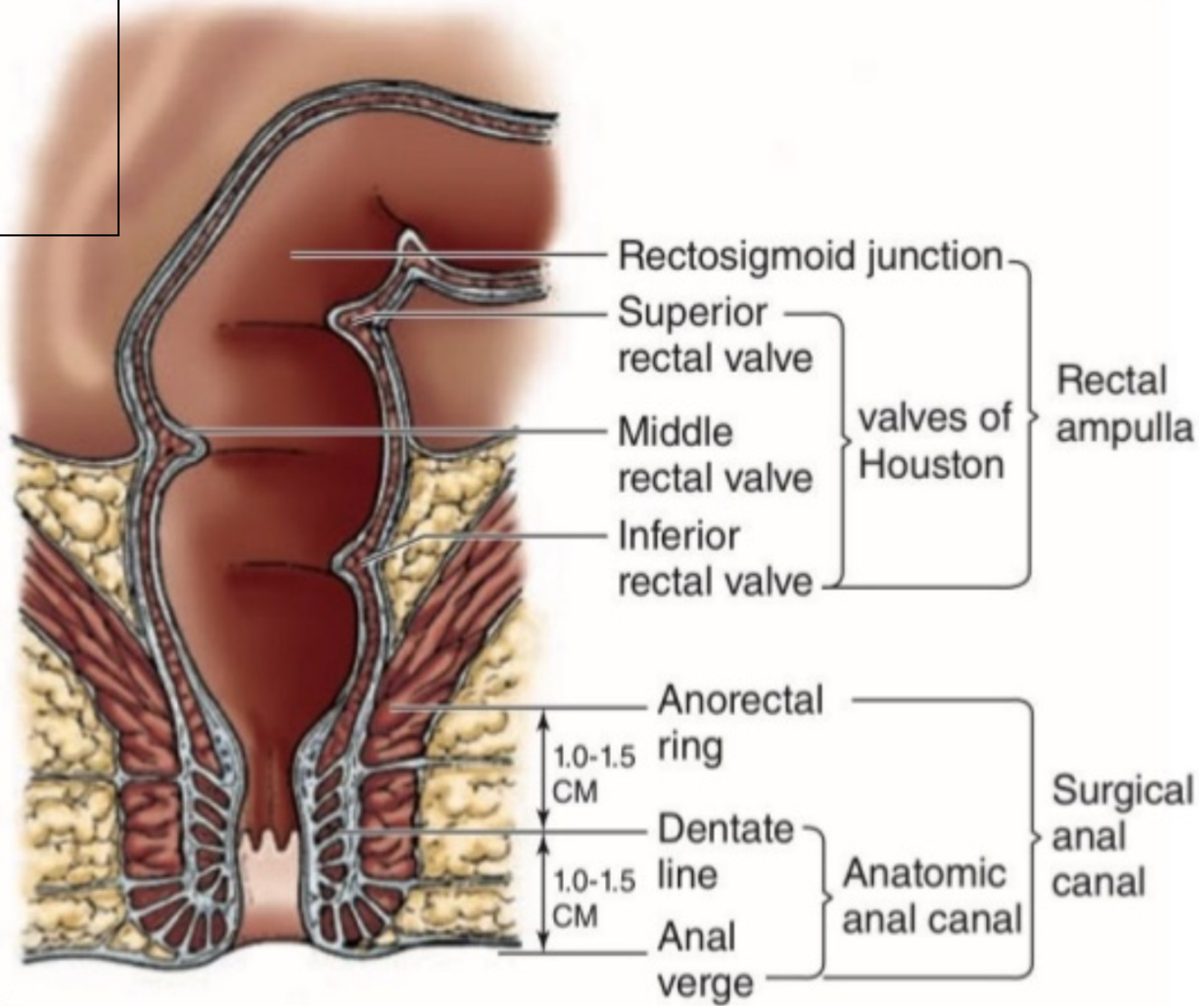
Rectal Cancer

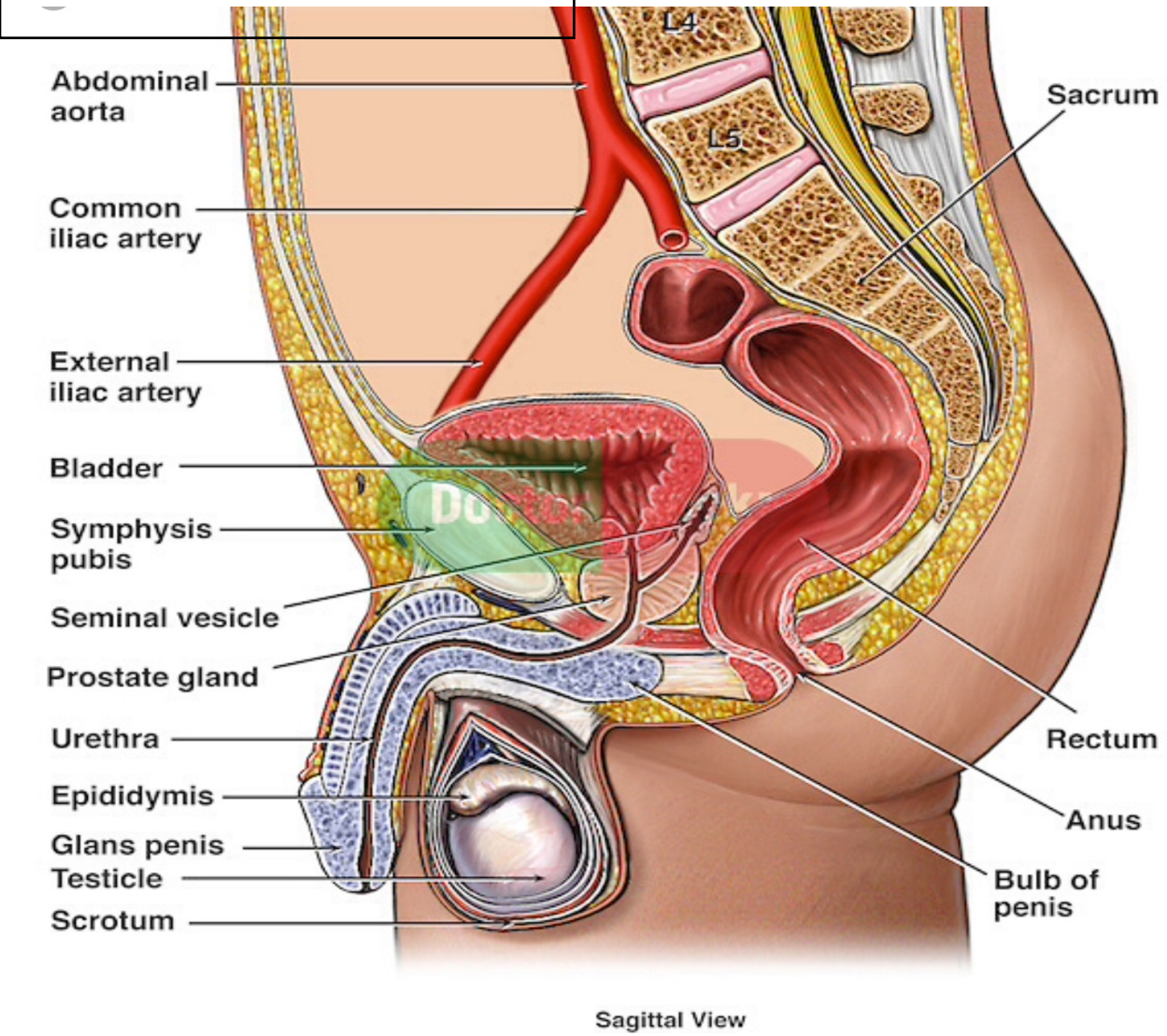
Dr. Ibrahim Falih Noori

Anatomy

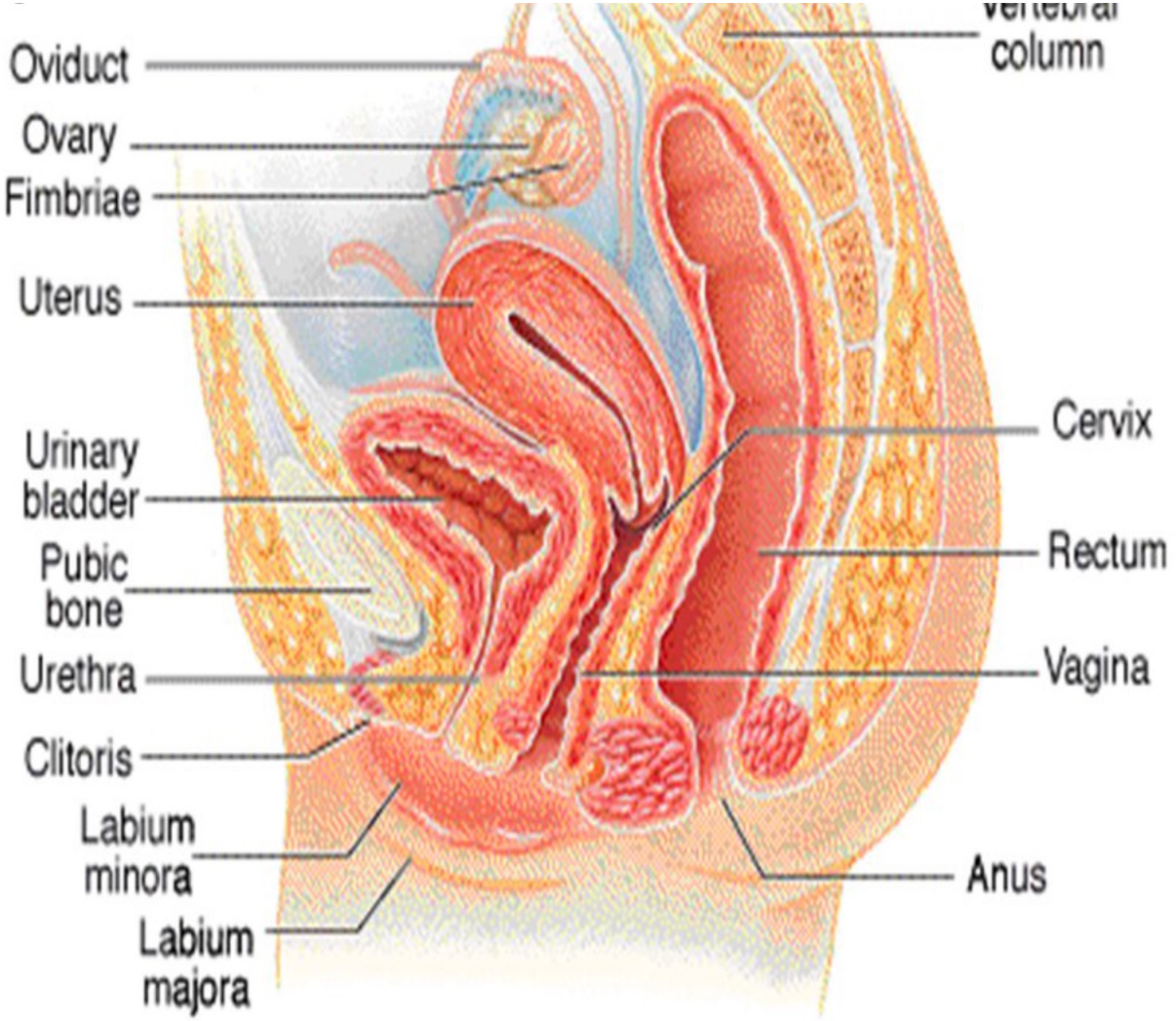
- The surgical definition of the rectum differs from the anatomical definition; surgeons define the rectum as starting at the level of the sacral promontory, while anatomists define the rectum as starting at the level of the 3rd sacral vertebra.
- Therefore, the measured length of the rectum varies from 12 cm to 15 cm.
- The rectum differs from the rest of the colon in that the outer layer consists of longitudinal muscle.
- The rectum contains three folds, namely the valves of Houston. The superior (at 10 cm to 12 cm) and inferior (at 4 cm to 7 cm) folds are located on the left side and the middle fold (at 8 cm to 10 cm) is located at the right side.


