Gastric Outlet, Small & Large Bowel Obstruction

Objectives

The student is expected to describe and explain the pathogenesis, etiology, clinical features and complications of each of the following conditions:

- Mechanical
- Non-mechanical
- Adhesive
- Non-adhesive
- Gastric outlet obstruction

Dr. Khayal:

- What i need you to know from this tutorial: the **clinical findings** and the **causes** of small bowel obstruction, large bowel obstruction and gastric outlet obstruction.
- Knowing the management options is advanced for your level, i will NOT ask you about them so **don't consume your BRAIN CELLS on them.**
- You must **ALWAYS resuscitate** the pt (correct electrolyte abnormalities & hydrate) **before** anything else
- ALL the questions will be from dr.Khayal slides, and he said: " if you found a question in the exam that isn't mentioned in my slides contact me and i'll delete it immediately ".

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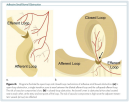
Intestinal obstruction

Definition:

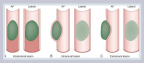
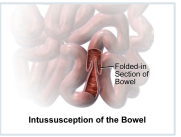
- Defined as **mechanical** or **functional (non-mechanical)** obstruction of intestine by causes in the lumen/ wall/ outside wall resulting in stoppage in anal ward movement of bowel content, proximal dilation and distal collapse and associated with complex of symptoms and signs
- **Mechanical (dynamic) obstruction**: Peristalsis is working against a mechanical obstruction "structural" (partial or complete)
- **Non-mechanical (Adynamic) (Functional) obstruction:** Mechanical element is absent, peristalsis may be absent (paralytic ileus) or present in **non propulsive form** (mesenteric vascular occlusion or pseudo-obstruction)
  - **Localized:** when there is appendicitis obstructing only part of intestine
  - **Generalized:** generalized peritonitis and after any abdominal surgery there is physiological ileus for two days
- One of the common cause of acute abdomen
- May lead to high morbidity and mortality if not treated correctly

Classification:

Location	• **Gastric outlet obstruction (GOO)**: obstruction at the level of the pyloric channel or duodenum. Its clinical or pathophysiological consequence of any disease process that produces mechanical impediment to gastric emptying. • **Small bowel obstruction (SBO):** obstruction at the level of the duodenum, jejunum, or ileum According to the ligament of treitz, it's divided into: ○ **High** → vomiting occurs early, profuse and causes rapid dehydration. Distension is minimal with little evidence of dilated small bowel loops on abdominal radiography ○ **Low** →Starts from ligament of treitz (4th part of duodenum) to the ileocecal junction. Predominant pain, and central distention. Vomiting is delayed, multiple central air-fluid levels seen on abdominal x-rays (dilated small bowel loops) (pic A) • **Large bowel obstruction (LBO):** obstruction at the level of the cecum, colon, or rectum. (Most common site of obstruction is sigmoid and rectum because the sigmoid is the narrowest part of the colon) (large bowel obstruction is an absolute contraindication enteral nutrition) 
Progress	• **Acute** ex: 2 weeks presentation • **Subacute** • **Chronic** ex: 6 months presentation that comes and goes
Severity	• **Partial** ○ **High grade** ○ **Low garde** • **Complete**
Anatomy	• **Open loop obstruction (Simple linear obstruction):** When there is one point of obstruction in intestine it is less severe in symptoms & signs (without interfering with vascular supply). Both incoming (afferent) & outgoing loops are open. • **Closed loop obstruction (Rotational obstruction):** When there are two points of obstruction in intestines. There is a disconnected loop between afferent & efferent loop. Progressive enlarges decreasing circulation, perforation if unrelieved (More severe than open loop because open loop can be resolved by vomiting or nasogastric tube but closed loop can not be decompressed by NGT and it will keep increasing in size till it might perforate) and more likely to strangulate and perforate and may need early surgical intervention. May present in those who have competent ileocecal valve (one way valve that allows the food to go from small bowel to large bowel 13% has competent valve and the rest has incompetent valve) Closed loop obstruction can occur in small bowel due to adhesions small bowel twisting on itself (volvulus) or malignant involvement of two parts of the small bowel. All colonic obstructions are considered closed loop obstructions because of the ileocecal valve. Ileocecal valve has a certain pressure once this pressure is exceed there will be reflux. **Detection of closed loop:** ○ Colon: always presume that its closed ○ Small bowel: detected by CT 
Outcome	• **Simple bowel obstruction:** bowel obstruction with no evidence of complications (i.e., no features of bowel ischemia, bowel perforation, or red flags for complicated bowel obstruction) Only lumen is obstructed. There is no strangulation. Blood supply is intact. • **Strangulated (complicated) bowel obstruction:** bowel obstruction associated with strangulation, ischemic necrosis, or perforation. A portion of bowel is dead.

Intestinal obstruction

Classification:

Site 	**Intraluminal**	○ **Impacted faeces:** common in elderly due to inability to pass stool. ■ **Management**? if they fail laxative, fecal disimpaction via hand, sometimes done under GA. ○ **Foreign bodies** ○ **Gallstone ileus:** gallstone goes through the fistula into duodenum and erodes into ileocecal valve. ■ Gallstone passes through a fistula between the gallbladder and small bowel (usually duodenum) that has been formed due to inflammation of gallbladder before becoming impacted at the ileocecal valve. ■ Ileus is a misnomer as the term ileus is usually used to describe a functional, rather than, mechanical obstruction. ■ **Management**? Surgical resection as it's stuck in the ileocecal valve, but if it's impacted with edema due to the obstruction we'd have to milk it backwards to a portion of normal bowel, open there and stitch the normal valve. ○ **Bezoars:** solid mass of indigestible (high fiber) material "hair, food, nails or قصفص" that stuck in areas of narrowing most commonly: GEJ, pylorus or ileocecal valves ○ **Parasitic infections:** Helminth e.g. ascaris
	Intramural (intrinsic)	○ **Tumors:** because they may origin from the layers of GI tract. ○ **Inflammatory strictures:** IBD (CD → stricture) ○ **Intussusception:** when one portion of the gut invaginates into an immediately adjacent segment due to peristalsis ■ Lesion without peritoneum that gets stuck with every peristalsis e.g. meckel's diverticulum in pediatric. ■ **Management**? Either spontaneously reduced, or needs to be resected. ○ **Other causes include:** ■ TB ■ Diverticulitis (if inflammation is significant → edema and obstruction)  Intussusception of the Bowel
	Extramural	○ **Adhesions** ■ Post-op (but can rarely happen congenitally), more common in open surgery due to bowel injury and manipulation. ■ The part of the bowel without peritoneum adheres to the abdomen, and if the adhesions happen at a wrong angle it causes obstruction. ■ **Management**? going into surgery causes more adhesions, but the aim is to do so in a way that heals without obstruction. It's mostly managed conservatively ○ **Hernias** ■ **Management**? You have to reduce the bowel back into the abdominal cavity thus removing obstruction ○ **Tumors:** by compressing the bowel ○ **Volvulus:** twisting or axial rotation of a portion of bowel about its mesentery

Etiology:

Small bowel	
Adhesions (Post-operative): 60% **(Most common) (Numbers are NOT imp)**	• 50% occur within 1 year post op → 20% of them within 1st month • 25% occur 1-5 years post op • 25% occur 5-25 years post op • 36-60% require laparotomy • 11- 21% recurrent SBO after lysis of adhesion • Once you perform a laparotomy > 50% of people develop adhesions which can cause obstruction. • Post - operative adhesions: Occurs due to the healing process/fibrous adhesions by fibroblasts (usually in the inflammatory phase) but can happen later.↑ years after surgery → ↓ chance of developing obstruction secondary to adhesions. Most patients are treated conservatively. • Can be congenital (very rare) but mostly post - operative • Those who had obstruction secondary to adhesions are at higher risk to develop recurrent SBO secondary to adhesions.
Tumor: 20%	• Primary or metastasis • Intraluminal or extrinsic compression Could be carcinomatosis: intraperitoneal metastasis from a primary tumor of other organ
Incarcerated hernia: 10%	• **Hernia :** is organ protrusion due to abdominal wall defect . • **Reducible hernia :** bulging occurs with cough or lifting but disappears after lying down . • **Irreducible/incarcerated hernia :** constant bulging/mass, painful, never reduced • **Strangulated hernia :** when the blood supply is compromised (ischemic) • The most common cause in virgin abdomen (never had a surgical procedure). • Paraumbilical hernia (PUH) , Incisional, Inguinal
Crohn's disease: 5%	Strictures Formation
Gallstone ileus: 3%	Large stone in the gallbladder causing chronic pressure necrosis to the gallbladder which will then adhere to the duodenum leading to cholecystoduodenal fistula which causes the stone to go through it and reach the terminal ileum (ileocecal valve) → obstruction 
Radiation fibrosis	Due to radiotherapy
Intussusception	Part of the intestine slides into adjacent part
Anastomotic stricture	
Foreign bodies	

