinal cord, without interruptions up to the brain.

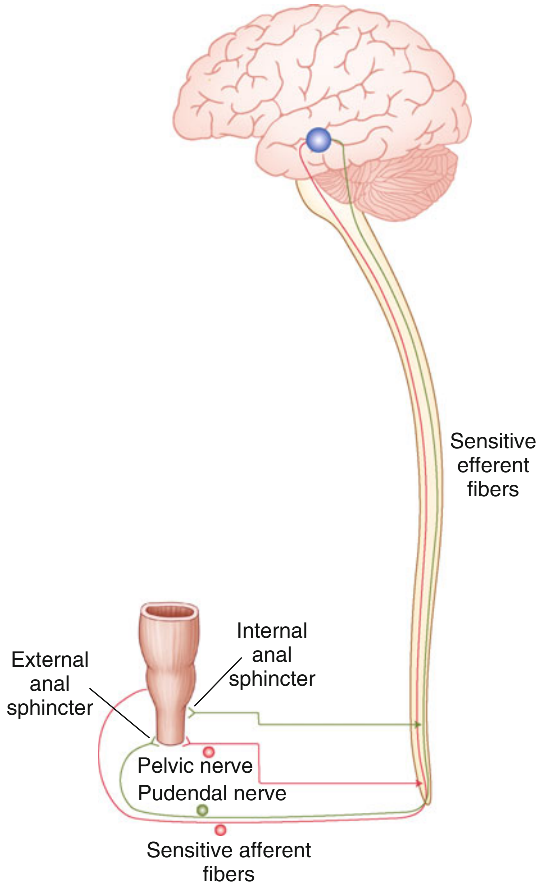


**Fig. 2.3** Central nervous control

Brain areas of central regulation are still poorly defined and are located in the brain stem, hypothalamus, limbic system, and neocortex (Fig. 2.3).

## Vascularization

The recto-anal canal is perfused from different arteries: the superior rectal artery, branch of the inferior mesenteric artery, middle rectal artery, branch of the internal iliac artery, inferior rectal artery branch of the internal pudendal artery, and branches of the lower sacral artery [15].

The veins that drain the recto-anal channel are the upper, middle, and lower. They come from the submucosal venous plexus or hemorrhoidal plexus. This plexus becomes richer of blood in two regions because they have ampullary expansions: above the dentate line, they form the internal hemorrhoidal plexus, and below the lower edge of the internal sphincter, the exterior hemorrhoidal plexus [16].

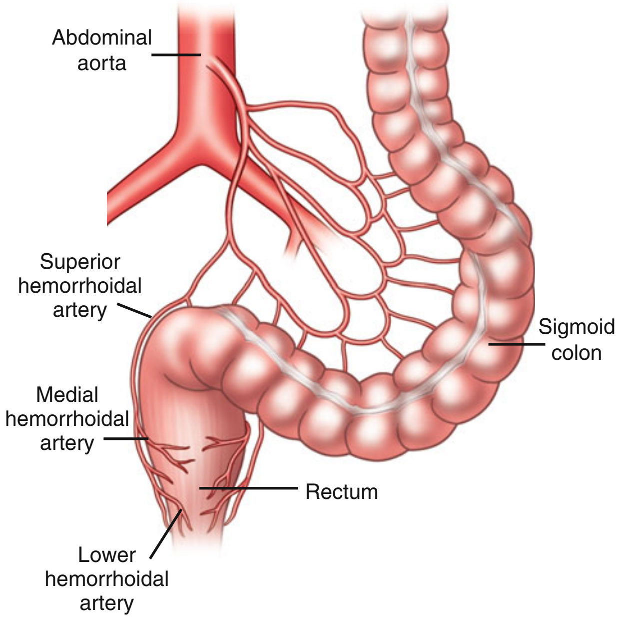


**Fig. 2.4** Vascular supply

At the level of the dentate line, there is a communication between the portal and systemic circulation: the upper part of the anal canal is a tributary of the portal system through the superior hemorrhoidal vein and the inferior mesenteric vein; on the contrary, the effluent blood from the lower portion reaches the vena cava through the middle and inferior hemorrhoidal veins, tributary of the hypogastric veins (internal iliac).

As well as the venous system, the lymphatic goes in two directions: by simplifying it can be said that above the dentate line the drainage is toward the hypogastric lymph nodes (Fig. 2.4).

## Neurophysiology of Defecation

The recto-anal canal serves two important functions, the fecal continence and defecation, through a complex process that integrates muscle function and somatic and visceral sensory information and checks for local and central control.