Rectosigmoid junction
Superior rectal valve
Middle rectal valve
Inferior rectal valve
valves of Houston
Rectal ampulla
Anorectal ring
1.0-1.5 CM
Dentate line
1.0-1.5 CM
Anal verge
Anatomic anal canal
Surgical anal canal

Rectum

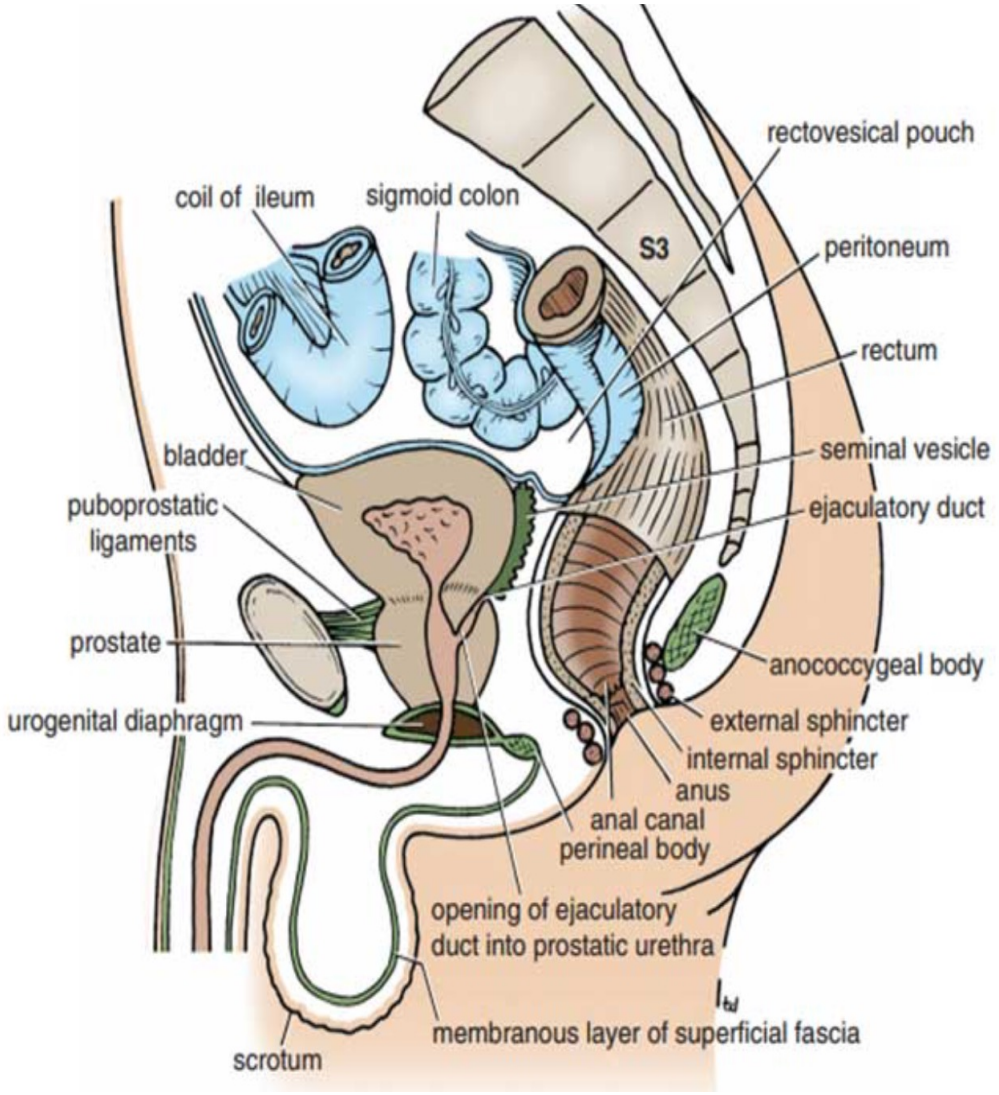


Sagittal View



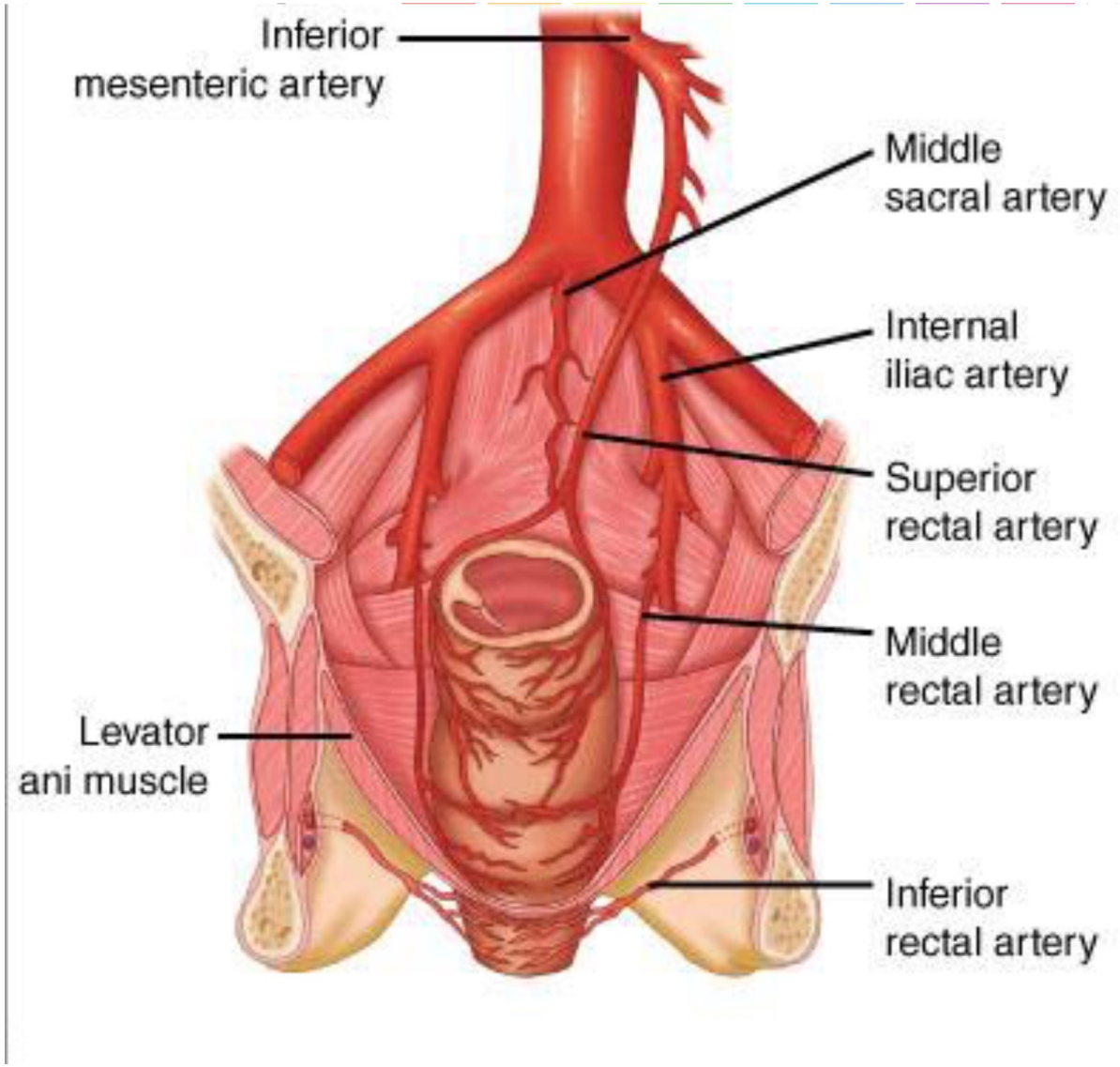
Peritoneal covering of Rectum

- Upper 1/3rd: Peritoneal covering all around
- Middle 1/3rd: Peritoneal covering anteriorly and laterally
- Lower 1/3rd: No peritoneal covering
- Lower rectum separated from other organs by fascial condensation
- Anterior-Fascia of DenonVilliers
- Posterior- Fascia of Waldeyers



Arterial supply of rectum

- **Superior rectal artery**
  -the direct continuous of inferior mesenteric artery
- **Middle rectal artery**
  -a branch of internal iliac artery
- **Inferior rectal artery**
  -branch of internal pudendal artery

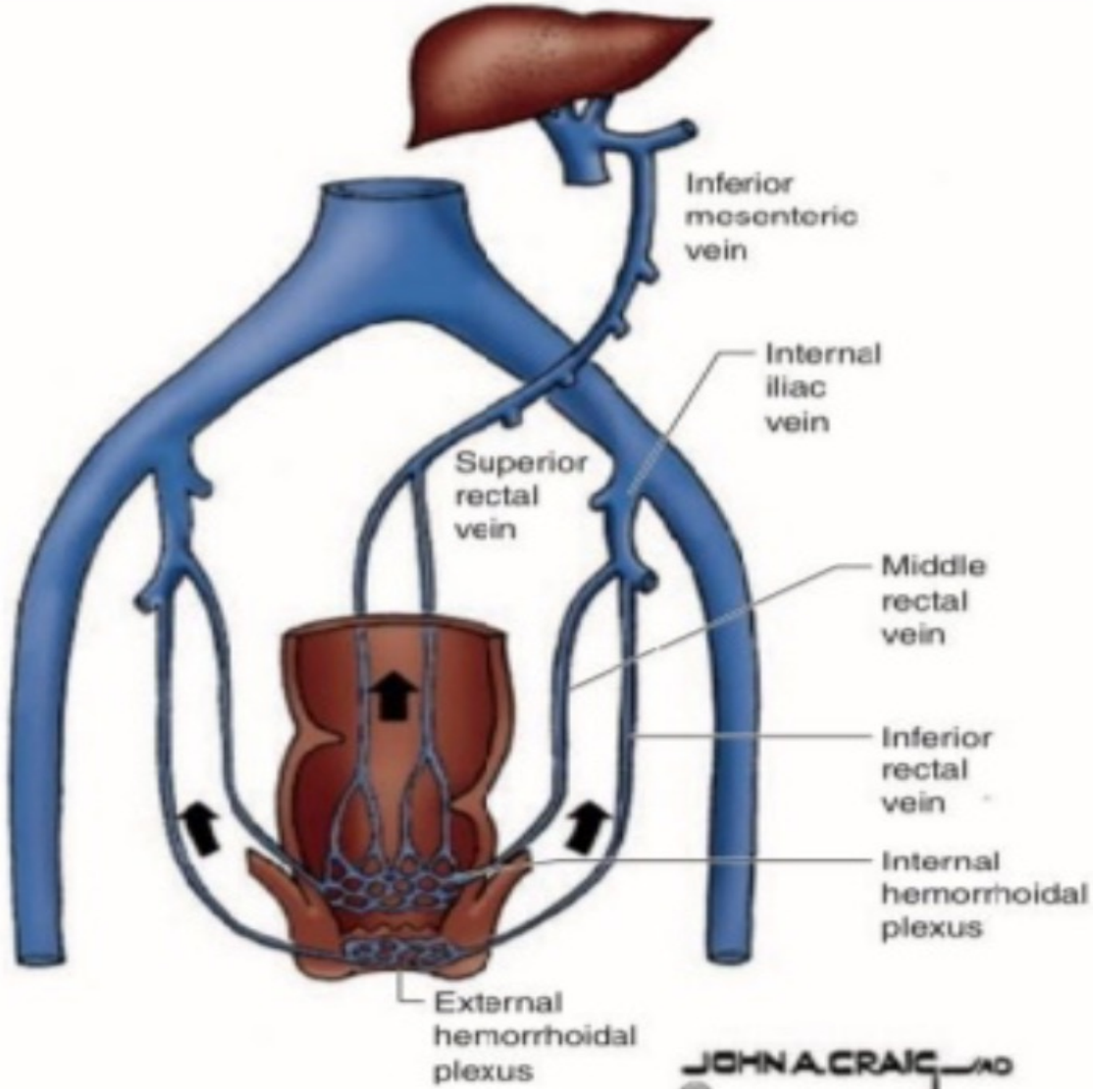


Venous drainage of the rectum.

- **Superior rectal vein drains the upper and middle thirds of the rectum to inferior mesenteric vein**

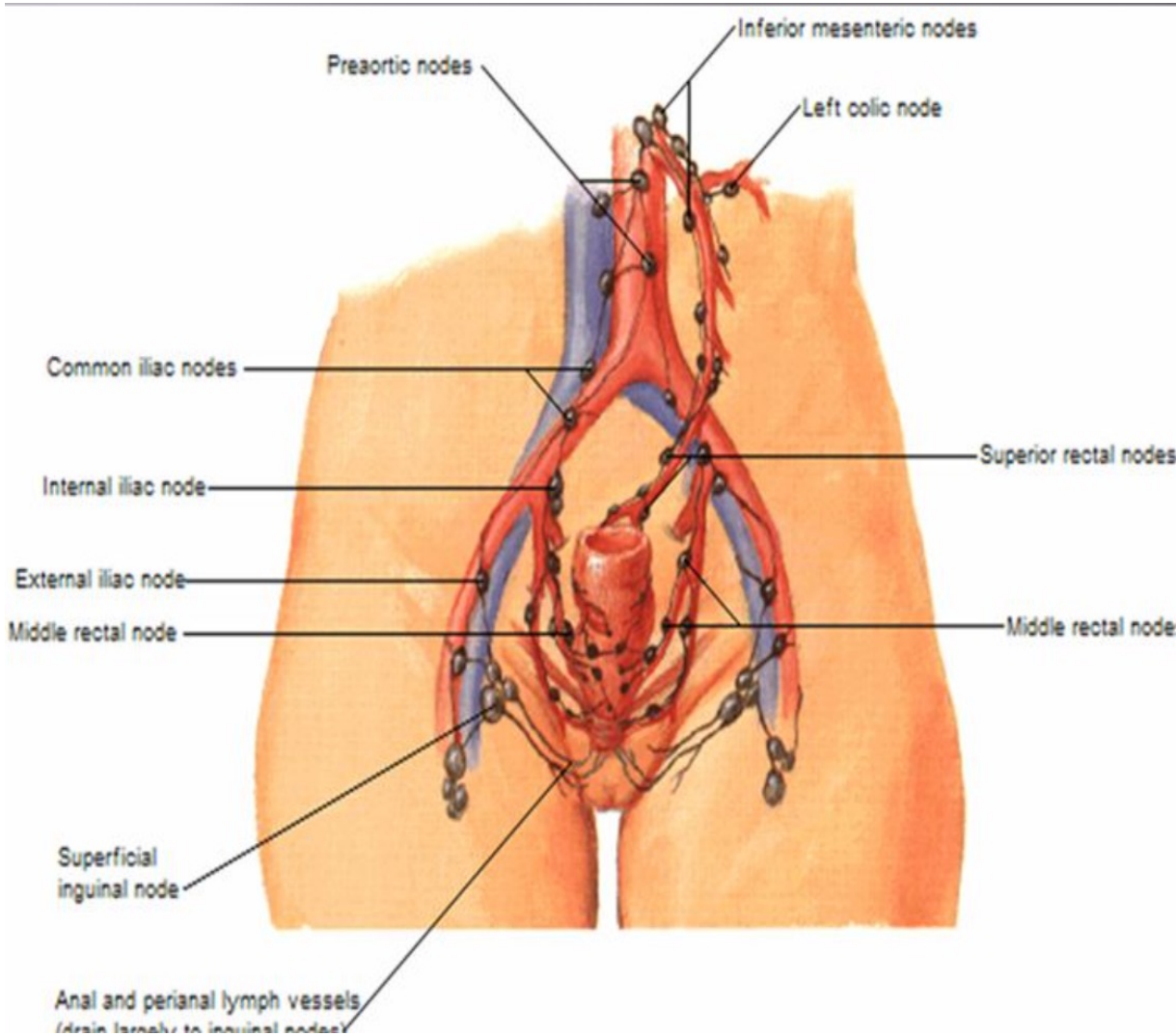
- **Middle rectal vein drains the lower third of the rectum and upper half of anal canal to IVC**

