ULTRASONOGRAPHY FOR EXOTICS: EFFECTIVE METHODS OF WORKING

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BRIGITTE REUSCH describes the challenges, and the rewards, of using ultrasound in these unusual patients

ULTRASONOGRAPHY is a valuable, non-invasive diagnostic tool for the examination of exotic animal patients' soft tissue structures.

However, little published reference data is available for the normal and abnormal ultrasonographic anatomy of exotic pet species. High-definition transducers (7.5MHz to 20MHz) with a small footprint (less than 2cm) are required for examination of these patients, as their bodyweight may vary from a 100g lizard to a 8kg French lop rabbit. Stand-offs, such as commercially available gel pads and latex gloves filled with acoustic coupling gel, may be useful to examine superficial lesions in small patients. The use of water baths as a stand-off for snakes, amphibians and fish may also be useful.

Patient preparation may include sedation or short anaesthesia, although in most cases physical restraint is usually sufficient. A minimal amount of fur should be clipped to reduce the risk of hypothermia, especially in very small mammals. Warmed acoustic coupling gel is applied liberally to the skin and transducer. The use of spirit is avoided to reduce the hypothermia risk. In general, the anatomy of small mammals is similar to more familiar domestic species; therefore, the animal's position and transducer placement are similar. The anatomy of reptilian species has been described in several textbooks, some of which are detailed in the further reading list.

Abdominal ultrasonography

Most ferrets can be restrained for conscious abdominal ultrasonography, although shortacting sedation may be required in some cases.

Ferrets have a simple and relatively short digestive tract, causing few gas artefacts and, in most cases, high-quality images of all the soft tissue structures in the abdomen should be achievable. The large hindgut of rabbits, guinea pigs and chinchillas may hinder abdominal ultrasonography of these patients, as gas artefacts may reduce the areas that can be examined.

However, in most cases, the majority of the liver, spleen and urogenital tract can be fully assessed percutaneously via the ventral or lateral abdomen.

Ultrasonography of the kidneys and ovaries is easier percutaneously via the flank. The testes may ascend into the abdomen when palpated in rabbits and rodents, as they possess an open inguinal canal.

Ultrasonography of the gastrointestinal tract is a useful aid to diagnosis of inflammatory bowel disease (IBD), proliferative bowel disease and eosinophilic gastroenteritis. IBD is a relatively common cause of gastroenteritis in ferrets.

Liver scanning with an ultrasound-guided needle biopsy of the liver is required for a definitive diagnosis of neoplasia and hepatitis. Lymphoma is the most common neoplasm seen in ferrets. Pancreatic islet cell tumours can also metastasise to the liver.

Hepatic lipidosis is uncommon in the ferret, but may be found in association with long-term anorexia and other chronic disease. Splenomegaly is a very common finding in ferrets more than a year of age and, therefore, ultrasonographic examination of the spleen is frequently indicated.

Common differential diagnoses include neoplasia, cardiac disease, hypersplenism and extramedullary haematopoiesis.

Splenic torsion is rare in ferrets, and splenomegaly may also be an incidental and unrelated finding, but is often concurrently present with adrenal disease and insulinoma. Renal disease is uncommon in ferrets, but renal cysts – which are seen as hypoechoic areas with smooth walls – are usually an incidental and frequently seen finding. Prostatic ultrasonography is usually needed for the diagnosis of prostatitis, which may not always have prostatomegaly. Prostatomegaly with secondary urethral obstruction is diagnosed more commonly in urolithiasis in male ferrets. Prostatic disease is often seen concurrently with adrenal disease. During a work-up for insulinoma, ultrasonography may be useful for prognosis if evidence of metastasis is detected. Some insulinomas are very small and discrete and, therefore, easily missed when using ultrasonography.

Adrenal gland ultrasonography is a valuable tool for the investigation of adrenal disease in the ferret. Not only can the size of the glands and their architecture be assessed, but evidence of concurrent disease, such as lymphoma or insulinoma, may also be found and will affect the approach to treatment and prognosis.

