RECTUM AND ANAL CANAL

I. INTRODUCTION

The rectum and the anal canal constitute the terminal portion of the large intestine.

The rectum acts as a faeces container and fecal continence and defecation is ensured by the anal canal. The rectum ends at the anorectal junction where its muscle coats are replaced by the sphincters of the anal canal. The anal canal ends at the anus and passes to the skin of the perineum. The rectum and the anal canal have different embryological origins.

II. DESCRIPTIVE ANATOMY

A- SITUATION

The rectum and anal canal are positioned posteriorly in the midline within the pelvic cavity. The rectum is straight following the posterior concavity of the sacrum and coccyx behind the urogenital organs. It is continuous with the sigmoid colon at the level of the third piece of the sacrum and extends to the anal orifice at the cutaneous margin of the anus, continues with the skin of the buttock, through the anal canal that starts towards the pelvic diaphragm three centimetres below and in front of the apex of coccyx.

B- SHAPE

On a lateral view, the rectum and the anal canal, together, form a S-shaped double curve.

The rectum commences in the hollow of the sacrum at the level of the third piece forming the first curve angled backwards, the sacral curve. It ends curving forwards over the coccyx and anococcygeal raphe at the level where the puborectalis part of levator ani clasps the gut and angles it forwards, the perineal curve.

From this right-angled junction with the rectum, the anal canal passes downwards and somewhat backwards to the skin of the perineum through the anal perineum just behind the perineal body.

Peritoneum covers the upper third of the rectum at the front and sides, and the middle third only at the front; the lower third is below the level of the peritoneum which is reflected forwards to form the pouch of Douglas. The rectum and the anal canal, together, are sixteen centimetres long, the rectum is twelve centimetres long and the anal canal is four. The internal diameter of the rectum measures four centimetres and the internal diameter of the anal canal measures two centimetres.

On a frontal view, the rectum is characterized by three slight lateral curves or flexures that are most prominent when the viscus is distended. The upper and lower curves are convex to the right when the middle curve is convex to the left. Thus, the middle part appears to bulge to the left. They correspond to the three sickle-shaped transverse rectal folds, the rectal valves of Houston that project into the lumen. The surface of the rectum has no haustra nor epiploic appendices and the taeniae coli come together over the rectum to invest it in a complete outer layer of longitudinal muscle. The distinction is merely a matter of peritoneal attachments,

where there is a mesocolon the gut is called sigmoid, where there is no mesentery, it is called

rectum just like the duodenum, retroperitoneal, and the jejunum on a mesentery.

III.   STRUCTURE

A- LUMEN OF RECTUM

The lowest part of the lumen of rectum is slightly dilated as the rectal ampulla. Its

compliance is important and reaches four hundred millilitres.

Three sickle shaped transverse rectal folds, formerly called rectal valves of Houston, project into

the rectal lumen, they are produced by the circular muscle of the wall and are not confined merely

to the mucous membrane. The latter is pinkish with temporary longitudinal folds when empty.

The upper and lower folds are situated on the left wall, respectively, thirteen and six centimetres

away from the anus, the middle is situated on the right wall nine centimetres away.

Functionally, they may be concerned in the separation of flatus from the faecal mass acting as a

shelf-like support while allowing flatus to pass.

B- LUMEN OF ANAL CANAL

The upper third of the lumen of the anal canal extends from the anorectal angle to the

pectinate line. At the bottom, this upper part is limited by a dozen of longitudinal ridges, the anal

columns, particularly, prominent in children. At their lower ends, adjacent columns are joined

together by small horizontal folds, the anal valves. The pockets so formed above the valves are the anal sinuses into which open up to ten mucous-secreting submucosal anal glands. At three and eleven o'clock, lie venous cushions corresponding to the internal rectal veinous plexus.

The level of the anal valves is the pectinate line or dentate line.

The middle third of the anal canal, called the pecten, is a smooth-surfaced bluish one centimetre and half long area. It extends down to the anocutaneous line towards the intersphincteric groove. It doesn't contain any hair follicles nor sebaceous glands nor sweat glands. At seven o'clock, lies a venous cushion corresponding to the internal rectal venous plexus.

