CPD article

Arthropathy of the temporomandibular joint: a diagnostic challenge

Equine temporomandibular joint arthropathy has been described as an underlying cause of various clinical signs. The anatomy of this incongruent joint is well described, as well as its appearance on different imaging modalities. However, pathologies of this joint are rare. This article provides an overview of the literature. Multiple possible aetiologies of temporomandibular joint arthropathy are not supported by current research and must be revised. Likewise, the imaging diagnosis or the classification of clinically relevant findings is difficult. A critical examination of this disease, including multiple diagnostic modalities, should be carried out to verify the clinical significance of findings in every case.

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The term arthropathy includes all diseases of the joint, and equine temporomandibular joint arthropathy has been described as a potential underlying cause of a diverse collection of clinical signs including changes in accepting the bit, gait abnormalities, sour attitude, headshaking, atrophy of the masseter muscle (Sanders et al, 2014), pain on palpation, and masticatory problems (Patterson et al, 1989; Nagy and Simhofer, 2006). However, diseases of the temporomandibular joint such as non-septic osteoarthritis, osteoarthrosis or degenerative joint disease (Stadtbäumer and Boening, 2002; Smyth et al, 2017) are rarely reported. Most single case reports describe septic arthritis (Patterson et al, 1989; Warmerdam et al, 1997; Carmalt and Wilson, 2005; Devine et al, 2005; Nagy and Simhofer, 2006; Barnett et al, 2013; Balducci et al, 2019; Frietman et al, 2019) (*Figures 1* and *2*) or joint luxation (Hurtig et al, 1984; Hardy and Shiroma, 1991; Devine et al, 2005).

Two single case reports diagnosed neoplasia (squamous cell carcinoma and sarcoma) invading the temporomandibular joint (Perrier et al, 2010; Carmalt and Linn, 2013).

It has been suggested that dental abnormalities and diseases of the oral cavity such as dental malocclusion lead to inflammation, disease, and pain of the equine temporomandibular joint. However, a correlation between increased levels of proinflammatory cytokines within the equine temporomandibular joint and oral pathology was not detectable (Carmalt et al, 2006) and the causal relationship between osteoarthritis as well as degenerative joint disease may develop acutely after a single trauma or chronically through repetitive strain or concussive forces. Histological age-related changes of the temporomandibular joint have been described and compressive stiffness of the disc in older horses (Smyth et al, 2017; Guerrero Cota et al, 2019) not related to temporomandibular joint pathology. Medial osteophyte formation has been noted in other older horses, but osteophytosis of the lateral aspect of the joint is not common (Smyth et al, 2017) and is potential evidence of degenerative pathology in this joint.

Anatomy

The equine temporomandibular joint is a synovial incongruent condylar articulation of the zygomatic process of the squamous temporal bone and the condylar process of the mandible. A biconcave, fibrocartilaginous articular disc with a hyaline-like cartilage meshwork (Adams et al, 2018) is connected to the joint capsule and separates the joint into a smaller ventral (discomandibular joint) and a larger dorsal compartment (discotemporal joint). Communication between the dorsal and the ventral compartement only occurs if there is damage to the disc or its capsular attachments. On dissections, a caudolateral pouch of the discotemporal joint and a smaller rostrolateral and caudolateral pouch of the discomandibular joint was obvious (Weller et al, 1999a, 2002; Rodríguez et al, 2006).