- **Inferior rectal vein drains the lower half of anal canal to IVC**



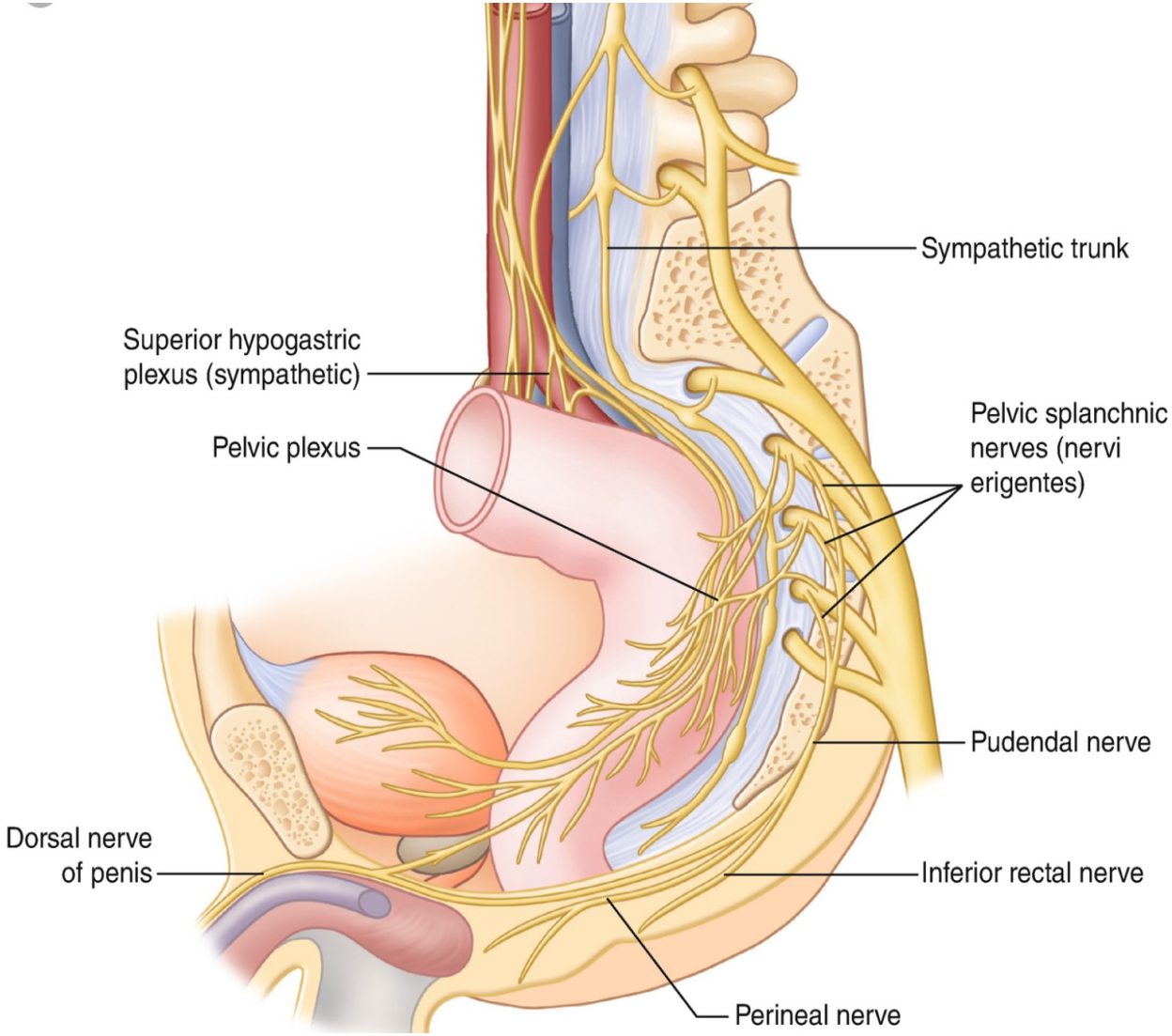
Lymphatic drainage of the rectum

- **Upper and middle rectum**
  - **Pararectal** lymph nodes, located directly on the muscle layer of the rectum
  - **Inferior mesenteric** lymph nodes, via the nodes along the superior rectal vessels
- **Lower rectum**
  - **Sacral group** of lymph nodes or **Internal iliac** lymph nodes
- **Below the dentate line**
  - Inguinal nodes and external iliac chain



Innervation of the rectum

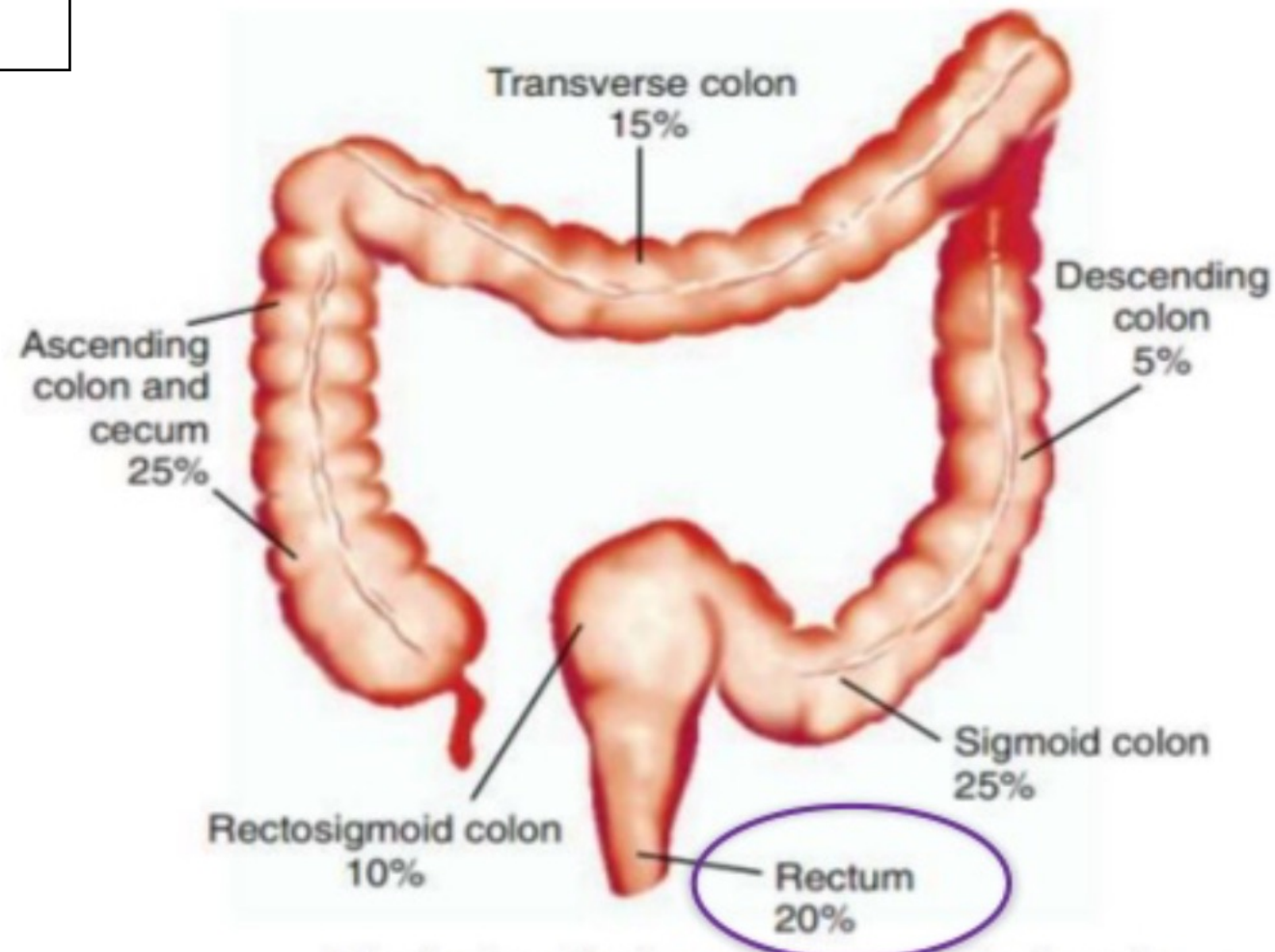
- Sympathetic nervous supply to the rectum is from the lumbar splanchnic nerves and superior and inferior hypogastric plexuses. Parasympathetic supply is from S2-4 via the pelvic splanchnic nerves and inferior hypogastric plexuses. Visceral afferent (sensory) fibers follow the parasympathetic supply



Rectal cancer- Background

- **Currently, colorectal cancer is the third most common cancer and the third leading cause of cancer deaths in both males and females**
- **Adenocarcinomas comprise the vast majority (98%) of colon and rectal cancers.**
- **Other rare rectal cancers, including carcinoid (0.4%), lymphoma (1.3%), and sarcoma (0.3%)**
- **Approximately 20% of colon cancers develop in the cecum, another 20% in the rectum, and an additional 10% in the rectosigmoid junction. Approximately 25% of colon cancers develop in the sigmoid colon.**

Distribution



Distribution of colorectal cancers within the colon.

Types of Carcinoma Spread

1. Local spread
   - Occurs circumferentially rather than longitudinally
   - Anterior penetration
     - ✓Prostate, Seminal vesicles, Bladder in male
     - ✓Vagina or uterus in female
   - Lateral penetration
     - ✓Ureter
   - Posterior penetration
     - ✓Sacrum and sacral plexus

Types of Carcinoma Spread

2. Lymphatic spread
   - Exclusively in an upward direction
   - Metastatic at higher level than superior rectal artery in late disease
3. Venous spread
   - Principal sites are:
     - ✓Liver (34%)
     - ✓Lungs (22%)
     - ✓Adrenal (11%)
     - ✓Remaining spread to other locations including brain
4. Peritoneal Dissemination
   - High lying rectal carcinoma

Clinical Presentations

- **Bleeding is the most common symptom of rectal cancer, occurring in 60% of patients.**
- **Many rectal cancers produce no symptoms and are discovered during digital or proctoscopic screening examinations.**
- **Change in bowel habits (43%): Often in the form of diarrhea; the caliber of the stool may change; there may be a feeling of incomplete evacuation and tenesmus**
- **Occult bleeding (26%): Detected via a fecal occult blood test (FOBT)**

- **Abdominal pain (20%): May be colicky and accompanied by bloating**
- **Back pain: Usually a late sign caused by a tumor invading or compressing nerve trunks**
- **Urinary symptoms: May occur if a tumor invades or compresses the bladder or prostate**
- **Malaise (9%)**
- **Pelvic pain (5%): Late symptom, usually indicating nerve trunk involvement**
- **Emergencies such as peritonitis from perforation (3%) or jaundice, which may occur with liver metastases (< 1%)**

Physical examination

- Pallor
- Abdominal mass
- PR mass
- Jaundice
- Nodular liver
- Ascites

- Rectal metastasis travel along portal drainage to liver via superior rectal vein as well as systemic drainage to lung via middle inferior rectal veins.

Pathophysiology of colorectal cancer

- **Three pathways to colon and rectal carcinoma have been described:**

- Adenomatous polyposis coli (APC) gene adenoma-carcinoma pathway:The APC adenoma carcinoma pathway involves several genetic mutations, starting with inactivation of the APC gene
- Hereditary nonpolyposis colorectal cancer (HNPCC) pathway:common carcinogenic pathway involves mutation in DNA mismatch repair genes.
- Ulcerative colitis dysplasia: Chronic inflammation such as in ulcerative colitis can result in genetic alterations which then lead into dysplasia and carcinoma formation

Etiology

- The etiology of colorectal cancer is unknown, but colorectal cancer appears to be multifactorial in origin and includes environmental factors and a genetic component.
- Diet may have an etiologic role, especially diet with high fat content.
- Risk was also increased in men and women who do not drink alcohol.
- Approximately 75% of colorectal cancers are sporadic and develop in people with no specific risk factors.