Ultrasonography can also be useful in differentiating between an adrenal tumour and an intact genital tract, which is the main differential for adrenal disease in a female ferret.

Abdominal ultrasonography of the hindgut fermenters is particularly useful in rabbits, where liver lobe torsion is not uncommon and uterine adenocarcinoma may be seen in up to 80 per cent of entire female rabbits more than four years of age.

Ultrasonography in female guinea pigs is indicated in all cases of abdominal enlargement. Ovarian cysts are seen frequently; up to 76 per cent of female guinea pigs aged between 18 months and five years old were found to have ovarian cysts in one study. Hypoechoic cysts of 0.5cm to 7cm and single or multilocular lesions may be seen on ultrasonography.

Pyometra is relatively common in female hamsters. Ultrasonography is required to differentiate the creamy vulval discharge from the normal postovulatory type that occurs at the end of the four-day oestrus cycle.

The use of ultrasound offers a non-invasive technique for examining the internal organs of conscious reptiles. Ultrasonography of most coelomic organs, including the heart, can be carried out in most reptilian species.

In snakes, the internal organs may be imaged using an aqueous contact gel via the ventral body wall. Snake ribs extend caudally to cover part of the coelom and, therefore, impede some views. Generally, the same organs scanned in mammals can be usefully scanned in reptiles.

In tortoises and turtles, the transducer is placed in the spaces between the carapace, plastron and limbs. The ventral and lateral flank approaches are useful for the examination of most species of lizards.

Ribs may limit full examination of structures in the middle third of snakes. The anatomical position of internal organs in most snake species can generally be divided into three parts from head to tail. The first cranial third of the snake includes the oesophagus, trachea and heart. The middle third contains the lungs, liver, stomach and cranial air sac. The caudal third contains the pylorus, duodenum, intestines, kidneys, gonads, fat body and cloaca.

Reproductive disease is common in female captive reptiles. Ultrasonography is extremely useful in infertility assessment, diagnosis of follicular disease, egg stasis and egg peritonitis.

Pre-ovulatory egg binding or follicular stasis may be seen in all female reptiles and is particularly common in iguanas. The follicles fail to continue normal egg-forming development and the retained follicles may then become necrotic and inpissated.

Ultrasonography is essential in the assessment of follicular disease in reptiles, where large hyperechoic follicles (with or without free coelomic fluid) are diagnostic of this disease. Hepatic lipidosis is an important prognostic indicator in the management of post-hibernation anorexic tortoises. Where the liver is found to be hyperechoic, the prognosis is poor to grave.

Renal disease and renomegaly is not uncommon in lizards, especially iguanas, where ultrasonography of the flank ventral to the lumbar spine will allow evaluation of the lobulated kidneys. Neoplasia is not an uncommon finding in reptiles and all masses and body swellings should be investigated.

Ultrasonography is generally more limited in birds, due to their large air sacs. However, this useful diagnostic tool can be valuable in assessing the coelomic cavity and air sacs for fluid.

Echocardiography

Cardiovascular disease is recognised more frequently in exotic pets and is seen relatively frequently in ferrets, rabbits, chinchillas and hamsters.

Little is known about the pathogenesis and management of naturally occurring heart disease in these animals.

Heart disease can rapidly develop into heart failure when the heart is unable to maintain a normal cardiac output at normal filling pressures. Ideally, a high-frequency transducer (at 7.5MHz to 20MHz) and high frame rate are required to evaluate the small hearts. This is due to the fast heart rates in these species: from 180bpm to 250bpm in ferrets and 180bpm to 280bpm in rabbits.

Two-dimensional and M-mode echocardiography allows assessment of individual chamber sizes, wall thickness, movement of walls, valves and blood flow, detection of hypertrophy patterns and fluid versus soft tissue differentiation (such as pericardial and pleural effusion).