In the caudal aspect, the joint is formed by the mandibular caput and the retroarticular process of the temporal bone. The middle part is wider and formed by the mandibular fossa of the temporal bone and the mandibular caput (*Figure 3*). In the narrow rostral part, the articular tubercle of the temporal bone articulates with the mandibular caput (Weller et al, 1999a). The lateral and the caudal ligament are embedded in the joint capsule, and the temporalis muscle as well as the masseter muscle are attached to

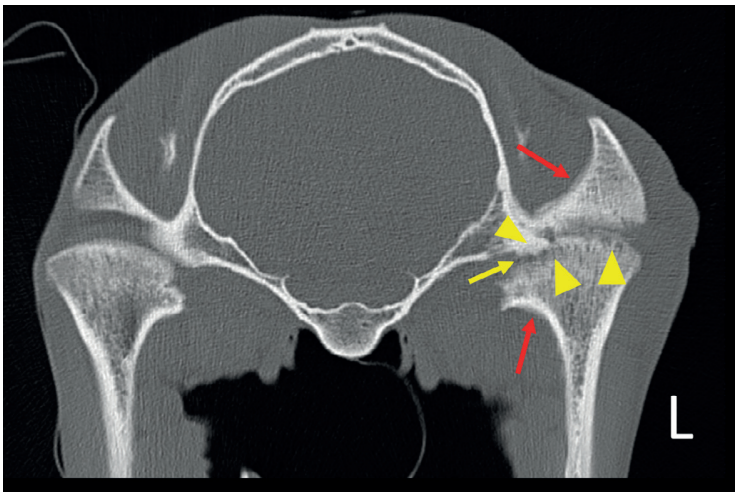

Figure 1. Transverse computed tomography image of a horse with left-sided septic arthritis of the temporomandibular joint. There is a narrowed joint space (yellow arrow), irregular joint surface, moth-eaten appearance of the subchondral bone of the mandibular condyle and the temporal bone (yellow arrowhead). Mild periosteal reaction is visible at the ventral margin of the left mandibular condyle and the dorsal aspect of the temporal bone (red arrow).

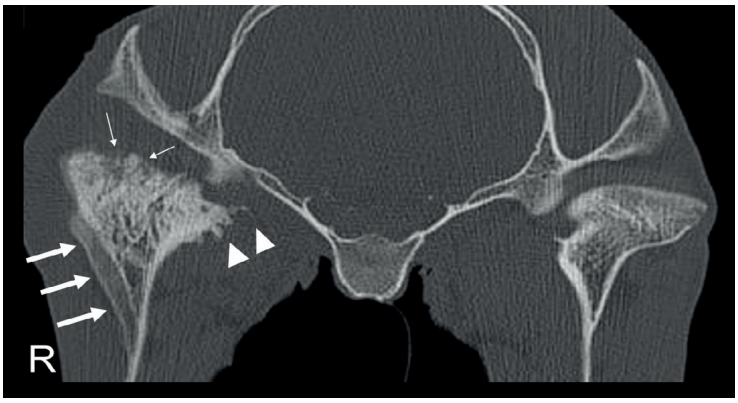

Figure 2. Transverse computed tomography image of a horse with severe chronic right-sided septic arthritis of the temporomandibular joint. There is osteophyte formation at the axial aspect of the right mandibular condyle (arrowheads), markedly irregular joint surface (thin arrows) and moderate, smoothly marginated periosteal new bone formation at the lateral aspect of the right mandibular condyle (arrows).

the capsule and the disc (Rodríguez et al, 2006). The temporomandibular joint is in close relationship to the parotid gland, the maxillary artery and vein, the transverse facial branch of the auriculotemporal nerve and the lateral aspect of the facial nerve. The caudal aspect of the articular capsule is near the facial nerve and the superficial temporal artery and vein. Medially, the joint is adjacent to the temporohyoid joint, the dorsal aspect of the stylohyoid bone, the guttural pouch, the mandibular nerve, and the external acoustic meatus (Rodríguez et al, 2006).

