بسم الله الرحمن الرحيم
Colorectal Cancer and Colostomies

By

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Lecture Outline

- Objectives
- Colorectal Cancer
  - Introduction
  - Anatomy/Embryology
  - Pathology/Pathogenesis
  - Etiology / Risk and Protective Factors
  - Screening
  - Clinical presentation
  - Diagnosis
  - Staging
  - Management
  - Points Specific to Rectal Cancer
  - Prognosis
  - Colostomies
Objectives:

- The student will be able to:
  1. Discuss the anatomy of the colon and rectum.
  2. Understand the pathology of colorectal cancers.
  3. Discuss the etiology of colorectal cancers.
  4. Discuss the different screening modalities and investigative tools used to diagnose colorectal cancer.
  5. Correctly stage colorectal cancer according to the TNM and Dukes' staging systems.
  6. Outline a plan of management according to the stage.
  7. Know the indications, types and complications of colostomies.
Colorectal Cancer
Introduction / General:

- Colorectal cancer is cancer of the large bowel and rectum.
- The behavior of cancers of the colon and rectum are similar and are therefore grouped together.
- Globally, the third most common type of cancer and the fourth most common cause of cancer death after lung, stomach, and liver cancer.
- More common in developed countries.
- More common in men.
- 5 yr survival is around 65% in the U.S. but depend on:
  - Degree of spread.
  - Resectability.
  - Overall health.
Anatomy

Layers of the Colon and Rectum

mucosa
submucosa
muscularis propria
serosa*

*serosa is not found on most of the rectum
Embryology

- Rathke’s pouch
- Lung bud
- Liver
- Gallbladder
- Ventral pancreatic bud
- Yolk sac (vitelline duct)
- Cecal bud
- Allantois
- Cloaca

pharyngeal pouches 1-4

- Esophagus
- Stomach
- Celiac artery
- Dorsal pancreatic bud
- Superior mesenteric artery
- Inferior mesenteric artery

Foregut

Midgut

Hindgut
Embryology
Pathology

I- Benign tumours (polyps)
   1- Pedunculated
   2- Sessile

II- Precancerous conditions
   - Adenomatous polyps (adenomas)
     1- Tubular adenomas:
     2- Villous adenomas:
     3- Tubulovillous adenomas:
   - Polyposis syndromes
     - Familial Adenomatous Polyposis (FAP)
     - Hereditary Non-Polyposis Colon Cancer (HNPCC)

III- Malignant tumours
**Pathology**

- Different types of tumors can affect the colon and rectum.
- **I- Benign tumours (polyps)**
  - Non-cancerous
  - Seen in about half of adults over the age of 40.
  - More common in men than women.
  - Grow from the inner lining (mucosa).
  - Unclear how or why they develop.
  - Polyps may be:-
    - **1- Pedunculated**; These look like a mushroom with a head and a stalk.
    - **2- Sessile**; These are flat and grow along the inner surface of the wall of the colon or rectum.
Types of benign colonic polyps include:

1- Hyperplastic polyps
   The most common type of benign polyp.

Other less common benign polyps include:

2- Inflammatory polyps (pseudopolyps). These are usually associated with chronic inflammatory bowel disease.

3- Hamartomas. These contain normal cells arranged abnormally.

4- Juvenile / retention polyps. These usually present in children under 10 yrs of age as a single large polyp containing many mucous glands.

5- Lipomas. These develop from the fat cells in the colon.