- The remaining 25% of cases occur in people with significant risk factors—most commonly, a family history or personal history of colorectal cancer or polyps, which are present in 15-20% of all cases.
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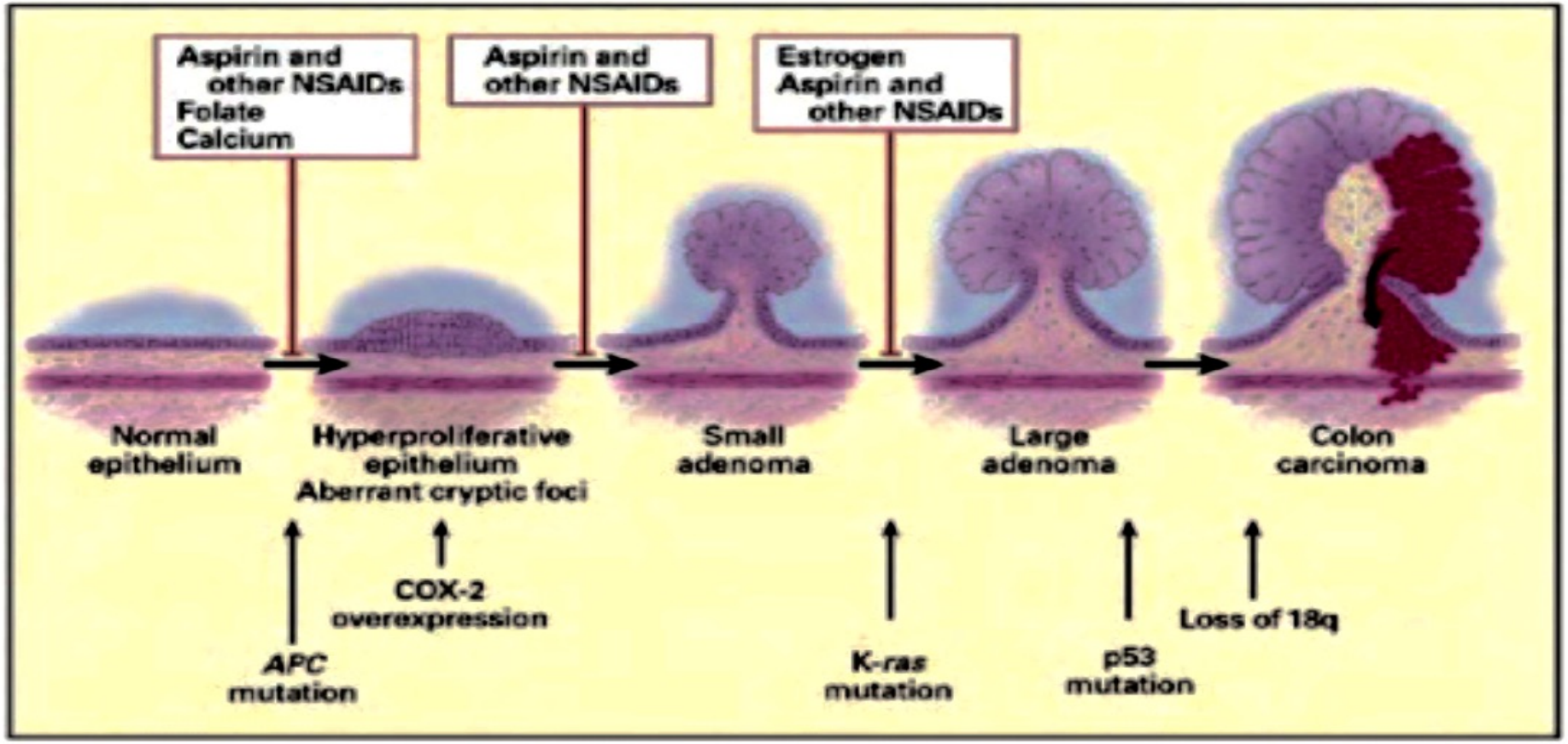
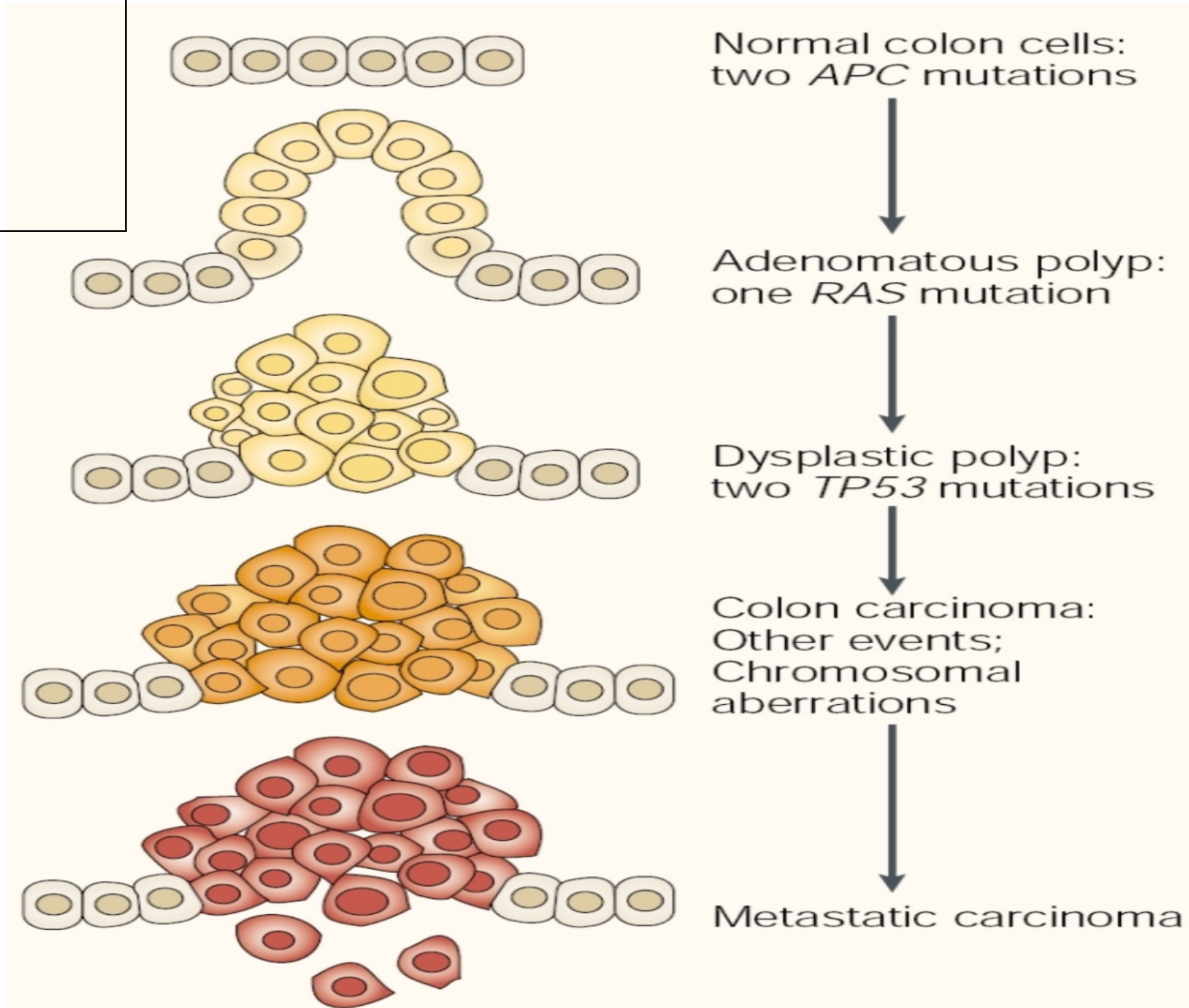
- Other significant risk factors are certain genetic predispositions, such as hereditary nonpolyposis colorectal cancer (HNPCC; 4-7% of all cases) and familial adenomatous polyposis (FAP, 1%); and inflammatory bowel disease (IBD; 1% of all cases).

Adenoma – Carcinoma Sequence

- Accounts for upto 80 % of sporadic colon tumours and typically includes mutation of APC gene




Normal colon cells:
two *APC* mutations
Adenomatous polyp:
one *RAS* mutation
Dysplastic polyp:
two *TP53* mutations
Colon carcinoma:
Other events;
Chromosomal
aberrations
Metastatic carcinoma

Staging

❖Dukes Classification

- **Duke A** : Those limited to the rectal wall
- **Duke B** : Those that extended through the rectal wall into extra-rectal tissue (
- **Duke C :** Those with metastases to regional lymph nodes

❖ This system was modified by others to include subdivisions of stages B and C, as follows:

- **Stage B** was divided into **B1** (ie, tumor penetration into muscularis propria) and **B2** (ie, tumor penetration through muscularis propria).
- **Stage C** was divided into **C1** (ie, tumor limited to the rectal wall with nodal involvement) and **C2** (ie, tumor penetrating through the rectal wall with nodal involvement).

Staging : TNM Classification

Primary tumor (T)	
TX	Primary tumor cannot be assessed
T0	No evidence of primary tumor
Tis	Carcinoma in situ: intraepithelial or invasion of lamina propria
T1	Tumor invades submucosa
T2	Tumor invades muscularis propria
T3	Tumor invades through muscularis propria into the subserosa or into nonperitonealized pericolic or perirectal tissues
T4a	Tumor perforates visceral peritoneum
T4b	Tumor directly invades other organs or structures

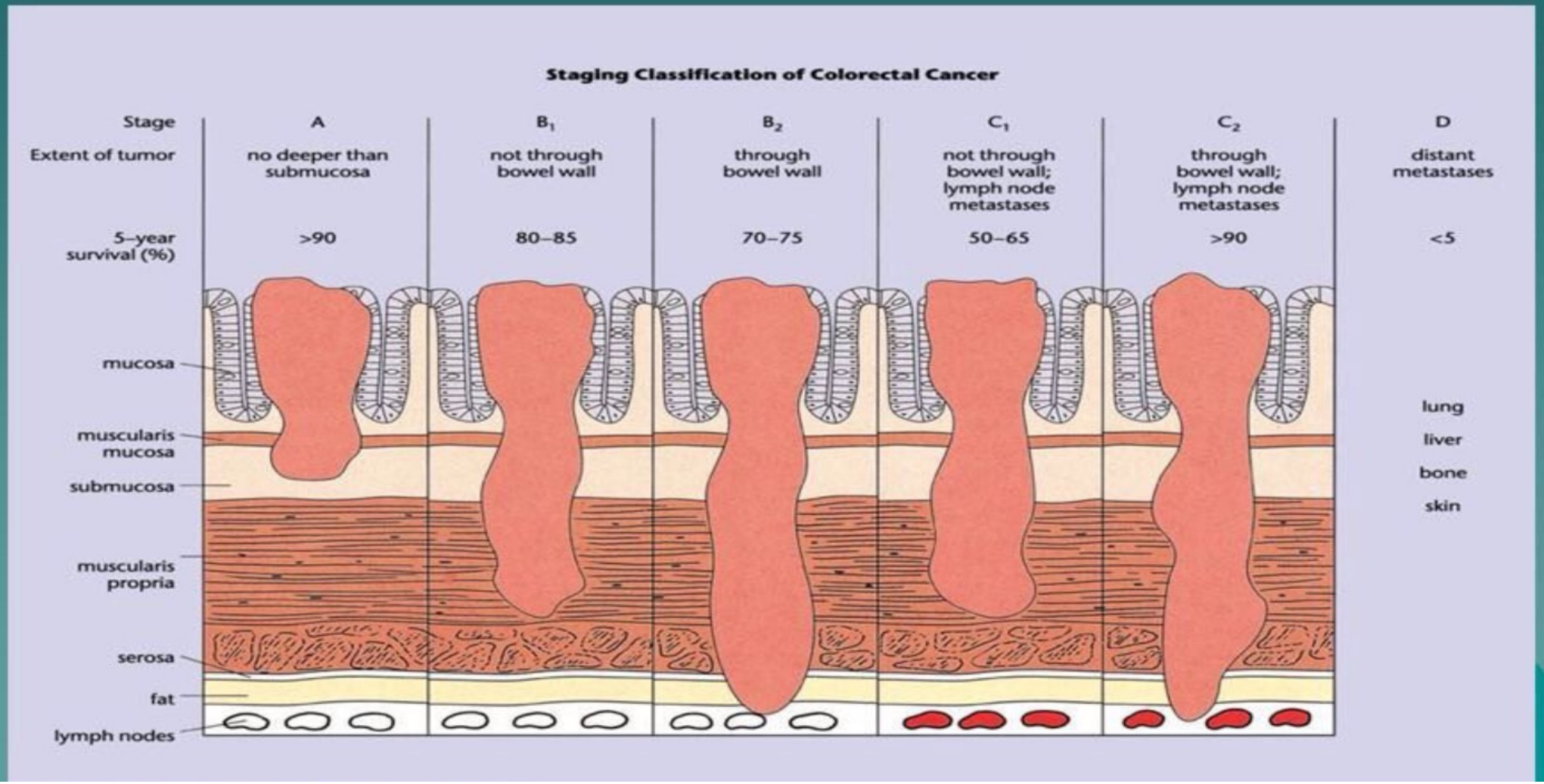
Regional lymph nodes (N)

NX	Regional lymph nodes cannot be assessed
N0	No regional lymph node metastases
N1	Metastasis in 1–3 regional lymph nodes
N1a	Metastasis in 1 regional lymph node
N1b	Metastasis in 2–3 regional lymph nodes
N1c	Tumor deposit(s) in the subserosa, mesentery, or nonperitonealized pericolic or perirectal tissues without regional nodal metastasis
N2	Metastasis in 4 or more regional lymph nodes
N2a	Metastasis in 4–6 regional lymph nodes
N2b	Metastasis in 7 or more regional lymph nodes

Distant metastasis (M)

M0	No distant metastasis
M1	Distant metastasis
M1a	Metastasis confined to one organ or site (for example, liver, lung, ovary, nonregional node)
M1b	Metastases in more than one organ/site or the peritoneum

Modified Dukes' staging classification of colorectal cancer.

