بسم الله الرحمن الرحيم

Surgical Management
of
Distal Cancer Rectum

An essay
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By

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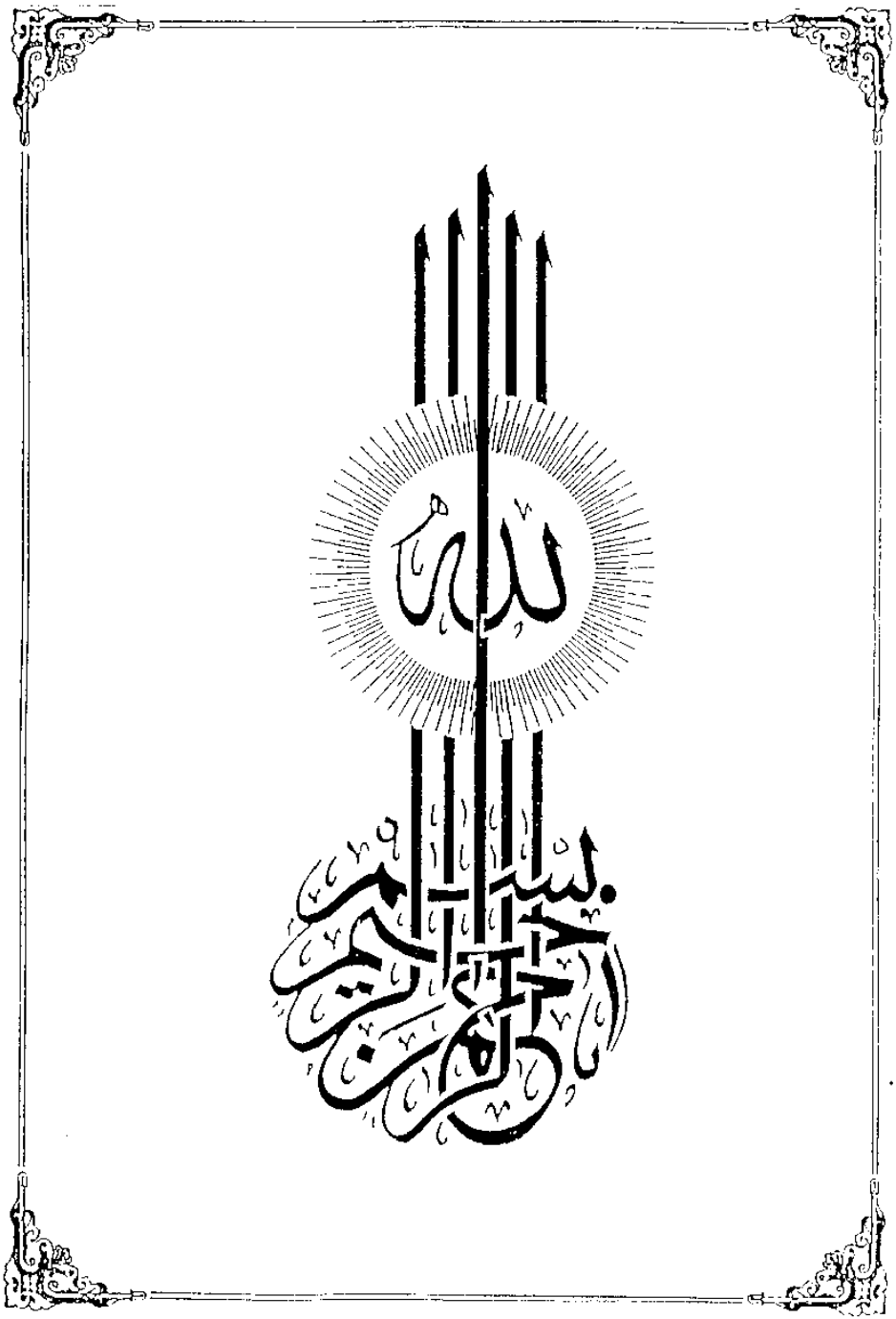

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SURGICAL ANATOMY OF RECTUM, ANAL CANAL AND ANAL SPHINCTERS

The latin word (rectus) means straight. The rectum is misnamed, for it is curved (*Last, 1984).* It follows the hollow of the sacrum and as it descends, it forms 3 curves which are known as the "lateral flexures". The upper and lower are concave to the left, while the middle one is concave to the right. The beginning and termination lie in the median plane.