However, echocardiography does not provide information about the lungs, unless severely consolidated. Conscious thoracic radiography is usually possible in most debilitated patients.

Doppler echocardiographic methods have been validated to evaluate structural and functional cardiac abnormalities in rabbits and ferrets. Reference values for normal echocardiographic values in ferrets and rabbits have been reported as study controls.

The author has seen several cases of congestive heart failure in exotic species (one ferret, five

rabbits and one chinchilla in the past five years), where both myocardial and valvular cardiac disease was diagnosed with the aid of echocardiography.

Where the diagnosis was made early in the course of the disease, management of heart disease was successful.

Clinical signs include dyspnoea, tachycardia, lethargy, exercise intolerance (presented as a reluctance to go up stairs or run around, hindlimb weakness and reluctance to move), weight loss, anorexia and sudden death.

Coughing is mainly seen in ferrets and, in most cases, a heart murmur may be detected on thorough thoracic auscultation. Heart murmurs have been described in young asymptomatic chinchillas presented for routine examination; the relationship of these heart murmurs to cardiac disease is not understood at this time.

Auscultation of the lungs may reveal crackles or muffled lung sounds, and care must be taken not to misinterpret the digestive tract sounds of hindgut fermenters and pseudoruminant hamsters. Pale mucous membranes or cyanosis with a slowed capillary refill time may be seen in cases of advanced disease.

In rabbits, the pinna are highly vascular and, when cold and pale, indicate peripheral vasoconstriction. Albino rabbits will appear to have blue-coloured irises in severe cynosis. Cold extremities are seen in hamsters with cardiomyopathy.

Signs of venous congestion include jugular distension and pulses; the veins on the ventral abdomen can be obvious. Jugular distension or pulses may be difficult to assess in a female rabbit with a prominent dewlap. Ascites due to heart failure is uncommon in the rabbit, but a pendulous distended abdomen may be noted in some cases.

Ascites, splenomegaly and hepatomegaly may be palpated on physical examination of ferrets afflicted with cardiac disease. Echocardiography can often be carried out without sedation in ferrets, rabbits and chinchillas. Inhalant isoflurane or sevoflurane is usually required for hamster echocardiography.

Pericardial effusions are not an uncommon finding in tortoises and, in some cases, they have been an incidental finding.

Cardiomypathies and endocarditis are not uncommon in older snakes. In severe cases of cardiomegaly, the enlarged heart may be seen as a body swelling in the caudal first third of the snake.

Echocardiography has been well described in African grey parrots, where heart disease is not

uncommon. Similarly, heart disease is not an uncommon finding in older pet birds – echocardiographic parameters have been published.

Ocular ultrasonography is particularly useful in rabbits, where ocular and retrobulbar disease is not uncommon. Ultrasonography can also be used to tract sinus tracts in rabbit abscesses to help surgical planning.

Ultrasonography is a very useful non-invasive diagnostic tool that can, in most cases, be used with a conscious exotic animal patient. It will, in many cases, also help determine the prognosis.

Further reading

- Petrie J P (2004). Cardiovascular and other diseases. In Quesenberry K N and Carpenter J W (eds), *Ferrets, Rabbits and Rodents: Clinical Medicine and Surgery* (2nd edn) Saunders, Missouri: 58-66.
- Reusch B (2005). Investigation and management of cardiovascular disease in rabbits, *In Practice* **27**: 418-425.
- Girling S and Raiti P (eds; 2004). *BSAVA Manual of Reptiles* (2nd edn), BSAVA, UK.


