Cross-sectional imaging: the key to anatomy

Regine Hagen

IN recent years, cross-sectional imaging has become more and more important in veterinary medicine, to aid exact diagnosis of pathology and surgical planning. Both CT and MRI are used for this purpose. Once a pathological process has been identified and diagnosed, the ability of cross-sectional imaging to reconstruct the anatomical situation in any desired image plane, and also three-dimensionally, is the tremendous advantage of these modalities.

Recently, both CT and MRI have become much more popular and available than only a couple of years ago. Many larger and specialist clinics have either a CT or MRI scanner, if not both, installed. The more recent equipment is very sophisticated and able to reconstruct cross-sectional images of any scanned anatomical part in a chosen image plane and create 3D representations of the imaged structures within a useful time frame.

Cross-sectional imaging is used in all species. The limiting factor for examination is usually the relative size of the gantry and patient or body part of the patient. Complicated anatomical structures such as the skull can be viewed in cross section without having to struggle with superimposition of many structures of different opacities. Thus CT is often used to image the skull in horses, small animals, cattle and exotic species (Burk 1992, Arencibia and others 2000, Saunders and others 2002).

To improve visualisation of soft tissue structures in CT, the application of iodinated contrast media allows visualisation and 3D reconstruction of the vascular system and even complicated vascular anomalies, such as, for example, portosystemic shunts (Frank and others 2005, Zwingenberger and others 2005, Bertolini and others 2006). In such cases, 3D reconstruction of the contrast-filled vascular structures including the anomalous vessel(s) will help surgical planning, the correct approach and a suitable vascular occlusion method to treat the shunt. In horses, for example, vascular contrast studies have been used to increase soft tissue contrast in CT of the distal limb (Puchalski and others 2007).

Cross-sectional imaging has also revolutionised interventional imaging, in that the exact location of a lesion can be defined and an optimal approach for safe biopsy of abnormal tissue can be planned (Flegel and others 2002, Giroux and others 2002, Vignoli and others 2004, Zekas and others 2005).

Cross-sectional imaging has become a very popular tool in student teaching and resident training as it allows much better understanding of anatomy. A multitude of CT or MRI-based anatomical studies have been performed, and serve as a good basis for understanding anatomy, also highlighting breed or species differences (Burk 1992, Ober and Freeman 2009). The ability of cross-sectional modalities to reconstruct 3D anatomy, especially bony structures, saves dissection or sectioning of anatomical specimens and allows a multitude of different approaches (Zarucco and others 2006) and also helps with orthopaedic surgical planning (Vandeweerd and others 2009). Bony malformations and deformities may be visualised without disturbing the overlying soft tissue structures (Crosse and Worth 2010).

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In a paper summarised on p 20 of this week’s Veterinary Record, Burrow and others (2011) describe how frontal sinus depth was assessed in dogs using CT. The authors describe how they measured sinus depth with the aim of finding the most suitable and safe entry point into the frontal sinus for application of topical treatment for fungal sinusitis without the risk of injury to underlying structures such as the brain since, by inserting a pin into the frontal sinus, depending on the depth of the cavity, the calvarium may accidentally be penetrated. They chose repeatable landmarks according to previous publications by Holt (1998) and Matthews (2004) and compared these recommended sites with alternative sites they had defined to critically evaluate the usefulness and safety of the recommended sites.

They found that, in the majority of the examined skulls, the recommended landmark was not located at the deepest, and thus safest point of the frontal sinus, but that a point 1 cm caudal to the recommended location gave, in the majority of dogs, a point 1 cm caudal to the recommended landmark was not located at the deepest, and thus safest point of the frontal sinus. Moreover, in most dogs examined in this study, the recommended point was actually located where the sinus was shallowest. The authors also discovered a range of variability of sinus depth between and within the dogs they examined.

In some clinics with a CT scanner available, most dogs suffering from sinonasal disease will undergo a diagnostic CT scan, it should be easy enough to measure the deepest point of the diseased or both frontal sinuses. The point of safest trephination is the deepest point of the diseased or both frontal sinuses. The point of safest trephination will undergo a diagnostic CT scan, it should be easy enough to measure the deepest point of the diseased or both frontal sinuses. The point of safest trephination within breeds of dogs and even within individual dogs, as the sinuses may present a range of variability of sinus depth between and within breeds of dogs, as the sinuses may present a range of variability of sinus depth between and within individual dogs, as the sinuses may present variable configuration that does not need to be symmetrical.

References


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