ABDOMINAL ULTRASONOGRAPHIC EVALUATION OF HEALTHY JUVENILE EASTERN GREY KANGAROOS (*MACROPUS GIGANTEUS*)

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Purpose

The purpose of this study was to describe the ultrasonographic anatomy of the kidneys, urinary bladder, adrenal glands, spleen, liver, gall bladder and gastrointestinal tract in healthy juvenile eastern grey kangaroos (EGK) (*Macropus giganteus*).

Interactive Anatomy

Methods

This descriptive study involved carcass dissections, ultrasonographic water bath examinations and live ultrasonographic examinations on macropods. Ten macropod cadavers (eight EGKs and two swamp wallabies) were used for initial dissections to develop landmarks and anatomical illustrations (Fig 1). Seven EGKs (four females and three males; age range 9-25 months; mean mass 18 kg (±4.5)) were ultrasonographically examined under heavy diazepam sedation. Animal Care & Ethics (A20247 & A20303) and a National Parks and Wildlife Service License (SL102465 & SL100018) was obtained.

Results

Abdominal dissections and ultrasonographic results are described below and illustrated in Figures 1-6.

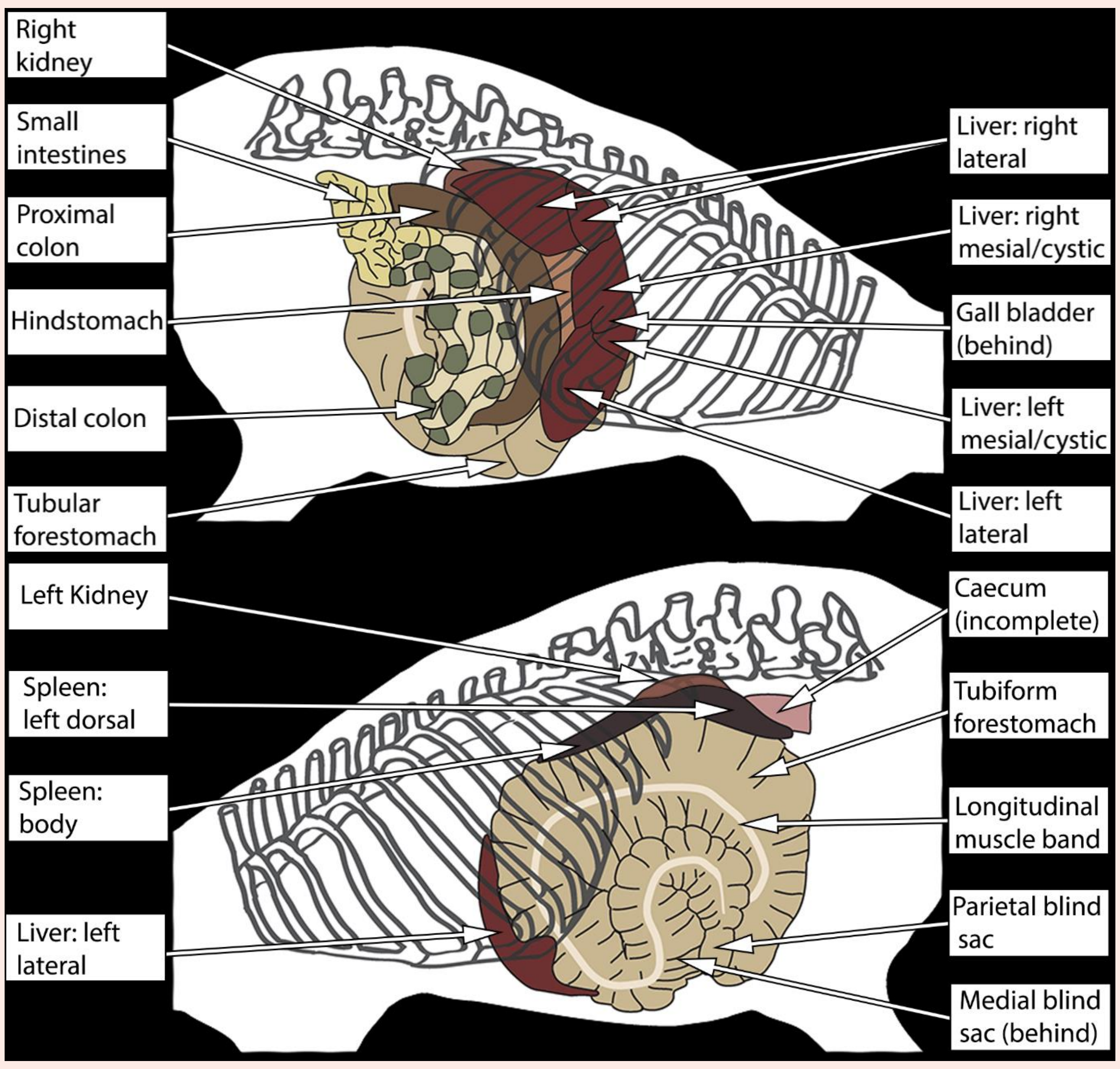

Fig 1. Labelled illustrative anatomy of the right (top) and left (bottom) abdominal topography in a kangaroo.

Adrenal glands

- The adrenal glands had good corticomedullary distinction and were easily distinguishable in the kangaroo compared to other domestic species (Fig 2).[1] EGKs possess enlarged adrenal glands in sodium-scarce areas in order to synthesise and secrete additional aldosterone.[2]

Liver