6- Lymphoid polyps. These are polyps which contain lymphoid cells.
II- Precancerous conditions

- Adenomatous polyps (adenomas)
- It takes 10 years for an adenomatous polyp to develop into an invasive colorectal cancer.
- The incidence of adenomas increases with age. More than 50% of people 80 years of age or older will have an adenoma.
- Most commonly found in the rectum and sigmoid colon.
Pathology

• There are 3 types of adenomatous polyps:

• 1- Tubular adenomas:
  - Commonest type.
  - Least likely to become malignant.
  - Malignant potential is related to size (polyps larger than 2 cm being more likely to develop into cancer).
  - Pedunculated (look like a mushroom with a head and a stalk).
  - Easily removed during a colonoscopy.
Pathology

• 2- Villous adenomas:
  • Sessile (flat with a wide, broad base) with a fuzzy velvety appearance with numerous long, slender projections.
  • Can become quite large.
  • When large are difficult to remove without excising part of the bowel wall.
• The most likely to develop into cancer (especially when large).
Pathology

• Tubulovillous adenomas:
• These are in between the tubular and the villous adenomas in all respects.
Pathology

- Polyposis syndromes
  - Familial polyposis coli or familial adenomatous polyposis (FAP)
  - Affected individuals carry an almost 100% risk of developing colon cancer by age 40 years.
  - Hereditary nonpolyposis colon cancer syndrome (HNPCC)
  - Poses about a 40% lifetime risk for developing colorectal cancer
Pathology

• III- Malignant tumours
• Adenocarcinoma
• Rare malignant colorectal tumors
  – Carcinoid tumours
  – Lymphoma
  – Sarcoma
  – Gastro- Intestinal Stromal Tumours (GIST)
  – Adenosquamous cell carcinoma
  – Squamous cell carcinoma
  – Small cell carcinoma (oat cell carcinoma)
  – Medullary carcinoma
  – Melanoma
Pathogenesis

- Originates from the epithelial lining cells
- A result of mutations (inherited or acquired)
- Cancer develops via an adenoma to carcinoma sequence.
- Normally, tumor suppressor genes inhibit cell proliferation. Inhibition is lost when both alleles are inactivated by mutation.
- Mutation of these genes leads to abnormal oncogenic over-expression.
Etiology

- The factors which have been linked to colorectal cancer are multiple.
- Some promote its development while others are protective against its occurrence.
Risk factors

- Dietary factors
  - red and processed meat
  - animal fat
  - low-fiber diets
  - low intake of fruits and vegetables
- Obesity / BMI
- Smoking
- Alcohol
- Sedentary habits / Lack of Exercise
- Other disease conditions
  - IBD: (ulcerative colitis and Crohn’s disease)
    - Greater risk of developing colon cancer.
    - Risk increases with duration of disease.
    - Risk increases with severity of inflammation.
- Genetics.
  - A Positive family history of colon cancer.
  - Familial polyposis coli familial adenomatous polyposis (FAP).
  - Hereditary nonpolyposis colon cancer syndrome (HNPCC)
Prevention / Protective factors

1 - Changes in lifestyle
- Diet
  - High fiber diet, such as whole grains, fruits and vegetables.
  - Reducing red meat intake.
  - High yogurt intake
  - Regular physical activity.

2 - Medications / Pharmacologic prevention
- Aspirin
- NSAIDs
  - Not recommended for use as protection.
  - Have been found to decrease:
    - The risk of developing colon cancer
    - The number and size of polyps in patients with FAP.
- Calcium supplementation may be protective.
- Vitamin D is associated with a lower risk of colon cancer.

3 - Early detection (Screening)
Screening

- The goal of screening is to detect:
  - Precancerous (adenomatous colon polyps)
  - Early curable cancerous lesions.

The importance of early detection (Screening)

- More than 80% of colorectal cancers arise from adenomatous polyps
- Diagnosis through screening occurs 2-3 years before the development of symptoms.
- Early detection can reduce colorectal cancer deaths by 60%.
Screening

- Should start at an earlier age.
- Should be more frequent and more stringent for high risk individuals such as those with:
  - Prior history of polyps
  - Prior history of colorectal cancer
  - Family history of colon cancer
  - History of inflammatory bowel disease
  - Those genetically diagnosed or suspected of having hereditary familial syndromes.
Screening tests / tools