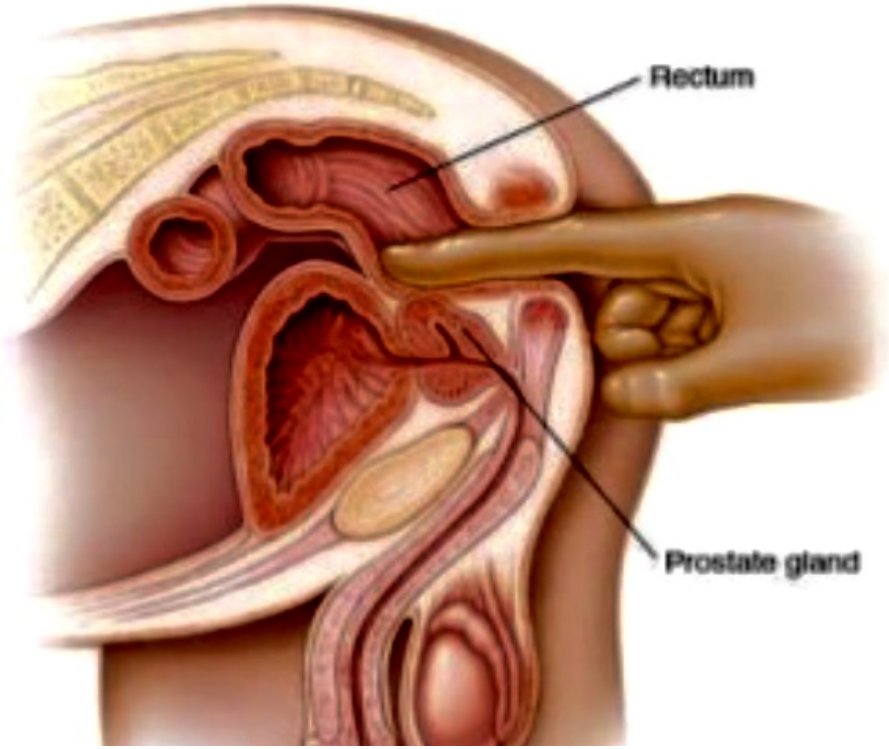


Investigations

- **DRE: size , Fixity, location, distance from anal verge, sphincter involvement**
- **Proctoscopy, Sigmoidoscopy , Colonoscopy with biopsy.**
- **Barium enema in case of FAP and synchronous growth.**
- **Ultrasound of abdomen to look for secondaries in liver, ascites.**
- **CT scan of pelvis.**
- **Endorectal ultrasound: very useful to assess the local extent of the tumor.**
- **Flourine – 18 flourodeoxyglucose PET scan: detect recurrent local tumors, metastatic disease**
- **Blood tests likeCBC, RFT, LFT, CEA.**

Digital Rectal Examination (DRE)

- **DRE :** size, mobility, fixation, location, distance from anal verge, relationship with anal sphincter

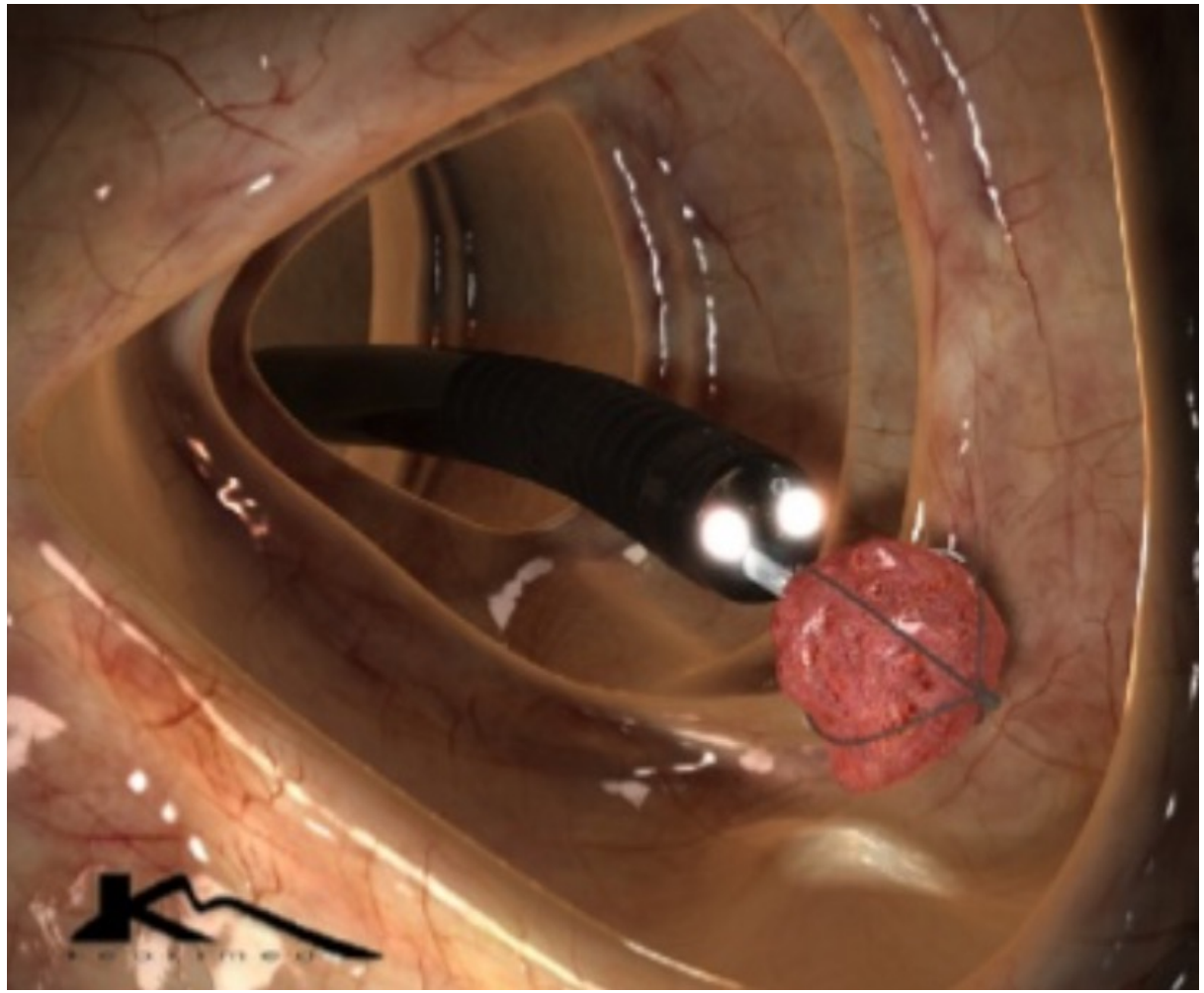


Rigid Proctoscopy.

- Demonstrates the proximal and distal levels of the mass from anal verge
- Extent of circumferential involvement
- Orientation within the lumen
- Aids in determining the feasibility of local excision

Colonoscopy

- To rule out synchronous cancers - which occur 2 - 8% of the time.



Barium Enema

To evaluate remainder of large bowel to rule out synchronous tumor or presence of polyp syndrome.

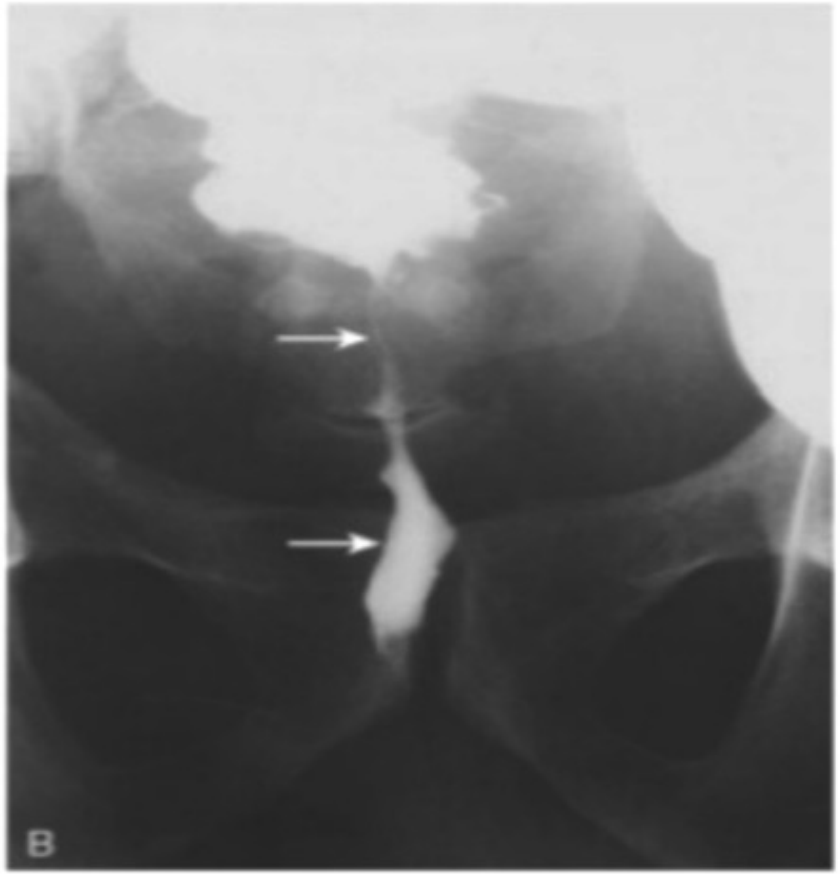
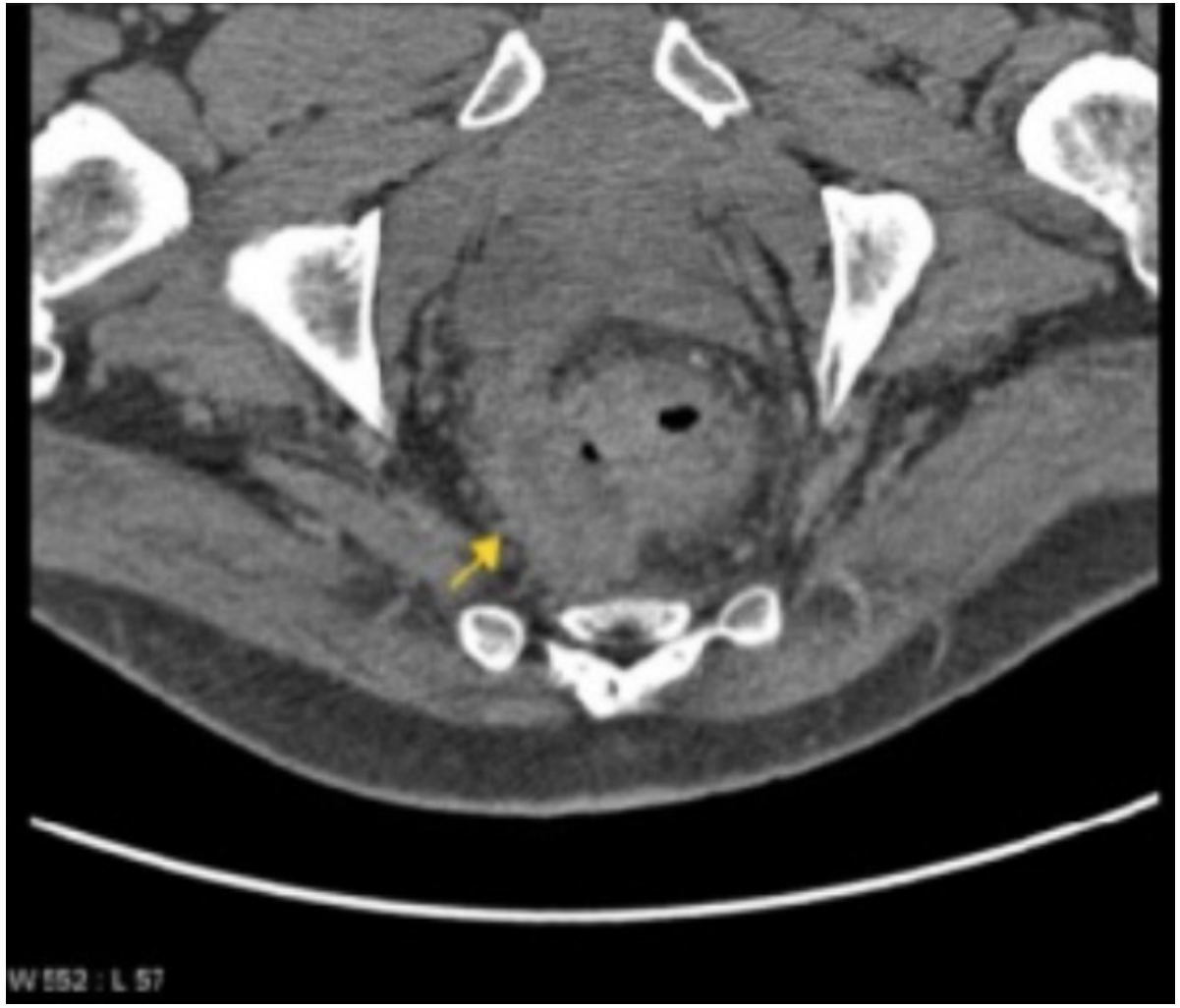


Figure: Carcinoma of the rectum. Double-contrast barium enema shows a long segment of concentric luminal narrowing *(arrows)* along the rectum with minimal irregularity of the mucosal surface.