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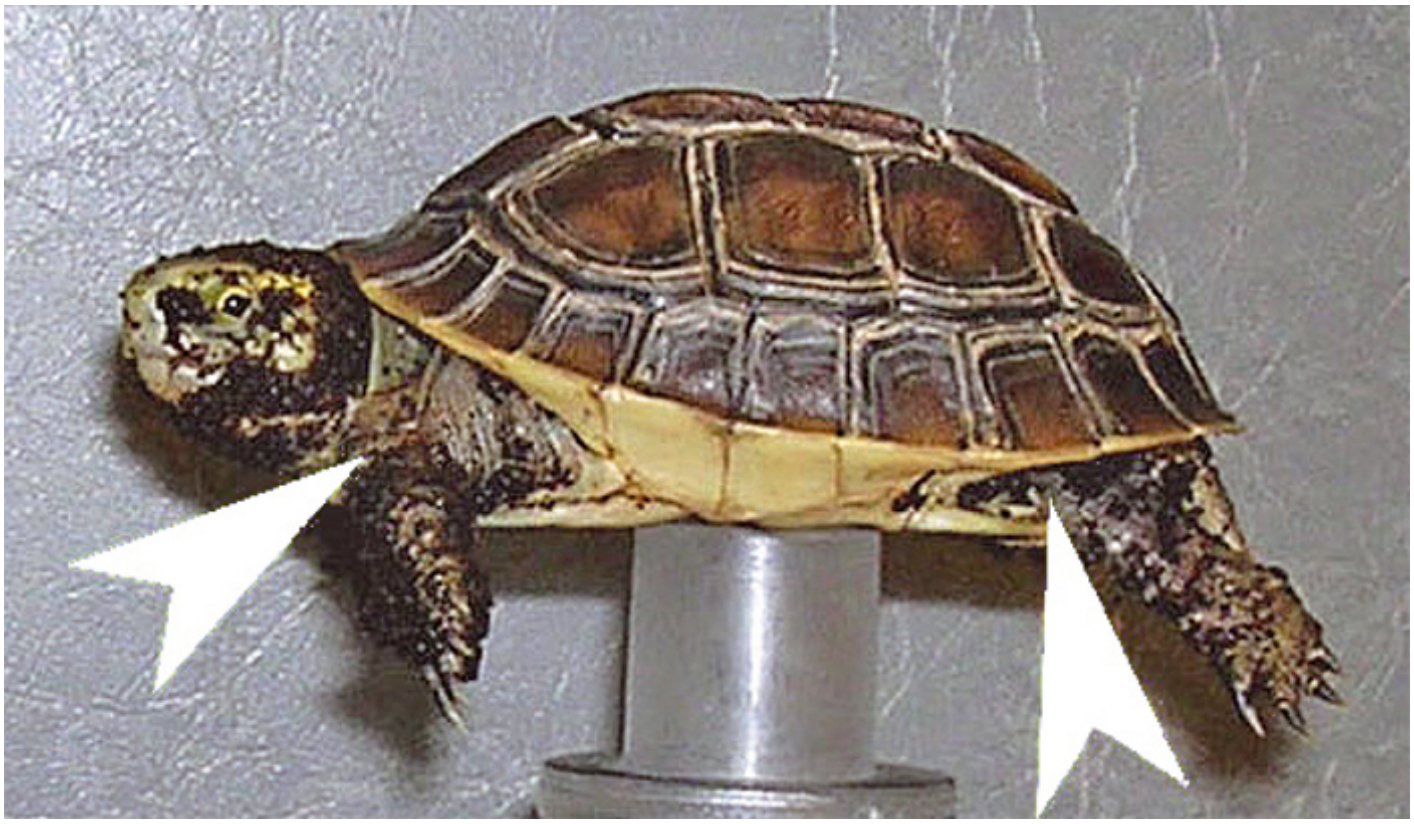
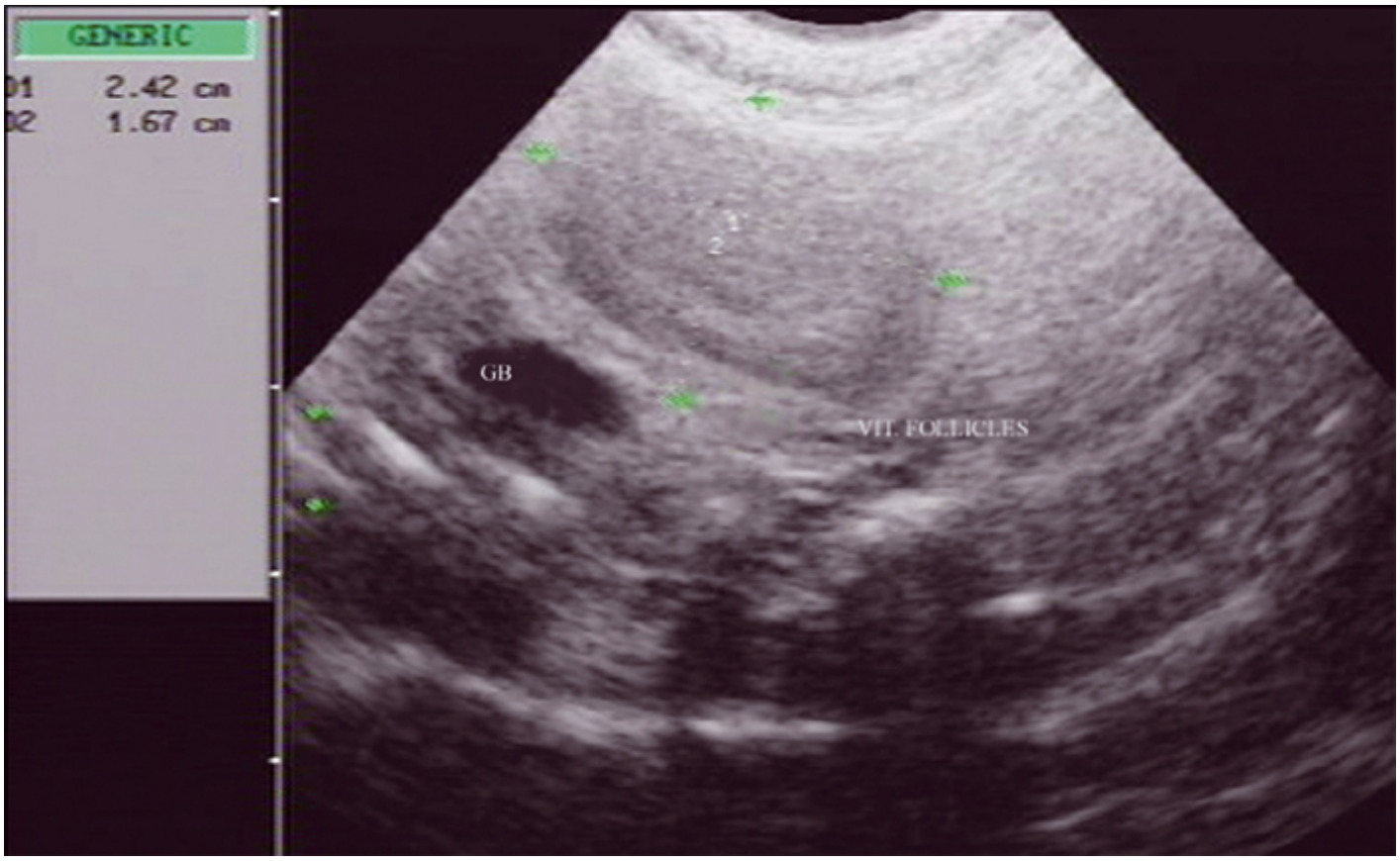
A conscious rabbit restrained for abdominal ultrasonography. This rabbit was found to have a uterine lesion, later confirmed on histopathology to be uterine adenocarcinoma.