Intestinal obstruction

Etiology:

Large bowel	
Dynamic (mechanical) (Usually occurs in 60-70 YO patients)	
Colon cancer (90%)(Most common)	

Volvulus (5%)	• Twisting of the colon on itself.
	• Occurs in patients with long mesentery (tall thin patients or elderly).
	• It has a characteristic radiological sign called (omega sign Ω / coffee bean sign).
	• Most commonly in the sigmoid colon or the right side (cecum).
	• **Differences between the two types of volvulus:**
	  ○ **Sigmoid volvulus:** more with elderly bed ridden patients (comorbid in the geriatrics ward). Occurs on the left side of the colon so the distention is more on the right side.
	  ○ **Ileocecal volvulus:** more with females, someone with congenital anomaly or pregnancy which causes the cecum and appendix to move upward then downward after delivery. Occurs on the right side of the colon so the distention is more on the left side.
	  Type of Ileocecal volvulus:
	  ■ **Cecal bascule:** upward folding of the cecum. There is no axial twisting. Easier because it doesn't cause much ischemia.
	  ■ **Rotates:** Results in ischemia
	 
	 

Diverticular disease (3%) / Diverticulosis	• **Diverticular disease / Diverticulosis:** bulges / pouches of mucosa (without serosa) due to weakness of the colon wall. The patient has no symptoms and it is common among the population.
	  ○ Diagnosed incidentally by CT scan or colonoscopy.
	  ○ No treatment required.
	• **Diverticulitis**: in some pts , stool is stored in these bulges → ↑pressure → microperforation → inflammation → fever.
	  ○ Give antibiotics.
	• **Diverticular abscess:** due to ↑immune response, and might lead to free perforation resulting in acute abdomen and surgical emergency.
	• **Recurrent diverticulitis and abscess:** might cause:
	  ○ Colovesical fistula (most common)
	  ○ Coloenteric fistula
	  ○ Colovaginal fistula (in females who removed their uterus)
	  ○ Lower GI bleeding

Hernia	Sliding hernia
Adhesions	• Not a common cause of LBO because the colon is fixed. • **First line management** is conservative except closed loop obstruction which needs operation immediately.
External compression	e.g. Patient with appendectomy which resulted in collection and bowel obstruction
Intussusception	
Stricture (IBD)	
Fecal impaction	
Foregin body	
Adynamic obstruction (Ogilvie's)	
Inflammatory	All patients who developed pancreatitis, diverticulitis, appendicitis or cholecystitis their intestine undergoes paralytic ileus because of the inflammation.
Postoperative	Most common is orthopedic surgeries
Autoimmune dysfunction	
Cardiovascular	
Traumatic	
Respiratory	
Metabolic	
Neurological	
Pharmacological	

Intestinal obstruction

Contents:

To know when an organ is obstructed what will happen and what will accumulate

Stomach

if stomach is obstructed these normal contents will accumulate

1. Swallowed air
2. Saliva (1.5 L per day)
3. Gastric juice (500 ml - 1 L)

Small intestine

1. Partially digested food
2. Gas from fermentation of microorganisms
3. Bile (300 - 500 ml per day)/ Pancreatic (300 - 500 ml per day)/ Intestinal juice (3 - 4 L)

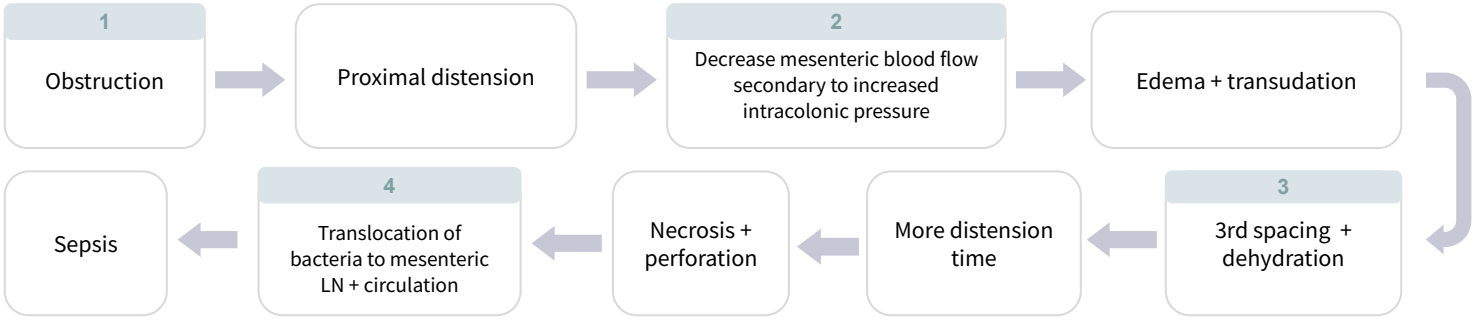
In the upper intestine (jejunum and proximal ileum) 6 L of fluid will pass in 24 hours and this is a large quantity if it is obstructed.

Large intestine

1. Stool
2. Microorganisms

Pathophysiology:

The same for both SBO & large bowel obstruction.



1

Proximal intestine

- Dilates above level of obstruction: (due to accumulated food / fluid / gas).
- Gas: there is a significant overgrowth of both aerobic and anaerobic organisms, resulting in considerable gas production.
- Fluid: this is made up of the various digestive juices. (saliva 500 mL, bile 500 mL, pancreatic secretions 500 mL, gastric secretions 1 litre – all per 24 hours).
- Internal pressure rises: (draining veins & lymphatics are compressed (but arteries aren't compressed) walls become congested and edematous)
- Mucosal irritation due to stagnation causing: (fluid collection in the lumen) produced by the mucosa (Third space shift of fluid happens and fluids collects from the body causing hypotension and dehydration "not physiological: same as what happens in burned patients and with peritonitis")

Distal intestine

- Collapses (no contents)
- Continues to show peristalsis

2

At the level of obstruction

- Venous compromise
- Arterial compromise (causing ischemia)
  - If recovered (stricture due to fibrosis)
  - If progress (Gangrene & perforation)

3

3rd spacing: movement of fluid into extracellular space
Resulting in Hypovolemia / Dehydration / Hypotension and Electrolytes depletion

4

Translocation: Invasion of indigenous intestinal bacteria through gut mucosa to normally sterile tissues & organs
sometimes inflammatory compounds are translocated, which result in development of Systemic inflammatory response syndrome defined as (SIRS) and peritonitis (If peritonitis was prolonged it might develop into systemic sepsis). Normally the bacteria are contained within the intestine but when an obstruction is present due to the high pressure it goes through the veins and arteries to the systemic system then it can infect different organs. The translocation can either be microorganisms or toxins (inflammatory compounds) (Enteral nutrition prevents gut mucosal atrophy and subsequent bacterial translocation)

- **Fecalization:** Defined as conversion of intestinal contents into stool like material. (Gas, fluid and food which becomes hard then resembles stool meaning that the obstruction is advanced)(Only seen in CT scan)
- Due to Stasis / absorption of water / bacterial overgrowth / production of gas (happens in small bowel where there is no stool usually (only chyme); microorganisms will grow in the stagnated chyme and converted to a stool like material then the wall of the intestine will be inflamed)
- Some patients may vomit this foul smelling fecalization material.

Intestinal obstruction

Complications:

Local

1. Local peritonitis
2. Collection
3. Abscess formation
4. Fistula formation
5. Stricture formation

General

1. Generalized peritonitis
2. Septic shock
3. Multi organ failure / Acute respiratory distress syndrome
4. Mortality

Paralytic ileus

- If obstruction not overcome > peristalsis subsides and paralytic ileus (bowel atony) ensues due to electrolyte imbalance and gross distension proximal to the obstruction
- Decreased reabsorption with time and flaccidity prevent vascular damage from high pressure

Clinical picture:

Clinical features depend upon:

- Level of obstruction
- Degree of obstruction
  - Low grade (incomplete) → Air in rectum
  - High grade (complete) → No air in rectum
- Duration of obstruction
- Amount of destination
- Underlying disease
- Complications: presence or absence of intestinal ischaemia.

Cardinal symptoms of bowel obstruction are:

1. Abdominal pain
2. Nausea & vomiting
3. Abdominal distention (depends on location; only the stomach would be distended in gastric outlet obstruction, whereas the whole small bowel would be distended in colonic obstruction.)
4. Constipation (no stool) or obstipation (no gas nor stool) (diarrhea at the beginning due to hyperperistalsis)

As we move distally; abdominal pain↓ vomiting↓ distention↑ constipation↑ **(**The clinical presentation of mechanical bowel obstruction reflects the anatomical location of the lesion)

- The more proximal the obstruction: the less the distention is. Diarrhoea at the beginning.
- The more distal the obstruction: the more the distention is with constipation and obstipation preceding the pain and vomiting unless there is ischemia or volvulus.