Course

The rectum is a part of the large intestine, as a continuation of the sigmoid colon. At first the rectum proceeds downward, then downward and forward, closely applied to the concavity of the sacrum and coccyx for 13-15 cm to end 2-3 cm. in front of and below the tip of the latter bone by turning abruptly downward and backward and passing through the levator muscle to become the anal canal *(Goligher, 1984).*

The rectosigmoid junction is marked by a distinct flexure, as the terminal sigmoid, which is directed backward and upward, turns sharply downward. Also when the mesentery ceases the gut is called rectum *(Last, 1984).*

The lower boundary of the rectum is no more agreed upon than the upper boundary. The anatomist considers the anal canal to be the region lying distal to the Pectinate line, the Surgeon considers all the region distal to the insertion of the levator ani muscle to be the anal canal *(Rowe et al., 1974).*

Relation of pelvic peritoneum to the rectum:

The pelvic mesocolon ceases at the level of the third sacral piece. The rectum possesses no mesentery. However, the upper 1/3 has a complete peritoneal investment except for a thin strip posteriorly where the peritoneum is reflected off it as the two leaves of what is sometimes called mesorectum *(Goligher, 1984).* As the rectum descends into the pelvis the mesorectum becomes broader and shorter until only the anterior aspect has a peritoneal coat. Finally, this becomes reflected forwards at the bottom of the rectovesical or rectouterine pouch on the back of seminal vesicles and bladder, or of the vagina and uterus in the female, leaving the lower 1/3 of the rectum without peritoneal covering. As the peritoneum passes from the sides of the upper 1/3 of the rectum to the side wall of the pelvis, it forms the floor of a depression on each side which is known as the "para rectal fossa" or gutter *(Goligher, 1984).*

Fascial relations of the rectum:

On either side of the rectum below the pelvic peritoneum between it and the floor of the pelvis, there is a space filled with fibrofatty tissue. The fibrous elements in this tissue are a part of the pelvic fascia and connect the parietal pelvic fascia on the side wall of the pelvis with the rectum. They are known as the lateral ligaments of the rectum and as seen from above, they have roughly triangular shape with the base on the pelvic side wall and the apex joining the side of the rectum. They may conceivably give some support to this part of the bowel. Their division is an essential step in the operation of rectal excision, and is followed by a variable amount of bleeding from the middle haemorrhoidal arteries which run in them.

The posterior aspect of the extraperitoneal rectum is loosely bound down to the front of the sacrum and coccys by connective tissue which is easily separated by blunt dissection. When this is done it is found that there is still a thin layer of fascia

covering the fat, vessels and lymph glands on the back of the rectum, this is the so called fascia propria or fascial capsule of the rectum and is a part of the visceral pelvic fascia. The sacrum and coccyx are also still covered with a fascia; this is much stronger and tougher and is a specially thickened part of the parietal pelvic fascia which is known as the fascia of Waldeyer (1899). This fascia extends downwards and forwards on the upper aspect of the anococcygeal ligament to fuse with the fascia propria of the rectum at the anorectal junction. During excision of the rectum, when the coccyx is removed, or the anococcygeal raphe is severed, the fascia of Wadeyer has to be divided to give access to the retrorectal space. In carrying out the dissection from below for rectal excision it is important to severe the rectosacral fascia as it is met and not to strip the presacral fascia off the sacrum, for the middle sacral vessels, which lie between the latter fascia and the bone, are very liable to be torn if this faulty plane is struck. *(Goligher, 1984).*

Anteriorly, the extraperitoneal part of the rectum is also covered with a layer of visceral pelvic fascia which extends from the anterior peritoneal reflection above to the superior fascia of the urogenital diaphragm (triangular ligament) below, and laterally becomes continuous with the front of the lateral ligaments. It is a definite fascial layer, easily seen at operations for excision of the rectum, and known to surgeons as Denonvillier's fascia. It intervenes between the rectum posteriorly and the prostate and seminal vesicles or vagina anteriorly but is more closely adherent to the rectum than to these structures, so that it is more convenient to separate it from them along with the rectum in the course of rectal excision and then divide it transversely at a lower level. Sometimes the fascia consists of 2 layers (*Goligher, 1984*)

Relations of the rectum:

