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RADIOLOGICAL STUDIES OF SECONDARY COMPLICATED SINUSITIS IN A RACING MARE – CASE REPORT

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ABSTRACT

The purpose of this research reflects the development process of secondary sinusitis in horses regarding the topographic-anatomical preconditions for unilateral involvement of the all six sinuses complex. The medical anamnesis and diagnostic imaging tests conducted previously in a veterinary clinic in Germany were used. The head of the mare was examined by X-ray radiography and computed tomography (CT) methods after its death. The following procedure included a treatment of the skull and the established osteolytic alterations have been compared by us with those obtained from the X-ray images and CT scans, as well as the applied CT slices and 3D reconstructions of the alive patient. This prominent clinical case reveals an opportunity for an interpretation of the expansion and complications of sinusitis in horses with an emphasis on the anatomical characteristics of the sinuses, visualized by diagnostic imaging methods. Through this study we hope to contribute to the timely diagnosis and treatment of the paranasal sinuses inflammation in horses.

Key words: paranasal sinus system, secondary sinusitis, computed tomography, horse.

Introduction

The equine paranasal sinuses are an intricate area of interests. The horse head had six pairs of sinuses, three paranasal; the frontal, maxillary and sphenopalatine sinuses and three nasal; dorsal, middle and ventral conchal sinuses and all of these spaces communicate with each other and the nasal passage either directly or indirectly. Different sinus compartments communicate with each other, grossly creating a rostral and more caudal complex (Vlaminck, 2013). The rostral complex consists of the ventral conchal sinus which communicates with the rostral maxillary sinus over the infraorbital canal through the conchomaxillary opening. The caudal complex consists of the caudal maxillary sinus which broadly communicates with the conchofrontal sinus through the frontomaxillary opening. Over the infraorbital canal, the caudal maxillary sinus also communicates with the more medially located sphenopalatine sinus. Caudal maxillary sinus communicates with middle conchal sinus. Rostral and caudal maxillary sinuses communicate with the nose through separate narrow nasomaxillary openings into the middle meatus. This close communication with the nose renders these sinuses vulnerable for development of infectious problems.

The large size and complex anatomy of the sinuses can allow a pathologic process to be present for weeks or months before any external signs, such as facial swelling or nasal discharge were noticed by the owner or veterinarian. This can negatively affect the prognosis (Waguespack, 2011).

Disease processes that can develop in the sinuses include: ethmoid hematomas, cysts, neoplasia, and bacterial and fungal infections.

Clinical signs of any type of sinusitis usually include unilateral purulent nasal discharge, ipsilateral mandibular lymph node enlargement, and epiphora. Less common signs include facial swelling, exophthalmos, abnormal respiratory noises, head shaking, and exercise intolerance (Lane 1993; Tremaine & Dixon, 2001a).

Diseases involving the head are frequently encountered in horses and require imaging studies for further work-up (Tucker and Farrell, 2001). There is apparently no breed, age or gender predisposition to sinusitis.

Historically, radiography has been the primary imaging technique for assessing the skull, nasal cavity, dental structures and paranasal sinuses (Wyn-Jones 1985a,b; Tremaine and Dixon 2001a). However, the anatomic complexity and superimposition of the osseous, dental and soft tissue structures complicate radiographic interpretation (Tucker and Farrell 2001). Cross-sectional imaging modalities, such as computed tomography (CT) and magnetic resonance imaging (MRI), are therefore particularly useful for this area (Kraft and Gavin 2001; Solano and Brawer 2004).

The purpose of this research reflects the development process of secondary sinusitis in horses regarding the topographic-anatomical preconditions for unilateral involvement of the all six sinuses complex. Through this study we hope to contribute to the timely diagnosis and treatment of the paranasal sinuses inflammation in horses.

Materials and Methods

Animals

The object of this study was a head of racing mare obtained from a veterinary clinic in Gessertshausen, Germany. The mare was eight years old. The medical anamnesis and diagnostic imaging tests conducted previously in a veterinary clinic in Germany were used. The head of the mare was examined by X-ray radiography and computed tomography (CT) methods after its death. The following procedure included a treatment of the skull and the established osteolytic alterations have been compared by us with those obtained from the X-ray images and CT scans, as well as the applied CT slices and 3D reconstructions of the alive patient.

Computed tomography study

The head of racing mare were placed in lateral and dorso-ventral recumbency on the CT table. CT was performed along the transversal planes from the muzzle to the atlas in 1.5 mm thick helical CT slices at 10 mm intervals, by a Picker® CT PQ 5000 scanner. The CT scan images were analyzed with computer software DIKOM-VIEWER and were subsequently compared with radiographic images and pictures of the processed skull and are compared right with left side too.