- **Screening tests / tools**
- **Stool Testing**
  - Fecal Occult Blood Testing (FOBT) of the stool.
  - Cologuard: detects DNA mutations and hgb in stool.
  - The M2-PK test detects an enzyme in polyps + cancers.
- **Capsule colonoscopy**
- **Flexible sigmoidoscopy**
- **Colonoscopy**
- **Virtual colonoscopy** via a CT scan
  - Only detects large lesions.
  - Expensive and associated with radiation.
Screening

• **Screening methods and policies**

  • - For those between the age of 50 and 75 years
  •     - Sigmoidoscopy every 5 years
  •     - Colonoscopy every 10 years.
  • - For those at high risk, screening usually begins at around 40 years with colonoscopy.
Clinical Presentation (S/S)

• 1- S/S from the local tumor
  • a - As a growth inside the bowel (obstruction)
  • b - As a sloughing mass (bleeding)
• 2- S/S from metastasis
• 3- General S/S
Clinical Presentation (S/S)

- **1- S/S from the local tumor**
  - **a - As a growth inside the bowel (obstruction)**
    - Abdominal pain
    - Change in bowel habits
    - Intestinal obstruction or perforation
      - Alternating constipation and diarrhea
    - Decrease in stool caliber
    - Worsening constipation
  - **b - As a sloughing mass (bleeding)**
    - Iron-deficiency anemia
    - Rectal Bleeding
      - Anemia associated symptoms
      - Alternating constipation and diarrhea
Clinical Presentation (S/S)

- 2- S/S from metastasis
Clinical Presentation (S/S)

• 3- General S/S
  • - loss of appetite
  • - loss of weight
  • - nausea or vomiting
Clinical Presentation (S/S)

• **Signs depend on the stage of the disease and may include the following:**
  • **In early disease:**
    - No signs
    - Nonspecific findings such as fatigue and weight loss.
  • **In advanced disease:**
    - Abdominal tenderness
    - Rectal bleeding
    - Abdominal mass, hepatomegaly or tumor
    - Ascites
Clinical Presentation (S/S)

- Impact of Clinical presentation on prognosis
Diagnosis

- **Useful laboratory studies include:**
  - Complete blood count (CBC)
  - Electrolytes and liver function tests (LFTs)
  - Carcinoembryonic antigen (CEA)
Diagnosis

- Imaging studies useful for diagnosis and staging include:
  - CXR
  - Chest CT
  - Barium Enema / Double contrast
  - Abdomen and liver U/S
  - Abdominal/pelvic CT
  - Abdominal/pelvic MRI
  - Positron emission tomography PET scan
  - Sigmoidoscopy/Colonoscopy
Colonoscopy
Spread

• **The most common sites where colorectal cancer spreads are:**

  • **Direct spread:**
    • Through the colorectal wall into nearby tissues.

  • **Lymphatic spread:**
    • Through the lymphatics to nearby lymph nodes

  • **Hematogenous spread:**
    • Through the blood to distant organs, including:
      • - liver
      • - lungs
      • - bones
      • - brain
      • - ovaries (in women)
Staging

• **Several staging systems:**

• **The TNM staging system:**
  • Based on tumor size (T), the presence of lymph nodes or not (N) and the presence of metastasis or not (M).

• **The Dukes classification:**
  • Based on the extent of the tumor in relation to the bowel wall and the degree of spread outside its original site.
The Dukes Staging System
The Dukes Staging System

• **Dukes stage A:** The cancer is only in the inner lining of the bowel. (90% 5-y survival)
• **Dukes stage B**: The cancer has invaded the muscle. (70% 5-y survival)
The Dukes Staging System

• **Dukes stage C:** The cancer has invaded the nearby lymph nodes. (20-30% 5-y survival)
The Dukes Staging System

- **Dukes stage D:** The cancer has metastasized (<5% 5-y survival)
The TNM Staging System (T)

