

ABDOMINAL RADIOGRAPHY

INDICATIONS

- Vomiting
- Abdominal pain
- Regurgitation
- Abdominal masses
- Diarrhea
- Hematuria/dysuria
- Tenesmus
- Herniation
- Rectal bleeding
- Suspected foreign body
- Staging of neoplasia
- Others

TECHNICAL FACTORS FOR ABDOMINAL RADIOGRAPHY

- Adequate restraint
- Obtain enough view – at least 2 views at right angle
- Include diaphragm and pelvic inlet
- Use grid when abdomen is greater than 9cm in thickness
- Make exposure at expiratory pause to avoid motion artifact.

HINTS ABOUT INTERPRETING ABDOMINAL RADIOGRAPHS

- You may use regional or organ approach
- Spine, caudal thorax and other intra-abdominal structures should be examined first
- Begin examination with large solid organs like the liver, spleen, kidneys etc.
- Identify visible portions of GI tract
- Mentally check off organs that are not usually seen and look for them.
- Look for unusual opacities that cannot be readily identified.

ABDOMINAL STRUCTURES NORMALLY VISUALIZED ON SURVEY FILMS

Stomach	Caecum
Urinary bladder	Spleen
Duodenum	Liver
Prostate gland	Caudal ribs
Small intestine	Kidneys
Diaphragm	Pelvis
Colon	Body Wall

ABDOMINAL STRUCTURES NOT NORMALLY VISUALIZED ON SURVEY FILMS

Adrenal glands	Ovaries
Mesentery	Uterus
Mesenteric lymph nodes	Ureters
Omentum	Abdominal aorta
Pancreas	Abdominal venacava
Gall bladder	

ROENTGEN SIGNS TO LOOK FOR

- Do the organs have their expected relative opacity?
- Is there an unusual opacity?
- Do the organs have a normal shape?
- Is there a change in the position of the organ?
- Do the organs have abnormal margins?
- Are there abnormal intraluminal or extra-luminal opacities

A WORD ABOUT RADIOGRAPHIC OPACITIES

- It is determined by chemical composition.
- Absorption of x-ray is a factor of subject density and thickness
- X-ray will turn the film black

- Structures that absorb x-ray will be white or light grey (radiopaque).
- Structures that do not absorb x-ray will be black or dark grey (radiolucent).
- When two structures of the same opacity are in contact, the confluent borders cannot be distinguished (silhouette sign).
- If two structures are superimposed, their opacities will be added together creating a summation effect.

ABDOMINAL OPACITIES

- All abdominal organs are fluid opaque, so subject contrast is poor.
- Fats surrounding organs allows serosal surface to be seen.
- Intraluminal gas allows mucosal surfaces to be seen and permits identification of intestinal loops.
- Subject contrast is best seen in fat or obese animal. However there is loss of detail in too large animal due to scatter.

DECISION MAKING FOLLOWING ABDOMINAL RADIOGRAPHY.

- Make a list of differential diagnosis.
- Decide on additional views or contrast radiography.
- Additional imaging procedure such as ultrasound, CT, MRI etc.
- Additional diagnostic procedure such as biopsy, laparotomy.
- Are we ready to treat?

CONTRAST RADIOGRAPHY

- Contrast media is required because of poor subject contrast in the abdomen.
- Contrast media are given to visualize organs or organ system.
- Negative contrast media include gases such as air, CO₂ NO₂ etc.
- Positive contrast media include barium sulphate, ionic and non-ionic iodides.

- Double contrast procedures involved the use of both positive and negative contrast media.

BARIUM SUPHATE

- Less expensive than iodine
- Provides excellent mucosal coating
- Not absorbed or diluted
- Stays in suspension.
- Sometimes results in remission of clinical signs even when a diagnosis is not reached.
- Causes a fulminating granulomatous inflammatory reaction in the peritoneal cavity.
- Creates added complication if surgery is necessary although its use does not preclude surgery.
- Can cause problem if a large amount is inhaled. Thus use stomach tube to administer.
- Slower transit than iodide.

Ionic organic iodide

- Water soluble
- Innocuous in peritoneal cavity
- Rapid transit in GI tract.
- Poor mucosa coating
- Hypertonicity causes fluid to enter the GIT to dilute it.
- Can lead to dehydration or hypovolemic shock.
- Irritation and subsequent diarrhea can occur.
- Can cause pulmonary edema if inhaled.