Intestinal obstruction

Table from Dr. Mufti's slides that compares clinical picture of different types of obstruction

Clinical picture:

Small Bowel

Symptoms

- Crampy central abdominal pain (around the umbilicus) (Colicky pain: viscus is trying to move "contraction against obstruction")
- Nausea & vomiting (intermediate)
- Central abdominal distention
- Dehydration (intermediate)
- Obstipation [Diarrhoea at the beginning (because the bowel undergoes hyperperistalsis to overcome the obstruction) then followed by constipation then obstipation (Loss of stool and gas)]

Signs

- Central abdominal tenderness
- Distention
- Central Rebound tenderness
- Guarding & Rigidity
- Exaggerated bowel sounds
- Dilated rectum

Proximal small bowel:

- Very short history of anorexia, vomiting
- Relatively severe upper abdominal pain
- **Absent/minimal abdominal distention**
- Limited if any changes in bowel
- ★ **Profound vomiting!**

Distal small bowel:

- Short history of colicky midgut (periumbilical) pain
- Little abdominal distension
- Vomiting
- Constipation (if high grade/complete = obstipation)

Large intestine
An emergency, take to OR!

Symptoms

- Lower abdominal pain (mostly left lower quadrant because most of the obstructions are in the sigmoid colon) (poorly defined hindgut abdominal pain/discomfort)
- Vomiting late As you move distal to the stomach the vomiting becomes less (little or no vomiting)
- Early pronounced abdominal distention
- Dehydration (very late)
- Early constipation (The patient complains of not passing stool)

Signs

- Lower left abdominal tenderness
- Distention + (central maximum abdominal distention is seen in colonic obstruction because there is a lot of intestine to dilate)
- Lower left rebound tenderness
- Guarding & Rigidity
- Exaggerated bowel sounds
- Dilated rectum

Symptoms of sigmoid obstruction:

- Obstipation
- Distention
- Pain later on
- Late vomiting

Symptoms of distal large bowel obstruction with competent valve: (Closed loop obstruction: obstruction at two points)

- Obstipation
- Distention
- Pain later on
- No vomiting (Because the content can't go back to the small bowel instead the food comes from the small bowel and accumulate more which causes more distention)
- Very high risk to complicate and perforate or gets ischemic because the blood vessels gets twisted

★ Red flags for complicated bowel obstruction

Features that indicate imminent perforation, strangulation or established peritonitis from perforation are:

- Pain out of proportion
- Peritoneal signs: tenderness with rigidity, guarding and peritonism/rebound tenderness
- Signs of systemic toxicity, e.g., SIRS
- Hemodynamic instability: Hypotension and shock
- Laboratory abnormalities: e.g., significant leukocytosis, leucopenia, metabolic acidosis, ↑ lactate dehydrogenase and potassium amylase
- Pyrexia, tachycardia and dehydration (hypovolemia)
- Completely absent bowel sounds

The risk of perforation increases as the cecal diameter exceeds 12 cm, so take immediately to the OR.

- **Dehydration** caused by:
  - Reduced oral intake
  - Defective intestinal absorption
  - Losses as a result of vomiting
  - Sequestration in the bowel lumen
  - Transudation of fluid into the peritoneal cavity (third space loss)
  - Enforced fasting

- So when i see a patient with symptoms of bowel obstruction, I have to answer these Qs:
  1. Is it an obstruction?
  2. If yes, is it complete or partial ?
  3. What is the level of it (high-level SBO, low-level SBO or large bowel obstruction) ?
  4. What is the **CAUSE**?

- Reflex contraction of smooth muscle → colicky pain.
- Increased intraluminal pressure → Vomiting.
- Increased peristalsis because the bowel is trying to empty itself (normal property) → confirmed by exaggerated bowel sounds during auscultation (Loud + more frequent = Exaggerated bowel sounds)
- If obstruction not overcome → bowel atony (Absent bowel sound in paralytic ileus).
- Fatigue due to dehydration
- Weight loss due to cancer
- Fever due to infection

Intestinal obstruction

Investigations:

Imaging: used to confirm the Dx and answer the four Qs: Is it an obstruction? If yes, is it complete or partial ? What is the level of obstruction? (high-level SBO, low-level SBO or large bowel obstruction) ? What is the **CAUSE**?
Even with the best imaging techniques, the diagnosis of strangulation remains a clinical one.

★ **Abdominal x-ray (Best initial)** (signs of obstruction) Not used nowadays.
- (pic A): In an erecto-supine position reveal distended small bowel (small intestine in x-rays: lines completely crossing the bowel) air-fluid levels, and no air in rectum.
  If there is air in the rectum → incomplete obstruction.
- (pic B): Distended large bowel loops. No air in rectum.
- May give indication of the level of obstruction.
- Grossly distended bowel loops or evidence of a closed loop obstruction also merit early surgical intervention.
- Confirms **increased quantity of air and fluid** where it shows air fluid level (normally 3-4 air fluid levels appears in erect x-ray: stomach, proximal jejunum, terminal ileum and cecum. If there is multiple air fluid levels this means that there is increased quantity of air and fluid due to two things either obstruction or paralytic ileus. The cause can be determined based on the clinical history of the patient (e.g.: if a patient is post op he'll develope paralytic ileus) "The x-ray has to always be in the erect posture if the patient is laying down it won't show air fluid level")

- **Chest x-ray**
  - A chest x-ray should be obtained to screen for air under the diaphragm indicates perforation and mandates laparotomy

- **CT with contrast** 90% sensitivity & specificity. **Most commonly** widely used now. **Most accurate** (will decide the management)
  - Determine:
    - Site (transition zone) You can see the transition zone = distended bowel followed by collapsed bowel. It will show you "Pneumatosis intestinalis " air in the intestinal wall. It's a feature of ischemia. And it can show poor blood supply.
    - Adhesions aren't clear in CT, so how to know ? Distended bowel is separated from the collapsed bowel by the transition point/zone (determined by the radiologist). The CT scan should be normal showing no tumor, no hernia and the patient should have +ve Hx of previous surgery to diagnose adhesions.
    - Masses
    - Hernias
    - Features of strangulation → edema , enlarged bowel
  - Strangulation: pneumatosis (air within the **wall** of bowel NOT lumen), good sensitivity by CT but poor specificity with false +ve rate 25%
  - Timing for CT: (not important)
    - Some advocate for initial CT at presentation
    - Others recommend obtaining CT if no improvement after 24 hours NGT
  - It allows interpretation of the likely need for surgery.

- **Contrast studies :** not used anymore
  - **Contrast follow through**
    - Indicated in patient SBO with failure to resolve (enteroclysis) → to determine site & degree of obstruction
    - Contrast passed → Continue conservative management
    - Delayed passage & distended proximal → OR
    - Study of choice when investigating possible malrotation and contraindicated in the presence of acute obstruction and may be life-threatening.

  - **Contrast enema**
    - Contrast study are used to assess the level and the degree of obstruction.
    - Water-soluble enema used to differentiate large bowel obstruction from pseudo-obstruction.
    - Contraindicated when complete obstruction is suspected.
    - Has a therapeutic role.

- **Sigmoidoscopy**
  - Only in carcinoma and volvulus

- **Labs in case of strangulation** (order everything)
  - CBC: High WBC (neutrophilia)
  - VBG
  - Electrolytes
    - Hyperkalemia: due to the release of intracellular K+ from ischemic cells into the circulation
    - Hyperamylasemia
  - Raised lactate dehydrogenase

Intestinal obstruction

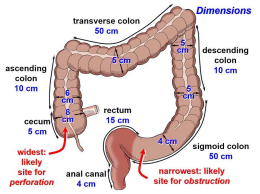
Further management from Dr. Khayal's slides "Dr: above your level"

Management algorithm from Amboss

Management:

- There should be frequent clinical assessments and monitoring ins and outs.
- Some cases will settle by using this conservative regimen, other need surgical intervention.
- **Initial management:** called (suck and drip)
    - ABC!!
        - Secure Airway/Breathing → aspiration risk in vomiting.
        - Secure Circulation → hypovolemia caused by dehydration third spacing.
            - Fluid resuscitation 2 large bore IV fluids & maintenance (Normal saline + K): patient has ↓Cl, ↓K, metabolic alkalosis.
            - Nasogastric tube decompression or orogastric tube sucks all the collected fluid (kept for 2-3 days till the obstruction is gone and the food passes). NGT especially if:
                - Recurrent vomiting
                - Significant abdominal distention → pressure on vasculature → blood supply compromise. Suction all the fluids via NG tube to relieve obstruction.
            - Restore good volume status
            - Investigate for cause
    - Make the patient NPO "nil per os" (doesn't eat nor drink anything)
    - Foley catheter to monitor the urine output to assess dehydration and measure sufficient fluid supply.
    - Withdraw blood
    - Get Hx and do physical exam
    - Pain medication: controversial especially if the diagnosis is unclear. Mandatory for all patients undergoing surgery for intestinal obstruction.
    - Use of routine antibiotics: controversial, but generally No evidence (If needed)
    - Give O2 if needed
    - Get a surgical consultant