### Continence

A normal anal continence allows emission voluntarily controlled, periodic, and selective of the various components of the contents of the alimentary canal: gas or

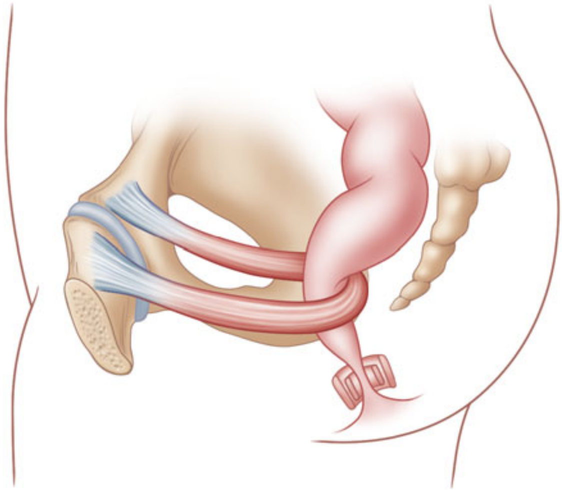

**Fig. 2.5** Pelvic floor with pubo-rectal sling

liquid and solid stool. In normal conditions and during the filling of the rectal ampulla, continence is achieved by the contraction of the internal anal sphincter and the hemorrhoidal pillows. During the filling of bulb, the distension of the rectum activates the recto-anal inhibitory reflex with consequent relaxation of the internal sphincter, and this causes a small amount of fecal material to come in contact with the mucous membrane. This is rich in nerve endings and can differentiate the feces from the gas and decide whether or not to defecate [17]. If defecation should be delayed, the voluntary contraction of the external anal sphincter sends back fecal material, postponing the stimulus.

Continence is based on two elements: the ability of the rectum to host feces and anal lock mechanism, which, together with the ability of sensory discrimination of the anal canal, prevents the involuntary leakage of stool (Fig. 2.5).

## "Rectal Reservoir" Function

The rectum acts as a physiological and mechanical reservoir, which extends from the angle between the rectum and sigmoid colon to the valves of Houston. It has the ability to relax and adapt, ensuring that the fecal content does not generate an increase in pressure that starts the urge to defecate [18-20].

A high-pressure zone 2 cm from the anal margin and caudal to pubo-rectal sling is important for continence because it acts as a barrier to the feces progression. This pressure difference is due to the fact that this point in the motor activity of the bowel is more pronounced than sigmoid colon, with muscular contractions more frequent and powerful; it is difficult to discriminate which muscle is responsible for this high pressure value because at this level the EAS surrounds the IAS. Nevertheless, several studies in the international literature have demonstrated that the IAS is mainly responsible [22]. The anal canal contributes to form this barrier; it has a differential pressure between its highest and lowest portion. Under normal conditions, the pressure in the rectal reservoir is between 5 and 25 mmHg.

## Mechanisms of Anal Lock

The closing mechanism of the anal canal is based on the action of the sphincters and anatomical characteristics of the canal:

1. The pubo-rectal muscle is contracted tonically and causes the acute angle of the recto-anal junction, which is opposed to rectal emptying.
2. The internal anal sphincter is a smooth muscle of visceral origin. It looks like a white ring of 3–4 cm, in continuity with the rectal musculature. It is in permanent nonvoluntary tonic contraction and ensures automatic closure of the anal canal at rest. It produces the majority of the resting pressure, 80 % compared to 20 % produced by the external sphincter, which is recorded with the anorectal manometry (AMR). Its opening is induced by the rectal distension due to reflex of anorectal inhibition. The recording of the electrical activity of smooth muscle cells of the IAS has allowed the identification of sinusoidal waves, called "slow waves," with a frequency of about 16 cycles/min; this frequency does not decrease after the induction of general anesthesia or after paralysis of the external anal sphincter muscle. Other known waves are the "ultraslow electrical waves," with a frequency of about 1.6 cycles/min, identified in patients having a pressure of the anal canal higher than average. It is not clear if there is a correlation between the electrical activity of the cells and pressure measurements of the anal sphincter [21], but electromyographic recordings (EMG) of the IAS are able to demonstrate the correlation between the increase of the baseline blood pressure (with the use of a balloon inflated with air) and the frequency of the slow waves.
3. The external anal sphincter is responsible for a little part of the relaxing pressure (about 20 %); it increases anal pressure when there is a change in the intra-abdominal or intra-rectal (Valsalva maneuver) pressures. The external anal sphincter has a double contractile activity, tonic and phasic type; this may be a reflex action (stimulated by laugh, sneezing, crying with increase of abdominal pressure) or voluntary occurring during the defecatory urgency. Capacity of voluntary contraction is typically two to three times higher than the basal anal tone, and the time varies from 30 to 60 s. The contraction of the external sphincter is undoubtedly the most important mechanism for voluntary continence, but it can be maintained for short periods only, during which the rectum has time to adapt to the new volume reached and the pubo-rectal sling translates forward and at the top the anorectal junction, thus making the angle more acute. All these mechanisms allow to postpone defecation.
4. Reflexes have fundamental importance in the mechanism of fecal continence. We recognize:
   - Reflex of IAS
     If the rectum is filled with air, the IAS is released. Such reflex is also observed in patients with complete section of the spinal cord, suggesting a total independence from the control of the central nervous system.
   - Reflex of EAS
     The muscle activity of the EAS increases not only during voluntary contraction but also during the straining maneuvers (cough or Valsalva maneuver).