The lower third of the anal canal is below the level of the intersphincteric groove. It is a truly cutaneous area continuous at the anal margin with the skin of the buttock. It is one centimetre long.

C- WALL OF RECTUM AND ANAL CANAL

The wall of the rectum and anal canal is made of four layers. From the outer to the inner layer, the serous coat or adventitia, the muscle, the submucosa and the mucous membrane. There are several differences according to each part of the rectum and anal canal.

The rectum and the upper part of the anal canal are, structurally, similar.

The mucous membrane is lined by columnar intestinal cells and crypts. The lining of anal columns is mixed with columnar and stratified squamous epithelium with no abrupt line of change

contrasting with the gastroesophageal junction where there is an abrupt change from stratified squamous to columnar epithelium.

The submucosa is highly innervated and contains the internal rectal venous plexus. It constitutes a zone of portosystemic anastomosis.

The rectal muscle is made of an inner circular layer continuous with the internal anal sphincter. The outer layer is longitudinal continuous with the puborectal part of levator ani laterally, the rectourethral muscle in men and the rectovaginal muscle in women forwards and the rectococcygeal muscle backwards.

The outer layer is made of serous coat at peritonised parts and of the rectal fascia made of connective tissue in the other parts.

The middle part of the anal canal is lined by a stratified non-keratinizing squamous epithelium.

The mucous membrane is particularly firmly attached to the lower part of the internal sphincter in the intersphincteric groove.

The submucosa above this is, thus, lax and known clinically as the submucous space.

The lower part of the anal canal contains, in the submucosa, the external rectal veinous plexus. The fatty subcutaneous tissue adjacent to the anal margin is called the perianal space, it overlies the base of the ischioanal fossa.

D- ANAL SPHINCTERS

The internal anal sphincter is a 5 mm thickened downward continuation of the inner circular muscle of the rectum. It does not occupy the whole length of the canal since the lowest part of the external sphincter comes to lie below its well-marked rounded lower border. It is three centimetres high. At the anorectal junction, the outer longitudinal layer of rectal muscle fuses with fibrous elements of the puborectalis sling to form a thin fibroelastic sheet known as the conjoint longitudinal coat which runs down between the two sphincters.

The external anal sphincter is a skeletal muscle. The rectal deep part forms the anorectal ring continuous with the laterorectal and retrorectal parts of puborectalis sling of levator ani. The middle superficial part is elliptical and bony attached. It attaches to the perineal body forwards and to the apex of coccyx and the anococcygeal ligament backwards.

The subcutaneous part overlies the intersphincteric groove.