The CT study and 3D reconstructions provided from German clinic were used.

Radiography

The head of mare wes captured by X-ray machine – Eickemeyer® Vet, model E 7239X in standard orthogonal projections – dorsal-ventral and lateral images. The available dissection results were clarified, supplemented and compared right with left side.

Bone cleaning technique

From the head a faded bone sample was prepared. The scull was cleaned by boiling and soaked for overnight in peroxide solution. The results from CT and Radiography was compared with osteology results.

Results and Discussion

This case observes an eight-year-old mare, which had developed secondary sinusitis after an apical dental disease of the upper right premolar. The inflammation of the teeth roots progressed

into the right rostral maxillary sinus. The development of this sinusitis resulted in cavity formation and accumulation of purulent exudate. This cavity has led to hyperventilation which alleviates the breathing and as a result, the mare was stopped from racing. Due to the difficult drainage of the sinus, the exudate has been inspissated. The cavity started to enlarge and led to face asymmetry with clear distinguishable swelling of the right maxilla (Fig. 1), which is one of the clinical signs of sinus diseases, especially in an apical infection of the first three premolars, according to a large number of authors (Waguespack, 2011; Khairuddin, 2016; Tremaine and Freeman). On the CT scans and 3D imagining is established asymmetrical inflection of external lamina of the maxilla dorsally of the right infraorbital foramen (Fig. 1). On the CT scans is visible an asymmetry caudally of *apertura nasi ossea* and *incisura nasoincisiva* (Fig. 1), signs that the above-mentioned authors do not describe.

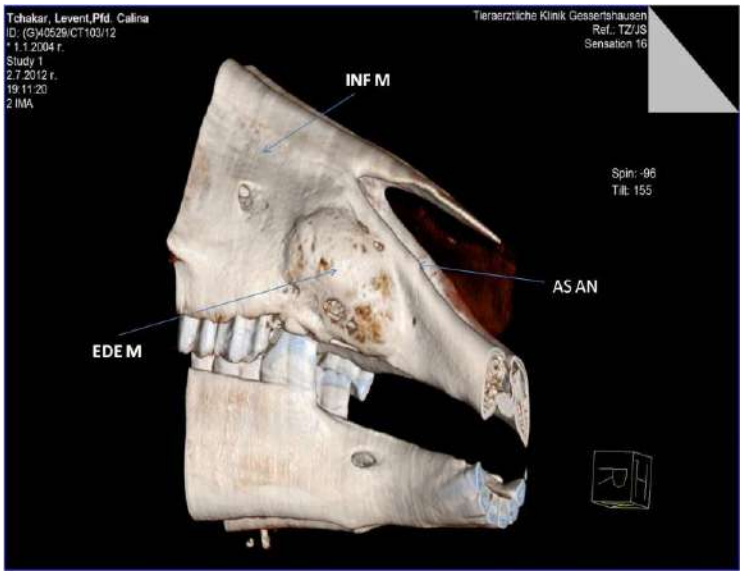

Figure 1: 3D reconstructions of head of the mare (Veterinary clinic in Gessertshausen) – INF M – inflexion of the external lamina of maxilla; EDE M – facial swelling of the maxilla; AS AN – asymmetry caudally of apertura nasi ossea.

The adjacent dorsal and ventral nasal concha were affected with the development of the inflammation process. Osteolytic changes had occurred in the bones that had affected the maxilla and its palatine process, as well as the ventral and dorsal nasal concha (Figs 1; 2). Similar changes are described from Schumacher & Crossland, 1994; Waguespack, 2011. The ventral conchal sinus is relatively isolated and communicates only with the rostral maxillary sinus. This is a predisposition for accumulation and inspissation of exudate (Waguespack, 2011), which is fully confirmed by this clinical case (Fig. 2).

We observed deviation of the cartilage nasal septum and the vomer in the right direction under the inflamed tissue pressure and osteolytic changes in right maxillary sinus (fig.2), as Tremaine and Freeman describe.

Osteolytic changes between right infraorbital canal and molar's alveoli are observed on CT scans and X-ray images. Canal's bone proliferation indicates a possible inflammatory process that

we identified when comparing it to the left side of the mare's head (Fig. 3). There is no data in the literature regarding this changes.