- Due to the large forestomach the kangaroo may be better compared to a deep-chested dog, as an intercostal approach provided better visualisation.[1]
- The liver was best evaluated with the animal in left lateral recumbency, as both right and left lateral liver lobes were orientated on an angle towards the right abdominal wall.

Spleen

- The splenic body and left dorsal process was easily visualised due to its superficial location and attachment to the tubiform forestomach (Fig 3).
- As the right ventral process extends behind the forestomach, this was more difficult to evaluate.

Gastrointestinal tract

- A good understanding and knowledge of the topographic anatomy was important in identification of gastrointestinal (GIT) structures.
- The GIT layers were best identified using a linear transducer, which highlighted the five layered appearance of different echogenicity (Fig 5).[1]
- The hindstomach was ultrasonographically similar to the monogastric stomach.[1]
- The tubiform forestomach was distinguished by its large size occupying most of the abdomen and the presence of haustra.
- The sacciform forestomach was not identified ultrasonographically due to sample size and time constraints. However, the blind sacs are located in close proximity to the left abdominal wall so could potentially be visualised.
- The small intestines were identified in the caudodorsal abdomen (Fig 6).

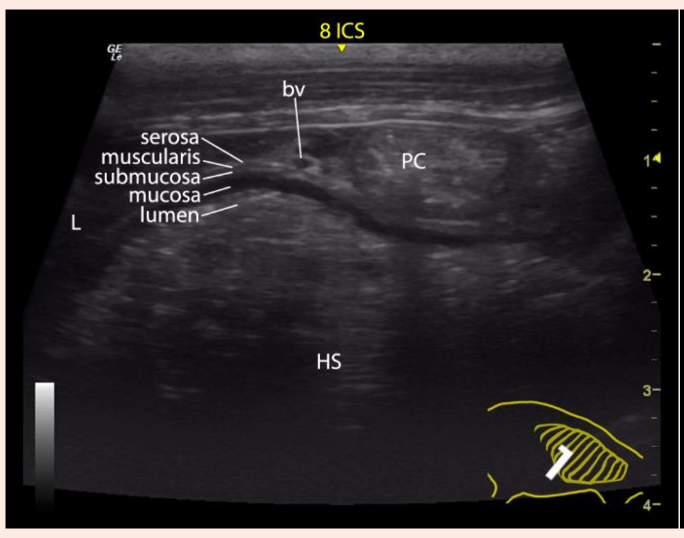

Fig 5. Ultrasonographic image of the hindstomach illustrating the layered appearance. Dorsal is to the left of the image. ICS, intercostal space; L, liver; bv, blood vessel; HS, hindstomach; PC, proximal colon.

