In spite of the advancement of various imaging modalities, radiology remains the mainstay of veterinary diagnostic imaging. In order to obtain the best information and value from abdominal radiographs, proper patient preparation, diagnostic quality radiographs/digital images (with optimal exposure techniques), patient restraint and positioning, and most importantly high competency in radiological interpretation are necessary. The main objective of this lecture series is to improve your competency in abdominal radiological interpretation. Hence, simple concepts and principles on correlation between radiographic signs, radiographic anatomy, and abdominal diseases/pathology according to organ/system approach will be covered.

The abnormalities/lesions seen should be described carefully including their location, margins, number, opacity, size, and shape (Roentgen signs). All these features are important as each will give rise to a different diagnosis of the lesions.

In many instances, determination of the origin of the visible abdominal abnormalities depends on its location. For example, a soft tissue mass located caudal to the left kidney in an intact female always indicates an enlarged ovary. A huge mid-ventral abdominal mass is most likely due to a splenic mass, an enlarged mesenteric lymph node or a pedunculated liver mass.

All organs should have smooth margins. The presence of an irregular margin may indicate the presence of nodules or masses. Splenomegaly also leads to rounded or blunted margins. The mucosal margin of the gastrointestinal tract and urinary bladder can only be assessed with contrast studies. The irregular margin of the small intestines may indicate infiltrative disease such as inflammatory bowel disease.

Although most if not all animals have 2 kidneys, visualization of both of them on radiographs is not always possible. The left kidney is seen in most animals. The right kidney silhouettes with the liver and is often superimposed by the gastrointestinal tract. Only its caudal pole is seen on lateral views and the entire right kidney is difficult to see on ventrodorsal views. Ranking of differential diagnosis will be different depending on single abdominal mass vs. multiple abdominal masses.

All internal abdominal organs, which include the liver, spleen, kidney, bladder, and the wall of the gastrointestinal tract, should be soft tissue opacity. Any change of the soft tissue opacity is abnormal. The presence of any soft tissue mass or nodule in the abdomen that does not associate with any internal organs is most likely an enlarged lymph node.

In the peritoneal cavity, gas is only present in the lumen of the gastrointestinal tract. Detection of any gas outside the gastrointestinal tract is considered abnormal and suggestive of a gastrointestinal perforation. This condition may occur secondary to a foreign body obstruction or neoplasia of the intestinal tract. Fat is commonly present in the falciform fat at the ventral abdomen, mesentery, and retroperitoneal cavity, which has fat opacity on radiographs. Fat opacity within the spleen may be due to the presence of myelolipomas. Masses with fat opacity in the abdominal cavity are most likely due to the presence of a lipoma, infiltrative lipoma, or liposarcoma.

Only bones have mineral opacity. Any intra-abdominal structure with mineral opacity is abnormal. Observation of structures with linear mineral opacity in the liver is due to the presence of choledocholiths in the hepatic bile duct. Mineralization of the wall of the urinary bladder is most often due to the presence of neoplasia such as transitional cell carcinoma. In castrated male dogs, mineralization of the prostate has a 100 percent positive predictive value of being neoplasia. Similar to mineral opacity, any metal structure present in the abdomen is abnormal. The most common cause of a metal foreign object is a gunshot pellet. Organ size determination is more accurate when using radiography compared to ultrasound. The most important aspect of interpretation is to correlate the findings with clinical signs. Some animals have an apparently smaller liver, which has no clinical significance. This is also true for a mild increase in liver size; it may be a normal variant for that particular animal. Besides size, the shape of the organs should be assessed carefully. The head of the spleen has a triangular shape. Rounding of the head of the
spleen indicates splenomegaly. In the small intestines, the presence of a soft tissue tubular structure is most likely due to intussusception while a rounded soft tissue structure is most likely due to neoplasia or foreign body.

In conclusion, the description of the abnormalities detected on abdominal radiograph should be comprehensive and includes the location, number, margin, opacity, size, and shape. One of the best examples of this is the evaluation of the abnormal kidney silhouette seen on radiographs. The size, shape, and margin of the kidney are important to generate meaningful differential diagnoses.

Veterinary ultrasonography has become an important part of the daily practice of veterinarians and often complements abdominal radiography. Factors that lead to this are (1) cheaper ultrasound machines; (2) better veterinary ultrasound training programs that are available in the teaching institution, organized by the veterinary ultrasound society and sometimes by the ultrasound machine vendors; and (3) availability of many good small animal ultrasound textbooks or manuals. Ultrasound is useful to evaluate the internal architecture of organs and is frequently used after diagnostic radiography. This helps in evaluation and assessment of organ parenchyma. Unlike radiography, there is no superimposition of structures/organs and the contrast is superior. Ultrasound is sensitive to detect abnormalities when there is a change of echogenicity, echotexture, size, and shape of the organ system. Function of the abdominal organs such as peristalsis movement of the gastrointestinal tract could be studied with ultrasound. Although ultrasound is sensitive in detecting changes associated with abnormalities, the specificity is low. This means that many changes/abnormalities detected have multiple or a long list of differential diagnoses. In many occasions, it is impossible to rank the differential diagnoses. Thus ultrasound-guided fine needle aspiration and/or biopsy is recommended to obtain samples for cytology/histology studies to confirm the diagnosis. Abdominal ultrasound is strongly recommended to be performed only when it is indicated. If it is performed in animals as a screening test, this should be interpreted with care as incidental findings of non-clinical significance may be detected. Ultrasound is more acceptable because there is no radiation hazard. One of the disadvantages of ultrasound is that it is operator dependent. Thus veterinarians and technicians should be properly trained to perform ultrasonography.

Ultrasound evaluation of the internal organs involves recognizing the normal and abnormal changes of the organ examined. Ultrasound abnormalities that are commonly encountered are changes of the echogenicity and echotexture, and alteration of the size and shape of the internal organs. All these changes should be carefully noted. It is important to note whether the abnormality is diffuse, multifocal, or only involves a focal area. As previously described, the changes detected on ultrasound are not specific. Each abnormality should not be interpreted separately but a global interpretation of all the abnormalities detected is required. Thus careful documentation of all the abnormalities is important and this will help to formulate meaningful differential diagnoses.

Small animal cases encompassing abdominal radiographs and ultrasonography with various degrees of difficulty will be presented in three sessions. At the end of the lecture, the participants will be able to describe radiological and sonographic abnormalities in a systematic manner and also be able to generate a list of appropriate differential diagnoses.