The perianal skin stimulation excites the muscles of the EAS, giving rise to what is called "anal reflex." This reflex is also present in paraplegic patients.

- Effect of Rectal Distension
  The rectal distension induced with 50 mL of air increases the activity of the EAS. This response precedes the inhibitory reflex of the IAS and is abolished if the pudendal nerve were blocked. This reflex persists during rectal distension, and the evidence studied proves its independence from the cortex. In normal subjects, stretching the rectum with more than 150–200 mL of air generates a conscious feeling of defecatory urgency, with the automatic inhibition of the EAS and the pubo-rectal muscle. Porter called this response "constant relaxation" [23].
- Effects of Distension of the Anal Canal
  Porter also showed that, in normal subjects, pulling down the anal canal with a finger generates an increase in EMG activity of the EAS and the pubo-rectal muscle. When the anal canal is relaxed, you have a sudden cessation of the contraction. In paraplegics initial peak recorded by EMG follows a complete inhibition for the duration of the anal distension. So in normal subjects such inhibition is masked by cortex of the EAS.
- Recto-anal Inhibitory Reflex RAIR
  At rectal filling, a relaxation of the IAS occurs, which is provoked by the intrinsic inhibitory nerve plexus. This reflex causes the descent of the rectal contents in the anal canal. At this level, the presence of receptors allows discriminating of rectal contents, triggering the act of defecation or the emission of gases.
- Anorectal Sensation
  The ability to keep feces and pass the air requires an "awareness" of the rectal contents. The rectal filling with air or water corresponds to a feeling of fullness in the pelvic floor. Nowadays it is believed that consciousness on rectal filling is due to the presence of pelvic receptors, sensitive to stretching. Despite the absence of specialized receptors in the rectal mucosa, as Pacini and Golgi-Mazzoni corpuscles, there is evidence to suggest that the rectal sensitivity is due to the stimulation of terminationes nervorum and mechanoreceptors in the rectal wall and in adjacent pelvic structures [22]. Furthermore, recent studies in guinea pig models have confirmed the existence of terminationes nervorum intra-ganglionic in the myenteric plexus of rectal wall sensitive to mechanical distension. It ensures gas-stool discrimination, very important for continence. The loss of this sensitive zone is accompanied by sensory incontinence, which appears even if the muscular apparatus is anatomically and functionally normal.

## Defecation

The defecation reflex is an act that takes place under the control of will. When the feces reach the rectum, this is stretched, and there is relaxation of the internal anal sphincter (RAIR) and decrease of the pressure of the anal canal; these mechanisms allow the feces to enter in contact with the mucosa of the rectum to enable discrimination between feces and gas. If social conditions do not allow defecation, the subject can voluntarily postpone it through the contraction of the external anal sphincter and pubo-rectal muscle.

When the distension of the rectum continues and conditions allow it, the person decides to defecate; this decision implies a sitting position with hip flexion that results in the disappearance of the angle between the anal canal and rectum. A complex defecatory mechanism begins that combines the voluntary control of defecation with the reflex of external anal sphincter, the relaxation of the pubo-rectal muscle, and the abdominal pushing.

