Abdominal ultrasound - using practice based machines

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Equipment and scanning technique

KEY: use highest frequency transducer that penetrates to area under investigation and display smallest depth of field necessary. Curved linear transducers combine desirable characteristics of sector and linear transducers - providing wide near and far fields of view. Start with 7.5 MHz transducer at depth 4–8 cm and then 5.0 MHz. Most rectal and tendon probes are 5–7.5 MHz and work well for visualisation of most abdominal structures.

***KEY: Order of echogenicity: Kidney < Liver < Spleen

Liver
Liver parenchyma is homogeneous and of medium echogenicity. Bile ducts are not normally visible, but the portal veins are. Hepatic veins can be traced to the caudal vena cava, although this structure can only be visualised in smaller horses. Estimation of hepatic size in horses is hard and is only relative. In older horses atrophy of the right liver lobe is common making it hard to image any liver in some normal aged animals. Hepatomegaly should be considered if the liver continues beyond the border of the costochondral junctions. The ventral margin of the liver should always appear sharp.

- **Acute hepatitis and hepatocellular necrosis:** Decreased echogenicity and small liver.
- **Chronic hepatic fibrosis:** Increased echogenicity (similar to that of spleen) and a shrunken liver.
- **Cholangiohepatitis:** Markedly enlarged liver with increased echogenicity associated with fibrosis and cellular infiltrate and thickening of bile ducts.
- **Cholelithiasis:** Distension of biliary tree. Parallel channel sign: dilation of bile ducts alongside portal vein. Bile duct proliferation and bile stasis seen. Obstructing stone blocking common bile duct is often large but inaccessible to imaging. Cholelithiasis should be suspected in all horses with bile duct dilation. Smaller multiple hepatoliths may be seen as hyperechoic structures casting acoustic shadows.
- **Hepatic lipidosis:** Generalised hepatomegaly. Diffuse increase in echogenicity; ‘bright liver’.
- **Focal ‘cavitary’ liver disease:** Differential diagnoses: Hydatid cysts, polycystic liver disease, hepatic abscesses.
- **Hepatic neoplasia:** most commonly lymphosarcoma. Diffuse increase in echogenicity; hepatomegaly; rounded margins. Discrete masses have been reported.

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**Fig 1:** Area to be clipped for full abdominal scan.

**Fig 2:** A: kidney - right kidney lies immediately ventral to transverse processes between 14th and 17th intercostal space (ICS) at level of tuber coxa, left kidney lies further caudal and ventral at the 17th ICS to paralumbar fossa and is medial to spleen; B: liver - right lobe of liver extends from 6th/7th ICS to 14th/15th ICS, left lobe is smaller and extends from 6th to 9th ICS, immediately caudal to diaphragm; C: spleen - extremely variable in size, left abdominal wall from 8th ICS to 17th ICS or paralumbar fossa.
Spleen
Most echogenic and homogeneous organ.
- **Splenectomy**: 37% of lymphosarcoma cases have splenic involvement at post mortem. Marked enlargement is seen, along with masses bulging from the surface.
- **Spleenic haematoma**: Loculated anechoic mass; may contain echogenic masses associated with clot formation.
- **Splenomegaly**: almost impossible to reliably diagnose in horses due to wide normal variation.

Kidneys
Remember the transrectal window can also be used. The renal cortex is hypoechoic compared to surrounding tissues, with a mottled appearance, and is 1–2 cm thick. The adjacent medulla is less echogenic than cortex. The renal pelvis is very echogenic due to intrapelvic fat and fibrous tissue.
- **Acute renal failure**: Kidneys are enlarged with parenchyma less echogenic than normal with a thicker cortex. Per-renal oedema may be seen with oliguria/anuria. Note: an increase in echogenicity is seen with renal insufficiency and iatrogenic drug toxicity.
- **Chronic renal failure**: Kidneys smaller and irregular. Increased echogenicity associated with fibrosis and inflammatory infiltrate. Poor differentiation between cortex and medulla.
- **Nephrolithiasis**: Nephroliths seen as hyperechoic structures casting an acoustic shadow.
- **Hydronephrosis and hydro-ureter**: Marked dilatation of renal pelvis; thin renal cortex; irregular contour. Dilated renal calyces may have a cystic appearance. Hydro-ureter seen transrectally, as a thickened wall and diameter 2–3 cm.
- **Pyelonephritis**: Echogenic purulent debris in renal pelvis. Gross enlargement is present with a dilated renal pelvis and renal calyces.
- **Renal masses**: Differential diagnoses include: neoplasia (adenocarcinoma >lymphosarcoma); abscess; haematomata; parasitic granuloma.

Gastro-intestinal viscera
The stomach is visualised as a large semicircular echo on the ventral left abdomen at about the 8th to 13th ICS. Wall thickness up to 7.5 mm.

- **Splenomegaly**: A lack of coordinated peristalsis is evident.
- **Nephroplenic ligament entrapment**: Entrapment of the large colon impairs visualisation of the left kidney. Gas echo seen dorsal to spleen in left paralumbar fossa. Straight horizontal dorsal border of spleen extends cranially and caudally. Ventral displacement of spleen to right of ventral midline. Caution!! Small colon and small intestine can occasionally be visualised between spleen and kidney - incidental finding. The condition is correctly diagnosed ultrasonographically in 88% horses, compared to only 32% on rectal examination.
- **Entersis**: Fluid-filled hypermotile small and/or large intestine. Wall thickness increased: symmetric, extensive and oedematous in appearance.
- **Anterior enteritis**: Fluid-filled hypomotile small intestine with gasitic distension.
- **Inflammatory bowel disease**: Thickened oedematous small intestinal wall, up to 5 cm thick. Mesenteric lymph node enlargement.

Peritoneal cavity
Peritoneal fluid may not be visualised at all, or only a small amount ventrally and should be anechoic.
- **Peritonitis**: determine quantity and character of peritoneal fluid. Fibrous tags, fibrinous loculations, cellular debris and adhesions may be seen.