

Malignant bowel obstruction(MBO): what does your surgeon need to know?

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Learning objectives

- To describe the background features and incidence of malignant bowel obstruction (MBO)
- To recognize the features on imaging that determine patient management and stratification to surgical or non surgical management
- To understand the contribution that radiology makes to the management of MBO beyond diagnosis and the recognition of complications

Background

- **MBO**(malignant bowel obstruction) is a common finding in patients with disseminated abdominal or pelvic malignancy
- Overall incidence in around 2% in advanced cancer
 - Seen in 10-28.4% of colorectal cancers
 - 5.5-42% of ovarian malignancies
- Can be seen at
 - Initial presentation
 - As a manifestation of disease recurrence
 - Or be reflective of disease progression

So how do I approach this patient group?

STEP 1 :Is the obstruction truly malignant? If not what is the etiology?

- **True MBO** usually in context of diffuse peritoneal disease
 - Direct obstruction or
 - Secondary to malignant adhesions
 - Most likely however to be a mixed etiology with ileus and mechanical obstruction
 - Can also be totally unrelated and be due to other etiologies e.g. volvulus ,hernia ,adhesions etc.
 - Synchronous lesions or an unresected primary in situ can also cause obstruction
- **Non malignant etiologies**
 - Previous surgery/adhesions
 - After surgery for cancer adhesions account for 21-38% of obstruction
 - Malignant obstruction accounts for 62-79%
 - Intra peritoneal chemotherapy
 - Radiation enteritis
 - Opioids
 - Other typical incidental etiologies such as a hernia,IBD

What is the etiology?

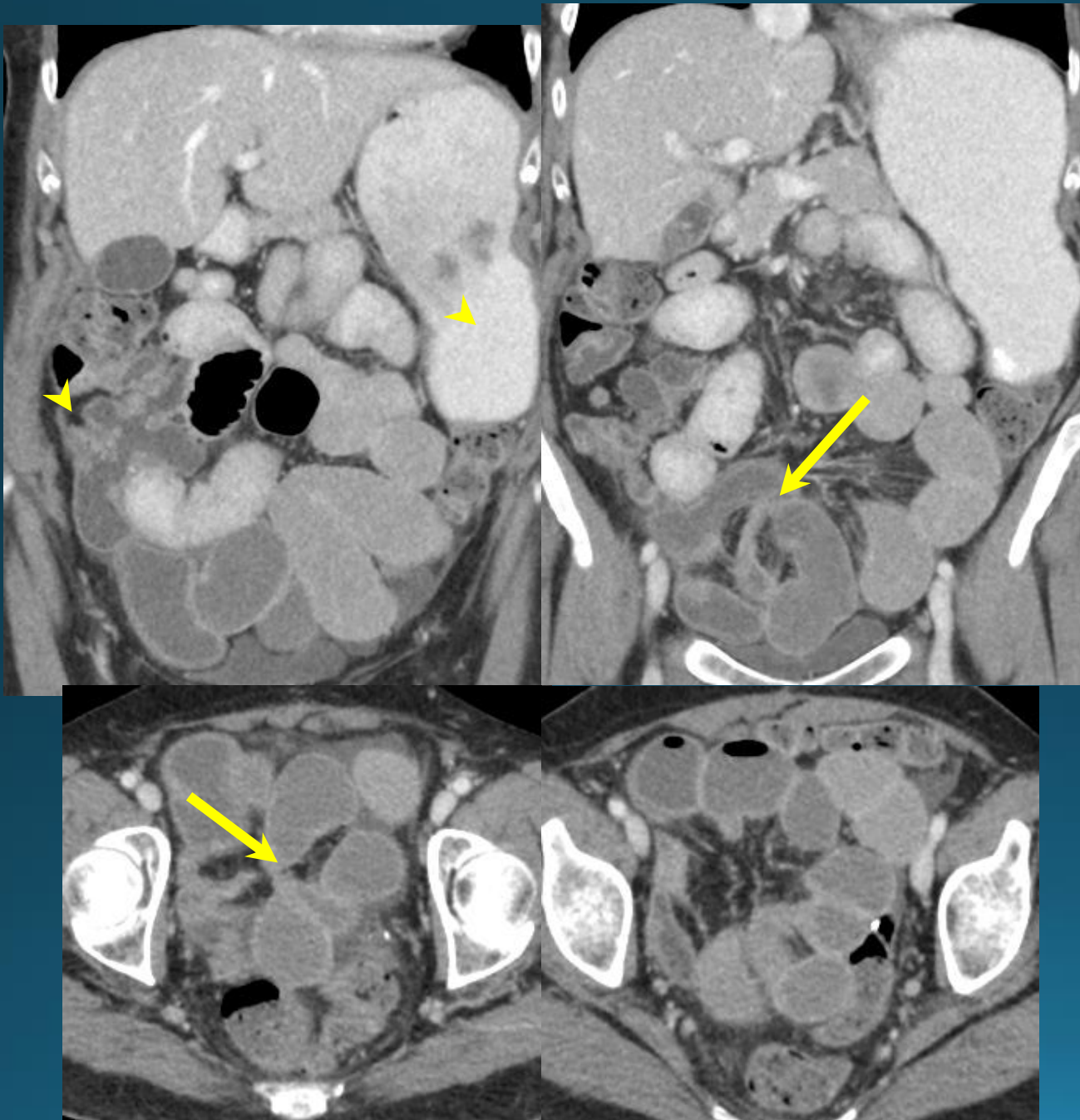
	Benign	Malignant
Peritoneal enhancement	Mild	Moderate to bulky
Obstructing mass	No	Yes
Mural thickening	Segmental or diffuse	Focal often due to a serosal mass

Derived from Low et al¹

Is there a single transition or are there multiple ?

Transition corresponds to the area of calibre change between dilated and decompressed bowel

- Typically is the site where cause for obstruction is apparent
- CT accuracy ranges from **63-93%**



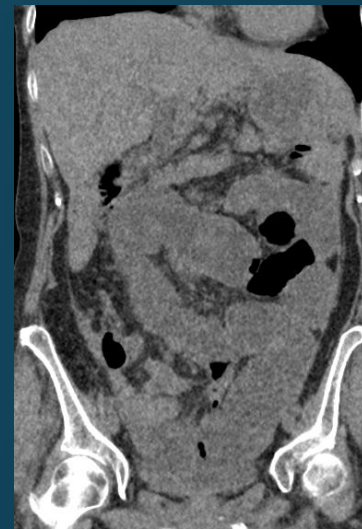
65 year old patient with recurrent ovarian malignancy presents with peritoneal disease and multifocal transitions (arrows) due to serosal disease (arrowheads) and tethering of bowel in the pelvis. Patient was managed conservatively.

Step 2 :Which segment of bowel is involved?

- MBO affects
 - Only small bowel in 61%
 - Large bowel in 33%
 - Combined in 20%
- Which cancers are seen most frequently?
 - Ovary (20-50%)
 - Colon (10-28%)
 - Stomach (6-19%)
 - Pancreas (6-13%)
 - Bladder (3-10%)
 - Endometrium (3-11%)

Which modality ?

Low dose tomogram performed as part of our MBO program



WORKHORSE

• Plain film

- Low cost and readily available
- Diagnostic only in 50-60%
- Sensitivity is high only if grade of obstruction is high

- At our institution **low dose CT tomogram** has replaced plain film and has superior diagnostic confidence for MBO

• CT

- Sens of 92%
- Specificity of 93%
- NPV of 93%
- PPV of 91%

Identifies site and cause of obstruction

Accuracy for detection of transition ranges from 63-93%

Identification of peritoneal disease is less reliable especially when nodules are < 1 cm in size (65.5%)