N.B: Non-ionic organic iodide (include iohexol, iopamidol, iogenol) has the advantage of organic iodide and are not hypertonic. However they are relatively newer.

Types of contrast technique

- Esophagram
- Upper gastro-intestinal series
- Lower gastro-intestinal series
- Pneumocolography
- Double contrast barium enema
- Excretory urography
- Cystography
- Pneumocystography
- Double contrast cystography
- Urethrography
- Celiography
- Pneumoperitoneography
- Cholecystography
- Contrast studies of the reproductive tract.

A) Abdominal Gases (Decreased Peritoneal Opacity)

- Causes of free abdominal gas include (i) Penetrating wound (ii) Post operative abdomen and (iii) rupture of hollow organs. Other conditions include over-exposed film or over-developed film
- Free abdominal gas result in decrease peritoneal opacity but increase abdominal contrast.
- Small abdominal gas may produce unusually shaped or sharply pointed shadows or the gas may abut peritoneal reflection.
- Finding unusually shaped gas shadows in abnormal place e.g. ventral to the liver is a good indication of free abdominal gas.

B) Abdominal Fluid (Increase Peritoneal Opacity)

- Causes of increase peritoneal opacity include (i) hemoperitoneum (ii) Ascites (iii) Intrabdominal masses. Other conditions include under- exposed film or under-developed film.
- Abdominal fluid is characterized by increase peritoneal opacity and decrease abdominal contrast (Ground glass appearance).
- Paracentesis can be done to know the nature of abdominal fluid.
- Small amount of abdominal fluid are focal in location and are usually associated with inflammatory diseases e.g. pancreatitis.
- A small volume of fluid is best seen in the mid abdomen given the fat between the bowels loops a hazy or streaky opacity.

C) Extrapleural masses

- Extrapleural diseases are uncommon because the pleural tightly adhere to the chest wall.
- Majority of disease that produces signs of extrapleural disease are neoplasms of the ribs. Other pathologic conditions of the ribs such as fractured ribs with hematoma and multiple cartilaginous exostoses may produce the signs.
- Roentgen signs of extrapleural diseases include
 - A well defined mass with sharply demarcated borders and a convex contour facing the lungs.
 - The edge of the mass are smoothly tapered and may be concave toward the lungs.
 - The pleural space is usually uninvolved.

Destruction of adjacent ribs or periosteal reaction along rib margins is common

RADIOLOGY OF ABDOMINAL DISORDERS

D) Gastric Volvulus

- Two views will be adequate: right lateral and ventrodorsal abdominal views.

- The right lateral and dorsoventral views are used to move the gas in the stomach into the abnormally located gastric antrum and pylorus of the patient.
- If contrast gastrogram is used, left lateral and ventrodorsal views of the abdomen should be taken. These views will keep the contrast in the pylorus and the antrum.
- Roentgen signs of gastric volvulus include
 - (i) Gas filled pylorus and antral portion of the stomach displaced dorsocranially
 - (ii) Compartmentalization of the stomach
 - (iii) Splenomegaly or abnormally placed spleen.
 - (iv) In the dorsoventral view, the pylorus and gastric antrum is displaced to the left cranial quadrant of the abdomen and are gas filled.

Gastrointestinal Obstruction:

- Radiographic interpretation of the gastrointestinal tract is prone to very large errors due to poor contrast, absence of intra-abdominal fats or the presence of some fluid.
- Two techniques used to enhance the evaluation of the gastrointestinal tracts are (i) positional radiography and (ii) contrast studies.
- The aim of positional views is to move the fluid and gas in the GIT from one place to another in the tract.
- The right lateral abdominal radiograph usually depict the pylorus and the descending duodenum as fluid filled structures while a left lateral radiograph will move gas into these structures helping in identifying pyloric mass or foreign body.
- Similarly the right lateral abdominal radiograph moves fluid and gas in other bowel loops to a new position to permit visualization of radioluscent GI foreign bodies.
- Contrast technique using either barium meal or iodinated compounds can be used where luscent foreign body cannot be seen by this technique.
- The choice of contrast agent should be based on the integrity of the GI wall, the physical status of the patient and whether or not surgery will precede the study.
- Another technique that is useful in the radiographic examination of the abdomen is the compression technique. The aim of the technique is to separate superimposed or overlying organs and reduce scatter radiation. When using this technique the exposure factors should be reduced by 10-15% because of the decreased thickness of the area of interest.