Canine Head Imaging

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The head is one of the most challenging anatomic areas to image, as it contains parts of the central nervous system, the respiratory system, and the alimentary system. Dogs are predators by nature and have a very powerful masticatory system.

Dental Imaging

Intra-oral radiography remains the gold standard for dental imaging in dogs. It provides the highest spatial resolution of all imaging modalities, and this is necessary for the small anatomic structures of interest, such as the periodontal ligament and root canals. However, CT has gained popularity in dental imaging, as it is cross-sectional, provides high bone and dental detail, and is excellent for other conditions causing masticatory diseases, which cannot be diagnosed radiographically. A head CT is performed in under one minute under sedation only, providing information of all teeth. All major dental diseases can be diagnosed with CT. Cone beam CT, which is more cost- and space-efficient, can provide excellent detail for dental and bone structures, but not for the soft tissues.

Masticatory Disease

Masticatory trauma can be successfully imaged radiographically, but CT has the edge in detecting skull and temporomandibular (TMJ) fractures. For conditions such as craniomandibular osteopathy, radiography is sufficient. Masticatory myositis is an immune-mediated disease in young and middle-aged large breed dogs. The muscular changes can be seen in CT and MRI best, CT offering the advantage of optimal viewing of dental structures whereas MRI, allowing imaging of the TMJ disk.

Oral Neoplasia

The standard for detection of oral neoplasia is CT. There are some benign oral neoplasms, such as some epulis tumours, however, the majority is malignant. Unlike in other body parts, oral cavity malignant neoplasia can have features of benign masses and cysts. CT is ideal for searching for local and distal metastatic disease.

Imaging of the Tongue

Ultrasound with a submandibular window is a quick, easy, and cost-effective imaging modality for the tongue, particular neoplasia, abscesses and foreign bodies. CT and MRI can both be applied for lingual imaging.

Salivary Gland Imaging

Radiographic sialography allows identification of the salivary ducts and the larger salivary glands. CT and MRI allow good delineation of all monostomatic salivary glands, but CT sialography allows additional assessment of the salivary ducts. Sialolithiasis, sialadenitis, abscesses, neoplasia and sialocele can be diagnosed. For limbic epilepsy, CT and MRI serve to exclude other potential differentials.

Imaging of the Ears

Radiography was traditionally used to diagnose middle ear disease in dogs, but always had a poor sensitivity and specificity. CT is currently the gold standard for external and middle ear disease and MRI for inner ear disease. It can be difficult to differentiate aggressive otitis from neoplasia and cholesteatoma from other mass lesions. Many brachycephalic dogs have a non-infectious secretory otitis, which currently cannot be differentiated from infectious otitis media. With a trigeminate nerve sheath tumour, there is paralysis and later atrophy of the tensor veli palatini muscle, which together with the levator veli palatini muscle, opens the auditory tube. The inability to open and excrete the middle ear secretions can then lead to an obstructive middle ear effusion (Wessmann et al. 2013 Vet Rec 173, 449). The specific muscle is relatively small but can be identified on MRI images, whereas on CT only the general area of these muscles can be seen as atrophied.
Occasionally, dogs can have signs of petrous osteitis associated with an ear infection. This is similar to Gradenigo's syndrome in people (triad of periorbital pain, diplopia and otorrhoea) which was a serious condition before antibiotic treatment availability. For otitis interna, the fibrosis of the cochlea lumen replaces the normal endolymph fluid. On transverse MRI T2 series, the normal cochlea fluid resembles the shape of a rubber duck. The absent duck sign signifies then otitis interna.

In CT this is not visible, however osteolysis of the petrous temporal bone also causes erosion of the cochlea and absence of a complete duck-like silhouette of the cochlea. In animals with head tilt, it is therefore important to inspect CT or MRI images of the inner ear carefully.

Conclusions Detailed anatomic knowledge is helpful in interpreting images of the canine head. Radiography was traditionally used for the imaging work-up of the head, but has been replaced by CT and MRI, due to their higher diagnostic yield. Ultrasound is an excellent imaging modality for accessible soft tissue structures. For CT imaging of the head, a good bone kernel reconstruction and pre- and post-contrast soft tissue kernel images series are essential. MRI has the edge on soft tissue structures of the head and the inner ear but is poor for dental and bone assessment.

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