Less commonly used

- **MRI** superior in discriminating benign vs malignant obstruction

¹

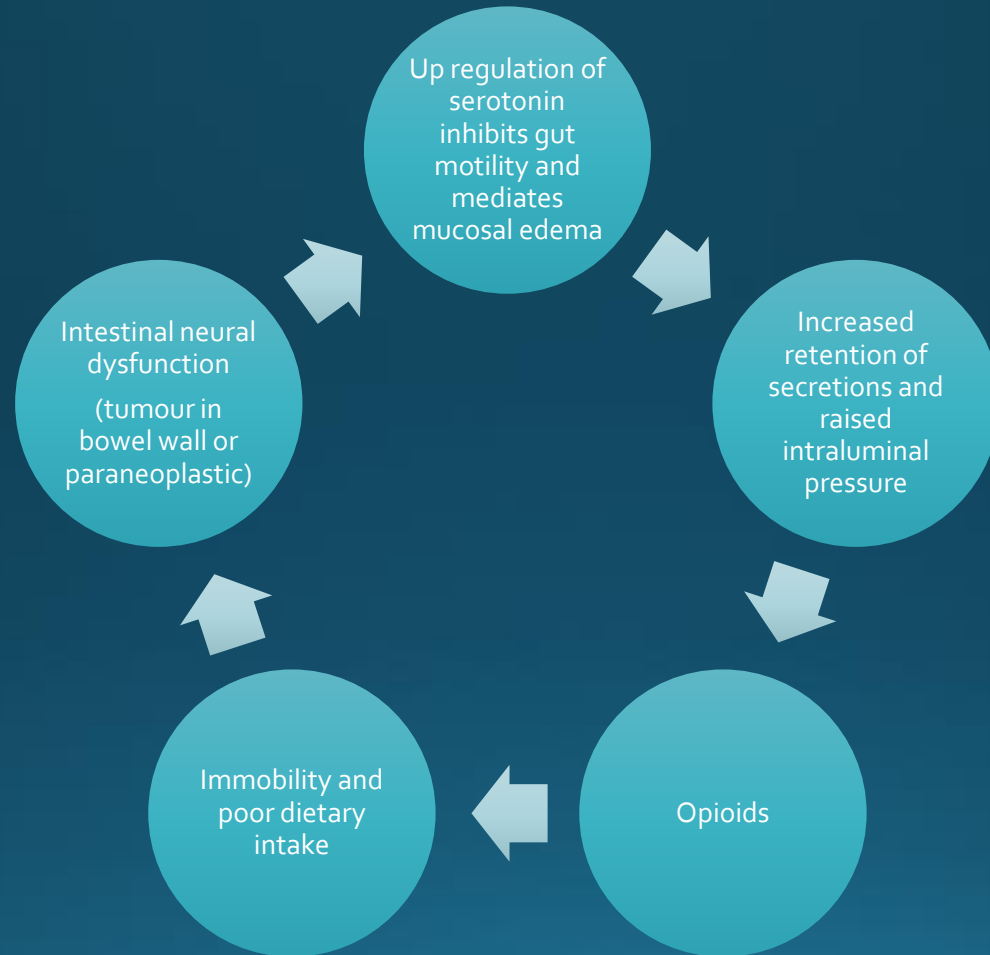
- Level of obstruction sens 93-95%
- Spec of 63-100%
- Predictive value of 81-96%
- Resource scarcity an issue
- Sick patient population not always able to tolerate variables needed for successful exam

TABLE 2
Combined MR Features of Malignant Bowel Obstruction

Obstruction Type	Obstructing Mass	Focal Mural Thickening	Obstructing Mass and Focal Mural Thickening	Obstructing Mass and Moderate or Marked Peritoneal Disease	Focal Mural Thickening and Moderate or Marked Peritoneal Disease	Obstructing Mass, Focal Mural Thickening, and Moderate or Marked Peritoneal Disease
Malignant	7	2	2	4	0	11
Benign	1	0	0	0	0	0

1. Low et al Radiology 2003;228:157-165

Pathophysiology



Step 3 :Confirming the diagnosis

SBO

- Dilated loops of SB >2.5 cm (CT) or >3 cm on X-ray
- SB dilated disproportionate to colon
- Differential air fluid levels
- String of pearls sign(air trapped in folds)
- Relative paucity of gas
- Discriminating high vs low grade obstruction
 - Bowel calibre >36 mm
 - Presence of more than 2 air fluid levels
 - Air fluid levels longer than 2.5 cm
 - Differential A/F levels within the same segment of unequal heights (>5 mm)

LBO

- Normal colon calibre 3-8 cm
 - Other than cecum remainder dilated if >6 cm
 - Cecum if >9 cm
 - Plain film has similar sensitivity for detection of SBO(84 %VS 82%) but specificity is lower and cannot discriminate pseudo-obstruction
- Air fluid levels seen unless hyperacute on upright/decubitus XR
- CT has a sens and spec of 96% and 93% respectively
- Relies on diagnosis of dilated LB proximal to a transition

Technique

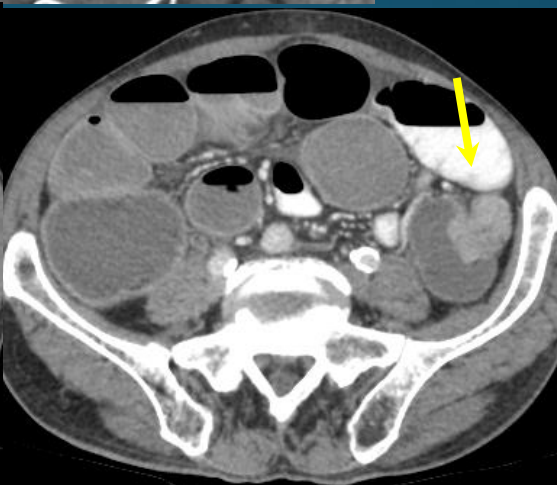
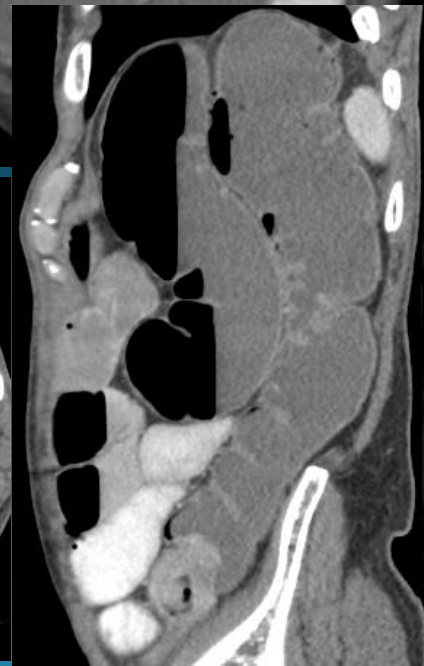
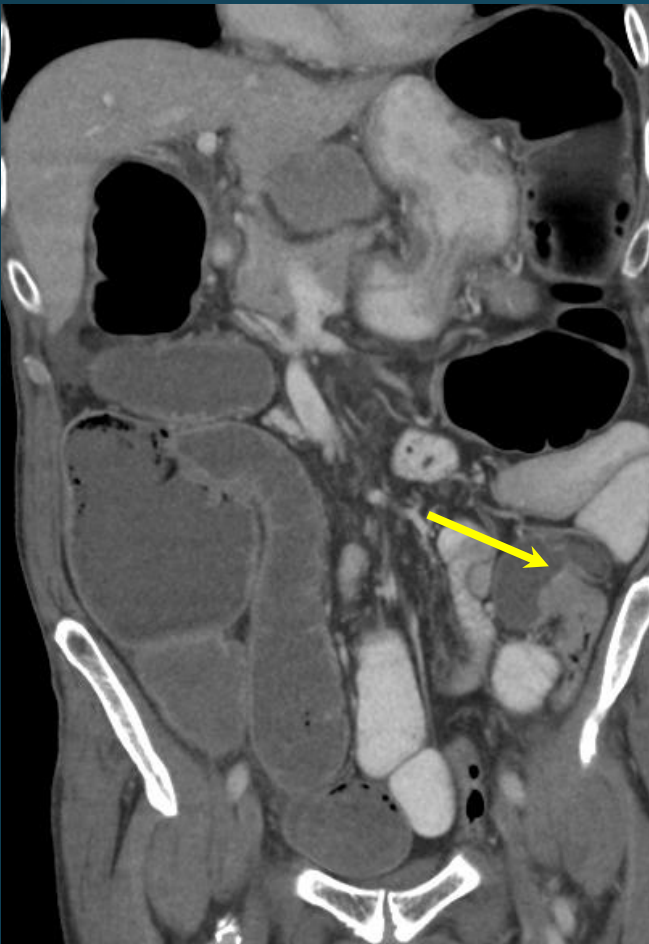
Oral contrast?