Diagnostic procedure

Diagnostic imaging is important in this challenging disease, as is intra-articular anaesthesia. For arthrocentesis of the temporomandibular joint, a blind approach dorso-caudal to the condylar process of the mandible is described (Rosenstein et al, 2001). An ultrasound-guided approach is equivalent to the blind procedure in healthy horses but is recommended in cases with osseous abnormalities of this joint. Fluid usually fills the needle hub. The synovial fluid parameters of the temporomandibular joint were close to the normal range of other equine synovial joints (Norvall et al, 2020). After aspirating synovial fluid, the temporomandibular joint is infused with 2–3 ml of local anaesthetic solution. Although resolution of clinical signs after analgesia of a temporomandibular joint identifies that joint as the probable site of disease, it does not provide information concerning the nature of the disease (Schumacher, 2006). When blocking the temporomandibular joint with local anaesthetic, one must be aware that there is currently no literature to determine how far the local anaesthetic will diffuse, or exactly what structures will be affected (Smyth, 2017).

Radiography

Oblique radiographic projections are described to minimise the superimposition of the osseous structure and to improve visibility of the equine temporomandibular joint. A rostral 45° ventral–caudodorsal oblique direction is described, obtained by placing the X-ray unit 30° laterally and positioning the plate on the occipital protuberance with a 15° angle rostrally (Ebling et al, 2009); as well as another similar rostral 35° lateral 50° proximal–caudal oblique projection centred on the ipsilateral joint with the plate placed above the poll in a horizontal position (Ramzan et al, 2008). Another radiographic technique is the tangential projection with a 15° caudal 70° dorsal–rostroventral angulation of the X-ray beam and the plate positioned lateral to the affected site (Townsend et al, 2009).

Ultrasound

Ultrasonography of the temporomandibular joint is easily performed in the standing horse and the ultrasonographic appearance of the lateral aspect of the temporomandibular joint is well described. Using a 7.5 MHz linear array probe a minimum of three transverse views is recommended to provide a complete examination. The procedure allows visualisation of the joint space, articular disc, subchondral bone surfaces, and surrounding soft tissue (Weller et al, 1999a; Rodríguez et al, 2007).

The fibrocartilaginous disc appears ultrasonographically as a triangular structure, with a slight widening in the caudal aspect of the joint (about 2 cm) and a decreased size to about 0.5 cm in the rostrolateral aspect. The ultrasonographic appearance of the disc is homogeneous with an echogenicity between that of loose connective tissue and tendons, like the menisci of the equine stifles. The lateral and the caudal ligament could not be identified on ultrasonographic examination because of their attachment with the joint capsule (Weller et al, 1999a).

The comparison of radiography, nuclear scintigraphy and ultrasonography in a case of temporomandibular joint arthropathy showed that radiographs were inconclusive and nuclear bone scintigraphy localised a pathological process within the temporomandibular joint but failed to characterise the lesion. Ultrasound was the only imaging modality in this case report that both localised and characterised the disease (Weller et al, 1999b).

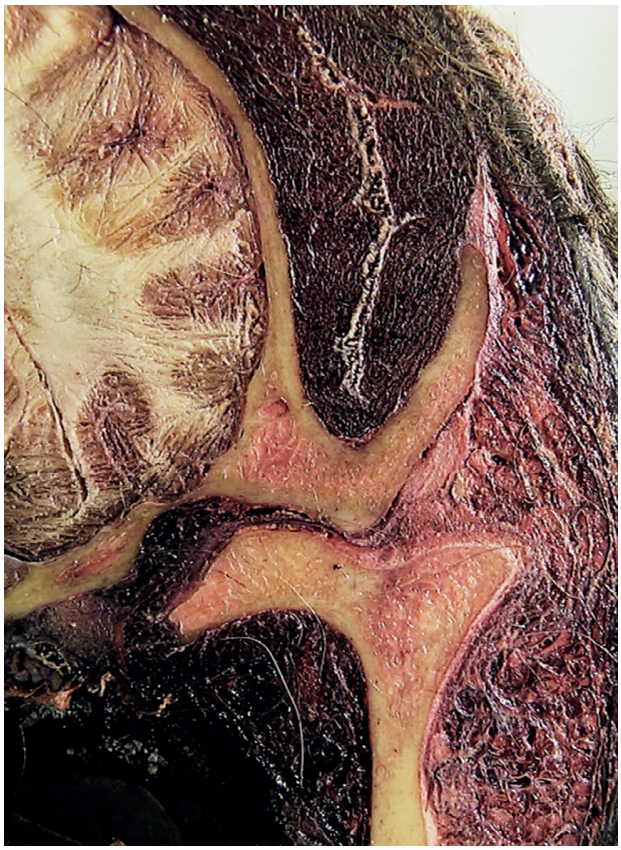

Figure 3. Transverse gross anatomical slice through the left temporomandibular joint.