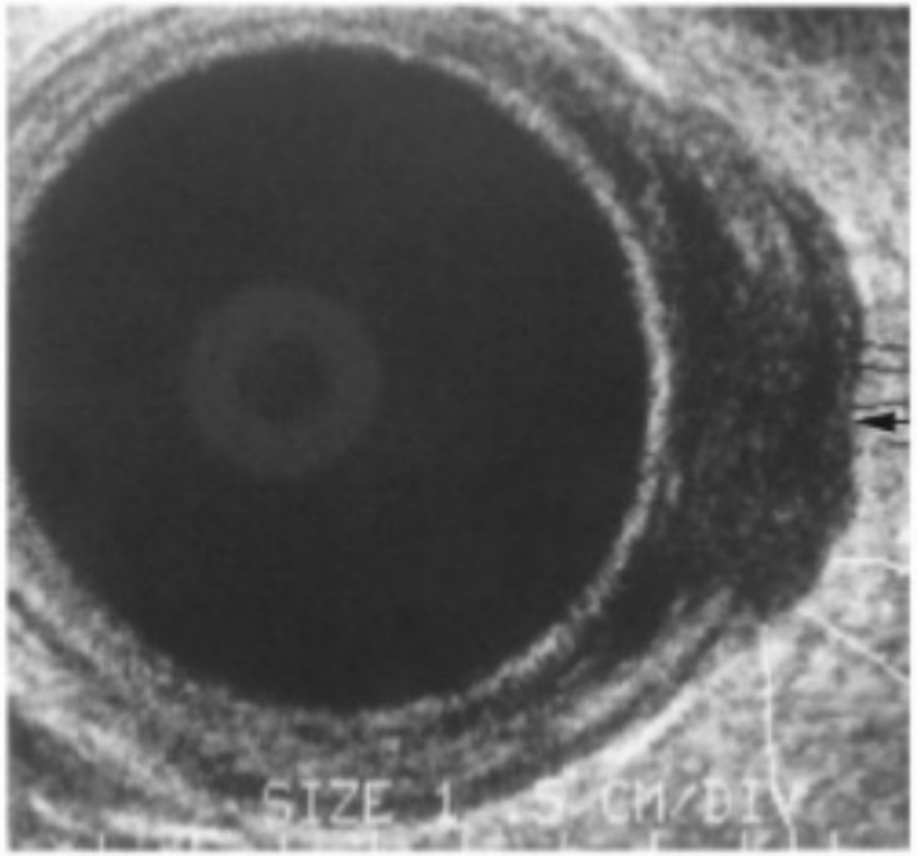
CT Scan

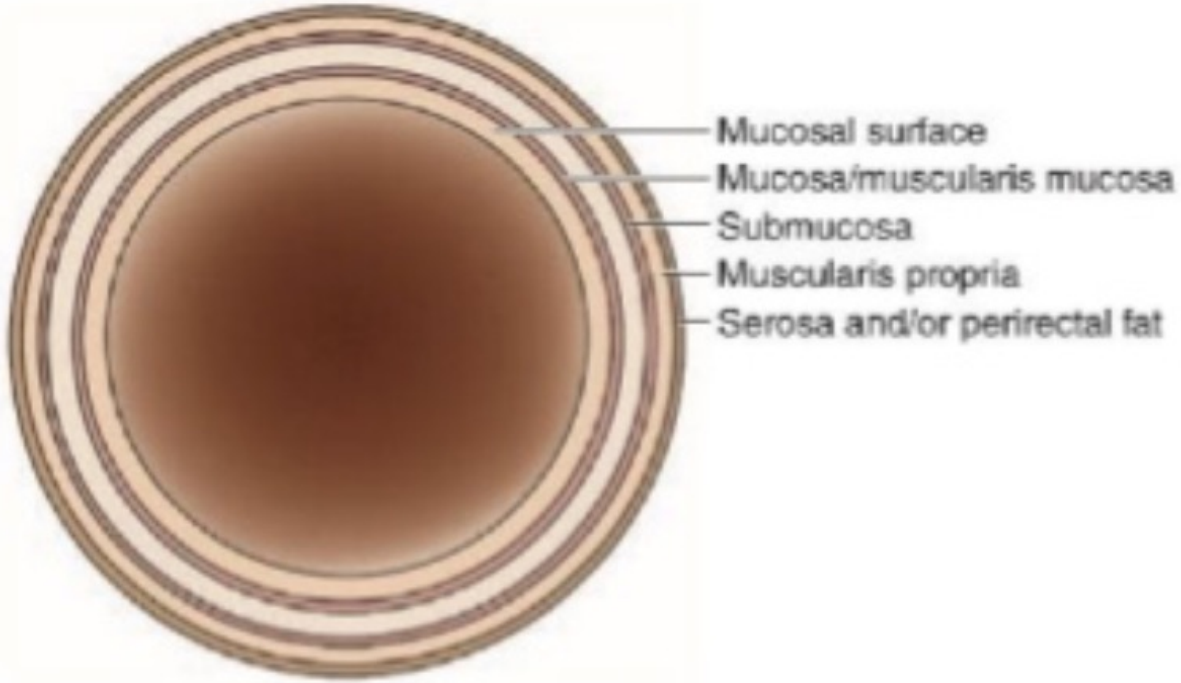
- Regional tumor extension
- Lymphatic and distant metastasis
- Tumor related complications - perforation or fistula formation



Transrectal Endoluminal Ultrasound

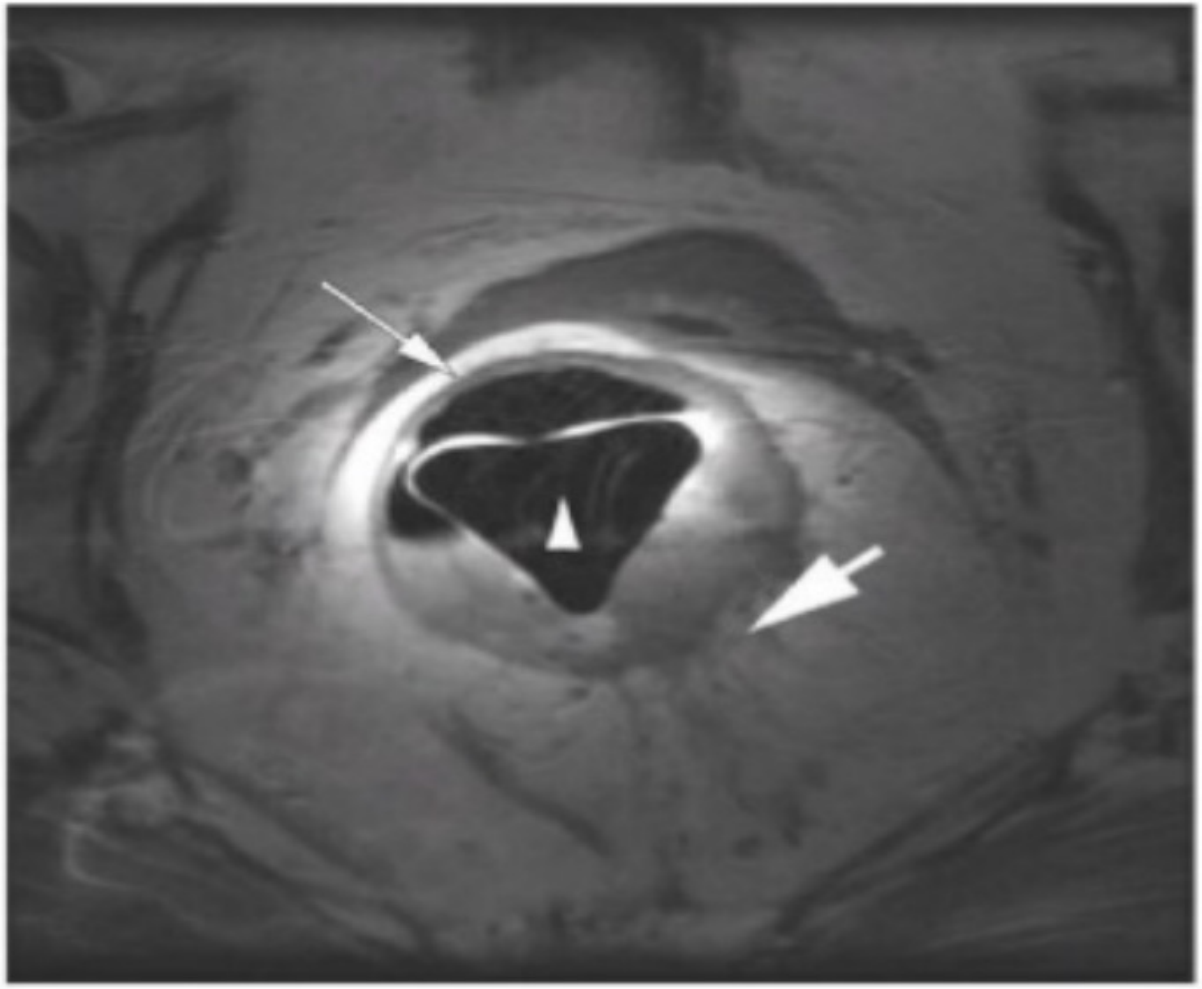
Permits accurate characterisation of the primary tumor and the status of the perirectal lymph nodes





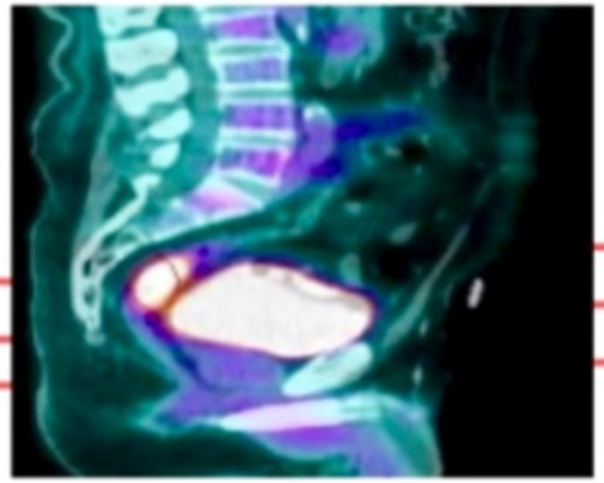
MRI

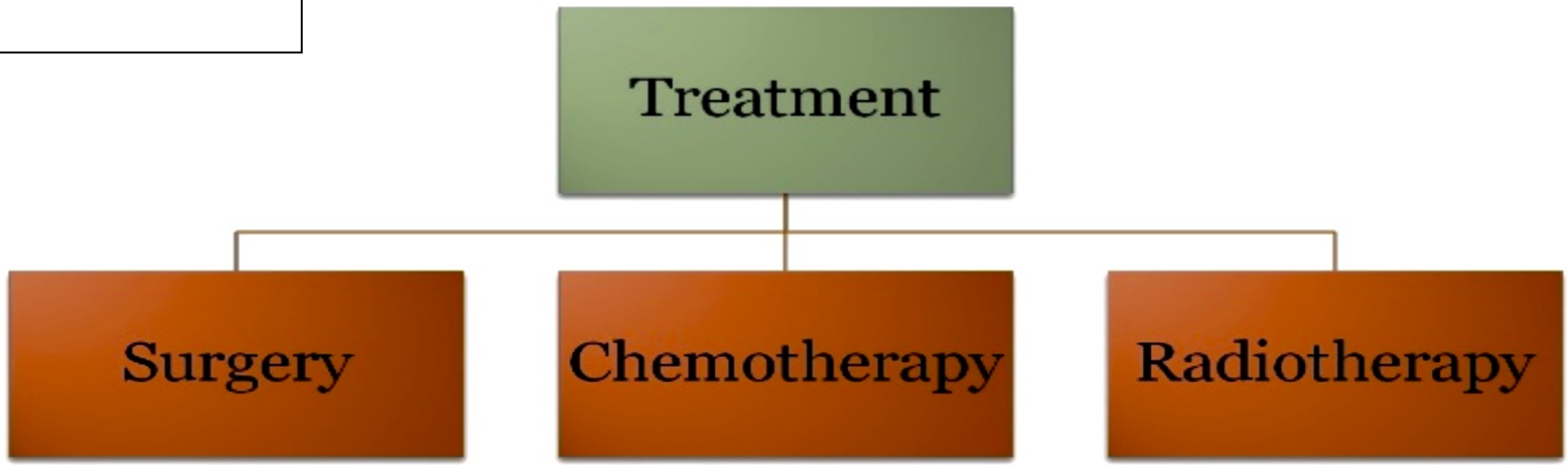
- Endorectal coil magnetic resonance imaging (ecMRI) and surface coil MRI
- Permits larger field of view and less operator and technique dependent



PET with FDG Scan

- Shows promise as the most sensitive study for the detection of metastatic disease in the liver and elsewhere.
- Sensitivity of 97% and specificity of 76% in evaluating for recurrent colorectal cancer.




Treatment
Surgery
Chemotherapy
Radiotherapy

Principles of Treatment.