- Utility of oral contrast remains controversial in the setting of obstruction and in many institutions is not routinely employed
- In the following settings however it may be useful
 - Partial/low grade obstruction (additional functional information)
 - Perforation with active extravasation of contrast can help define site of leak
 - In setting of fistulas
 - When iv contrast contraindicated see utility in defining serosal disease

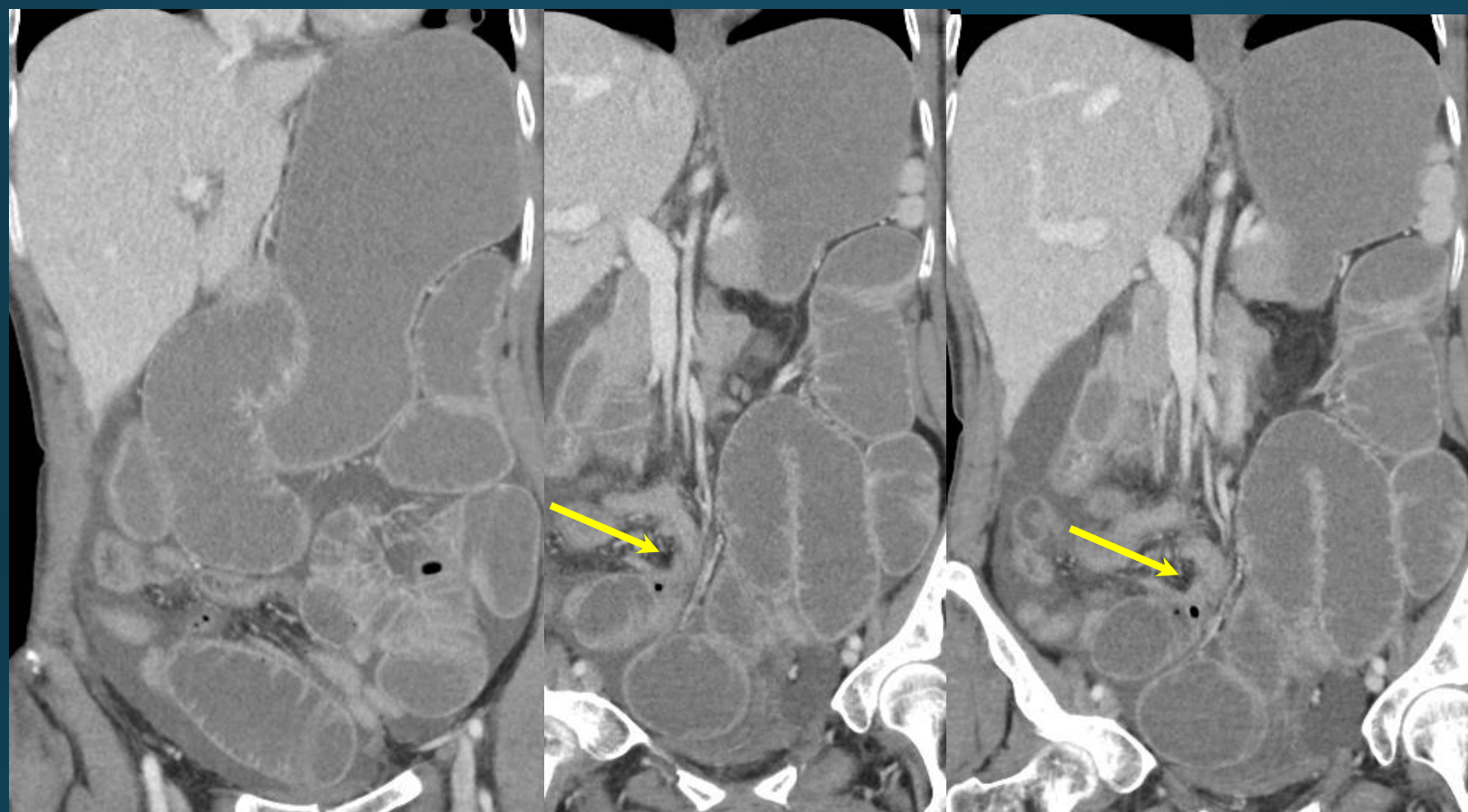


Same patient with NECT and CECT (below) examinations a few weeks apart. Note how serosal disease is appreciated more readily with positive oral contrast and a NECT exam. Patient re-presented with SBO and a single transition (arrow)





54 year old male.
Presents with
obstipation and
abdominal pain
No known history of
malignancy



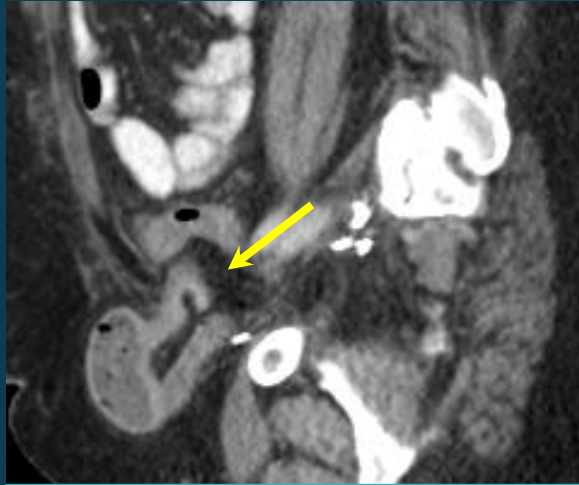
Patient with recurrent pelvic mass (M) following resection of rectal cancer. Presents with high grade SBO(transition marked with arrows)

Note segmental thickening without an obstructing mass classic for a benign adhesion

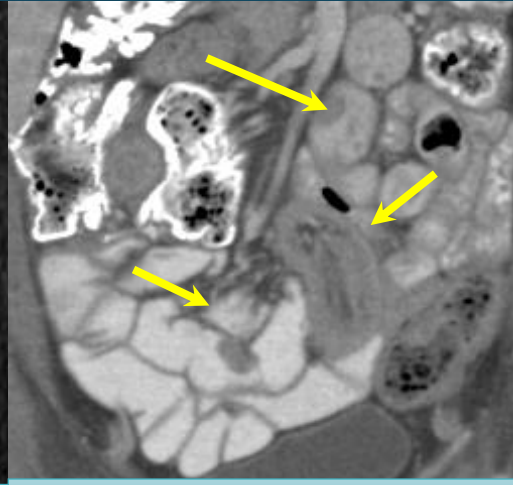


What are possible differentials?

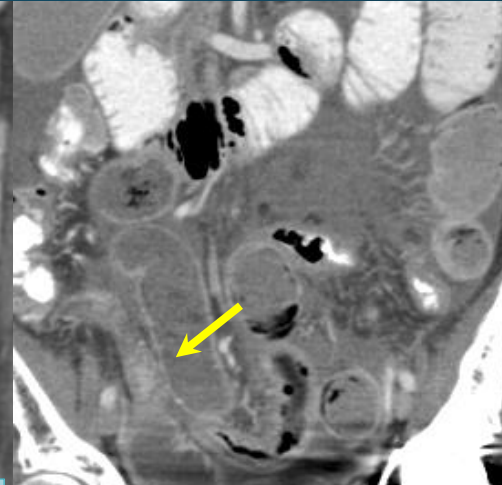
This non exhaustive list includes common etiologies as well as some pertinent to the oncological population



Inguinal hernia with low grade SBO



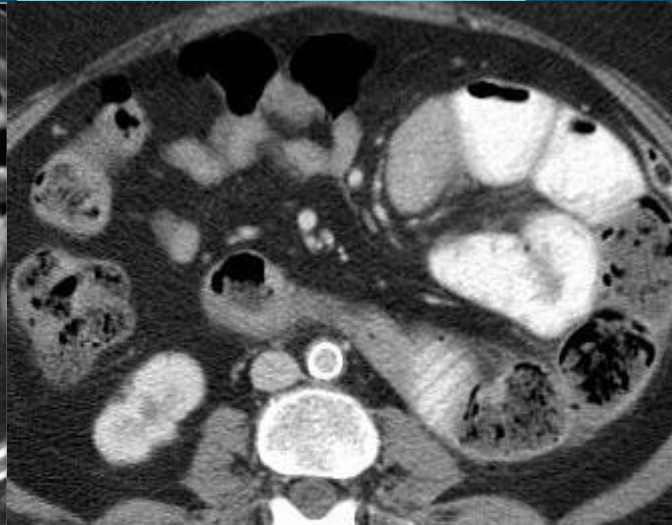
Intussusception in pt with serosal mets from melanoma



Radiation enteritis with SBO



Desmoplastic Rxn due to carcinoid (m)



Internal hernia due to paraduodenal hernia

Step 4 :What is the level and severity of obstruction?