Magnetic resonance imaging

The application of magnetic resonance imaging for examination of the equine head is less advanced compared to use in equine musculoskeletal diseases and is limited to high-field systems under general anaesthesia. The magnetic resonance imaging anatomy of the temporomandibular joint is described (Rodríguez et al, 2010), and this modality is the current 'gold standard' for imaging the human temporomandibular joint (Jank et al, 2005).

Computed tomography

Computed tomography imaging has become the leading imaging modality for the diagnosis of head disorders in the horse (Klopfenstein Bregger et al, 2019). The first case reports using computed tomography to diagnose diseases of the temporomandibular joint were published in the 1990s (Tietje et al, 1996; Warmerdam et al, 1997). Computed tomography of the head is increasingly performed on the horse via standing sedation and the computed tomography anatomy of the temporomandibular joint in young horses has been described (Rodríguez et al, 2008). In many reports of temporomandibular joint pathology, computed tomography was used to confirm the diagnosis (Devine et al, 2005; Nagy and Simhofer, 2006; Perrier et al, 2010; Barnett et al, 2013; Jørgensen et al, 2015; Smyth et al, 2017; Balducci et al, 2019).

Osteophytes and new bone formation associated with the joint capsule are significant for joint pathology and can be easily visualised on computed tomography images. Therefore, pointed new bone formation at the axial margin of the mandibular condyle can be overestimated as significant for temporomandibular joint pathology. A study found anatomical variations in computed tomography images of the temporomandibular joint in 40% of horses, as well as some age-related variances. Young horses (<1 year) commonly had alterations in the shape and density of the mandibular condyle. Older horses had changes within the mandibular condyles consistent with bone cysts and hyperdensities in the dorso-rostral part of the intra-articular disc with increasing age (>10 years), presumably caused by dystrophic mineralisation associated with degeneration. These findings indicate an age-related remodelling of the temporomandibular joint (Carmalt et al, 2016)