- **Radical excision of the rectum , together with mesorectum and associated lymph nodes is the choice of the treatment in most cases.**
- **When the tumor is locally advanced:**
  - **Course of neoadjuvant (preoperative chemoradiotherapy over approximately 6 weeks may reduce its size and make curative surgery possible.**
- **When rectal excision possible , aim should be to restore the gastrointestinal continuity and continence by preserving anal sphincter.**

- **The traditional 5 cm resection margin is required, however, 2 cm distal is now acceptable.**
- **Circumferential radial margin is more crucial.**
- **Length of mesorectum removed beyond the primary is between 3 to 5 as tumor implants have not been shown further than 4 cm.**

1- Surgery

- **A – Local excision**

Tumors amenable to local excision

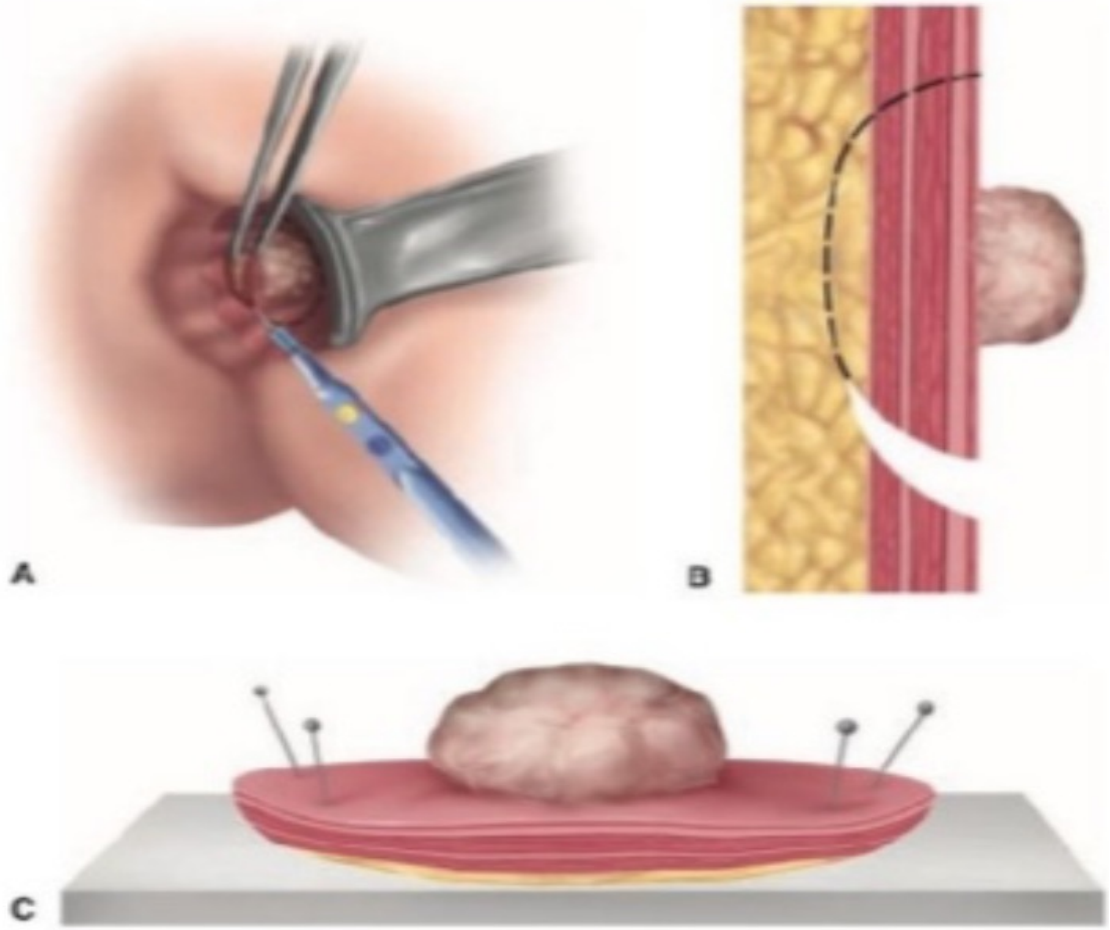
- T1N0 or T2N0 lesion
- <4cm in diameter
- <40% in circumference of lumen
- <10 cm from dentate line
- Well to moderately differentiated histology
- No evidence of lymphatic or vascular invasion
- Local control for advanced disease

Local Excision Procedures include:

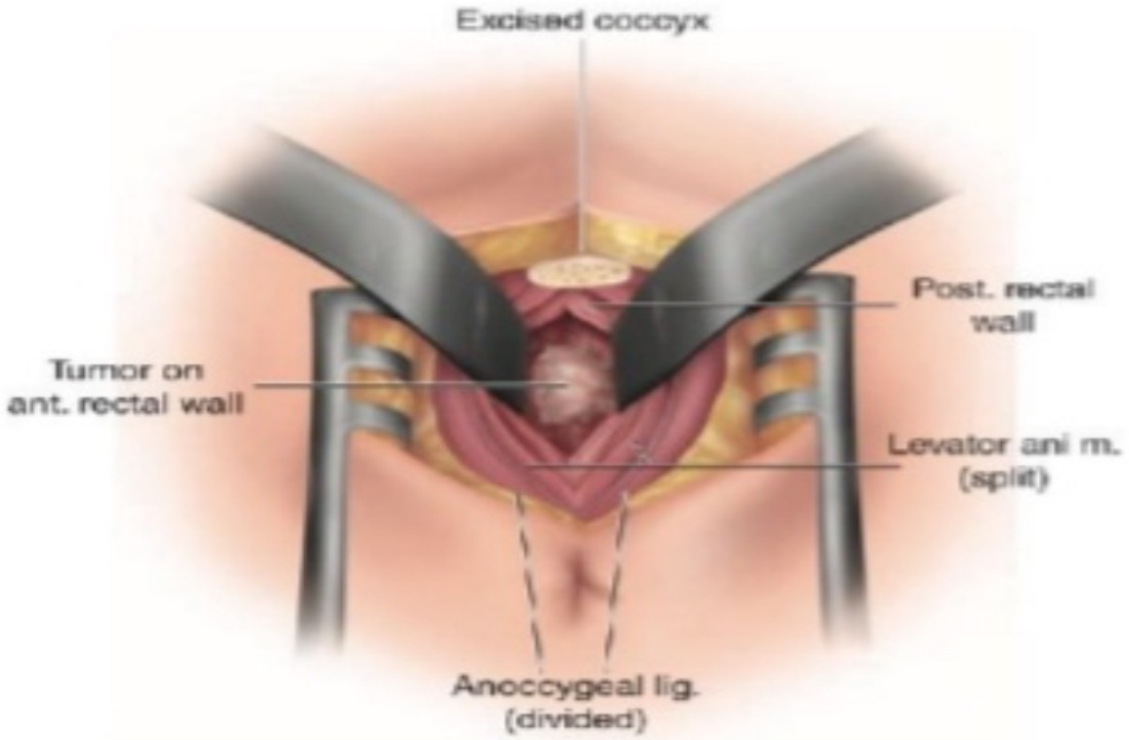
- Transsphincteric excision
- Transanal excision
- Transcoccygeal excision
- Transanal endoscopic microsurgery

Trans-anal excision

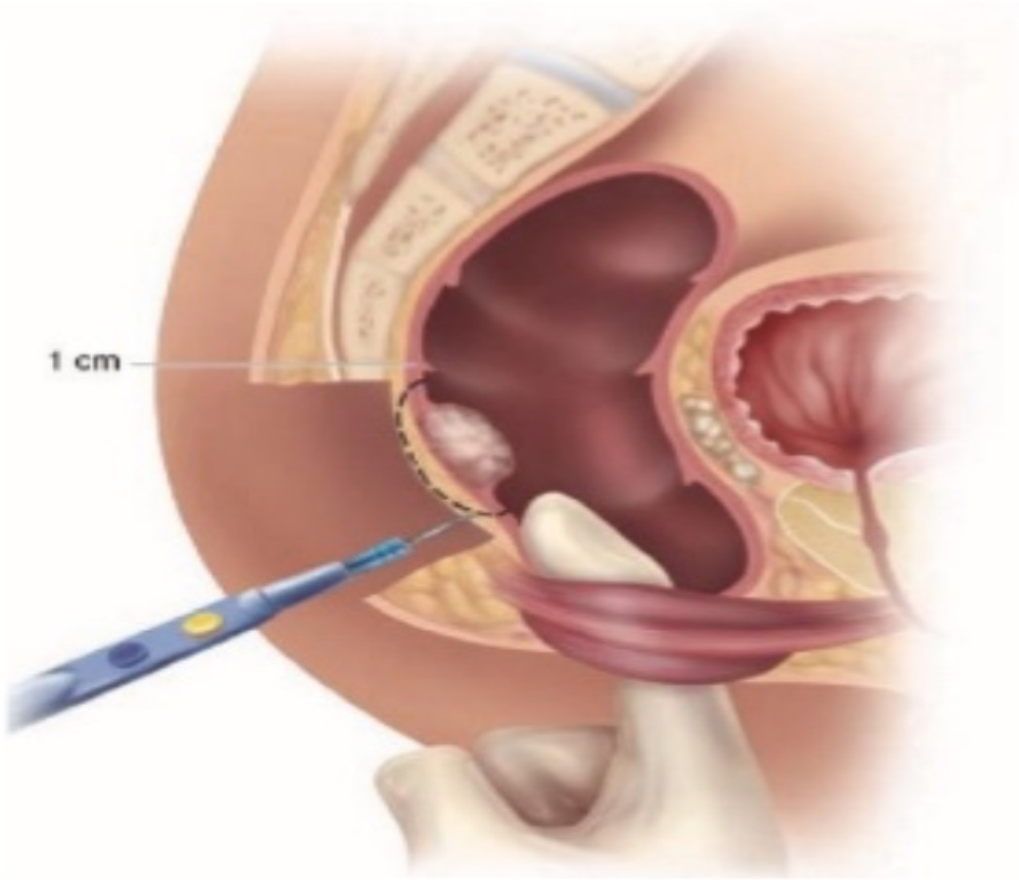
- Indicated in small distal rectal tutors which are 6 - 8 cms above the anal verge.
- Circumferential full thickness dissection upto perirectal fat is done with a margin of 1 cm from the border of tumour



Transcoccygeal Excision



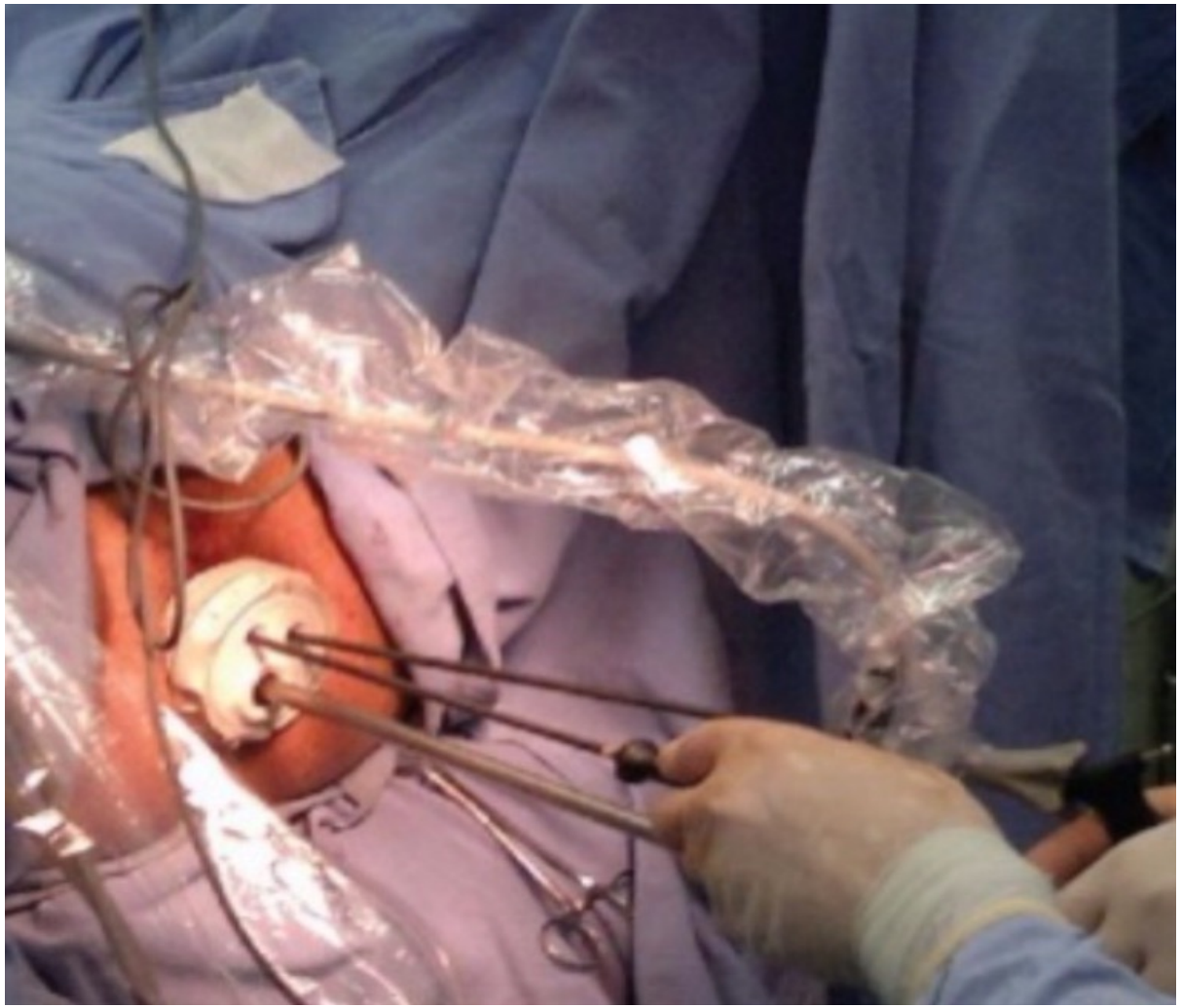
Approach to anterior lesion



Approach to posterior lesion

Trans-anal Endoscopic Microsurgery.