TABLE 1. AAST Grading Criteria for SBO

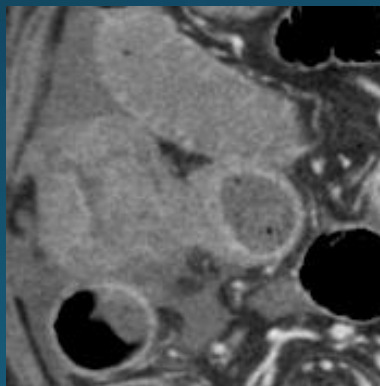
Grade	Description	Radiographic Criteria	Operative Criteria
I	Partial SBO	Minimal intestinal distension	Minimal intestinal distension with no evidence of obstruction
II	Complete SBO; bowel viable and not compromised	Intestinal distension with transition point without bowel compromise	Intestinal distension with transition point; no evidence of bowel compromise
III	Complete SBO with compromised but viable bowel	Intestinal distension with transition point, no distal contrast flow, evidence of complete obstruction or impending bowel compromise	Intestinal distention with impending bowel compromise
IV	Complete SBO with nonviable bowel or perforation with localized spillage	Evidence of localized perforation or free air; bowel distension with free air or free fluid	Intestinal distension with localized perforation or free fluid
V	SB perforation with diffuse peritoneal contamination	Bowel perforation with free air and free fluid	Intestinal distension with perforation, free fluid and evidence of diffuse peritonitis

SB, small bowel.

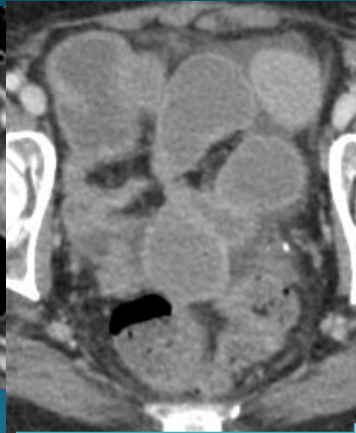
Incomplete/Partial; some fluid or gas pass beyond obstruction

Complete/high grade no fluid or gas beyond transition

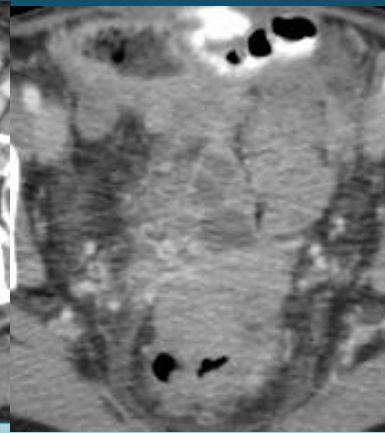
Useful indicator of malignancy as possible etiology



Focal mass



Multi-focality



Moderate carcinomatosis

STEP 5 :Are there any complications present ?

What are the risks ?

- Mortality of SBO ranges from 2-8 % and may be as high as 25% if there is
 - Ischemia
 - Delay in surgical management

What complications can we encounter

- Strangulated obstruction
 - Ischemia, necrosis and perforation
- Closed loop :progressive accumulation of fluid and risk of volvulus and ischemia
- Tumour bowel fistula
- Perforation secondary to high grade obstruction

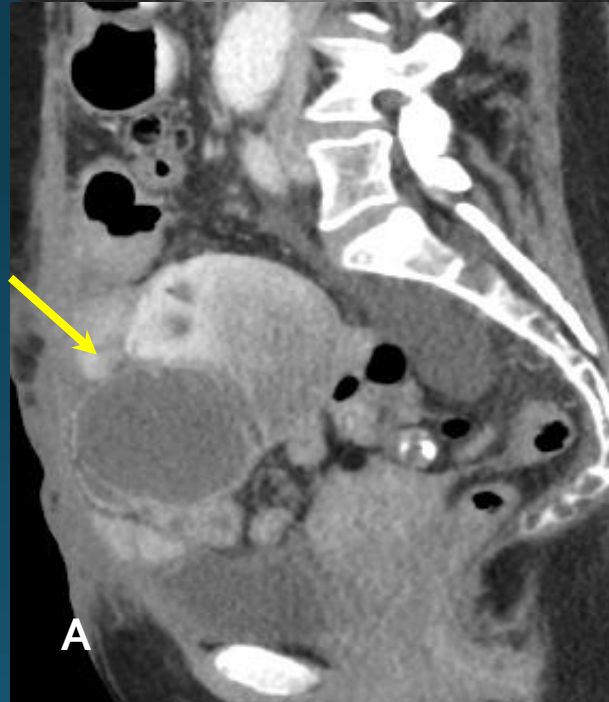
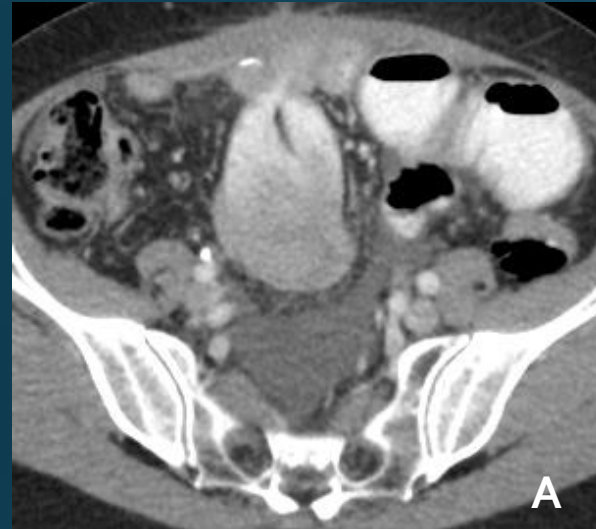
Perforation

- 8-10% of cases of pneumoperitoneum due to malignancy
- CRC comprises 3-10% of all cases
- GI lymphoma increased risk after chemo
- Erosive tumours can result in weakening and perforation of the bowel esp. if long standing obstruction



Localized perforation in a patient with an obstructing mass (M) at the ICV. Note regional peritoneal infiltration and high grade SBO

Closed loop obstruction

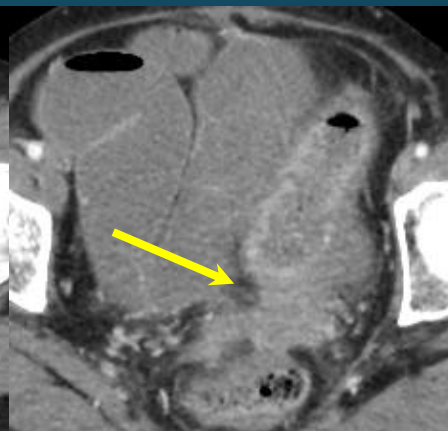
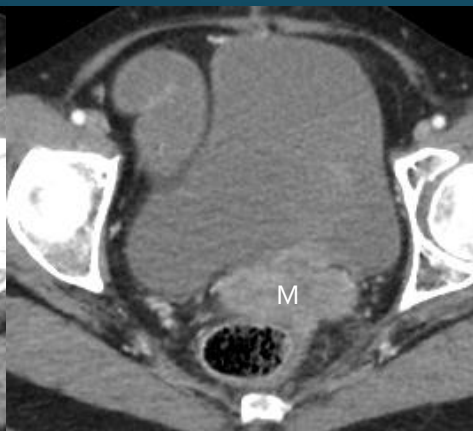
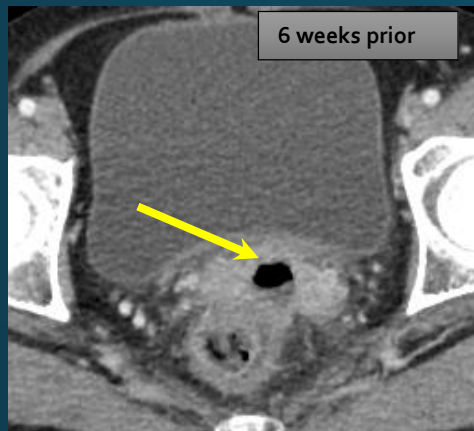


Pt A has a closed loop type morphology due to serosal disease close to the abdo wall tethering loops of bowel. Pt B has a classic radial array seen in a closed loop with ischemia of some of the SB

Close surveillance /watchful management may be appropriate in this patient group

- Typically associated with a segment of bowel obstructed at two points
- Isolated from remaining GI tract
- Two sites lie adjacent/close proximity
- Related to a single constricting lesion that impacts bowel and mesentery
- Obstruction results in progressive fluid distension and impaired venous return →
- Volvulus and resultant ischemia
- In MBO the etiology may be adhesions but remember serosal disease can cause "matting" of multiple loops and predispose to a closed loop.