The rectum rests upon the sacrum, coccyx and middle sacral artery, and is separated from them by the visceral layer of pelvic fascia and by extraperitoneal connective tissue. The extraperitoneal relationships form the rationale for the sacrococcygeal approach to the rectum. The peritoneum covering the apposed surfaces of the rectum and bladder forms the rectovesical cul-de-sac (of Douglas), which extends to the uppermost margin of the rectovesical fascia bridging the extraperitoneal portions of the rectum and bladder. The extraperitoneal portion of the rectum is in relation to that part of the base of the bladder lying between the deferent ducts through the intermedium of the rectovesical fascia of Denevilliers. This frontally placed aponeurosis explains why carcinoma of the rectum invades anterior structures only in late stages (*Anson & Mc Vay, 1984).*

In addition, the extraperitoneal rectum is related anteriorly from above downwards, in males, to the prostate, seminal vesicles, vasa deferentia and ureters. In females, it is related to the posterior vaginal wall *(Goligher, 1984).*

Lateral to the rectum, in each half of the pelvis, are situated the potential pelvirectal space, the pelvic diaphragm, the sacrotuberous and sacrospinous ligaments, the spine of the ischium, the sacral plexus of nerves and the pyriformis muscle *(Anson & Mc Vay, 1984).*

Curves of the rectum:

Anteroposterior curves:

At first the rectum proceeds downward, then downward and forward, closely applied to the concavity of the sacrum and coccyx to end 2-3 cm. below the tip of the latter bone by turning abruptly downward and backward to become the anal canal.

Lateral curves:

The rectum also has lateral curves, though their prominence varies considerably. Usually there are 3 of them, the uppermost and lowermost being both convex to the right, the middle one convex to the left. The angulation of the bowel on the concave side of each of these curves is accentuated by infoldings of the mucosa known as Houston's valves *(Houston 1830).* There is thus an upper and lower valve on the left side and a middle valve on the right. The lastnamed, which is also known as Kohlrausch's fold, is by far the most prominent as a rule. It is situated about the same level as the anterior peritoneal reflection. The part of the rectum lying below the right valve and the peritoneal reflection has a wider lumen than has the intraperitoneal part, this dilated lower portion is known as the ampulla of the rectum *(Goligher, 1984).*

The anal canal:

This short passage, though only 3 cm. long, is of the greatest surgical importance both because of its role in the mechanism of rectal continence and because it is prone to certain diseases *(Goligher, 1984).* It passes downward and backward to connect the rectal ampulla with the exterior. The sides of the canal are related to the fat pads of the ischiorectal fossa and are liable to involvement in any infection in the fossa. Anteriorly, the anal canal is related to the central tendinous point of the perineum, the membranous part of the urethra, and the bulb *(Anson & Mc Vay, 1984).*

The mucocutaneous lining of anal canal:

The anal canal presents four landmarks:

1. **The anocutaneous line:**

   It marks the lower end of the gastrointestinal tract. It is the external margin of the walls of the anus in its normal state of apposition. The epithelium superior to this line usually is thrown into folds by the action of an involuntary muscle, sometimes termed the "corrugator of the anal skin".

2. **Hilton's white line:**

   In the living subject, it is decidedly blue and is palpable rather than visible. It marks the linear interval between the internal and external sphincters. This interval lies halfway between the anal verge and the pectinate line.

3. **The pectinate (dentate) line:**

   The band of tissue between the intersphincteric space and the pectinate line has a smooth surface and a glossy, shining appearance. It may be likened to a circular sawblade whose teeth point upward. These dentations interdigitate with the rectal colums of Morgagni to form the anal papillae. The appearance of this area with its dentations led Stroud to call this region the pecten from its resemblance to a comb (Latin, pectin).

   The pectin is an important anatomic and clinical landmark. It is the muco-cutaneous junction and also is the lymphatic watershed of this region. The mucous membrane and bowel above this line drain into pelvic lymph nodes. The skin distal to this line drains into the subinguinal glands. The territories of the cerebrospinal and the sympathetic nerves also meet here.