Transverse rectal folds

Rectal ampulla

Level of anorectal angle

Internal rectal venous plexus

Anal columns

Anal valves

Anal sinuses

Pectinate line

Anal margin

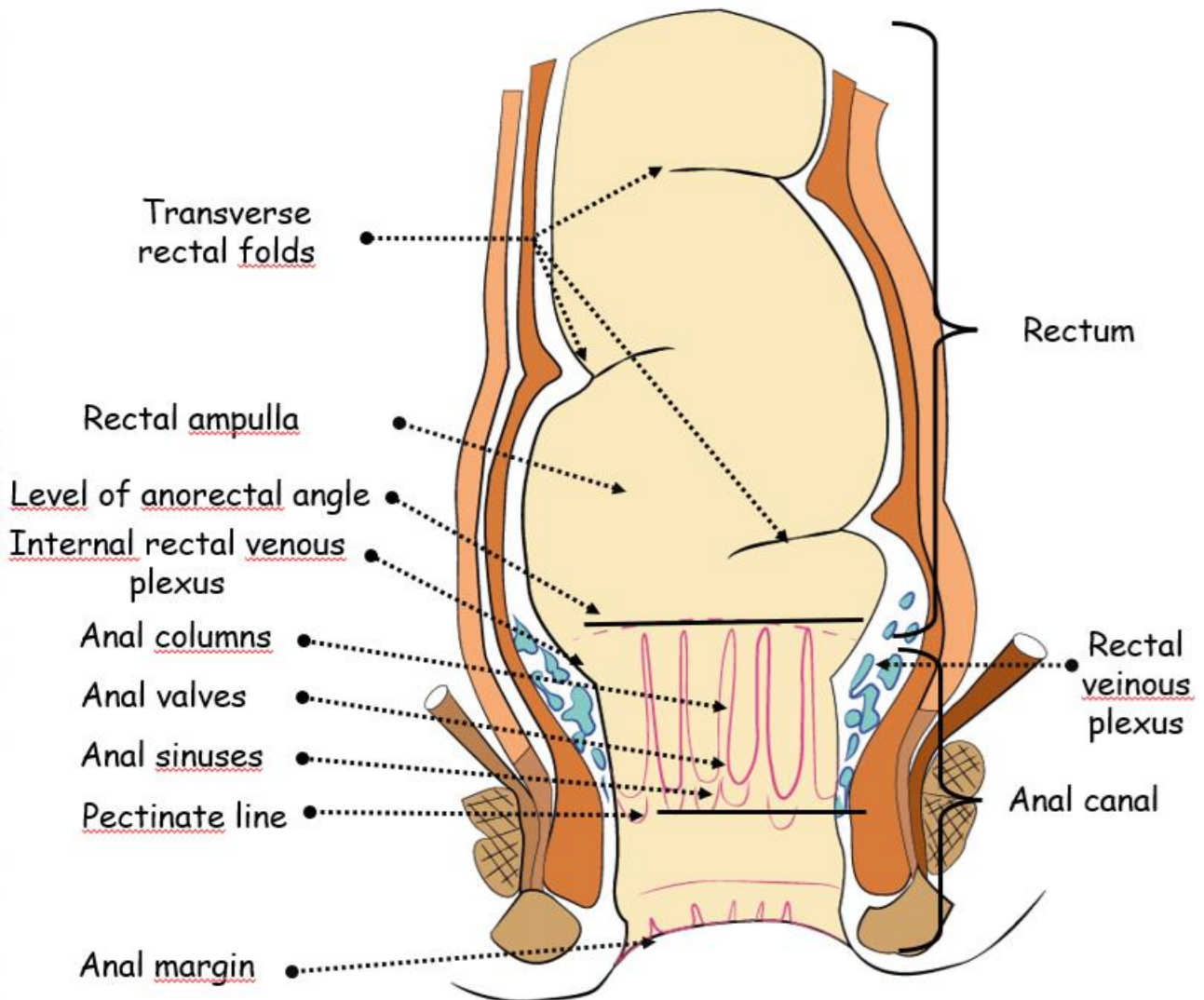Rectum

Rectal veinous plexus

Anal canal

Figure 1: Coronal section of the rectum

IV. SUPPORTS

The rectum is fixed, at the peritonised parts, by peritoneum, namely the superior ligament of the rectum a peritoneal fold around the superior rectal artery continuous with the sigmoid mesocolon.

The lower part under the peritoneal level is fixed by the rectovesical fascia of Denonvilliers intervening between this part of the rectum and the structures in front of it. It separates the rectovesical septum in two spaces, the upper is retrovesical and the lower is retroprostatic. Posteriorly, it is anchored to the curve of the lower sacrum by a condensation of connective tissue commonly known as Waldeyer's fascia. At the sides, the retroperitoneal tissue round the middle rectal vessels constitutes the lateral ligaments of the rectum.

The muscle fibres of the longitudinal muscle leave the lower part of each side of the rectal ampulla and pass forwards to the back of the urogenital diaphragm, the rectourethralis muscles. The levator ani muscles become continuous with the external anal sphincter.

V.   ANATOMICAL RELATIONS

Forwards, the anatomical relations of the rectum and the anal canal are arranged into two levels based on the pouch of Douglas and differ whether it is male or female.

In men, through the rectovesical pouch of Douglas, it is contact with the bladder, intestinal coils, sigmoid colon to the left and cecum and appendix to the right. Under the level of the pouch of Douglas, it is in contact with the base of the bladder, tips of the seminal vesicles, prostate, ductus deferens and the retrovesical portion of pelvic ureter.