- Look carefully for **"beak"** sign at level of tethering
- If volvulus present; **whirled** vessels
- **Lumen "track"** on coronal or sagittal plane



Pt with HGSOc (high grade serous ovarian carcinoma). Scan 6 weeks apart shows enlarging mass (M) fistulating between rectum and vagina (air seen) and resulting in LBO



Tumour bowel fistula

- **Communication between bowel and extra luminal malignant mass**

- Could be metastatic deposit
- Or an exophytic primary
- Rapid necrosis of tumour

- **Spontaneous** in advanced cancer

- Invade small bowel ,colon or rectum

- Or seen during course of treatments (chemo or DXT)

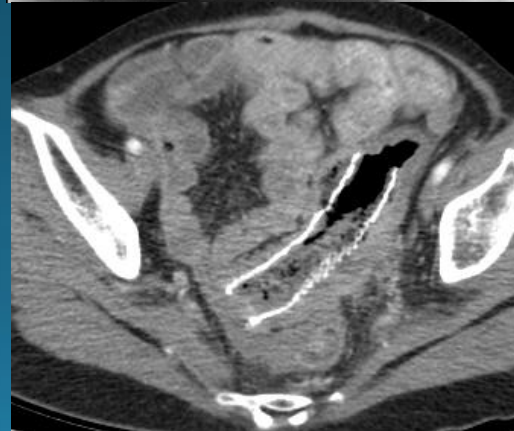
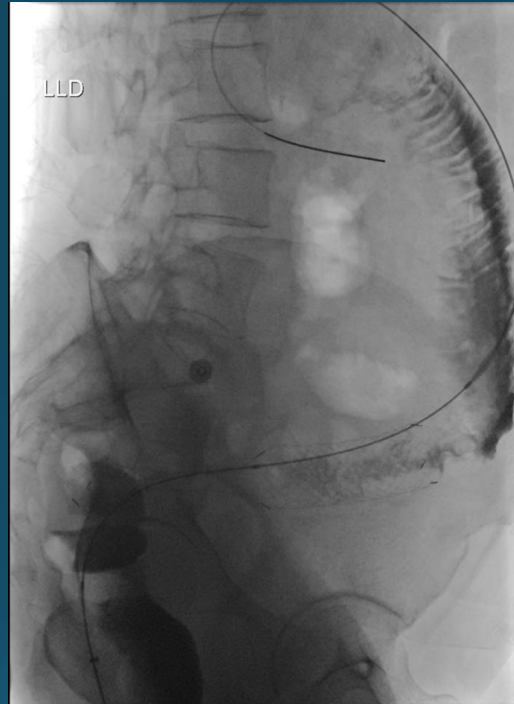
- Often seen with sarcomas

- Associated with MTT (anti-angiogenic agents)

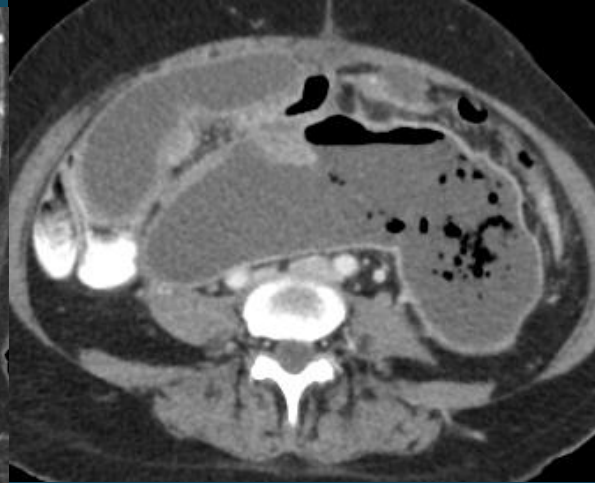
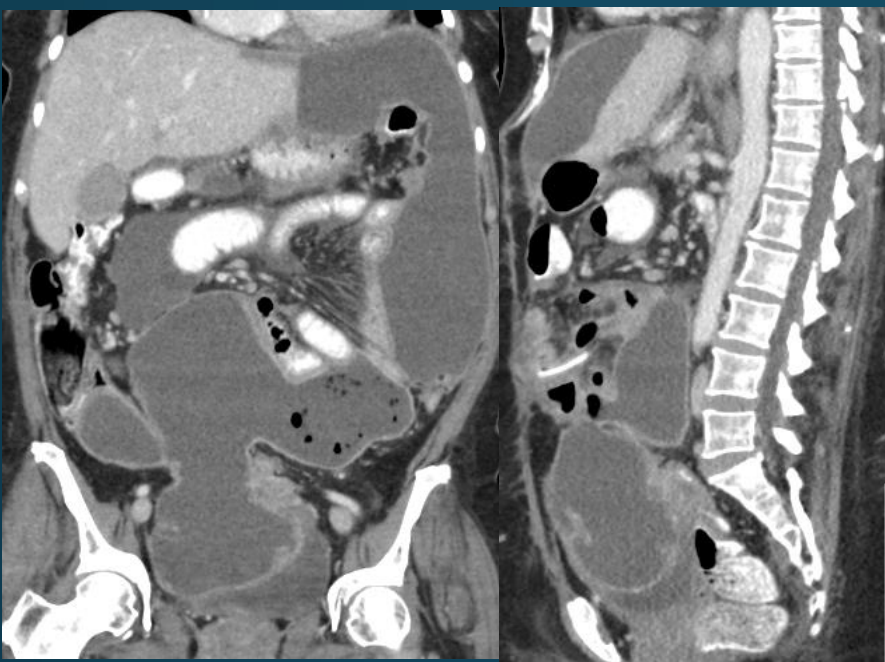
- Can be seen with either response or progression

Management

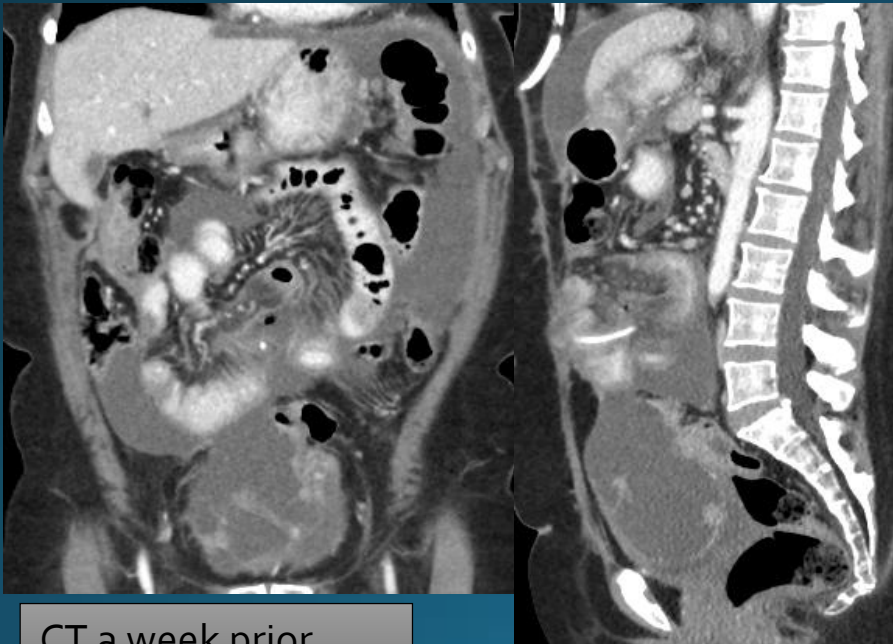
- Alert clinician if tumour abuts bowel
- Suspect if gas seen in lesion
- Be aware of risk if rapid change in size
- Higher risk if pt on anti-angiogenic Rx



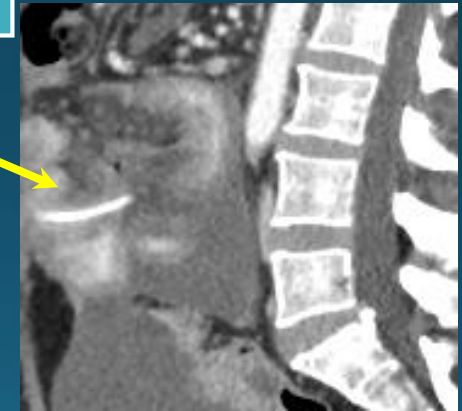
Patient seen on prior slide post stent insertion



Patient with recurrent clear cell ovarian carcinoma present with sudden onset severe abdominal pain. Note findings of re-staging scan performed a week prior .What is the source of the “collections”?



