Plain abdomen

The standard films are supine & erect AP views (alternative to erect, lateral decubitus film is used in ill patients).

The stomach can be readily identified by its location, gastric rugae in supine patient & by the air-fluid level beneath the left hemidiaphragm in erect patient.

The duodenum contains air usually & show air-fluid level. In the small bowel, gas is rarely sufficient to outline the whole of a loop. Short fluid levels in the small & large bowel are normal.

**How to look at plain abdominal film:**

- Look for any dilated loops of bowel & try to decide the dilated portion.
- Look for any gas outside the bowel.
- Locate any calcifications (if any).
- Look for ascites or soft tissue masses.
- Assess the size of the liver & spleen.

**Dilatation of bowel:**

- Colonic haustra (usually seen in the transverse & ascending colon) form incomplete bands across colonic gas shadows.
- Small bowel (SB) valvulaeconniventes (noted in dilated jejunum) are closer than haustra & cross the width of bowel (stack of coins). Remember that the sigmoid & ileum are smooth & may be similar.
- The radius of curvature; when tighter, it suggests a dilated small bowel loop.
- The presence of fecal material is reliable indicator of the position of the colon.
- The small bowel usually lies centrally while the large bowel lie peripherally (remember that the transverse & sigmoid colon may lie centrally when dilated).
- Numerous layered loops are often seen in small bowel dilatation, but not present in large bowel (LB) dilatation.

**Causes of dilatation:**

1. Mechanical SB obstruction: small bowel dilatation with normal or reduced caliber of colon.
2. LB obstruction: dilated colon to the point of obstruction +/- SB dilatation (if the ileocecal valve is incompetent).
3. Paralytic ileus: SB & LB dilatation (gas may be present in the rectum).
4. Local peritonitis: dilatation of loops adjacent to inflammation.
5. Toxic dilatation of the colon (in ulcerative colitis & rarely in Crohn's disease): distended LB especially the transverse colon (diameter > 6 cm) with grossly abnormal haustra or absence of haustration.
6. SB infarction may mimic both SB & LB obstruction.
7. Closed loop obstruction (if contains air), it is seen in a characteristic shape e.g. cecal or sigmoid volvulus.

NB: Patients with gastroenteritis may have normal film, or show excessive fluid levels with or without dilatation (mimicking paralytic ileus or SB obstruction)

**Gas in the peritoneal cavity (pneumoperitoneum):**

Is almost always due to GIT perforation or follows surgical intervention in the abdomen.

The most common cause of spontaneous pneumoperitoneum is a perforated peptic ulcer & 2/3 of such cases are recognizable radiologically.

Largest pneumoperitoneum occurs in colonic perforation & smallest in SB perforation & very rare in perforated appendicitis.

Pneumoperitoneum is seen as air under the right hemidiaphragm on an erect abdominal film or CXR, but air under the left hemidiaphragm is more difficult to identify because of overlying gastric & splenic flexure gas.

CXR is preferable to erect plain abdominal film & sometimes lateral decubitus film is required to confirm the presence of pneumoperitoneum (collected beneath the flank).

Post-operatively, pneumoperitoneum is normal finding (even after laparoscopy). In adults, it will absorb with 7 days & in children within 1 day. An increase in amount of air on successive films indicates leakage.

**Gas in an abscess:**

May form either small bubbles or larger collections of air (both can be confused with bowel gas). Fluid levels may be seen on a horizontal ray film. Abscesses may displace adjacent structures (e.g. elevation of a hemidiaphragm in subphrenic abscess & bowel displacement in pericolic & pancreatic abscesses).

Pleural effusion or pulmonary collapse/consolidation occur in subphrenic abscess.

US, radionuclide examination & CT are used in evaluating abdominal abscesses.
**Gas in the bowel wall:**
- Oval gas bubbles in bowel wall are seen in pneumatosis coli,
- Linear streaks of intramural gas usually indicate bowel infarction.
- If noted in the neonatal period is diagnostic of necrotizing enterocolitis.