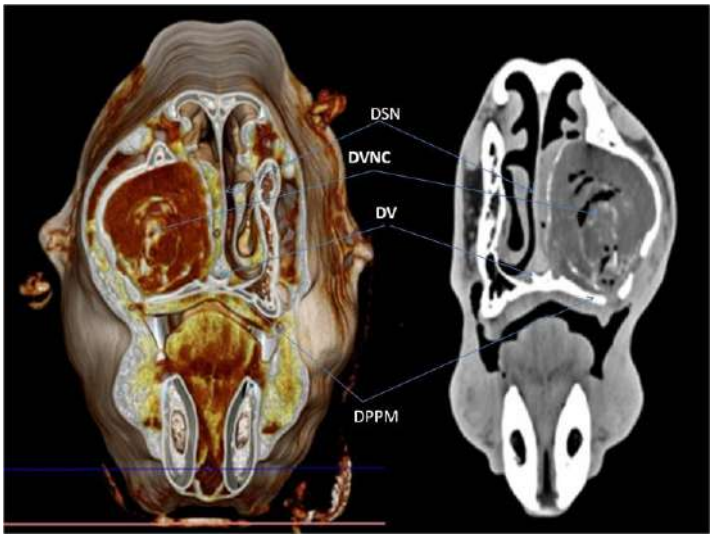

Figure 2: 3D reconstructions (left) and CT(right) through swelling region (Veterinary clinic in Gessertshausen) – DSN – deviation of the nasal septum cartilage; DVNC – destroyed ventral nasal concha with inflammatory and osteolytic mass; DV – deformation of the vomer; DPPM – deformation of the palatine process of the maxilla.

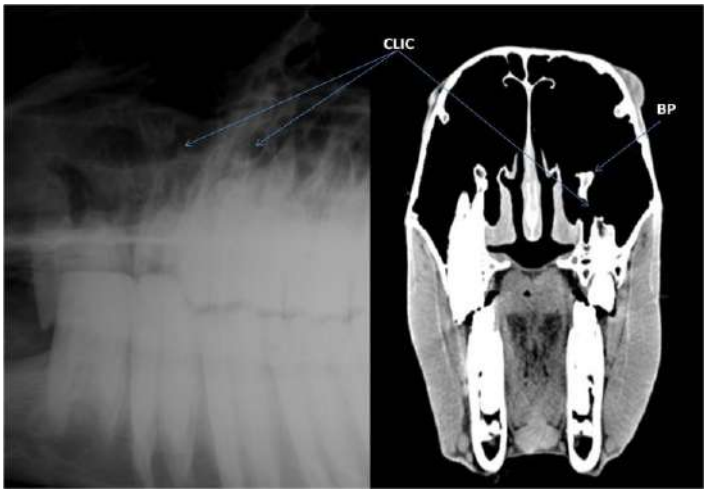

Figure 3: Lateral radiography of the head (left) compared with CT (right; Veterinary clinic in Gessertshausen) through first molar – CLIC – cavity after osteolytisis lower infraorbital canal; BP – bone proliferation of the right infraorbital canal.

In horse, compared to donkey, the septum between the rostral and caudal maxillary sinus is complete, as is described from El-Gendy and Alsafy, 2010. On the CT scans the destruction of *septum sinuum maxillarium* is evident, compared with the left sinus (fig. 4), in contrast to that observed by Tremaine and Freeman.

Figure 4: CT before orbit of head of the mare (Veterinary clinic in Gessertshausen) – BP – bone proliferation around right infraorbital canal; NSSM – normal septum sinuum maxillarium; DSSM – destroyed septum sinuum maxillarium.

Khairuddin (2016) observe a painless facial swelling formation of the frontal bone, due to inflammation of the frontal sinus. This is confirmed by our research as well, where the process was complicated and affect the conchofrontal sinus because of its communication with caudal maxillary sinus. We observed an inflection of *lamina externa* of the right frontal bone and deviation *of septum sinuum fronatalium* on the level of supraorbital foramen due to the osteolytic changes (Fig. 5).