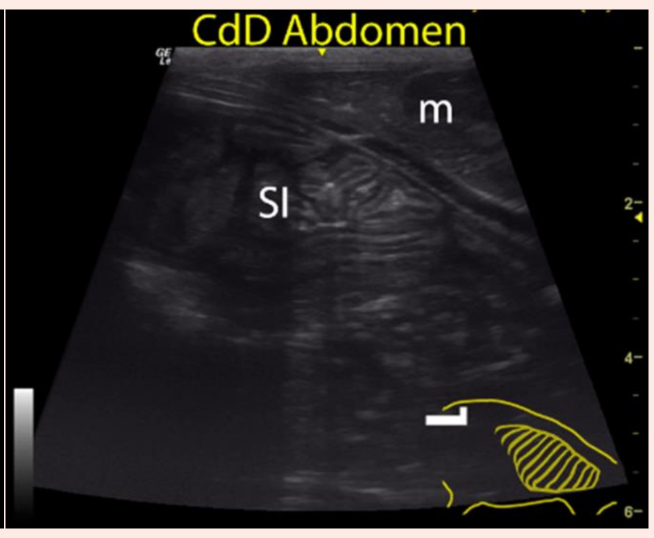

Fig 6. Ultrasonographic image of the small intestines. Cranial is to the left of the image. CdD, caudodorsal; SI, small intestine; m, muscle.

Kidneys

- The cranial aspect of the right kidney was in close contact to the right lateral liver lobe (equivalent to the caudate lobe in dogs or cats) (Fig 2).[1]
- In general, corticomedullary distinction was good and similar to that observed in cats and dogs,[1] inferring that poor corticomedullary distinction would likely indicate renal disease in kangaroos.

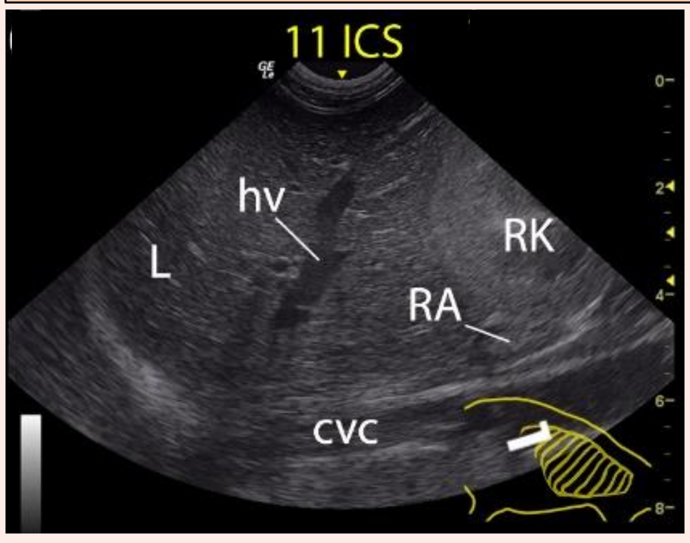

Fig 2. Right kidney in close association to the liver. Cranial is to the left of the image. ICS, intercostal space; RK, right kidney; L, liver; RA, right adrenal gland; hv, hepatic vein; cvc, caudal vena cava.

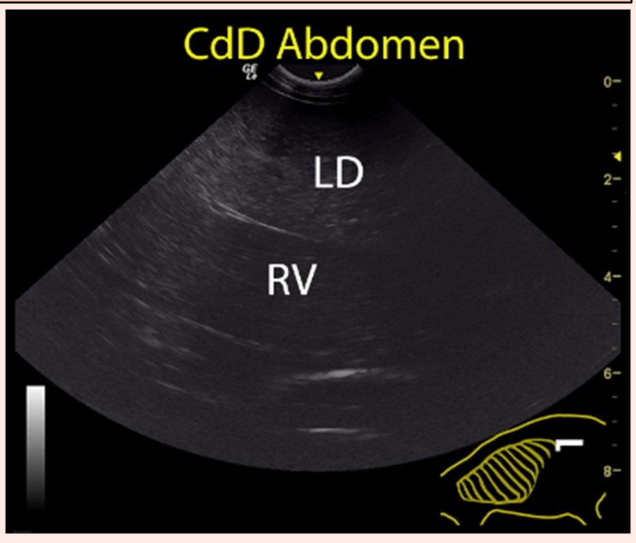

Fig 3. Spleen branching into left dorsal and right ventral parts. Cranial is to the left of the image. CdD, caudodorsal; LD, left dorsal; RV, right ventral.