- Surgery should be delayed till resuscitation is complete unless signs of strangulation and evidence of closed-loop obstruction and large bowel obstruction.
- Cases that show reasons for delay should be monitored continuously for 72 hours in hope of spontaneous resolution e.g. adhesions with radiological findings but no pain or tenderness.
- **Procedure:** exploratory laparotomy.
- "The sun should not both rise and set" in cases of unrelieved obstruction.
- The length of the small bowel is 6 meters and its function is nutrient absorption and most of the fluid nutrients are reabsorbed in the terminal ileum so the surgical removal of the whole small intestine is impossible (the patient can't live without small intestine) but we can resect up to 5 meters . However, we can remove the whole colon.
- **Sigmoid volvulus management:** rehydration and NGT insertion then colonoscopic detorsion
- **Indication for surgery:**
    - Virgin abdomen (No previous surgery)
    - Failure of conservative management
    - Tender, irreducible hernia
    - Strangulation or perforation which causes peritoneal contamination
    - Closed-loop or complete obstruction.
    - Free gas under the diaphragm indicates perforation and mandates laparotomy
    - **Dilated cecum** → **immediately take the pt to the OR** due to increased risk of cecal perforation. Area of highest risk of perforation in the colon is the cecum because it has the largest diameter which results in the highest pressure (**laPlace law**) If the diameter of the cecum is > 12 cm its an indication for surgery.

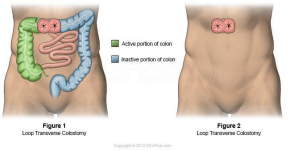


- **What should we do if we see a dark colored segment above the level of relieved obstruction?**
    - If you are not sure about what will happen to this segment always play safe and resect it
    - If you are sure that it will survive then leave it
        - **To check if the tissue is survivable or not:** Give 100% O2 and place warm laparotomy pads. If colour improves then it means that it will survive if it didn't improve then it means that it won't survive

- **Options during operation:**
    - **If you find a band obstructing:** Cut the band to relieve the obstruction and milk the contents to the colon.
    - **If you find that the intestine is dead:** Cut the dead part (resect) and reanastomosis.
    - **If the patient is sick:** we make a hole in the intestine and bring it out as colostomy or ileostomy (stoma) and then after one week when the patient gets better we do the operation.

- When doing decompression (refunction) of the colon we shouldn't leave behind closed loop so we can make the stoma in the terminal ileum (proximal to the ileocecal valve) or do loop stoma.

- The objective of surgery is damage control and it should be safe for the patient.



Intestinal obstruction

History:

- Full clinical history and examination is essential, along with immediate initiation of intravenous fluid and electrolyte therapy.
- Onset? Last time passing gas/stool (constipation vs obstipation), associated w/pain? previous episodes? Family Hx of chronic disease/TB/Cancer? Ingestion of foreign bodies?
- The diagnosis of mechanical obstruction depends mainly on the cardinal symptoms and signs, the nature of the presentation will also be influenced by the type of obstruction (small bowel/ large bowel) and degree (complete/ incomplete). Complete: has all the cardinal features, food and gas can't pass **(no air in rectum).** Incomplete: food and gas will be able to pass **(air in rectum)**.
- The symptoms:
  - **Abdominal pain:** first encountered symptoms, colicky severe around umbilicus (small bowel) or lower abdomen (large bowel)
  - **Vomiting:** early in proximal obstruction, late when distal
  - Constipation: absolute constipation (Obstipation: failure to pass stool & gas) is a cardinal feature of complete intestinal obstruction, or relative constipation (where only flatus is passed) Some patients may pass flatus or faeces after the onset of obstruction as a result of the evacuation of the distal bowel contents. The administration of enemas should be avoided in cases of suspected obstruction. This merely stimulates evacuation of bowel contents distal to the obstruction and confuses the clinical picture.
  - **Abdominal distention:** the distension greater the more distal the lesion.
  - **Dehydration:** most commonly in small bowel obstruction because of repeated vomiting and fluid sequestration
  - **Bowel sounds:** bowel sounds may be scanty or absent if the obstruction is longstanding and the small bowel has become inactive

Symptoms In strangulation (EMERGENCY):

- Severe constant abdominal pain
- ★ Fever indicate ischaemia, perforation and inflammation
- Tachycardia
- Tenderness with rigidity and peritonism / rebound tenderness
- Marked leukocytosis

Examination:

- In general examination check vital sign and signs of dehydration, tachycardia, hypotension, dry mucus membrane, decreased skin turgor, decreased urine output.
- Any patient with bowel obstruction; you **MUST** do digital rectal exam to check for stool & ALWAYS check for hernial orifices! It is often missed. If its a reducible hernia you'd have more time to manage

- **Inspection:** Distension, scars, peristalsis, masses, hernial orifices
- **Palpation:**
  - Tenderness: Pain when you press means there is inflammation in an organ
  - Rebound tenderness: When you press the abdomen and suddenly release your hand, patient will feel severe pain. That means there is inflammation in the abdominal wall
  - Guarding: Contraction of muscles of the abdominal wall whenever there's an inflammation in the abdomen so you feel the abdomen hard and tense
  - Masses and rigidity
- **Percussion:** Tympanitic abdomen
- **Auscultation:** High pitched bowel sound or silent abdomen, Early tinkling bowel sounds, absent bowel sounds lately
- Examine **rectum** for mass, blood, feces or it may be empty in case of complete obstruction or may reveal rectal or extrinsic malignancy.
- **Hernial orifices** must be carefully inspected and any previous surgical **abdominal scars** noted.
- **Right iliac fossa tenderness** along with radiological evidence of gross **cecal distension** in the presence of **distal colonic obstruction** is a **critical sign** as it indicates **imminent caecal perforation**, which is a frequent complication of distal colonic obstruction. and the need for urgent operation. think of competent ileocecal valve.
- The reason that the caecum perforates even with obstruction due to sigmoid cancer is because the caecum is anatomically the largest diameter segment in the gut. Thus tension is greatest in the caecal wall, despite equalized intra-luminal pressure along the colon.

Adhesive obstruction

- Most common cause of mechanical obstruction.
- The formation of adhesions starts within hours of abdominal surgery.
- Difficult to distinguish from paralytic ileus in the early postoperative period.
- Postoperative adhesions that cause intestinal obstruction usually affects the lower small intestine.

Etiology:

1. **Postoperative**
2. Acute inflammation
3. Foreign bodies (mesh, gauze or sutures)
4. Infection (peritonitis or TB)
5. Chronic inflammatory disease (Crohn's disease)
6. Radiation enteritis

Pathogenesis:

Any irritation of peritoneum may cause the local production of fibrin, which result in adhesions between opposed surfaces of the visceral organs. Early fibrinous adhesions after surgery may disappear when the underlying cause is eliminated or they may be replaced by mature fibrous tissue that forms the adhesions.

Management: (Not part of the objectives)

- The initial treatment is based on **intravenous fluid rehydration**, **electrolytes replacement**, and **nasogastric decompression**.
- Conservative treatment is successful and curative.
- **Treatment:** Laparoscopic adhesiolysis in the hands of advanced laparoscopic practitioners .
- Regular clinical evaluation is necessary and the **surgical intervention indicated in:**
  - Failure of conservative treatment > 72 hours
  - Evidence of strangulation or peritonitis
  - Free intraperitoneal gas in the abdominal imaging
  - Complete intestinal obstruction in the abdominal imaging
- When surgery is required, multiple adhesions may be found during laparotomy, however, only one may be causative. Such band should be divided and the remaining adhesions can be left unless intestinal angulation is present. Division of multiple adhesions will only cause further intestinal adhesions formation.

Outcomes:

1. Ten percent of patients who've undergone lysis of adhesions will obstruct in the future.
2. Incidence of recurrence increases with each subsequent operative intervention.

Non-mechanical obstruction

- **Non-mechanical obstruction:** Mechanical element is absent, peristalsis may be absent (paralytic ileus) and present in non propulsive form (mesenteric vascular occlusion or pseudo-obstruction)
- For the intestine to contract it requires neurological (autonomic nervous system) and hormonal functions.

Paralytic ileus

The term refers to lack of propulsive contractions or absent peristaltic movement of both jejunum and ileum due to neuromuscular failure (i.e. submucosal "Meissner's" and myenteric "Auerbach's" plexuses), although the ileus can be localized in some instances. It is common as a secondary feature of peritonitis due to any cause or sequela of the end stage of mechanical obstruction.