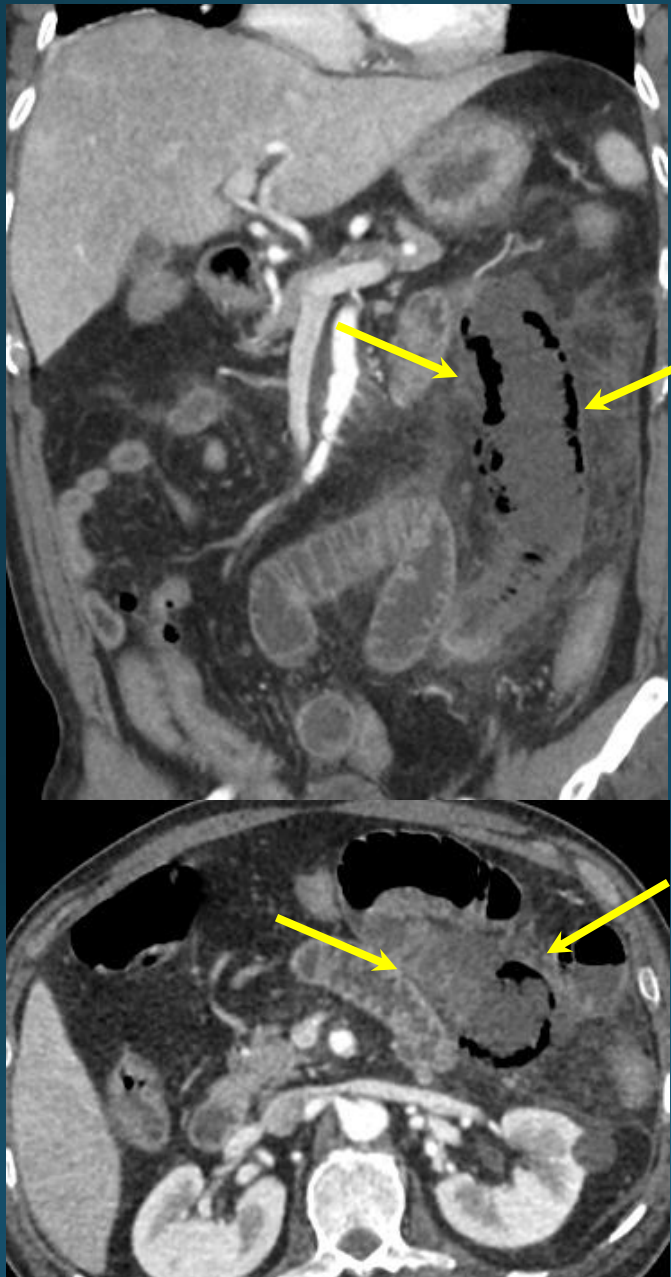
CT a week prior



Note the FB and ingested bone. Our patients are typically given dietary advice when managed as an OP for their recurrent MBO. This patient was non compliant with restrictions!

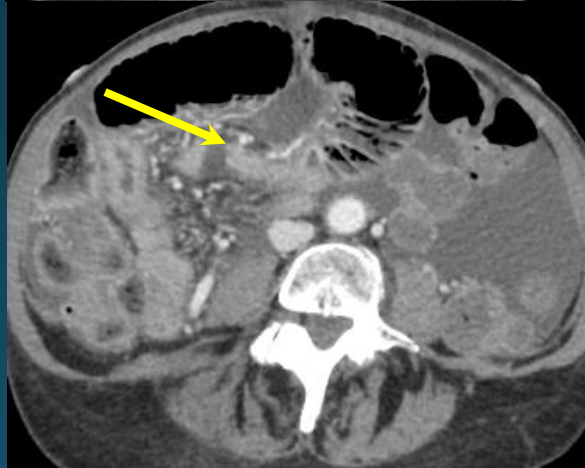
Ischemia

- Ischemia may be seen with strangulation in conjunction with a closed loop obstruction
- Usually $\sim 10\%$ of SBO
- Mortality as high as 25%
- In setting of delayed diagnosis or surgical delay
- CT sens varies between 75-100%
- Spec 61-93%
- Findings include
 - Bowel wall thickening $> 3-8$ mm
 - Mesenteric edema/fluid
 - Decreased bowel wall enhancement
 - Pneumatosis $\pm$ mesenteric/PV gas



Note pneumatosis, mesenteric edema and non enhancing bowel wall in this ischemic segment of jejunum

Is the patient a surgical candidate?

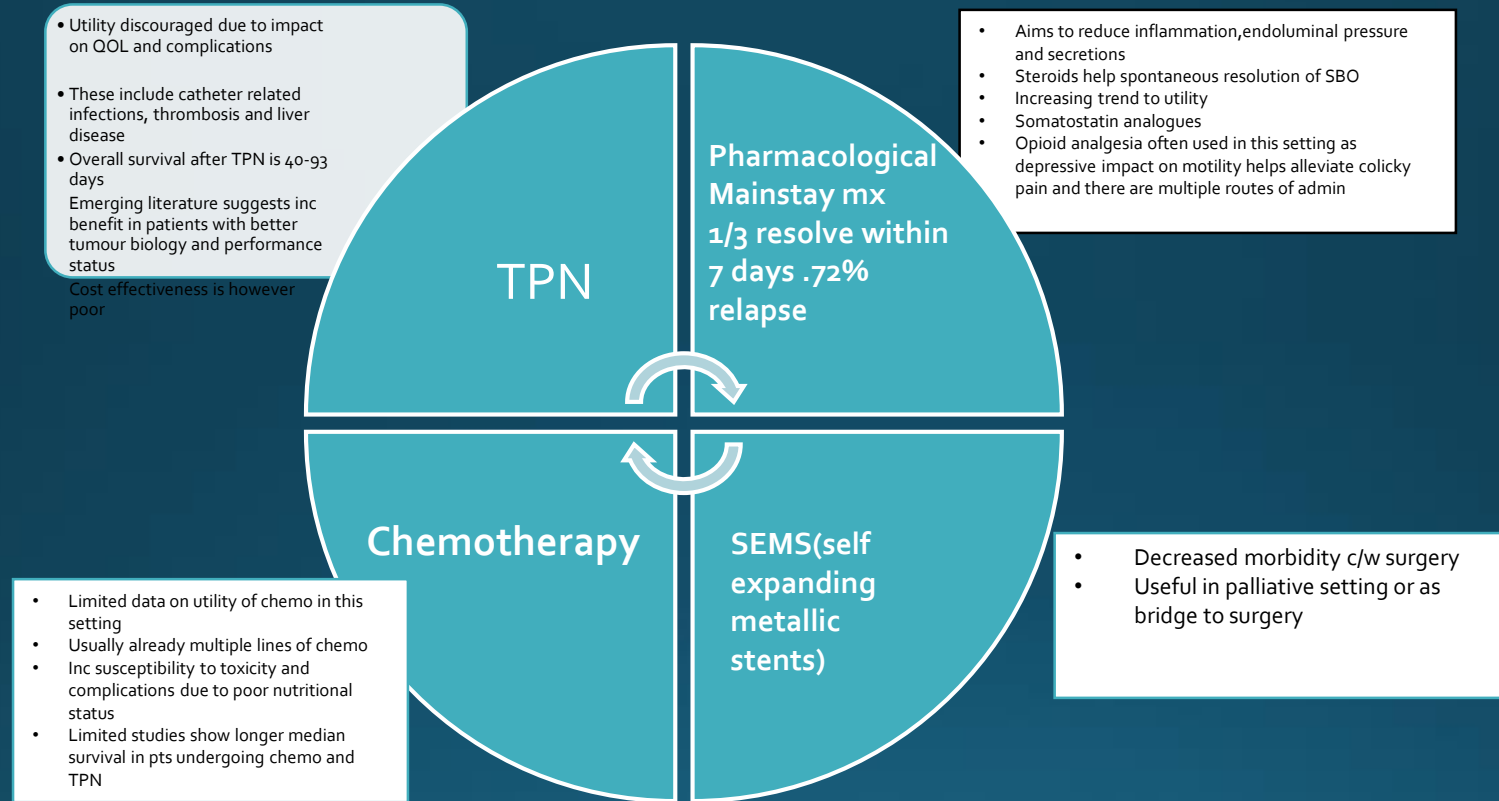


Patient with jejunal obstruction not suitable for surgery due to proximal transition and extensive PC

- LBO assocd with sig morbidity and risk of
 - Perforation
 - Death
 - Conservative Mx not appropriate
 - Typical approach is diverting stoma rather than a bypass or primary anastomosis
- SBO
 - Without strangulation can be Mx conservatively
 - Esp when multifocal disease
 - Minority of patients considered for resection/bypass
- Review of 868 pts with MBO
 - Surgery palliated symptoms (32-100%)
 - Allowed modified diet (45-75%)
 - Succ discharge home 34-87%
 - Another study ¹ comp medic and surg Mx found surgical group had
 - Longer median survival ($p=0.025$)
 - Shorter hospitalization ($p=0.02$)
 - More effective pain response ($p=0.001$)
 - Lower rate of re-obstruction ($p=0.02$)
- Role of surgery remains controversial and should be considered on individual basis on those with favourable risk

Good candidate	Not suitable
Good performance status	Poor performance status
Longer TFS	Intra-abdominal carcinomatosis
Absent/small volume ascites	Massive ascites
Single site disease	-
Albumin level	-

What are non operative management options ?