- Small benign and malignant lesions in the mid and proximal rectum that are too high for transanal excision.

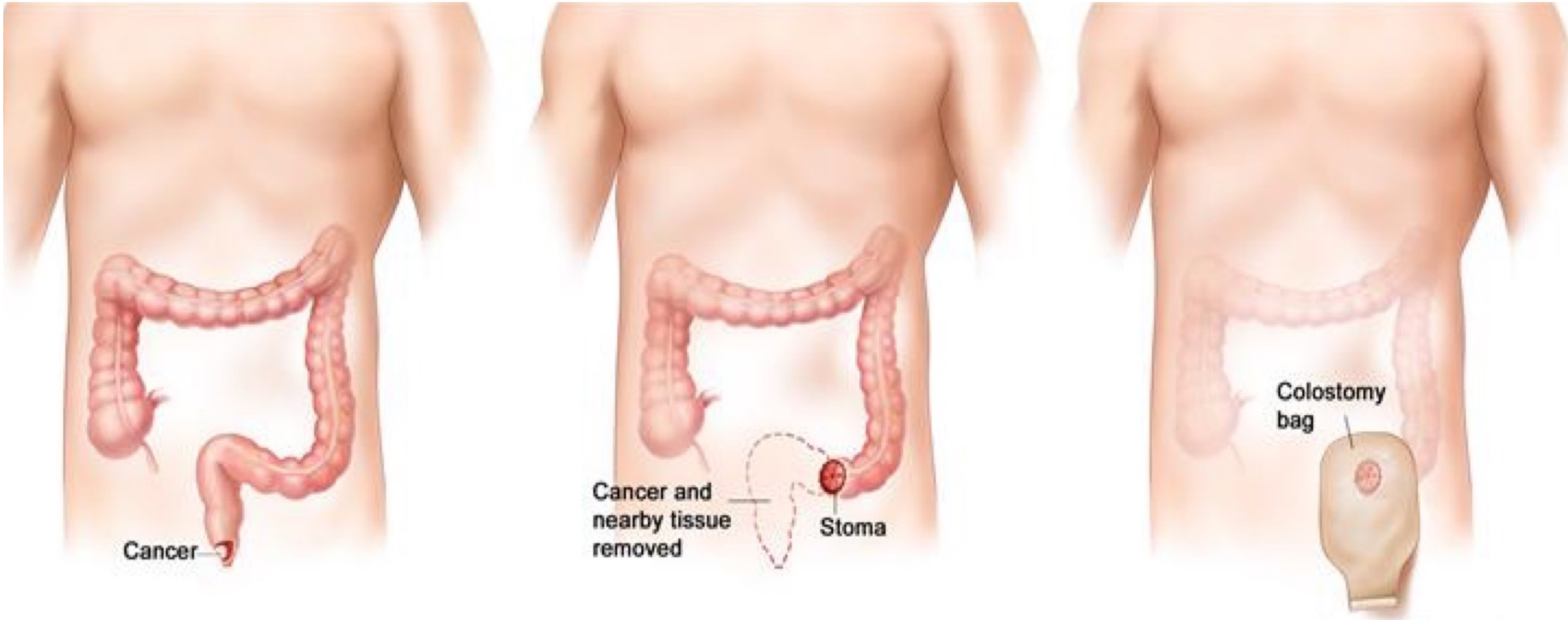


Radical Resection

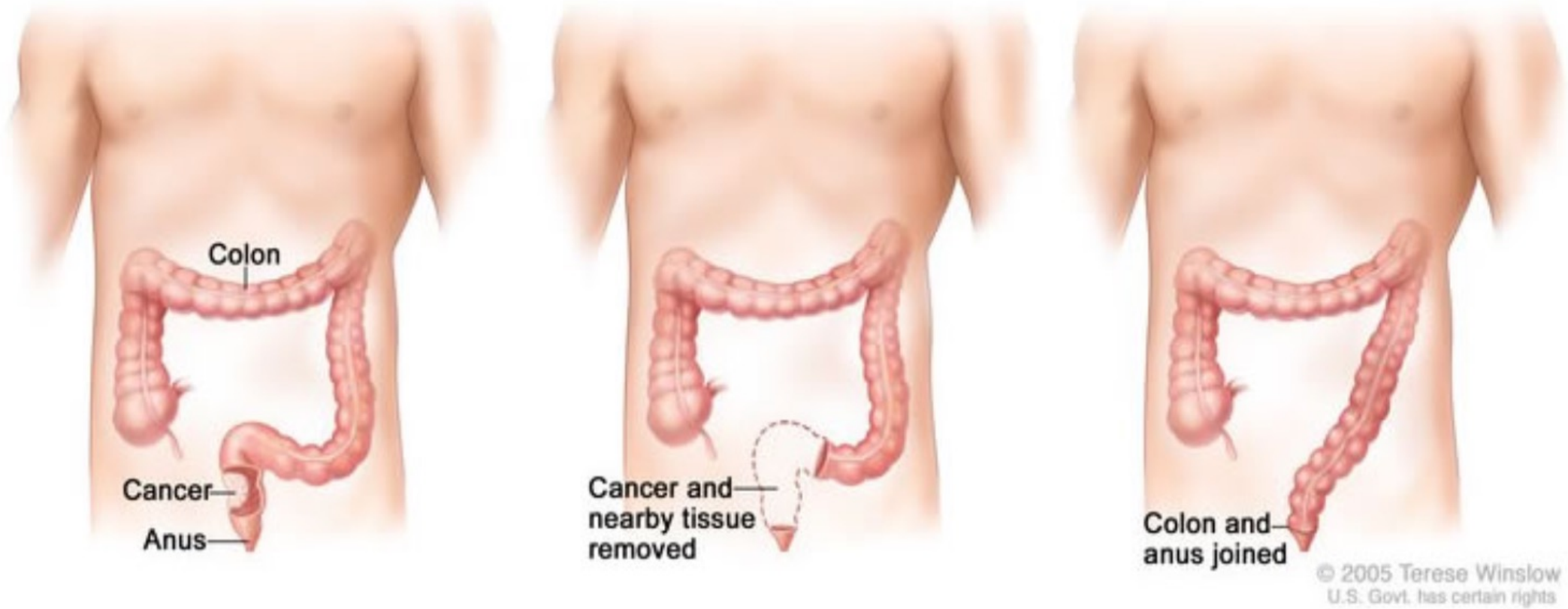
- **1- Abdomino- Perineal Resection (A-P resection) : is the treatment of choice when mesorectum is involved, or when it is poorly differentiated tumor or when the node is involved or when the tumor low in the rectum or involve the sphincter.**
- **2- Anterior Resection (Abdominal radical restorative operation): is done when the tumor is located in the mid and upper part of the rectum, which is well-differentiated , small size and with clear adequate length for anastomosis after resection.**

- **3- Hartmann’ s Operation:** here the tumor is resected and upper end of the rectum is closed completely and the proximal colon is brought out as end colostomy. It is an excellent palliative procedure for patients unfit for major surgery and for locally advanced tumor.
- **4- Pelvic exenteration (Brunschwig’s Operation):** it is removal of rectum, with the tumor, all the lymph nodes, Urinary bladder, fat, fascia, uterus, vagina with colostomy and urinary diversion. It is neither favourable nor popular.

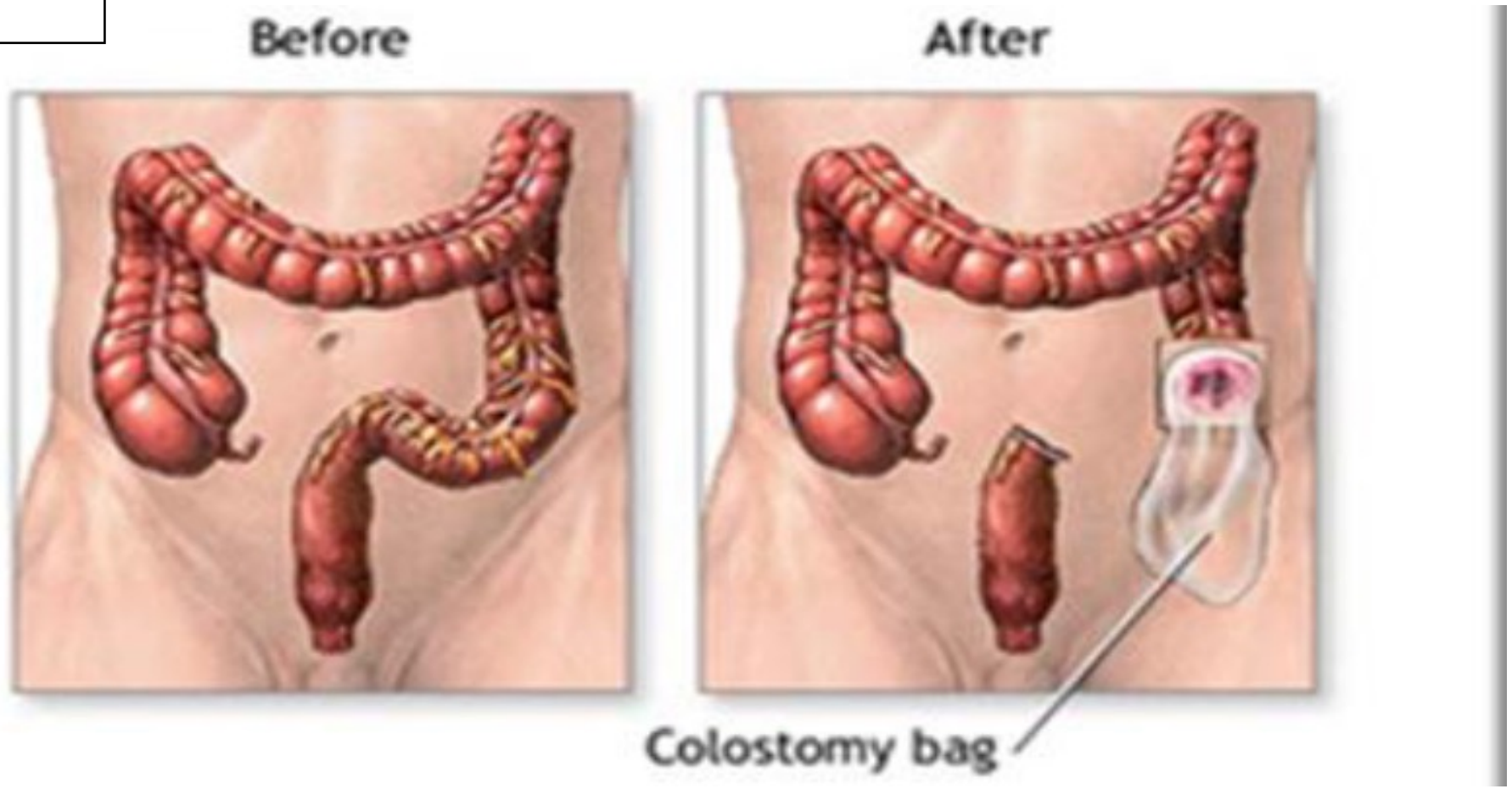
Abdominoperineal Resection



Low Anterior Resection of the Rectum



Hartmann operation



2- Radiotherapy

- **Only rectal adenocarcinomain GIT responds well to RT.**
- **Preoperative RT can be given to down stage the tumor to make it amenable to major resection.**
- **Postoperative RT is commonly used .**
- **Palliative RT.**
- **Intra-operative RT (IORT) : used in pelvic wall disease.**
- **As a component of chemoradiation.**
- **Short course of 25 Gy in 5 fractions in 5 days.**
- **Long course of 5040 Gy in28 fractions in 6 weeks.**

3- Chemotherapy

- **Chemotherapy for colon and rectal cancer have greatly expanded,but the efficacy of chemotherapy remains incomplete and its toxicities remain substantial.**
- **Combination therapy with use of as many drugs as possible is needed for maximal effect.**
- **Indications for chemotherapy include are positive nodes , T2 stage , metastasis, and recurrent tumor**
- **Drugs that commonly used include oxaliplatin, 5 FU, Leucovorin, Levamisole , Capecitabine and Irinotecan.**
- **New biological agent such as Bevacizumab (VEGF receptor antagonist) and Cetuximab (EGFR antagonist) is also used.**

Chemoradiation

- It is very useful adjuvant therapy .
- To prevent recurrence after anterior resection.
- Neoadjuvant chemoradiation can be used for T3 tumor to downstage the disease and make it possible for AP resection.
- Postoperative chemoradiation.
- Palliative chemoradiation for locally advanced tumor and metastatic disease.
- Recurrent local carcinoma of the rectum.
- In carcinoma of the rectum presenting with obstruction.