Etiology

- **Abdominal surgery** after any surgical procedure due to handling of the bowel. (**Post-operative** : normal and lasts few days, if persists > 1 week then do CT scan)
- **Peritonitis**
- **Advanced mechanical bowel obstruction**
- **Gastroenteritis** (Inflammation of intraabdominal, pelvic, or retroperitoneal organs)
- **Drugs** such as tricyclic antidepressant, lithium therapy, excessive opiate use and Narcotic analgesics (excessive take of **narcotics**: as they decrease bowel motility)
- **Electrolyte imbalance** such as hypokalaemia (when we put patient on NPO potassium decreases), hyponatraemia, hypocalcemia, hypomagnesemia, uraemia, diabetic ketoacidosis
- **Bowel ischemia**
- **Endocrine or metabolic abnormalities** (e.g. hypothyroidism or hyperthyroidism)
- **Neuropathy** (e.g. diabetes mellitus or spinal injury)
- **Reflex ileus** occurs in a patient with retroperitoneal hemorrhage, spine or ribs fractures, pelvic surgery or application of a plaster jacket.
- **Renal & lung disease** (e.g. chronic renal failur or renal injury)
- **Severe infection**

Mnemonic: The 5 **P**s: **P**eritonitis, **P**ostoperative, low **P**otassium, o**P**ioids, and **P**elvic/spinal fractures are among the most common causes of paralytic ileus.

Pathophysiology

- Stressful stimuli to the bowel (e.g., surgery, peritonitis) → sympathetic nervous system activation → decreased/arrested peristalsis
- Inflammation or intraoperative manipulation → local release of nitric oxide → relaxation of intestinal smooth muscles → decreased/arrested peristalsis
- Decreased/arrested peristalsis → stasis of luminal contents → bowel wall distention → progresses to paralytic ileus as detailed in mechanical bowel obstruction.

Clinical features

Paralytic ileus is clinically significant if it prolonged more than 72 hours after abdominal surgery:

- Constipation and **no passage of flatus**
- **Absent bowel sounds on auscultation (silent abdomen)**
- **Effortless** vomiting may occur in the absence of gastric aspiration
- Tympanic on percussion
- **Continuous (non-colicky) abdominal pain**
- Marked abdominal distension
- Increased pain in the abdominal wound due to abdominal distention

Diagnosis
Not part of the objs

- **Abdominal x-ray** (initial) shows gas-filled loops of small and large intestine down to the rectum with multiple air-fluid levels (erect film) without a cut off point
- When paralytic ileus persists > 72 hours, **abdominal CT scan** (gold standard)is a helpful tool to show any abdominal pathology or mechanical intestinal obstruction and will guide any need for surgical intervention
- **Laboratory studies** to investigate the underlying cause and assess for dehydration and metabolic imbalances secondary to diffuse bowel distension and third-spacing.

Management
Not part of the objs

Treatment is focused on the cause and **conservative management** with: (improves within 2-3 days)

1. Bowel rest (NPO)
2. Nasogastric aspiration
3. Fluid and electrolyte support give sodium and potassium (optimise the electrolytes)
4. Pass foleys
5. Treat underlying cause (Correct infections if present by antibiotics)

Nutritional management: Gradual increase in enteral feeding as tolerated by the patient. Parenteral nutrition may be considered if ileus persists for ≥ 7 days. (e.g TPN)

Surgery indications:

1. If the treatment of the underlying cause requires surgery
2. Treatment of complications (e.g. intestinal ischemia) or perforation

Complications

- Aspiration from emesis
- Hypovolemic shock due to third-spacing
- Bowel ischemia & necrosis
- A abdominal compartment syndrome
- Secondary peritonitis, sepsis

Non-mechanical obstruction

Pseudo Obstruction	
Etiology	• Metabolic: (DM, **hypokalemia**, uremia, myxedema) • Severe trauma (lumbar spine and pelvis) • Shock • Major burns • Extensive myocardial infarction • Septicemia • Stroke • Idiopathic • **Postoperative** • Drugs (Tricyclic antidepressants, Phenothiazine, Laxatives) • Secondary GIT involvement (scleroderma Chagas diseases)
Pathophysiology	Etiological factors → impairment/destruction of the autonomic nervous system → imbalance between sympathetic and parasympathetic control of intestinal motility → accumulation of feces, air, and intestinal secretions in the intestine → Intestinal dilation

Small Bowel Pseudo Obstruction	
Clinical features	Recurrent subacute intestinal obstruction
Diagnosis Not part of the objs	Exclusion of mechanical causes is required before the diagnosis of small intestine pseudo obstruction which is performed by: • Gastrografin follow through • CT scan
Management Not part of the objs	• Correction of any underlying cause • Metoclopramide • Erythromycin

Large Bowel Pseudo Obstruction		
Types	**Acute (Ogilvie's Syndrome)**	**Chronic**
Clinical features	• Gradual abdominal distention • Abdominal pain • Constipation/diarrhea • Tympanitic abdominal percussion • Decreased frequency of bowel sounds • **Signs of colonic ischemia or impending perforation:** Fever, tachycardia, and peritoneal signs (guarding, rigidity, rebound tenderness)	**Recurrent episodes of:** • Constipation • Abdominal pain and distention (bloating) • Anorexia, early satiety, and nausea • Mild abdominal tenderness • Signs and symptoms of the underlying disorder
Diagnosis Not part of the objs	• **Laboratory tests:** May show signs of the underlying cause • **Abdominal x-ray** • **Contrast enhanced CT:** confirms x-ray findings and rule out mechanical obstruction (It's more with elderly bed ridden patients (comorbid in the geriatrics ward) that's why we need to rule mechanical obstruction out because it affects the same group that sigmoid volvulus effects) • **Colonoscopy:** hemodynamically stable patients who can't perform contrast enhanced CT. Shows distended colon without any level of obstruction.	
Management Not part of the objs	Treat the underlying cause.	

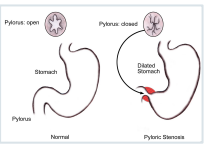
	• Supportive when the patient has mild symptoms and cecal dilatation is **<12 cm**
	  ○ Bowel decompression by nasogastric tube and rectal tube
	  ○ IV fluids
	  ○ Bowel rest
	  ○ Treat the underlying cause
	• Neostigmine: No improvement > 24 - 48 hours and/or cecal dilatation is **> 12 cm** with no signs of colonic ischemia, perforation or peritonitis
	• Neostigmine is **contraindicated**: colonoscopies bowel decompression
	• **Surgery** indications:
	  ○ Signs of colonic ischemia, perforation or peritonitis
	  ○ Failure of conservative therapy
		• **Conservative** management
		  ○ Dietary modifications
		  ○ Osmotic laxatives and enema
		  ○ Prokinetic drugs: Erythromycin (stimulate motility by binding to colonic motilin receptors), metoclopramide, neostigmine
		• **Surgery** indications:
		  ○ Patients who do not improve on conservative therapy

Complications	• Perforation of the cecum • Operative mortality in patients with pseudo obstruction is >15% and so surgery should be avoided wherever possible.	

Gastric outlet obstruction

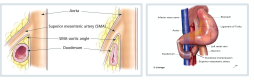
Definition:

- **Gastric outlet obstruction (GOO)** is clinical or pathophysiological consequence of any disease process that produces mechanical impediment to gastric emptying.
- **Types:**
- **Non-Mechanical (motility)** gastroparesis e.g. diabetics due to neuropathy OR vagal nerve injury in post-OP. Deposits of amyloid in the entroplexus.
- Managment? Cholinergic agents
- **Mechanical**: anything that obstructs pylorus or any outlet from the stomach → stomach distention , or obstructs the first part of duodenum. Can be benign or malignant. No grade or level is needed here.
- The two common causes of gastric outlet obstruction are **gastric cancer** and **pyloric stenosis secondary to peptic ulceration**.

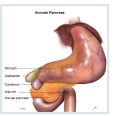


1) Benign causes:

- **Peptic ulcer disease:** near the pylorus (peripyloric ulcer) → edema → closed pylorus
  - **Most common cause of gastric outlet obstruction**
  - Type 3 (kissing ulcer): in the pylorus + antrum
  - Ulcer → inflammation → thickening of the pylorus → hypertrophy → obstruction
  - Chronic ulcers close to the beginning of duodenum causes fibrosis and narrowing.
  - **Risk factors**: smoking, NSAIDs, H. pylori.
  - **Management:** PPI, triple therapy in case of H. pylori
  - The incidence has decreased after the usage of PPIs.
- **Eosinophilic gastroenteritis:** Rare, Peristalsis issue and autoimmune inflammation of the first part of duodenum/pylorus → recurrent inflammation → scar → stricture.
  - Managment? (Severe) steroids
- **Gastric volvulus**
- **Hiatal hernia:** Management? reduce and fix it
- **Benign tumors: Gastric carcinoid cancer, Gastrinoma** (both can either be benign or malignant)
  - Management? **Terminal:** stent **Curable:** Chemo and then resect
- **Iatrogenic: Previous gastric surgeries** (Bariatric procedures, Vertical banded gastroplasty, Roux-en-Y gastric bypass) (stomach surgery can cause fibrosis and narrowing and can cause obstruction). الدكتور قال اجمعوها كلها تحت هالعنوان ما يحتاج تفاصيل ولا تحفظون اسماء
- **Adhesions:** Management? conservative. NG tube, NPO, hydrate and wait for 5 days. If no resolution: OR
- **Ingestion of caustics:**
  - High alkalines / acids → severe erosions → heal by fibrosis → obstruction
  - Managment? NPO and TPN, give enough time to heal.
- **Bezoars: Trichobezoars (Hairballs):**
  - Usually in psychiatric patients (eating hair until it blocks the stomach) .
  - Usually they have alopecia.
  - Bezoars (foreign bodies): forigen indigestible materials ingested by the people and it forms ball like structures, e.g. batteries (most dangerous coin shaped), cocaine balloon, nails or magnets (WORST type because one part would be in other segments of the lumen and they would attach together).
  - Food bezoar Managment? Give enzymes (they used to give 7up/Pepsi) If not passing endoscopy.
  - **Proximal:** Endoscopy,
  - **Colonic/Rectal:** Colonoscopy,
  - **Middle:** if not passing OR.



