Proceedings of the 15th ESVOT Congress

September 15 - 18, 2010
Bologna, Italy
Traumatic injuries are common indications for head and skull imaging. In most cases plain **radiography** is the first choice for imaging head injuries. Radiography aids in detection of bone lesions, such as fractures, temporomandibular joint luxation, symphyseal fractures and dental trauma, because it provides good osseous contrast. However, radiography provides poor soft tissue contrast, which limits its use for the evaluation of soft tissue lesions. Foreign bodies may be visible on radiographs, for example gunshot fragments in the orbit. A careful search for fractures, particularly of the frontal bone, should be undertaken when gas inclusions (emphysema) are seen in the soft tissues. A high detail film/screen combination should be used for good quality images. A grid is normally not necessary because of a high portion of bone and gas and a low portion of soft tissue and fat. The feline and canine skull consists of many bones and is an anatomically complex three-dimensional structure, but much of this complexity is lost with radiography because it provides a two-dimensional image. Superimposition of bone makes interpretation of skull radiographs difficult. When interpreting DV or VD views of the skull, the first goal is to determine whether both sides are symmetrical. Thus, care should be taken to ensure that the head is positioned symmetrically when taking these views. The standard views for the skull are laterolateral and VD or DV, but often additional views are necessary to obtain more information. Lateral oblique projections provide skyline views of different parts of the skull, and bilateral oblique views with the same projection angle may be necessary for comparison. Lateral oblique views are particularly helpful for evaluation of the temporomandibular joint because luxation and/or fracture are common in this area, especially in cats with “high rise syndrome” or dogs and cats after car accidents. In the lateral view, slight elevation (20°) of the nose improves visualization of the temporomandibular joint, which can be evaluated with the mouth open or closed. Bilateral 30° oblique views with rotation of the head are another option for evaluating the temporomandibular joints without superimposition of other structures. The tympanic bulla can also be visualized with bilateral oblique views, which allow visibility of lesions such as fractures or increased opacity caused by haemorrhage. An additional open-mouth rostrocaudal view in the dog and cat or a rostro-10° ventral-caudodorsal view in the cat completes radiographic evaluation of the tympanic bulla. A rostrocaudal or caudorostral view with the mouth closed provides skyline views of the cranial and frontal sinuses and depicts the foramen magnum. The exact angle of atlantooccipital flexion depends on the area of interest and the animal’s skull conformation. Intraoral DV and VD views allow evaluation of the rostral parts of the maxillae or mandibles without superimposition of the mandibles or maxillae, respectively. An open-mouth ventral 20° rostro-dorsocaudal view in dorso-recumbency is an alternative to the intraoral DV view in ventral recumbency. This angled projection allows a more caudal inspection of the upper jaw; however, one must take distortion into account. In many cases, dental trauma such as tooth avulsion, luxation or fracture, requires radiographic evaluation of the tooth root and alveolar bone. Tooth root fractures in particular can easily be missed on visual inspection. Possible dental involvement in jaw fractures should also be evaluated radiographically. For an isolated view of each quadrant, an extra- or intraoral oblique view (approximately bisecting angle technique) provides a good overview of the bone and associated teeth of each mandible and maxilla. For high-detail imaging of individual teeth, intraoral dental films provide superior spatial resolution. The incisors including the symphysis and the rostral part of the maxilla can be evaluated using intraoral DV and VD views of the rostral part of the mouth.

**Sonography** of the head can be helpful in cases with facial swelling and can be used to differentiate soft tissue and fluid-filled areas. Also the bone surface can be visualized with ultrasound. Traumatic disruption, such as a fracture line or periosteal reaction, can be seen. In animals with a persistent fontanelle, an intracranial view is achieved using a high frequency sector scanner with a small foot print. Sonography is a valuable tool for evaluation of the orbit and eye, for example in cases with posttraumatic eyelid swelling or third eyelid protrusion. A direct transconreal approach gives the best image quality, but transpalpebral images are also possible. Determining the size and shape of the globe, location of the lens as well as the presence of intraocular haemorrhage or retinal ablation are important information provided by ultrasonography in the trauma patient, especially if direct inspection of the eye is not possible.

**Computed tomography (CT)** is now widely used in veterinary medicine and is better for detection of skull fractures and temporomandibular joint luxations than radiography. Computed tomography is also better than radiography for soft tissue resolution because of the window technique. This is important in patients with traumatic brain lesions. Intracranial hematomas or brain oedema can be visualized with CT using a...
soft tissue technique. The proper window setting (soft tissue, brain or bone window) must be used and care should be taken in selecting the appropriate reconstruction algorithms (kernel). Thin slices without an interslice gap are required for excellent spatial resolution. For a temporomandibular joint of a cat, a slice thickness of 1mm is appropriate, whereas a slice thickness of 2-3mm may be adequate for a giant-breed dog. With thinner slices, partial volume effects decrease whereas the quality of multplanar reconstructions (MPR) and three-dimensional reconstructions (surface shaded display [SSD] or volume rendering [VR]) improves. For a comprehensive examination, sagittal and dorsal reconstructed images (MPR) should be evaluated in addition to the primary transverse scan. Three-dimensional surface rendering techniques are helpful to visualize and assess the course and dimension of osseous injury. Beam-hardening artefacts in the caudal cranial fossa (“Hounsfield bar”) limit evaluation of the brain stem and cerebellum. The neuronal structures in this area are best imaged with **Magnetic Resonance Imaging (MRI)**. MRI provides better soft tissue contrast resolution than CT, which makes this modality the first choice in patients with neurological signs. The limited spatial resolution of MRI may be a limitation in trauma patients because small fissures and non-displaced fractures can easily be missed, especially in bone with close contact to air such as the nasal cavity, paranasal sinuses or tympanic bulla. Cortical bone and air are hypointense (black) on MRI. This makes differentiation difficult and often impossible. The excellent soft tissue contrast provided by MRI may be advantageous for detecting blunt muscle or brain trauma, such as oedema after contusion, which can be missed on CT scans even in a soft tissue window.

For a comprehensive examination, complementary imaging is often necessary because of the advantages and disadvantages of the different imaging modalities.

**REFERENCES**