- **(T) classification is as follows:**
  - **Tx** - Incomplete information of tumor extent.
  - **Tis** - In situ carcinoma; tumor involves only muscularis mucosa
  - **T1** - Cancer extends into submucosa
  - **T2** - Cancer extends into muscularis propria
  - **T3** - Cancer has grown through muscularis propria and into outermost layer of colon but not through it.
  - **T4a** - Cancer has grown through serosa.
  - **T4b** - Cancer is attached to or invades nearby tissues or organs
The TNM Staging System ( N )

( N ) classification is as follows:

• Nx - Incomplete information of lymph node involvement.
• N0 - No cancer in nearby lymph nodes
• N1a - Cancer cells found in 1 nearby lymph node
• N1b - Cancer cells found in 2-3 nearby lymph nodes
• N1c - Small deposits of cancer cells found in areas of fat near lymph nodes, but not in lymph nodes themselves
• N2a - Cancer cells found in 4-6 nearby lymph nodes
• N2b - Cancer cells found in 7 or more nearby lymph nodes
The TNM Staging System (M)

- (M) classification is as follows:
  - M0 - No distant spread seen
  - M1a - Cancer has spread to 1 distant organ or set of distant lymph nodes
  - M1b - Cancer has spread to more than 1 distant organ or set of distant lymph nodes, or has spread to distant parts of the peritoneum
# TNM Staging System for Colon Cancer

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Grade of Colorectal Cancer

• - A description of how closely the cancer looks like normal colorectal tissue microscopically.
• - Affects the outlook for survival and helps decide on adjuvant treatment.
• - Described as a scale from G1 (where the cancer looks much like normal colorectal tissue) to G4 (where the cancer looks very abnormal).
• - Often simplified as either "low grade" (G1 or G2) or "high grade" (G3 or G4).
• - Low-grade cancers tend to grow and spread more slowly than high-grade cancers.
Management

• **The Aim:**
  - Decide whether the aim is curative or palliative.

• **Curative resection:**
  - Depends on the stage of the disease, which in turn is governed by early detection.

• **Palliative treatment:**
  - Reserved for advanced disease
  - Directed at improving the quality of life and symptoms to keep the person as comfortable as possible.

• **Options:**
  - Treatments used for colorectal cancer may include in addition to surgery, some combination of radiation therapy and chemotherapy.
Surgery

• Curative or Palliative?
• For curative resection, the aim is complete removal with adequate margins.
• Either by laparotomy or by laparoscopy.
• Chemotherapy is sometimes given pre-operatively (neoadjuvant therapy) to shrink the tumor before attempting to resect it.
• A single resectable metastasis on the liver or lung does not deter the surgeon from resecting the tumor.
Surgery
Surgery

• **Surgical options:**

• **Right hemicolecctiony:**
  - For lesions in the cecum and right colon

• **Extended right hemicolecctomy:**
  - For lesions in the proximal or middle transverse colon

• **Left hemicolecctiony:**
  - For lesions in the splenic flexure and left colon

• **Sigmoid colectomy:**
  - For sigmoid colon lesions

• **Total abdominal colectomy with ileorectal anastomosis:**
  - For patients with:
    - Hereditary nonpolyposis colon cancer
    - Familial adenomatous polyposis
    - Metachronous cancers in separate colon segments.
Chemotherapy

• **Indications:**
  
  • As *neoadjuvant therapy* where chemotherapy is used preoperatively to shrink the tumor.
  
  • Spread of the tumor to the lymph nodes.
Radiation

• **Colon Cancer:**
• Due to the sensitivity of the bowel to the effects of radiation it is not used in the treatment of colon cancers.

• **Rectal Cancer:**
• Radiation can and is used successfully in rectal cancers in both the adjuvant and neoadjuvant settings.
Palliative care

- **The aim is:-**
  - Not to cure the disease.
  - Relieving suffering and improving quality of life for both the person and his/her family.