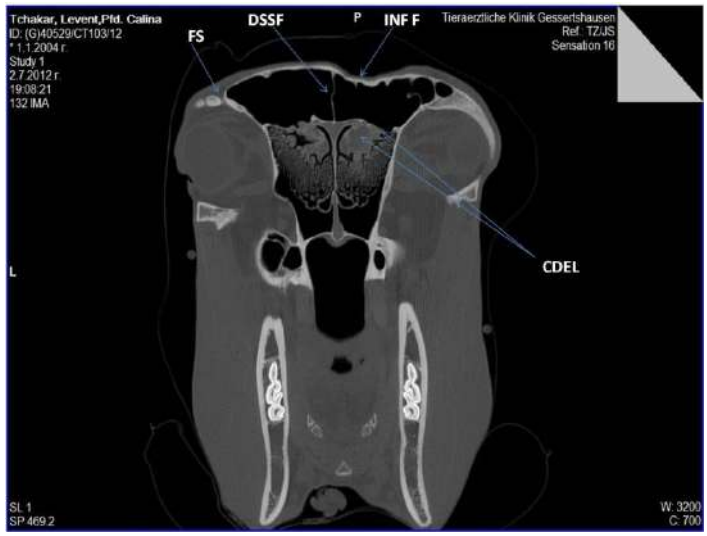

Figure 5: CT through the level of supraorbital foramen (Veterinary clinic in Gessertshausen) – FS – foramen supraorbitale; INF F – inflexion of the external lamina of frontal bone; DSSF – deviation of the septum sinuum fronatalium; CDEL – edema and asymmetry of dorsal part of the ethmoidal labyrinth.

We observed an asymmetrical location of *septum sinuum sphenoidalium* in the sphenopalatine sinus (Fig. 6), which is not very rare with healthy horses and donkeys (El-Gendy, 2010). Due to this often normal position of the septum, we cannot affirm the inflammatory changes in it. This was proven with the ventral part of the ethmoidal labyrinth, which was not affected.

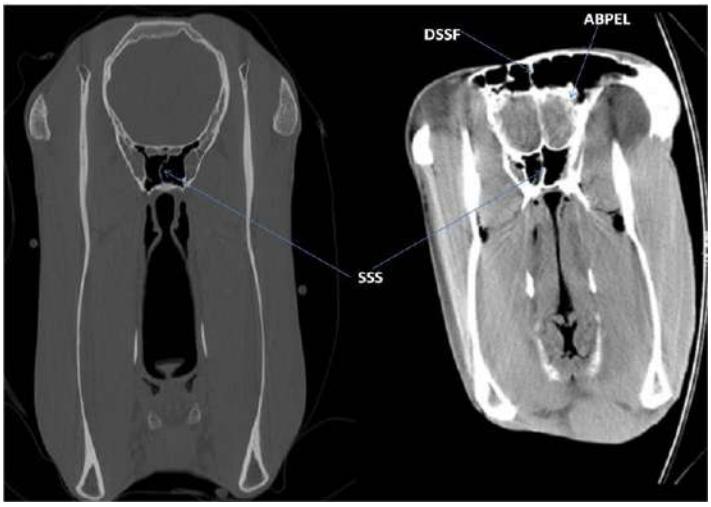

Figure 6: CT through the level of the orbit (left (Veterinary clinic in Gessertshausen) and right) – SSS – asymmetry of the septum sinuum sphenoidalium; DSSF – deviation of the septum sinuum fronatalium; ABPEL – asymmetry and bone proliferation of the cribriform plate.

We did not establish affected middle nasal concha from the radiological examination. Only the dorsal part of the ethmoidal labyrinth, which is located at the base of the frontal sinus, is influenced. It is evident that a bone proliferation and swelling had occurred, compared to the left half of the head (Figs. 5, 6). This is also seen in the rostral part of the telencephalon. Not very often, purulent meningoencephalitis and neurological signs can occur after severe chronic sinusitis with an erosion of the cribriform plate. Similar changes are described by Waguespack (2011).

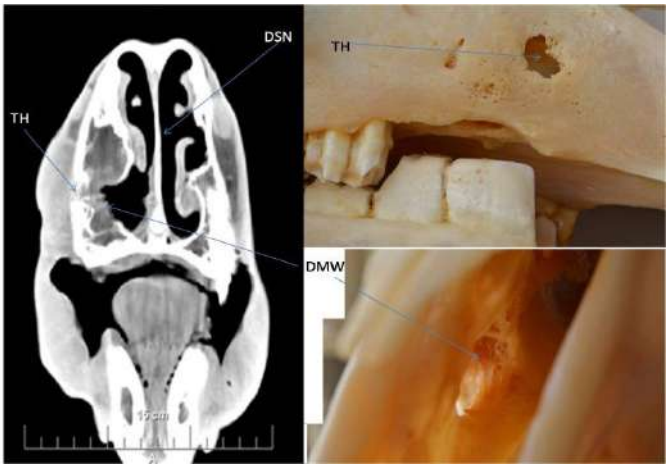

Figure 7: CT through the level of the trepanation hole (left) compared with native pictures of the skull (right) – TH – trepanation hole; DSN – deviation of the nasal septum cartilage; DMW – destroyed of medial wall of the maxilla.

The second and third right molars were removed for healing purposes. The removing of the teeth was made through a trephination opening above the second premolar (Fig. 7), which subsequently was filled with granulation tissue. So formed openings were used for lavage and drainage of the sinus, as some authors recommend (Schumacher & Crossland, 1994; Nickels, 2006; Dixon et al., 2012).