The effects of defecation reflex are intrinsic and parasympathetic. The first occurs when the rectum is distended by feces; by myenteric plexus start afferent signals that generate a peristaltic wave that push the stool from the descending colon through the sigmoid colon and rectum to the anus. This reflex is, however, weak and to cause defecation must be reinforced by the reflection of the parasympathetic that involves numerous sacral spinal segments; stimulation of rectal afferent fibers gives rise to signals that reach the bone and then, via reflected through the erigendi nerves, the colon to the anus. These parasympathetic signals amplify peristaltic waves and transform the reflex of defecation in a powerful process to allow emptying of the descending colon, sigmoid colon, rectum, and anus. The afferent impulses arriving at the spinal cord give rise to other effects: deep breathing, closure of the glottis, and contraction of the abdominal muscles, to increase the abdominal pressure, which in turn increases the rectal pressure to exceed that produced by the EAS, pushes down the pelvic floor, raises the anus, and helps to push out the feces [22] (see Fig. 2.2).

For defecation to occur, the voluntary mechanism is indispensable as it inhibits the external anal sphincter because this normally contracts with the arrival of stool.

## Bowel and Anorectal Changes in Pregnancy

Functional changes of the gastrointestinal tract are common in uncomplicated pregnancies. Heartburn, nausea and vomiting, abdominal bloating, constipation, hemorrhoids, anal fissures are most frequent clinical manifestations but also diarrhea, fecal incontinence, and irritable bowel syndrome can occur. Hormonal factors have the major influences on the bowel motility and on the pelvic floor musculature in the first and second trimester, while mechanical changes are associated with advancing gestation [23, 24].

### Constipation

It has been documented that constipation is second only to nausea during pregnancy, with up to 40 % of women likely to suffer symptoms at some stage of their pregnancy. The cause of constipation seems to be multifactorial and dependent on hormonal effects, fetus and placenta growth, dietary changes, and decreased physical activity. Small and large bowel hypomotility occurs in pregnancy due to intestinal smooth muscle relaxation secondary to increased progesterone [25, 26].

Even somatostatin may inhibit the release of motilin, a peptide hormone that normally inhibits smooth muscle. Also a polypeptide called relaxin, which inhibits myometrial contraction during pregnancy, could inhibit smooth muscle of the gastrointestinal tract [27–29]. Furthermore, estrogen and progesterone activate the renin-angiotensin-aldosterone system that results in increased colonic water absorption. During the last trimester of pregnancy, the growing uterus and fetal movements can impede onward progression of solid feces, obstruct defecation, and initiate constipation [30].

### Hemorrhoids

Hemorrhoids are another typical anorectal disorder during pregnancy and childbirth due to the same factors of constipation. Raising pressure on the superior rectal veins by gravid uterus increased circulating volume, and the effects of progesterone on the vascular system are the protagonists in etiology of hemorrhoids [31].

### Anal Fissures

Anal fissures are caused mainly by constipation. Pain related to fissures exacerbates constipation and further promotes fissure formation [32].

## Other Disorders

Pregnancy may exacerbate preexisting intestinal disorders like IBS, Hirschsprung's disease, idiopathic megacolon and megarectum, and diseases such as fecal incontinence that is typical of postpartum period (Fig. 2.6) [23].

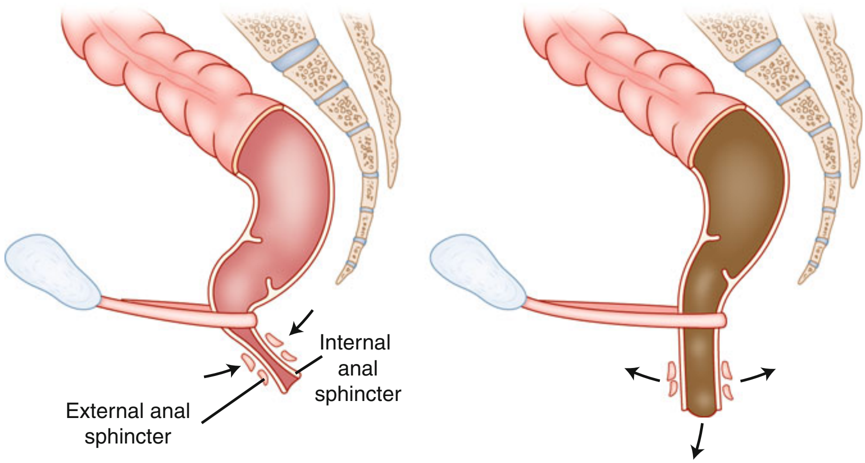


**Fig. 2.6** Anorectum at resting and defecation

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