- **SMA (Superior mesenteric artery) syndrome:** acute angulation of the SMA causes compression of the third part of the duodenum between the SMA and the aorta In people who lost a significant amount of weight the mesentery of SMA will press over the duodenum. The normal angle of the SMA is ≥35 degrees and its maintained by a fat band when its less than 35 degrees it compresses the underlying duodenum)
- **Adult hypertrophic pyloric stenosis:**
  - Pyloric stenosis usually occurs in pediatrics, they present with projectile vomiting of milk (non-bilious content because the level of obstruction is the pylorus). Projectile vomiting is aa classical finding in neonates with pyloric stenosis projectile means it's so strong that it's shooting off the patient's mouth لدرجة يضرب بالجدار
  - It is very rare in adults , not important
  - Management? Dividing pyloric muscle via pyloromyotomy.
- **Pyloric mucosal diaphragm:** very rare
- **Strictures in the pyloric channel** due to crohn's disease
- **Inflammation of other organs** e.g.:
  - **Diverticulitis** Managment? Antibiotics
    - **Abscess:** Drained
    - **Perforated**: Hartmann procedure: surgical resection of the rectosigmoid colon with closure of the rectal stump and formation of an end colostomy.
  - **Pancreatitis** (Edema and inflammation) Managment? HYDRATION
- **Pancreatic pseudocysts:**
  - Common complication in patients with pancreatitis.
  - Pancreatic juice- filled sac that causes external compression (pseudocyst).
- **Annular pancreas:** morphological anomaly that results in pancreatic tissue encircling the duodenum forming a pancreatic ring around the second part of duodenum. .
- **Gastric or duodenal polyps**
- **Congenital duodenal webs**
- **Gallstone (Bouveret syndrome):** a gastric outlet obstruction secondary to an acquired fistula between the gallbladder and stomach or in duodenum where the stone can pass and obstruct the gastric outlet, in duodenum called "gallstones ileus". Thus, it can be considered a very proximal form of gallstone ileus. (very rare Dr. Hussam: no need to know)
- **Peritoneal deposits**



2) Malignant causes:

- With the decrease in the incidence of peptic ulceration and the advent of potent medical treatments, gastric outlet obstruction should be considered malignant until proven otherwise.

Caused by:

- **Metastasis**
- **Carcinoma of stomach**
- **Gastric outlet carcinoma** (majority are benign very few are malignant)
- **Periampullary carcinomas** Carcinoma head of pancreas , Ampullary carcinoma , Carcinoma of second part of duodenum , Cholangiocarcinomas

Gastric outlet obstruction

History:

- **Epigastric** (upper abdominal pain)or left hypochondrial **pain** (which is most common feature in peptic ulcer disease). (abdominal pain can be due to the disease that caused the obstruction, not due to the distention itself
- Main most important presenting symptom: very early **Postprandial Vomiting** (unpleasant smell, copious amounts, projectile, **non bilious** (no bile, bile duct joins the GI at the 2nd part of the duodenum and the food content did not reach the small bowel and ampulla of vater "closed pylorus") and contains undigested food particles taken hours to several day ago.
- Feeling of unwell, anorexia, nausea, early satiety, weight loss, emaciation (they don't eat to avoid vomiting)
- Abdominal swelling (might have a bulge in the upper abdomen) (Generalized distention happens if the obstruction was at a lower level of the GI tract)
- Other manifestations depend on the cause:
  - E.g.: Malignancy: cachexic, chronically ill (they don't eat to avoid vomiting).

Physical examination:

General: Chronically ill looking, wasted, pale and early dehydration (because the patient won't be able to eat or drink anything).

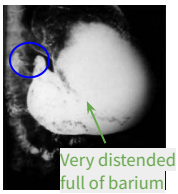
Abdominal:

- Distended stomach (fullness in epigastrium)
- Upper abdominal tenderness
- Visible gastric peristalsis from the left to right in the upper abdomen.
- Succussion splash: (characteristic finding) sloshing sound heard through stethoscope place over epigastrium during sudden movement of the patient (مثل صوت خض القربه) . The splash sound indicate the presence of a hollow viscus filled with both fluid and gas. The succession is physiological immediately after a meal but if present after > 4 hours of fasting it suggests a gastric outlet obstruction. Also can be found in post op patients as they present with closed pylorus because when surgery is performed the omentum is removed and there is direct manipulation with the pylorus) "المعلومة هذي سهلة؟ لو جبتها بالإختبار سهله: What is the finding of a patient with gastric outlet obstruction? Succussion splash"
- Bowel sounds are preserved because the intestines are normal
- Hepatosplenomegaly
- Ascites (sign of carcinoma spread)
- Signs of gastric cancer
  - Left supraclavicular lymph node enlargement "Virchow's node"
  - Sister mary joseph sign: palpable nodule bulging into the umbilicus as a result of metastasis of a malignant cancer in the pelvis or abdomen

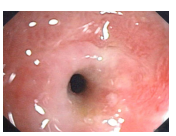
Investigation: (Not part of the objectives)

- **CBC**
- **Serum electrolytes** (Hypokalemic metabolic alkalosis)
- **Liver Function Test**
- **Test for H-pylori**
- **ABGs:** Metabolic alkalosis as a result of continuous vomiting (losing HCL)
- **Urine C/E:** paradoxical aciduria

- **Plane X-ray erect abdomen:**
  - Large gastric shadow and large amount of gastric fluid
  - Air-fluid level



- **Barium meal:**
  - 6 hour period of fasting is observed prior to study
  - Barium sulphate is ingested by the patient X-ray images are taken at 20 to 30 minutes interval in supine position.
  - Contrast study demonstrating an enlarged stomach. The point of obstruction is visualized at the pyloric-duodenal junction
  - (string sign) = thin column of barium leaking
- **Upper GI endoscopy: (Confirmatory)**
  - Visualize gastric outlet
  - Biopsy (if malignancy is suspected)
  - Endoscopic biopsy is essential to determine whether the cause of the problem is malignancy. Usually useless as first line investigation because the stomach will be full of hard food that we can't suck up so basically we won't see anything, we should do Gastric Aspiration first where we place 2 large tubes while the patient is fasting and if it got fIlled with 400 cc of gastric content then this is diagnostic of obstruction. Then we will do a gastric lavage using large tubes. Then we can do the gastroscopy and diagnose.
- **CT scan:**
  - For extraluminal obstruction
  - Periampullary carcinomas



- **Gastric emptying studies**

Gastric outlet obstruction

Management: Same as SBO and large bowel obstruction

Two Aims

1. Correct metabolic abnormality (includes adequate resuscitation, normalisation of electrolyte and acid–base abnormalities, nasogastric suction and washout).
2. Deal with mechanical obstruction (A subsequent OGD is mandatory to rule out carcinoma of the stomach. Surgical treatment will involve a gastrojejunostomy, performed by open or laparoscopic access).

- ABC if the patient is severely unstable
- Pass double **large Bore IV line.**
- Pass **wide bore nasogastric tube** or orogastric tube to lavage and empty the stomach and try to detect the cause.
- Sometimes an orogastric tube is required to lavage and empty the stomach as nasogastric tube may not be sufficiently large to deal with contents of the stomach.
- Intravenous normal saline (0.9% NaCl) with Potassium Supplementation.The metabolic abnormality of hypochloremic alkalosis is usually only seen with peptic ulcer disease (less in malignancy) and should be treated with isotonic saline with potassium
- Correct anemia by giving iron.
- Electrolyte and acid base abnormalities correction because the patient usually will be hyponatremic, hypokalemic and having high levels of bicarb (Correct metabolic alkalosis)
- A subsequent Oesophago-Gastro-Duodenoscopy is mandatory to rule out carcinoma of the stomach
- **Balloon dilatation & stenting are used.**
  - Endoscopic dilation
  - Repeated dilatations needed
  - May cause perforation

Management of GOO secondary to PUD:

- Early cases may settle with conservative management (NPO, antacids & PPI) as the edema around the ulcer diminishes as the ulcer is healed.