**Gas in biliary tree:**
- Following sphincterotomy
- Anastomosis of CBD to bowel
- Also seen in fistula from erosion of GB stone into duodenum or colon or following penetration of DU into CBD.

  Occasionally, gas may be seen in the wall or lumen of GB in acute cholecystitis from gas-forming organisms.

**Ascites:**
Small amount can not be detected by X-ray, while large amount will separate bowel loops & displace the ascending & descending colon from fat stripes. SB loops float to the centre of abdomen.

  Ascites is more readily recognized at US or CT.

**Abdominal calcifications:**
- Localize the calcifications using a lateral or oblique view.
- Assess the pattern & shape of calcification to limit the diagnosis.
- The most common calcifications are of little or no significance to the patient

**Causes:**
1. Pelvic vein phleboliths may be mistaken for urinary stones &faecoliths.
2. Calcified mesenteric LN: as in TB causing irregular calcification & very dense & are often mobile.
3. Vascular calcification e.g. aortic aneurysm (easier to be assessed on lateral film).
4. Uterine fibroids: spherical outline & contain numerous irregularly shaped well defined calcifications.
5. Soft tissue calcification in buttocks e.g. after injection of certain medicines.
6. Malignant ovarian tumors occasionally contain visible calcification. Dermoid cyst may contain teeth.
7. Adrenal calcification: e.g. after hemorrhage, TB, adrenal tumors. Minority of patients with Addison disease show adrenal calcifications.
8. Liver calcification: hepatomas, hydatid cyst, abscess, TB.
9. GB stones.
10. Splenic calcifications: in cysts, infarcts, old hematomas, & TB.
12. Faecolith: in colonic diverticulae or in the appendix (indicating the presence of acute appendicitis)
13. Urinary stones & other renal calcifications.

**Plain films of liver & spleen:**
As the liver enlarges, it will displace the hepatic flexure, transverse colon & right kidney downwards & the stomach to the left & the diaphragm may be elevated.

As the spleen enlarges, the tip may be visible in the left upper quadrant below the lower ribs, eventually may fill the left abdomen & may extends to the right lower quadrant displacing the splenic flexure, left kidney & stomach.

**Abdominal & pelvic masses:**
US, CT or MRI are the appropriate imaging modalities.

The site, displacement of adjacent structures & calcifications are the radiographic signs of a mass, but it cannot differentiate between solid & cystic masses.

Examples: enlarged bladder, uterine, ovarian enlargement can be seen as a pelvic mass displacing the bowel.

Retroperitoneal tumors & LN may become visible on plain films & may mask the psoas outlines.

Renal masses & hydronephrosis can appear as masses in the flank.

**CT, MRI & US examinations:**
CT show the whole width of bowel wall & used for diagnosing (especially in elderly where Ba enema & endoscopy may be unpleasant) & staging tumors & for assessing the complications of GI disease & surgery. It can be used to confirm or exclude appendicitis, intestinal obstruction & in bowel trauma.
MRI has a limited role in GIT disease, its major use is for assessing the local spread of rectal cancer & assessing perianal fistula & abscess formation.

US can assess bowel wall & detect ascites (not the mucosa), can also be used for the diagnosis of infantile pyloric stenosis, intussusception & suspected appendicitis. Endoscopic US is used to assess the depth of invasion of tumors in bowel wall & in diagnosing tumors of pancreas.

**Contrast examinations:**
Barium sulphate is the best contrast for GIT (with good mucosal coating & excellent opacification & being inert); its disadvantage is that it may impact proximal to colonic or rectal stricture.

Water-soluble contrast media (e.g. gastrograffin) are the other available agents. Gastrograffin is hypertonic (soon become diluted), less radio-opaque & irritant if enter the lungs. Its major uses are GIT perforation, immediate post-operative examinations, in specific conditions in pediatric patients & for GIT opacification prior to CT of the abdomen.

Contrast examinations are carried out under fluoroscopic control (so that only constant narrowing is filmed while peristaltic waves are transitory & not filmed).

Double contrast are the standard techniques used in contrast studies, where the mucosa is coated with barium & the lumen is distended by air, often in combination with an injection of smooth muscle relaxant.