Urinary Bladder

- Limited bladder identification in the study may be due to minimal filling.
- Epipubic bones were identified ultrasonographically and caused acoustic shadowing, which may have also obstructed bladder visualisation in this region (Fig 4).

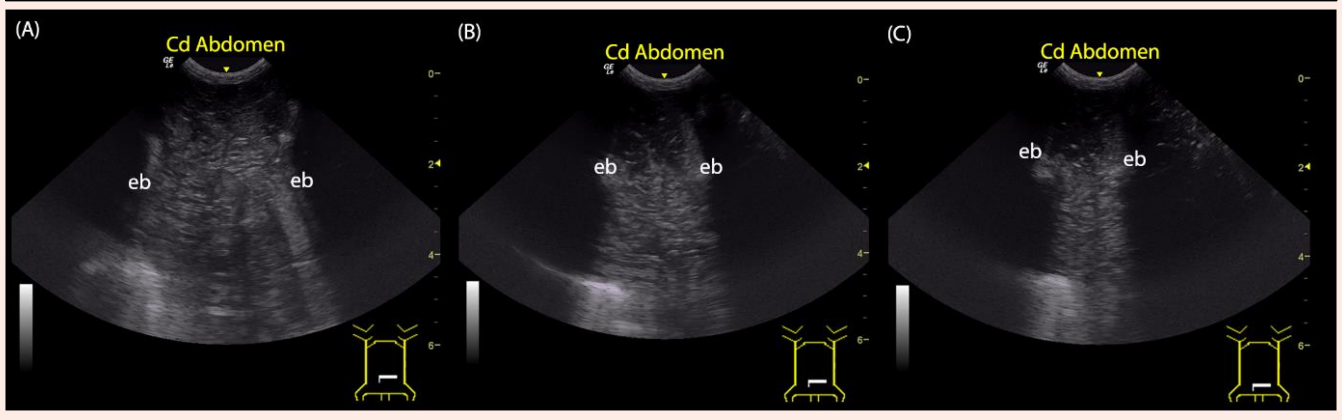

Fig 4. Transverse plane illustration of epipubic bones with acoustic shadowing; transducer was fanned cranial to caudal from A-C. Cd, caudal; eb, epipubic bones.

Discussion

Ultrasonographic data was recorded without abdominal clipping due to excellent visualisation with 70% ethanol. The kangaroos were evaluated in lateral recumbency as this positioning provided consistency without the need for general anaesthesia, which may be required to evaluate the animals in dorsal recumbency. The main challenge in the kangaroo was the gaseous forestomach that occupied a large proportion of the abdomen and caused dirty acoustic shadows and reverberation artifacts deep to this. Fasting may have improved visualisation of these areas. Given the relatively small size of the animals within the study, a microconvex transducer was used to evaluate the parenchymatous organs with an intercostal approach, whereas a linear transducer was superior for gastrointestinal evaluation and more superficial structures.

The main limitation of the study was the small sample size (7) and small weight range (14-25 kg), given as the maximum recorded weight of EGKs can reach up to 90 kg in males and 40 kg in females.[3] The variance within some parameters may be explained by this limitation.

Conclusion

Ultrasonography presents a more accessible imaging technique than radiography to use in the field during wildlife rescue and rehabilitation in Australia. This standardised protocol, including quantitative and qualitative measurements, landmarks, positioning, transducer selection and images in the EGK will facilitate the detection of abnormal pathologic ultrasonographic features (e.g. parasites, neoplasia, urolithiasis) to aid disease diagnosis in this and related macropod species (both free-living and captive).

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References

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