**Surgery may be used in palliative cure in the form of:-**
  - Limited resection
  - Bypassing the tumor to avoid early bowel obstruction
  - Placing a stent.

- **Other forms of Palliative treatment are:-**
  - Radiation to shrink the tumor
  - Cryotherapy
  - Hepatic arterial infusion of chemotherapeutic agents
  - Medications to relieve the pain
Points Specific to Rectal Cancer

- The length of the rectum varies from 12 cm to 15 cm and rectal cancer is defined as a cancer located within 12 cm of the anal verge by rigid proctoscopy.

- The rectum contains 3 folds, namely valves of Houston. The superior and inferior folds are located on the left side and middle fold is located at the right side.

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Points Specific to Rectal Cancer

- The risk of pelvic recurrence is high
- Locally recurrent rectal cancer has a poor prognosis.
- Strong considerations should be given to possible functional outcome, and preservation of anal continence and genitourinary functions.
Points Specific to Rectal Cancer

• **Colo-anal anastomosis**
  • Very distal rectal cancers that are located just above the sphincter occasionally can be resected without the need for a permanent colostomy. A straight-tube coloanal anastomosis (CAA) can be performed using the double-stapled technique, or a hand-sewn anastomosis can be performed transanally.
  • The functional results of this procedure have been poor in some patients, who experience increased frequency and urgency of bowel movements, as well as some incontinence to flatus and stool.
Points Specific to Rectal Cancer

- Preservation of both anal and rectal reservoir function in treatment of rectal cancer is highly preferred by patients and sphincter-saving procedures for rectal cancer are now considered the standard of care.

- The J pouch:
  - Decreased frequency and urgency of bowel movements because of the reservoir function of the pouch.
  - A temporary diverting stoma is performed routinely with any coloanal anastomosis.
Alternatives

Ileo-Anal

Colo-Anal Pouch

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Points Specific to Rectal Cancer

- **Surgical Options :-**
  - **1- High Lesions:-**
    - Low anterior resection (LAR)
  - **2- Low Lesions:-**
    - Local excision
    - AP Resection
Points Specific to Rectal Cancer

- **Low anterior resection (LAR)**
  - Lesions in the middle and upper 1/3 of the rectum.
  - A 2-cm margin distal free margin.
  - No evidence of extensive local disease.
  - No preexisting sphincter problems.
  - Less-than-perfect continence after surgery.
  - Transient urinary dysfunction secondary to weakening of the detrusor muscle.
  - Sexual dysfunction includes retrograde ejaculation and impotence.
Points Specific to Rectal Cancer

- **Local excision**
- May be performed on lesions:
  - Located in low rectum (within 8-10 cm)
  - Less than 3 cm in size
  - T1 lesions (TNM not beyond the submucosa or Dukes A)
  - Occupying less than 1/3 of the rectal circumference
  - Which are mobile and exophytic (polypoid)
  - Negative nodes (Preoperative ERUS)
  - Low grade
  - Endocavitary Radiation should be added
Points Specific to Rectal Cancer

- **Abdominal perineal resection (APR)**
  - Patients with lower-third rectal cancers.
  - Patients with involvement of the sphincters, preexisting significant sphincter dysfunction, or pelvic fixation.
  - When negative margin resection will result in loss of anal sphincter function.
  - Sometimes a matter of patient preference.

- **Disadvantages of APR**
  - Need for permanent colostomy.
  - Significantly higher short-term morbidity and mortality.
  - Significantly higher long-term morbidities.
  - Higher rate of sexual and urinary dysfunction.
Points Specific to Rectal Cancer

- **Adjuvant radiation therapy**
- Preoperative
- Intraoperative
- Postoperative
Points Specific to Rectal Cancer

• **Adjuvant radiation therapy**
• **Preoperative radiation therapy**
  • Radiation therapy works better in well-oxygenated tissues prior to surgery.
• **Advantages:**
  • Tumor down-staging
  • Increase in resectability
  • Decrease in tumor viability
  • Decrease in tumor recurrence
  • May increase 5 yr survival
  • Minimizes the radiation exposure of small bowel loops due to pelvic displacement and adhesions following surgery. [1]
Points Specific to Rectal Cancer