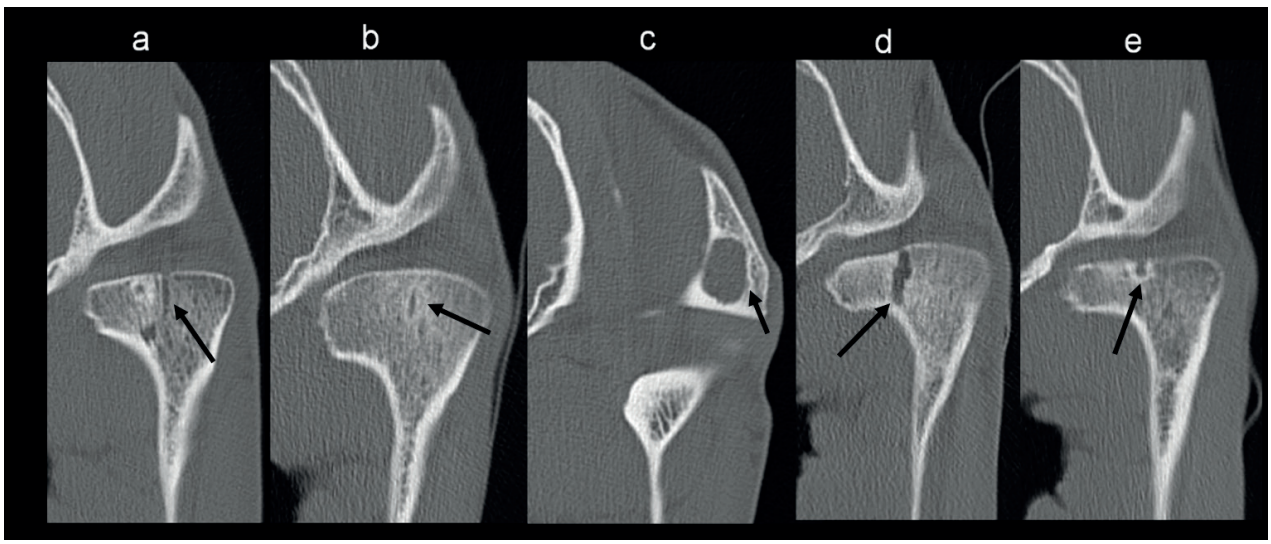

Figure 4a–e. Transverse computed tomography images of temporomandibular joints of different horses unrelated to temporomandibular joint pathology. Notice the variance in appearance and shape of spheroid or ovoid radiolucent areas within the mandibular condyles surrounded by a radiodense rim (black arrows; a,b,d,e). c: there is a rounded well-circumscribed radiolucent area within the zygomatic process of the temporal bone, surrounded by a mild sclerotic rim.

KEY POINTS

- Real pathology of the temporomandibular joint is rare. Based on the clinical signs, temporomandibular joint arthropathy is more often over- than under- diagnosed
- Clinical signs are variable and include masticatory problems, reduced opening of the mouth, weight loss and headshaking.
- Chronic cases of septic arthritis show pain on palpation, local swelling within the temporomandibular joint region, regional muscle atrophy and sometimes a drainage tract.
- Owing to the close relationship to the temporohyoid joint and cranial nerves, intra-articular analgesia of the temporomandibular joint may be not specific.
- Diagnostic imaging is important to diagnose temporomandibular joint arthropathy; ultrasound, radiographs and computed tomography are recommended, but must be interpreted critically.

and careful interpretation of the computed tomography appearance of this joint is indicated (*Figure 4*).

Therapy

A single intra-articular treatment of the temporomandibular joint with triamcinolone acetonide 18 mg and sodium hyaluronate 51 mg has been described, which improved the performance in this case report (Jørgensen et al, 2015). The caudodorsal arthroscopic approach provided the best evaluation of the lateral aspect of the dorsal compartment. Access to the ventral compartment is described as being precluded by the location of the transverse facial artery and vein (May et al, 2001) and may be used for treatment in cases of septic arthritis (Carmalt and Wilson, 2005). However, mandibular condylectomy or partial condylectomy is commonly used as a surgical procedure to treat fractured, luxated or infected temporomandibular joints (Barber et al, 1985; Devine et al, 2005; Nagy and Simhofer, 2006; Bienert-Zeit and Rötting, 2011; Barnett et al, 2013; Frietman et al, 2019) under general anaesthesia or under sedation (Sanders et al, 2014). Balducci et al (2019) described an arthrotomy for treatment of septic arthritis of the temporomandibular joint.

Conclusions

An absence of systematic reviews, controlled clinical trials, case-control studies and large case series means that definitive evidence of equine temporomandibular joint disorder in general is limited. This may be because of the diagnostic challenge that results from non-specific signs (Witte, 2016).

Simply relying on clinical examination such as palpation, or response to intra-articular steroid injection, is likely to lead to over-diagnosis rather than underdiagnosis (Carmalt, 2014). However, a single case report described temporomandibular joint arthropathy as a cause of decreased performance in a high-level dressage horse that responded very well to joint treatment (Jørgensen et al, 2015).

Temporomandibular joint arthropathy is not common in horses and an accurate and critical procedure including clinical examination, intra-articular anaesthesia and different imaging modalities is recommended to exclude or diagnose this disease. EQ

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