The cavity formed by the inflammation is medially destroyed, which led to wide communication with nasal cavity (Fig. 7). Similar pathologic changes are not mentioned from other authors. This osteolysis is identified on present radiological examinations and confirmed on the mare's skull. The great expansion and development of the chronical sinusitis are confirmed with comparing our examinations with those from the German veterinary clinic.

From our studies, we established that the changes are distinguishable and differentiable on CT scans, compared to x-ray images. On the radiographic views, there was a severe overlaying of the images, which confirmed Manso-Díaz, (2015) findings.

Conclusions

The specific morphology and communications of the horse paranasal sinus system predisposes sinusitis to spread and become chronic. All sinus compartments can be involved in sinus disease. The large size and complex anatomy can negatively affect the prognosis of horse sinusitis. They can exists for weeks or mounts before any signs will be noticed by the owner or veterinarian. CT is an imaging technique with high diagnostic value for evaluation the equine head, yielding additional information over multiple radiographic views, which may alter the outcome of the case. Computed tomography and skull radiography are of great value in diagnosing the presence and causes of equine sinus disease. X-ray examination alone is insufficient for accurate and timely diagnosis of sinuses diseases in the horses.

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References

1. Dixon, P. M., T. D. Parkin, N. Collins, C. Hawkes, N. Townsend, W. H. Tremaine, G. Fisher, R. Ealeyand, S. Z. Barakzai. (2012). *Equine paranasal sinus disease: A long-term study of 200 cases (1997–2009): Ancillary diagnostic findings and involvement of the various sinus compartments*. Equine Veterinary Journal, 44: 267–271.
2. El-Gendy, S. A. and Alsafy, M. A. M. (2010). *Nasal and Paranasal Sinuses of the Donkey: Gross anatomy and Computed Tomography*. J. Vet. Anat., 1(3): 25–41.
3. Khairuddin, N. H. and M. Armiladiana, M. Standing. (2016). *Frontonasal Flap and Maxillary Sinus Trephination in a Horse with Sinusitis*. Pertanika J. Trop. Agric. Sci., 39 (1): 117–126.

4. Kraft, S. L. and P. R. Gavin. (2001). *Physical principles and technical considerations for equine computed tomography and magnetic resonance imaging*. Vet. Clin. N. Am. Equine Pract., 17: 115–130.
5. Lane, J. G. (1993). *Management of sinus disorders, part 1*. Equine Veterinary Education, 5: 5–9.
6. Manso-Díaz, G. (2015). *The role of head computed tomography in equine practice*. J. M. García-López, L. Maranda and O. Taeymans. Equine vet. Educ., 27 (3): 136–145.
7. Nickels, F. A. (2006). *Nasal passages and paranasal sinuses*. In J. A. Auer, & J. A. Stick (Eds.). Equine surgery (3rd ed.). Missouri: Elsevier.
8. Schumacher, J. and L. Crossland. (1994). *Removal of inspissated purulent exudate from the ventral conchal sinus of three standing horses*. Journal of American Veterinary Medicine Association, 205(9): 1312–1314.
9. Solano, M. and R. S. Brawer. (2004). *CT of the equine head: technical considerations, anatomical guide, and selected diseases*. Clin. Tech. Equine Pract., 3: 374–388.
10. Tucker, R. L. and E. Farrell. (2001). *Computed tomography and magnetic resonance imaging of the equine head*. Vet. Clin. N. Am.: Equine Pract., 17: 131–144.
11. Tremaine, H. and D. E. Freeman. *Disorders of the Paranasal Sinuses*. http://www. equisan.com.
12. Tremaine, W. H. and P. M. Dixon. (2001a). *A long-term study of 277 cases of equine sinonasal disease. Part 1: details of horses, historical, clinical and ancillary diagnostic findings*. Equine Veterinary Journal, 33: 274–282
13. Vlaminck, L., C. Crijns, I. Gielen. (2013). *Nasal cavity and sinuses*. Conference: CT-User, 3rd International meeting, At Gent.
14. Waguespack, R. Wayne, J. Taintor. (2011). *Paranasal sinus disease in horses*. www. vetlearn.com, MediMedia Animal Health, February 2011.
15. Wyn-Jones, G. (1985a). *Interpreting radiographs 6: radiology of the equine head (Part 2).* Equine Vet. J., 17: 417–425.
16. Wyn-Jones, G. (1985b). *Interpreting radiographs 6: the head*. Equine Vet. J., 17: 274–278.