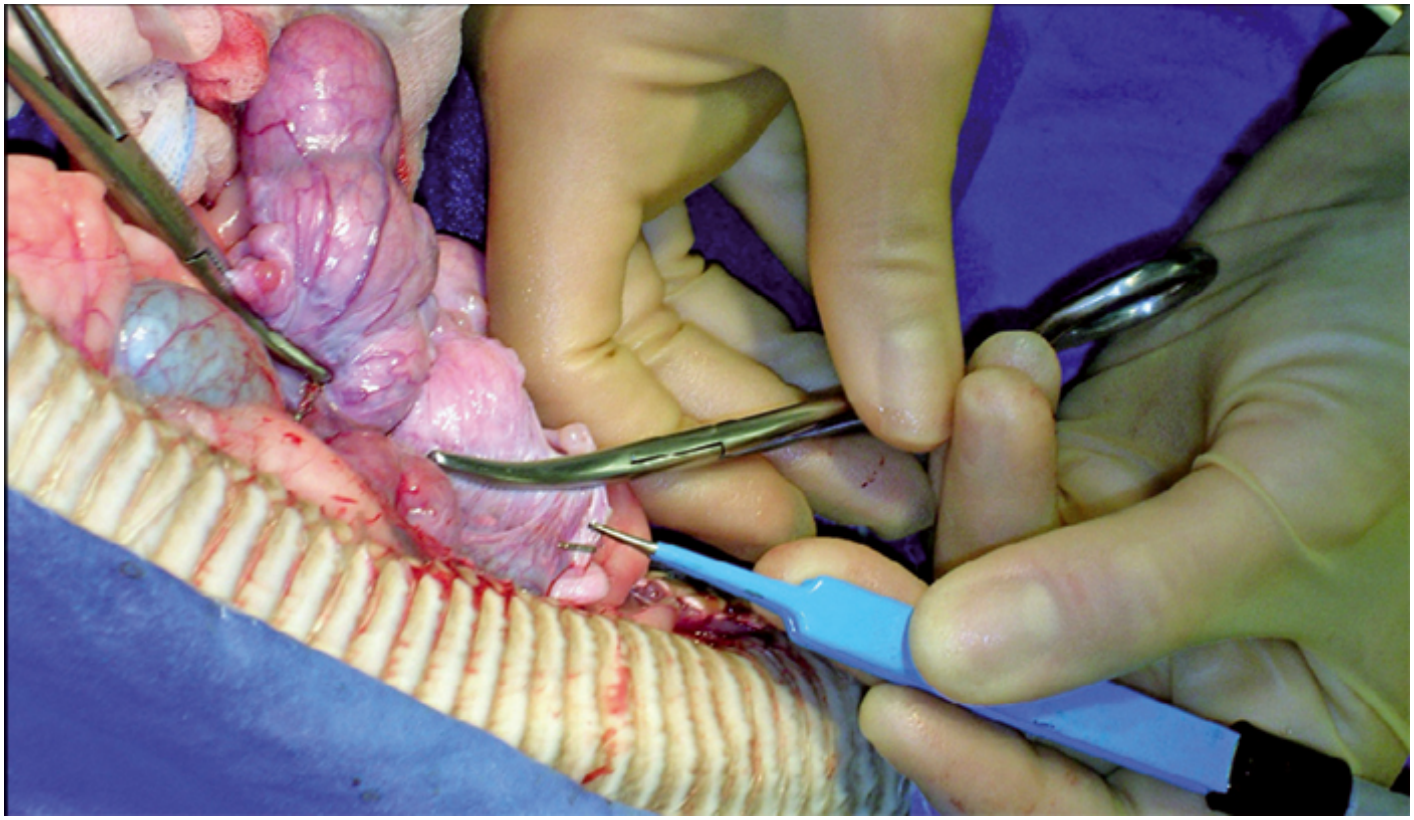
The transducer position sites for ultrasonography of the coelomic cavity of the tortoise.

Abdominal ultrasound of a female hamster with possible pyometra. This condition is relatively uncommon in hamsters.

Ultrasonography of the coelomic cavity in a snake.



An ultrasound scan of a snake’s ovarian follicles.



Intraoperative view of a snake ovariectomy with follicular stasis.