In women, through the rectouterine pouch of Douglas, it is in contact with the posterior face of the uterus and the posterior fornix of the vagina. Under the level of the rectouterine pouch, it is in contact with the rectouterine septum and the posterior wall of the vagina.

Back and laterally, the rectum and the anal canal are surrounded by the pelvic wall and floor, made of the sacrum and coccyx, piriformis muscle, levator ani muscle and coccygeus muscle and bordered by the anterior rami of the lower three sacral and coccygeal nerves and the branches of rectal vessels in the lateral ligament of rectum, the pelvic ureter and the uterosacral ligaments in women and vesicosacral in men.

The anal canal is in contact with, forwards, the deep and superficial perineal spaces and their content, the anococcygeal ligament backwards, the ischiorectal fossae laterally.

VI. BLOOD SUPPLY; LYMPH DRAINAGE AND NERVE SUPPLY

A- ARTERIES

The arteries of the rectum supply all layers of the rectum and anastomose with each other.

The superior rectal artery is the principal artery of the rectum and anal canal, it is the terminal branch of the inferior mesenteric artery in the sigmoid mesocolon after crossing the pelvic brim, it crosses the left common iliac vessels medial to the ureter and descends in the base of the medial

limb of the mesocolon. At the level of S3 vertebra where the rectum begins it divides into various branches.

They supply the whole thickness of the rectal wall including the mucous membrane and continue within the mucosa into the anal columns.

The middle rectal artery is the most posterior branch of the internal iliac artery. It may be double or absent and reaches the lower rectum from the side, along the lateral rectal ligaments.

The inferior rectal artery penetrates the walls of the anal canal below the level of levator ani and their branches run upwards within the walls to reach the rectum. They supply, mainly, the pecten and the lower part of the anal canal.

The median sacral artery has an unimportant contribution to the posterior wall in the region.
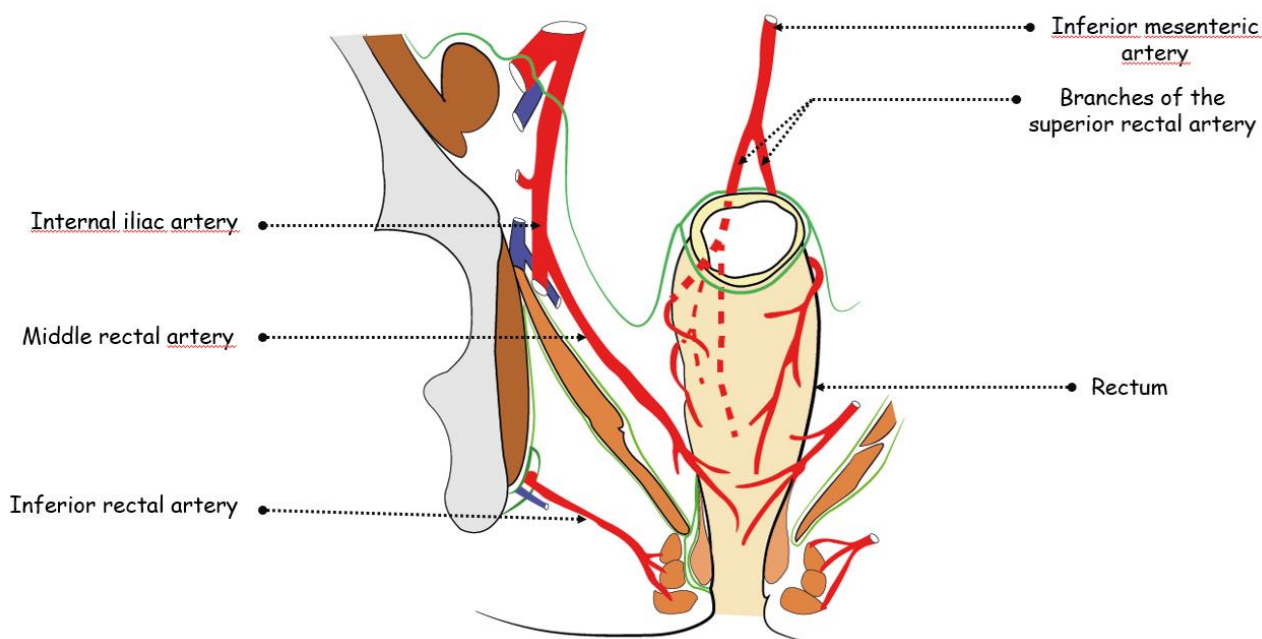
Figure 2: Coronal section of the rectum showing its arteries