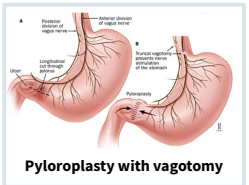
Management of gastric volvulus: surgical repair

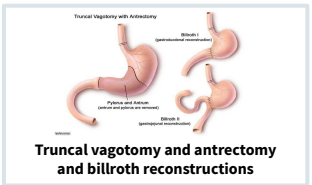
- If medical therapy failed surgical treatment will involve a **gastrojejunostomy**, performed by open or laparoscopic access

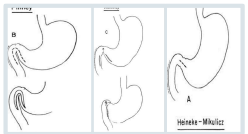
Dr. Khayal: Surgical procedures at the end are NOT important and beyond our level ane most of them are NOT done anymore.

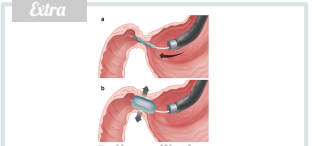
The most common surgical procedures performed for GOO related to PUD are:

- Vagotomy and antrectomy
- Vagotomy and pyloroplasty
- Truncal vagotomy and gastrojejunostomy
- Pyloroplasty
- Laparoscopic variants of the aforementioned procedures.
- Vagotomy and antrectomy with Billroth II reconstruction (gastrojejunostomy) seem to offer the best results.
- Vagotomy and pyloroplasty and pyloroplasty alone, although used with some success, can be technically difficult to perform due to scarring at the gastric outlet.

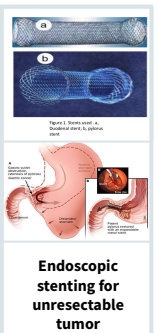

Pyloroplasty with vagotomy

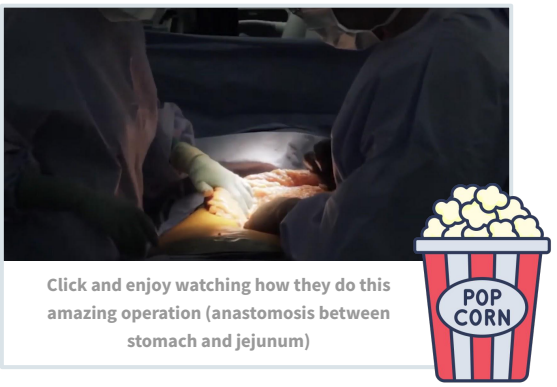

Truncal vagotomy and antrectomy and billroth reconstructions


Pyloroplasty


Extra

Balloon dilation


Endoscopic stenting for unresectable tumor



Click and enjoy watching how they do this amazing operation (anastomosis between stomach and jejunum)

Summary

- The obstruction patient is gonna present in ER because it's a surgical emergency
- There are imp things to know about them like
  - the level of obstruction (gastric, small bowel, large bowel)
  - is it acute or chronic?
  - What is the cause of it?
  - What is the grade of obstruction? (complete, partial)

Etiology

SBO

- Adhesions
- Tumors
- Inflammatory
- Obstructed hernia
- Intraluminal

LBO

- Colorectal carcinoma
- Stricturing diverticular disease
- Sigmoid volvulus

GOO

- PUD
- Cancers
- Gastric, duodenal polyps
- Pyloric stenosis
- Gallstone
- Bezoars
- Pancreatic pseudocysts
- SMA

Paralytic ileus

- Abdominal surgery
- Peritonitis
- Advanced mechanical bowel obstruction
- Gastroenteritis
- Drugs
- Electrolyte imbalance
- Renal & lung disease
- Bowel ischemia

Clinical Features

First exclude **strangulation**, **perforation** and **peritonitis** symptoms. Then try to differentiate based on cardinal symptoms:

	SBO	LBO	GOO	Paralytic ileus
Pain	• Colicky, periumbilical	• Colicky or constant	• Epigastric pain	• Continuous (noncolicky) abdominal pain or discomfort
Vomiting/ nausea	• Early-onset • Large volume • Bilious	• Late-onset • Little vomiting • Initially bilious Progresses to fecal vomiting	• Postprandial, nonbilious projectile vomiting	• Effortless vomiting
Constipation	• Late-onset	• Early-onset • Pronounced	-	-
Distention	• Minimal or absent	• Early • Pronounced	• Upper abdominal distention	• Marked
Other	• Dehydration. • Tympanic percussion. • Increased high-pitched, tinkling bowel sounds (early) or absent bowel sounds (late) • Generalized tenderness • Collapsed, empty rectum on digital rectal examination		• Dehydration • Early satiety • Alkalosis • Epigastric ,left or right hypochondrium tenderness • Succussion splash • Sister mary joseph sign	• Tympanic percussion • Bowel sounds usually absent • No tenderness unless there is peritonitis

Summary

Investigation:

In the workup of suspected mechanical bowel obstruction, **imaging** allows for quick confirmation of the diagnosis as well as detection of conditions requiring immediate surgery (e.g., perforation). **Laboratory tests** may further help to assess the severity of the condition (e.g., electrolyte imbalance due to vomiting).

Imaging

- Erect and supine abdominal x-rays (best initial):
  - SBO → central dilated loops
  - LBO → peripheral dilated loops
  - GOO → enlarged stomach
  - Paralytic ileus → generalized small and large bowel gaseous distention
- Erect chest x-ray: air under the diaphragm indicates perforation
- Abdominal CT: most accurate determine the cause and assess the bowel
  - Mechanical obstruction → transition point
  - Paralytic ileus → only to rule out suspected mechanical bowel obstruction
- Contrast study: has a therapeutic role
  - Water-soluble enema → differentiate large bowel obstruction from pseudo-obstruction
  - Barium meal → apple core appearance in GOO
  - To follow up conservative treatment if not passed take to OR

Laboratory

- Blood work and electrolyte:
  - Vomiting → Hypochloremic hypokalemic metabolic alkalosis and Hyponatremia
  - Strangulation → neutrophilia, hyperkalemia, hyperamylasemia & raised LDH

Endoscopy

- Sigmoidoscopy → in carcinoma, volvulus
- Gastroscopy → to determine pathology in GOO

Management

Management in general is conservative by **Fluid resuscitation, correction of electrolyte imbalance, Intestinal decompression(nasogastric tube), Bowel rest (NPO)** and **Administration of IV analgesics and antiemetics if needed**. Procedure:

	Mechanical	Adhesive	GOO	Pseudoobstruction
Procedure	**Exploratory laparotomy**	**Laparoscopic adhesiolysis**	**Gastrojejunostomy**	**Colectomy**
Indication	• Virgin abdomen (No previous surgery) • Failure of conservative management • Tender, irreducible hernia • Strangulation or perforation • Complete or closed-loop obstruction	• Failure of conservative treatment > 72 hours • Evidence of strangulation or peritonitis • Free intraperitoneal gas in the abdominal imaging • Complete intestinal obstruction in the abdominal imaging	• If medical therapy failed	Failure of conservative treatment which is: • Stimulant enemas • Colonoscopic deflation • IV erythromycin • IV neostigmine

Summary

Recall

Q1: What is small bowel obstruction (SBO)?
Answer: Mechanical obstruction to the passage of intraluminal contents

Q2: What are the signs/symptoms?
Answer: Abdominal discomfort, cramping, nausea, abdominal distention, emesis, high- pitched bowel sounds

Q3: What lab tests are performed with SBO?
Answer: Electrolytes, CBC, type and screen, urinalysis

Q4: What are classic electrolyte/acid–base findings with proximal obstruction?
Answer: Hypovolemic, hypochloremic, hypokalemia, alkalosis

Q5: What must be ruled out on physical exam in patients with SBO?
Answer: Incarcerated hernia (also look for surgical scars)

Q6: What major AXR findings are associated with SBO?
Answer: Distended loops of small bowel air-fluid levels on upright film

Q7: Define complete SBO.
Answer: Complete obstruction of the lumen

Q8: What is the danger of complete SBO?
Answer: Closed loop strangulation of the bowel leading to bowel necrosis

Q9: Define partial SBO.
Answer: Incomplete SBO

Q10: What is initial management of all patients with SBO?
Answer: NPO, NGT, IVF, Foley

Q11: What tests can differentiate partial from complete bowel obstruction?
Answer: CT scan with oral contrast

Q12: What are the ABCs of SBO?
Answer: Causes of SBO:
1. **A**dhesions
2. **B**ulge(hernias)
3. **C**ancer And Tumors

Q13: What is the treatment of complete SBO?
Answer: Laparotomy and lysis of adhesions