4. **The anorectal line:**

   It lies about 1.5 cm. proximal to the pectinate line, and between the two are the columns and crypts of Morgagni. The anorectal junction, so formed, lies 1 1/2 inches proximal to the anocutaneous line when the canal is empty. *(Anson & Mc Vay, 1984).*

The internal anal sphincter:

It consists of plain muscle fibres and is superiorly contineous with the circular muscle coat of the rectum. Inferiorly, it ends with a well defined rounded edge 6-8 mm. above the level of the anal orifice and 12-8 mm. below the level of the anal valves. The muscle fibres are grouped into discrete bundles which in the upper part of the sphincter lie obliquely with their transverse axis running internally and downward giving them an imbricated arrangement. The obliquity becomes progressively less downward so that the lower muscle bundles lie horizontally *(Goligher, 1984).*

The external anal sphincter:

The classical description of the external sphincter has been of a group of muscle fibres surrounding the anal canal and continuing with the pelvic floor at the edge, puborectalis portion, of the levator ani muscle. There has been considerable debate about the sub-divisions comprising the external sphincter. Initially it was described as being in three separate parts - subcutaneous, superficial and deep. The sphincter has also been described as consisting of two parts - subcutaneous and deep *(Goligher et al., 1955).*

This dispute has been largely resolved by two studies using careful dissection together with meticulous histological examination of the structures in this region *(Oh and Kark, 1972; Shafik, 1975).* They show that part of the reason for the discrepancy in the previous findings is that the relationships of the various parts of the sphincter muscles are not the same around the circumference of the anus. Thus, while in the mid-line posteriorly three layers are not difficult to distinguish, in the lateral aspects of the anus the deep and superficial parts may quite well be fused, and unless they are traced either anteriorly or posteriorly, they could not clearly be separated.

Oh and Kard (1972) have clearly defined three layers of muscle in the external sphincter, as in the classical description. The subcutaneous part is below and outside the end of the internal anal sphincter and in their description is an annular muscle which is penetrated by longitudinal bands of conjoined smooth muscle. The superficial portion is elliptical in form, and above and slightly inside the subcutaneous part. Some fibres of the longitudinal muscle also penetrate the superficial portion, which has a major attachment posteriorly on the dorsal surface of the coccyx. The deep portion of the sphincter is fused with the puborectalis part of the levator ani and is mainly an annular muscle. Although describing three portions, these authors prefer to allow for the variation round the lateral aspect of the anal canal and descibe the external anal sphincter as consisting of a part in the deep compartment (that is, the puborectalis and deep muscle) and a superficial compartment which contains the superficial and sub cutaneous *(Duthie, H.L., 1975).*

Anterior saggittal section, however, as *Oh and Kark (1972)* have recently pointed out, reveals a different state of affairs, which is, moreover, different in the two sexes. In the male, the lower half of the external sphincter is intersected and split up by longitudinal muscle fibres, as in coronal and posterior sagittal section; but the upper half of the muscle has longitudinal fibres not merely internal to it but also external or in front, or sometimes this part of the sphincter is bisected by such fibres into anterior and posterior halves. In the female, the whole external sphincter appears as a compact rounded bundle of muscle encased by longitudinal muscle running down anteriorly and posteriorly to it. No part of the external sphincter is traversed by longitudinal fibres in this plane of section (Goligher, 1984).

The other study *(Shafik, 1975)* also emphasises the presence of three layers in the sphincter. However, Shafik does not think that these three layers fuse posteriorly to become two layers. In addition, he has found that the subcutaneous layer is attached mainly anteriorly to the perineal body. Both groups are in agreement that the superficial layer of the sphincter, which Shafik calls the middle loop, is attached to the posterior aspect of the coccyx. The deep portion of the sphincter or top loop is intimately blended with puborectalis in this study also but it does not show many circular fibres *(Duthie, H.L., 1975).*

Longitudinal fibres:

It has been generally agreed that a prolongation of the longitudinal smooth muscle coat of the rectum splits up in a fan-like manner and penetrate the fibres of the external anal sphincter to gain attachment to the skin around the anus. A much more complicated arrangement has been suggested on the basis of histological findings *(Shafik, 1976),* and three well-formed layers of longitudinal muscle were identified, each with a different origin and separated from the others and from the internal and external sphincters by four fascial septa. The medial longitudinal muscle is innermost and related to the internal sphincter, and is the true prolongation of the longitudinal muscle coat of the rectum. The intermediate longitudinal muscle is apparently a direct prolongation of pubococcygeus and is only related to the lateral and posterior aspects of the anal canal. The third layer of the lateral longitudinal muscle is said to be a prolongation of the deep external anal sphincter *(Duthie, H.L., 1975).* According to him the longitudinal muscle fibres terminate inferiorly shortly above the level of the lower margin of the internal sphincter, Below this point the fascial septa decussate to form what he terms the "central tendon" lying between the termination of the longitudinal muscle and the subcutaneous external sphincter. Numerous fibrous bands proceed from the central