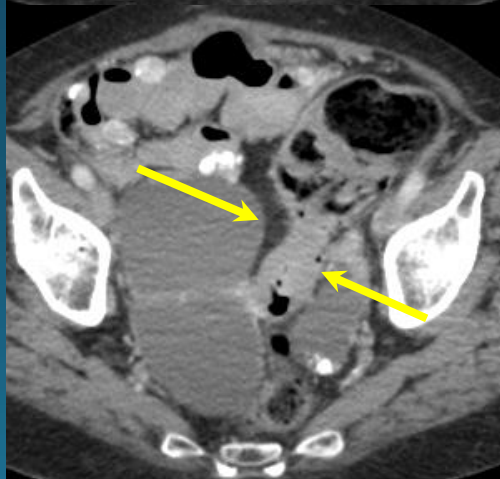
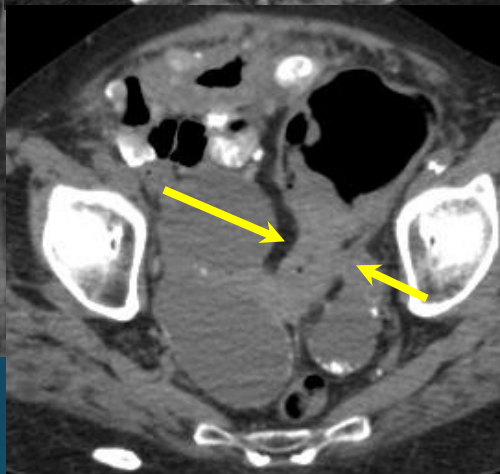
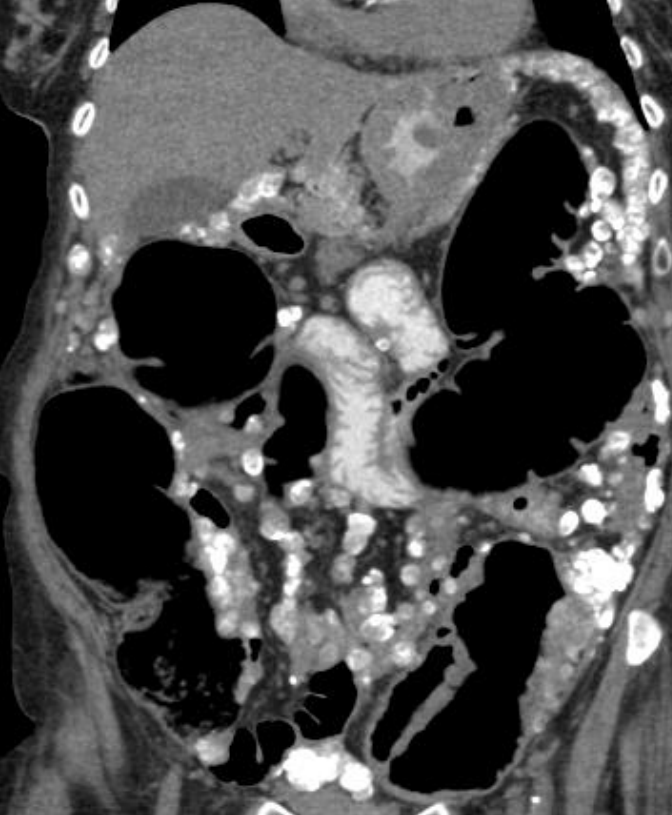
Self expanding metallic stent

General principles

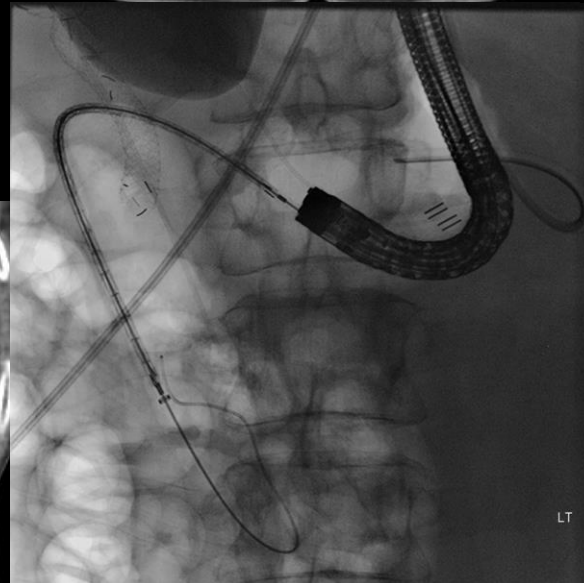
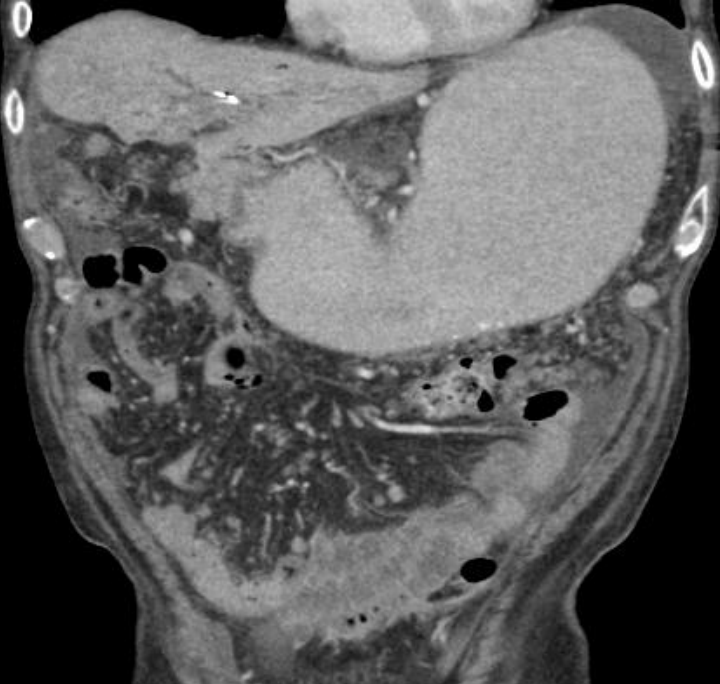
- Consider if
 - Single point of obstruction on imaging
 - Provides symptomatic relief especially in patients
 - Medically unfit
 - Declined surgery
 - Specific issues
 - Duodenal stent with gastric outlet obstruction associated with lower complications than GJJ
 - Mean survival shorter than GJJ (105 vs 164 days)
 - Higher rate of recurrent obstruction (18% vs 1 %)

Colonic Stent

- Controversial
 - Higher risk of peri-procedural perforation
 - Risk of tumour dissemination
- In selected cohort proven benefit
 - Unresectable disease
 - Not suitable for resection due to comorbidities
- Higher rates
 - Re-intervention is 30.8%
 - 11% required a stoma



Patient with LGSOC presents with obstructive symptoms. On NECT note annular narrowing of sigmoid colon with diagnostic CT (with contrast a few weeks prior for comparison). There is increasing LB distension

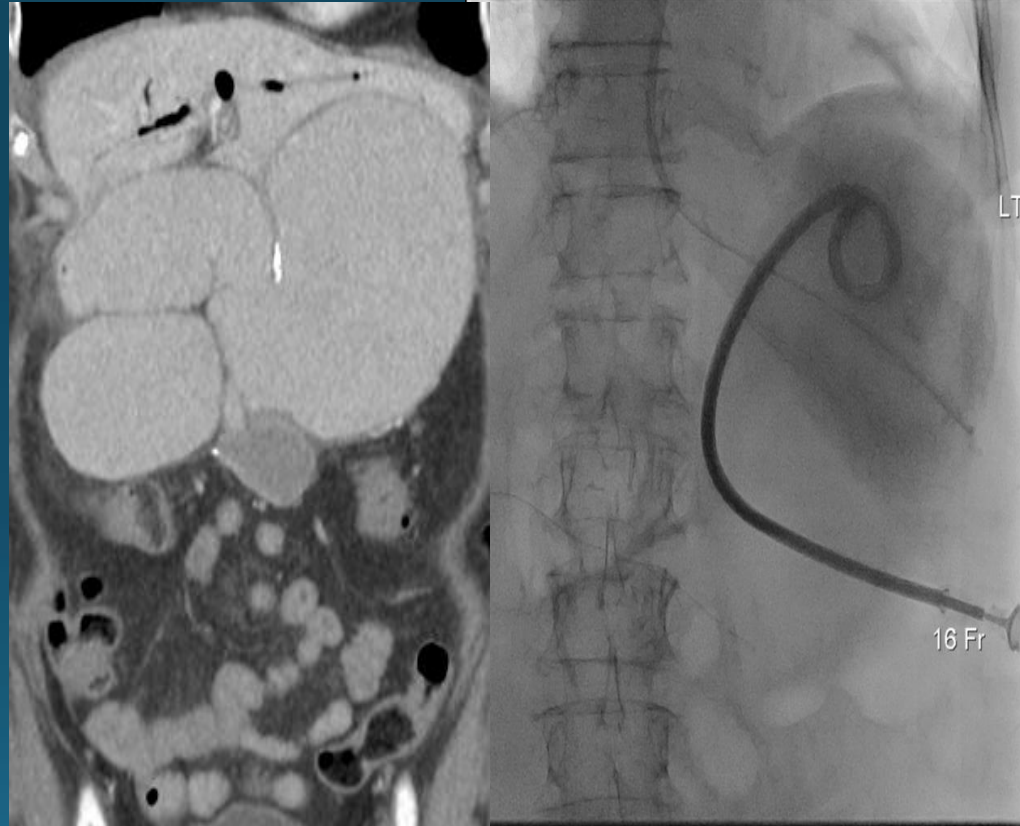


Patient with metastatic GB carcinoma presents with symptoms of nausea and abdominal "fullness". CECT shows increasing gastric distension due to peri gastric infiltration(arrows)