- **Adjuvant radiation therapy**
- **Preoperative radiation therapy**
- **Disadvantages:**
  - Delay in definitive resection
  - Possible loss of accurate pathologic staging
  - Increased postoperative complications and morbidity and mortality secondary to radiation injury.
Points Specific to Rectal Cancer

- Adjuvant radiation therapy
- Intraoperative radiation therapy
- Is recommended in patients with large, bulky, fixed, unresectable cancers.
- Requires specialized, expensive operating room equipment, limiting its use.
Points Specific to Rectal Cancer

• **Adjuvant radiation therapy**
• **Postoperative radiation therapy**

**Advantages:**
• Immediate definitive resection
• Accurate pathologic staging

**Disadvantages:**
• Delay in adjuvant radiation therapy especially if postoperative complications ensue
• No effect on tumor cell spread at the time of surgery
• Decreased effect of radiation in tissues with surgically-induced hypoxia
Prognosis

- Five year survival rates in the west range between 60-65% but depend on several factors:
  - Early detection (stage of the tumor at diagnosis and removal):
    - Single vs multiple lesions
    - Small vs size greater than 5 cm
    - Negative vs positive LN at surgery
  - Disease-free interval of less than a year
  - Normal or low Carcinoembryonic antigen (CEA) vs levels greater than 200 ng/mL-
  - The general health of the patient
Follow-up

- The aim of follow-up is to diagnose as early as possible any recurrence of the cancer.

- Follow-up involves several elements:-
  - H/O and O/E
  - CBC and LFT
  - CEA
  - Abdominal U/S if LFTs are abnormal.
  - CXR if chest symptoms are present.
  - CT-scan of the chest, abdomen and pelvis.
  - Colonoscopy
Colostomies
A colostomy is a surgical procedure in which a stoma is formed by drawing the healthy end of the large intestine or colon through an incision in the anterior abdominal wall and suturing it into place. This opening, in conjunction with the attached stoma appliance, provides an alternative channel for feces to leave the body.
Colostomies

- Stoma
- Colostomy bag
Location (Sites)

Colostomy Types

- Ascending colostomy
- Transverse colostomy
- Descending & Sigmoid colostomies
Indications

- Partial or complete large bowel obstruction.
- Rectal or colon cancer
- A portion of the colon (or large intestine) has been operated upon and needs to be 'rested' until it heals.
  - A section of the colon has been removed
  - Injury to the colon or rectum
- Fecal incontinence non-responsive to other treatments.
- Infection of the abdomen caused by a leak, such as perforated diverticulitis.
- Perineal wounds or fistulas.
Types

• Colostomies are either:-
  - Temporary (Reversible) or
  - Permanent (Irreversible)

• They take different forms:-
  • Loop colostomy
  • End colostomy
  • Double barrel colostomy
Types

- **Loop colostomy:**
- A loop of the bowel is pulled out onto the abdomen and held in place with an external device. The bowel is then sutured to the abdomen and two openings are created in the one stoma: one for stool and the other for mucus.
Types

- **Double barrel colostomy:**
  - The bowel is severed and both ends are brought out onto the abdomen. Only the proximal stoma is functioning.
Types

- **End colostomy:**
- A stoma is created from one end of the bowel. The other portion of the bowel is either removed or sewn shut (Hartmann's procedure).
The Colostomy Bag (Pouch)

- To collect intestinal waste.
- Must be emptied or changed depending on the frequency of activity.
- The further from the anus the ostomy is located the greater and more liquidy the output.
Complications

• Bleeding
• Herniation
• Prolapse (Falling in of the stoma)
• Stenosis (Narrowing or blockage of the stoma)
• Infection
• Skin irritation
• Wound complications
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