Q14: Intraoperatively, how can the level of obstruction be determined in patients with SBO?
Answer: Transition from dilated bowel proximal to the decompressed bowel distal to the obstruction

Q15: What is the most common indication for abdominal surgery in patients with Crohn's disease?
Answer: SBO due to strictures

Q16: Can a patient have complete SBO and bowel movements and flatus?
Answer: Yes; the bowel distal to the obstruction can clear out gas and stool

Q17: What may cause SBO if patient is on Coumadin® (Warfarin) ?
Answer: Bowel wall hematoma

Q18: What is an absolute indication for operation with partial SBO?
Answer: Peritoneal signs, free air on AXR

Q19: What tumor classically causes SBO due to "mesenteric fibrosis"?
Answer: Carcinoid tumor

438's Quiz

Q1: A 54-year-old man comes to the emergency department because of a 2-day history of increasingly severe abdominal pain, nausea, and bilious vomiting. His last bowel movement was yesterday and he has not passed flatus since then. He takes a topical corticosteroid, ramipril, metformin, and ibuprofen daily. Abdominal examination shows three well-healed laparoscopic scars. The abdomen is distended and there are frequent, high-pitched bowel sounds on auscultation. Which of the following is the most likely cause of this patient's condition

A) Ibuprofen
B) paralytic ileus
C) History of abdominal surgery

Q2: A 63-year-old man comes to the emergency department because of a 2-day history of persistent vomiting after meals. The vomit consists of undigested food and a clear fluid. Abdominal examination shows epigastric fullness with mild tenderness. Which of the following is most likely to confirm the diagnosis?

A) Upper endoscopy
B) AXR
C) Esophageal manometry

Q3: Four days after undergoing a total abdominal hysterectomy for atypical endometrial hyperplasia, a 59 year-old woman reports abdominal bloating and discomfort. She has also had nausea without vomiting. Her postoperative pain has been well controlled on a hydromorphone patient-controlled analgesia (PCA) pump. Examination shows a mildly distended, tympanic abdomen; bowel sounds are absent. An x-ray of the abdomen shows uniform distribution of gas in the small bowel, colon, and rectum without air-fluid levels. Which of the following is the most appropriate next step in the management of this patient?

A) Reduce use of opioid therapy
B) Gastrografin enema
C) Return to OR for bowel resection

Q4: A 63-year-old man is brought to the emergency department for evaluation of abdominal pain. The pain started four days ago and is now a diffuse crampy pain. The patient has nausea and has vomited twice today. He has a history of hypertension and recurrent constipation. Five years ago, he underwent emergency laparotomy for a perforated duodenal ulcer. His father died of colorectal cancer at the age of 65 years. The patient has been smoking one pack of cigarettes daily for the past 40 years. Abdominal examination shows distention and mild tenderness to palpation. There is no guarding or rebound tenderness. The bowel sounds are high-pitched. In addition to fluid resuscitation, which of the following is the most appropriate next step in the management of this patient?

A) Colonoscopy
B) Nasogastric tube placement and bowel rest
C) Surgical bowel decompression

Answers

Q1	C	Q4	B
Q2	A		
Q3	A		

Extra Questions

438's Quiz

Explanations

Q1 Explanation: Peritoneal adhesions are responsible for about 75% of all cases of small bowel obstruction. A past history of abdominal surgery is the most important risk factor for the formation of peritoneal adhesions, which cause mechanical obstruction through extraluminal compression of the bowel. Given this patient's history of appendectomy, the clinical findings of mechanical small bowel obstruction support the notion that previous abdominal surgery is the cause of this patient's complaints.

Q2 Explanation: Both a CT scan of the abdomen and an upper endoscopy can be used to confirm the diagnosis of structural GOO. In cases of suspected malignant GOO, endoscopic evaluation with biopsy is the preferred method to obtain a histological diagnosis.

Q3 Explanation: Opioids, such as the hydromorphone that was used for analgesia in this patient, also have an inhibitory effect on peristalsis, which has likely contributed to the development of paralytic ileus. Treatment consists mainly of supportive measures (i.e., bowel rest, using a nasogastric tube for intestinal decompression, fluid resuscitation, and electrolyte correction). Drugs that might sustain or prolong paralytic ileus (e.g., anticholinergics, opioids) should be reduced or discontinued

Q4 Explanation: This patient presents with diffuse abdominal pain, nausea, vomiting, high-pitched bowel sounds, and a distended and diffusely tender abdomen, all of which suggest bowel obstruction, possibly due to adhesions from the patient's previous abdominal surgery. A trial of conservative management is appropriate in all patients with mechanical SBO who have no indication for immediate intervention (i.e., no bowel ischemia, necrosis, or perforation), as in the present case.

439's Quiz

Q1: A 57-year-old man presents with acute colicky pain in the suprapubic area. He has been constipated over the last 2 days and has been feeling bloated. He feels nauseous, but he has not vomited. On examination of the abdomen you notice marked abdominal distension, and increased bowel sounds. What is the most likely diagnosis?

A) Small bowel obstruction
B) Irritable bowel syndrome
C) Diverticular disease
D) Large bowel obstruction
E) Appendicitis

Q2: From the list of options below which one is the most unlikely cause of mechanical intestinal obstruction?

A) Fecal impaction
B) Cecal volvulus
C) Paralytic ileus
D) Congenital intestinal atresia
E) Crohn's colitis

Q3: A 55-year-old man who has been constipated for the past 5 days presents with suprapubic colicky pain. On examination his abdomen is distended and there is marked tenderness in the suprapubic region. Bowel sounds are increased. A plain film supine abdominal film shows dilated loops of large bowel. A barium enema shows an 'apple core narrowing' in the rectosigmoid area. The most likely cause of this man's large bowel obstruction is

A) Adhesions
B) Colorectal carcinoma
C) Volvulus
D) Faecal impaction
E) Inflammatory bowel disease

Q4: You see a 55-year-old woman in the emergency department, who was admitted with central colicky abdominal pain and multiple episodes of vomiting. She last opened her bowels 4 hours ago. On examination she appears dehydrated and is in pain. The abdomen is generally tender and slightly distended. Bowel sounds are increased. You suspect a bowel obstruction and decide to order some investigations. What is the most valuable initial investigation that will support your suspected diagnosis?

A) Upper GI endoscopy
B) Colonoscopy
C) Computed tomography scan of the abdomen
D) Plain film radiograph of the abdomen
E) Barium follow-through

Answers

Q1	D	Q4	D
Q2	C	Q5	
Q3	B	Q6	

Extra Questions

439's Quiz

Explanations

Q1 Explanation: The most likely answer here is large bowel obstruction. Pain is usually colicky in nature and is felt commonly in the suprapubic area rather than the central area of the abdomen, which is experienced in small bowel obstruction. Vomiting is usually a late sign in large bowel obstruction, but an early sign in small bowel obstruction. Absolute constipation (not passing faeces or flatus) is an early feature of large bowel obstruction, due to the lower site of obstruction, and a late feature of small bowel obstruction. Abdominal distension is marked in large bowel obstruction and may be absent or slight in small bowel obstruction depending on the level of obstruction in the small bowel.

Q2 Explanation: Intestinal obstruction can be broadly divided into mechanical and paralytic obstruction (also known as paralytic ileus). A paralytic ileus occurs when the intestines are in a complete state of atony. Clinical features include abdominal distension, absolute constipation, vomiting and the absence of intestinal motility (thus bowel sounds are absent). Due to the lack of intestinal movement, colicky abdominal pain is not a feature, unlike what is seen in mechanical obstruction. Postoperative abdominal surgery, peritonitis, trauma, acute pancreatitis, potassium deficiency, uraemia, anticholinergic and antidiarrhoeal drugs are some of the frequent causes of a paralytic ileus. Causes of mechanical obstruction can be divided into:

- Luminal (e.g. faecal impaction, foreign body, intussusceptions, large polyps)
- Intramural (e.g. congenital intestinal atresia, Crohn's colitis, tumours, strictures)
- Extraluminal (e.g. volvulus, adhesions, strangulated hernia, extrinsic compression also known as a 'mass effect')

Q3 Explanation: The apple core lesion seen on the contrast barium enema is highly suggestive of an underlying malignancy, and also the cause of the large bowel obstruction. In the UK, the most common cause of large bowel obstruction is colorectal carcinoma. The colonic luminal diameter decreases as tumour infiltration increases, leading to a narrowing of the bowel lumen, which further results in intraluminal mechanical obstruction of the large bowel.

Q4 Explanation: The abdominal plain film radiograph is a valuable tool and should be the first line imaging investigation in confirming the diagnosis of small bowel obstruction. Barium follow-through, colonoscopy (if mechanical obstruction is suspected, but it carries the risk of perforation) and CT scan are all helpful investigations and can be performed after the initial plain abdominal film is obtained. Upper gastrointestinal endoscopy is not usually helpful in diagnosing small bowel obstruction.

Good Luck!

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