B- VEINS

The veins correspond to the arteries. They anastomose freely with one another. The internal rectal plexus in the submucosa forms the three and eleven o'clock venous cushions of the upper third of anal canal and the seven o'clock cushion of the pecten. More specifically, the lower end of the internal plexus is continuous with the vascular cushions of the anal canal. The external rectal plexus lies outside the muscular wall in the lower third of anal canal.

The internal rectal plexus drains into the superior and middle rectal veins to, respectively, the inferior mesenteric and internal iliac veins.

The external rectal plexus drains into the inferior rectal veins that flow into the internal pudendal vein. The superior and inferior rectal veins are the main veins and follow closely their arteries.

The rectum and anal canal constitute a zone of portosystemic anastomosis in the region of the anal columns.

C- LYMPH DRAINAGE

The lymphatics of the rectum and anal canal run back with the branches of the superior and middle rectal and median sacral arteries. The lymphoid follicles in the mucous membrane provide the first filter, they pierce the wall of the rectum and travel to three groups of nodes.

The superior group drains in the hollow of the sacrum along the median sacral artery and inferior mesenteric artery to preaortic nodes at its origin.

The middle group, on the side wall of the pelvis along the middle rectal artery, drains to internal iliac nodes. The inferior group drains to inguinal nodes and concerns the part of the anorectal wall below the anocutaneous line.

D- NERVES

The sympathetic supply is derived by branches directly from the hypogastric plexuses and by fibres which accompany the inferior mesenteric and superior rectal arteries from the coeliac plexus. The parasympathetic supply is from S2 and 3 or S3 and 4 by the pelvic splanchnic nerves, which are motor to rectal muscle. As from the bladder pain fibres appear to accompany both sympathetic and parasympathetic supplies. The inferior rectal branches of the pudendal nerves from S2 supply the external sphincter and provide the sensory supply for the lower end of the canal which like skin is highly sensitive. The external sphincter has a high proportion of slow twitch fibres and shows constant electromyographic activity even in sleep and under light anaesthesia. Autonomic nerves pass to the internal sphincter and the upper end.

VII. SURGICAL APPROACH

With access to the pelvis through the anterior abdominal wall, tumours in the upper part of the rectum can be removed leaving the lower part and the anal canal intact, anterior resection. The rectum can be freed by incising the peritoneum at the level of the rectovesical or rectouterine pouch and dissecting it away from surrounding structures. It must be freed from the

sacrum by cutting through Waldeyer's fascia, and at the front from the bladder, seminal vesicles and upper part of the prostate or vagina. The ureters are a hazard, and interference with the hypogastric nerves in the male may cause impotence. The sigmoid colon and mesocolon are transected where required, and the superior rectal vessels ligated usually just below the aortic origin of the inferior mesenteric artery. The descending colon is anastomosed to the remaining end of the rectum. For complete excision of the rectum and anal canal, the freeing of the rectum as above is supplemented by a perineal approach, abdominoperineal resection, which includes dividing the pelvic diaphragm. Elliptical incisions either side of the anus allow the ischioanal fossae to be entered so that the tissues in front of the coccyx can be released to open up the space containing Waldeyer's fascia from below. The plane between the rectum and prostate, or rectum and vagina, is defined and opened up, and puborectalis divided to allow the freed bowel to be withdrawn through the perineum. A colostomy is usually made in the left iliac fossa.

VIII. <u>CONCLUSION</u>

The rectum and the anal canal constitute the terminal part of the gastrointestinal tract, they are pelviperineal organs with different embroyological origins. They are in contact with several pelvic and perineal anatomical relations. Their blood supply is rich, and their lymph drainage is large. The rectum and anal canal constitute a zone of portosystemic anastomosis.