Post
stent CT

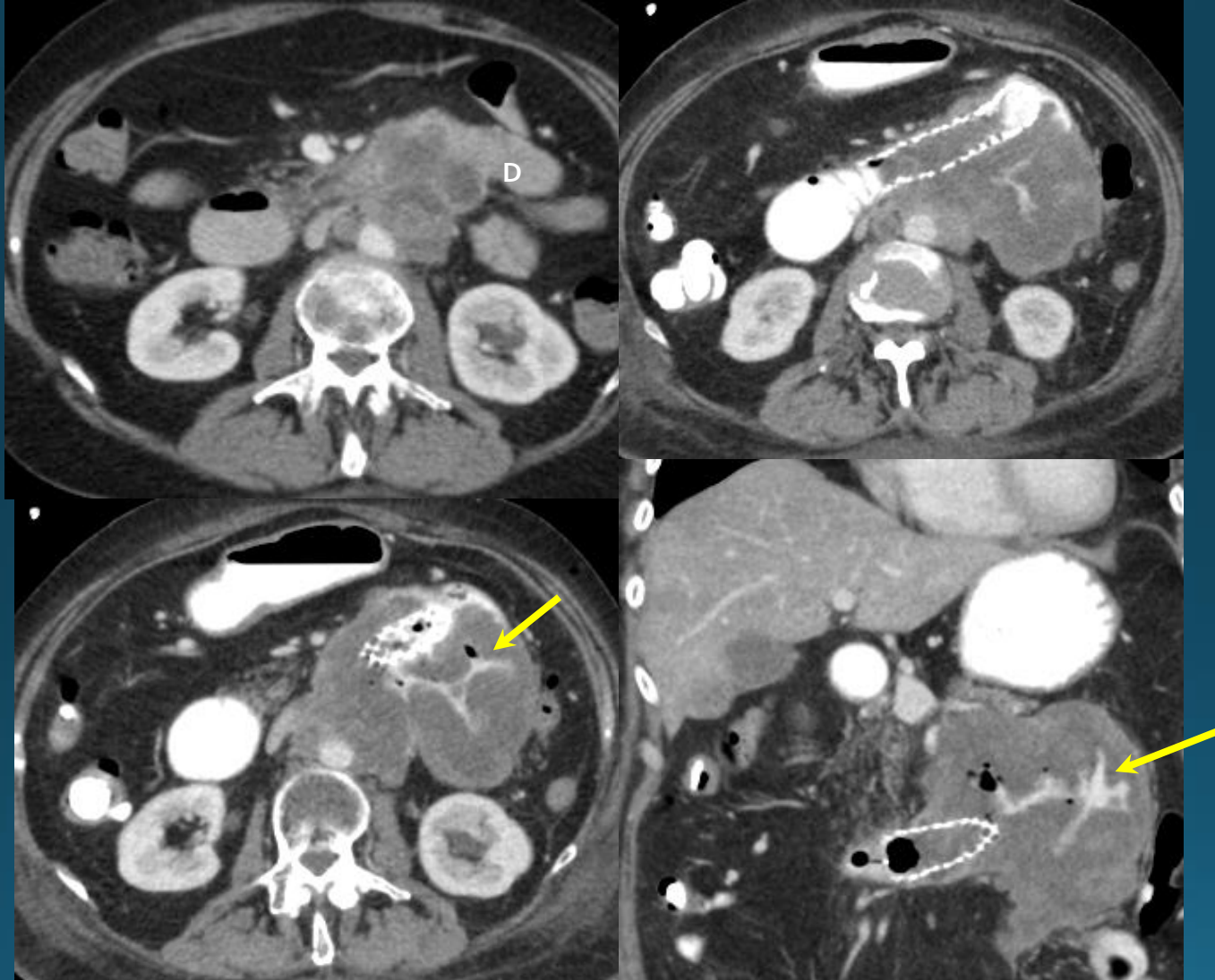
Percutaneous gastrostomy

- Intractable vomiting
 - Challenging to manage with long term NGT
 - Issues such as misplacement, dislodgement and need for check of position render long term usage unwieldy
- **Venting gastrostomy**
 - Can aspirate gastric contents
 - Has good symptom relief
 - Avoids repeat NGT/admission in 96%
 - Reduces polypharmacy burden
 - Allows modified diet
 - Allows OP discharge
 - Mean survival of 63 days post procedure



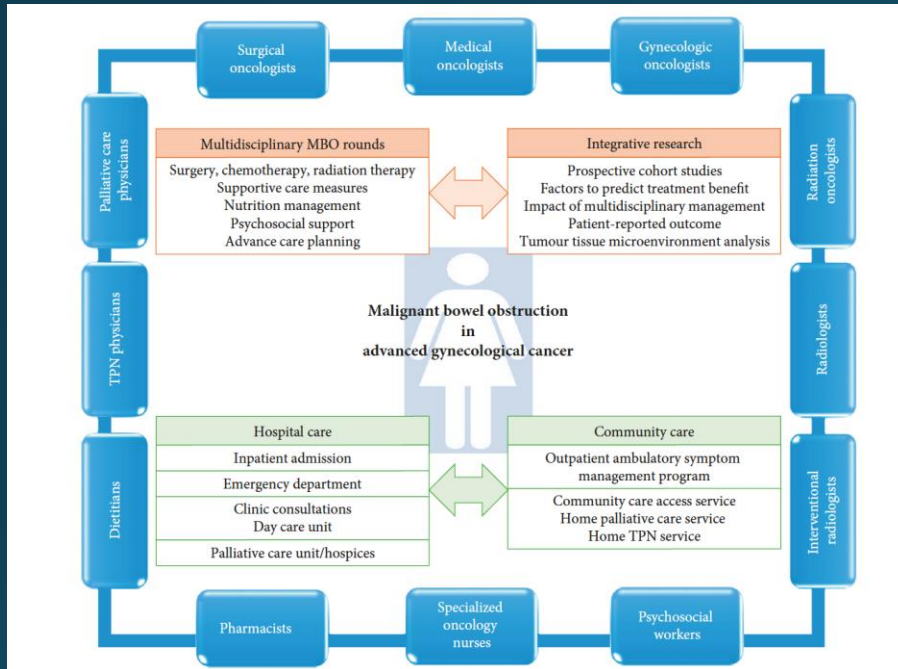
Pt with met pancreatic adenocarcinoma and proximal SBO and gastric outlet obstruction due to peritoneal disease

Post procedural complications



Patient with uterine sarcoma presents with duodenal invasion secondary to a nodal mass (image A). Following duodenal stent placement note the presence of a fistula between the duodenum and tumour mass (dense oral contrast is seen centrally as well as air (arrows))

Our institutional experience



- We have a inter-professional MBO program
 - Nurse led ambulatory service
 - Inpatient algorithm for management
 - Patient directed approach
 - Discussion in the 2 years since program commenced has resulted in management change in 54% of patients
 - Length of stay was sig shorter (14 vs 23 days) in those in program compared with baseline controls



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Conclusion

- Complex group of patients with potential for
 - Catastrophic complications
 - Multiple potential etiologies for bowel obstruction
- Considered and logical approach to image interpretation
 - Adds **value** in Multi disciplinary setting
 - Significantly impacts patient management
 - And improves overall QOL and has potential to reduce length of admission
 - Recurrent issue so health economic benefit
- Interventional radiology has the potential to
 - Minimize operative management
 - Provide symptom relief in the palliative setting

