

## **Nasal cavity and sinuses**

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The anatomy of the horse's nose and sinuses is very complex. Profound knowledge of its development and construction is a prerequisite to understand the pathogenesis of different upper respiratory tract diseases, to interpret the results of a variety of diagnostic medical imaging techniques, and to make correct decisions regarding surgical approaches and techniques.

The nasal cavity is divided into equal halves by the nasal septum and the vomer bone. Two major nasal conchae in each nasal cavity divide the nasal passage into the dorsal, middle, ventral, and common meatus. The complex paranasal sinus system consists of six pairs of sinuses of which the maxillary and frontal sinuses are of major clinical importance. Different sinus compartments communicate with each other, grossly creating a rostral and more caudal complex. 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. 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.

Given the complex structure of the upper respiratory tract, it can be very challenging to make a precise diagnosis of the encountered pathology. After completing a basic clinical examination of the head (inspection, palpation, percussion, ...), nasal endoscopy is the primary diagnostic tool. Further use of different medical imaging techniques are essential in the assessment of structural abnormalities in those areas that are difficult to explore with the endoscope.

Standard radiographic techniques can be beneficial in imaging most abnormalities within the nose and sinus but have limitations specifically due to the superimposition of structures. This can make interpretation difficult. Scintigraphy is extremely sensitive for detecting bone remodeling and can be used to distinguish among dental disease, neoplasie, and primary sinusitis. But CT has a distinct advantage over both former techniques because it delivers highly detailed cross-sectional images of the nasal cavity and paranasal sinuses which allow more precise determination of a disease process. The availability of CT systems which allow acquisition of images in the standing horse greatly facilitates its use. MRI, a technique that has become widely accepted for diagnosing soft tissue lesions of the distal limb, is becoming more recognized as a valuable tool to image the head of horses.

From a surgical point of view, the exact localization and determination of the boundaries of the disease process are imperative to choose the best surgical approach and the correct modalities of the envisaged surgical treatment.

Facial trauma is frequently encountered in equids and often results in depression of osseous fragments into the nasal passage or sinus cavities. Fractures commonly involve the nasal and frontal bones but may also involve the maxillae and lacrimal bones. Clinical and radiographic examination of

the skull is most often inconclusive in determining the real extent of the damaged structures. Involvement of the calvarium, temporomandibular joint or comminuted fractures frequently carries a poor prognosis which excludes further treatment. 3D reconstructed CT images provide the surgeon with a detailed insight into fracture configuration which permits the best possible reduction and fixation of fracture fragments.

Thickening, malformation, deviation or other diseases of the nasal septum are rarely seen. Some of these conditions may improve with removal of a small or larger portion of the nasal septum, a choice based on the results of computed tomography. A dystrophic calcification process located within the nasal conchae can sometimes be encountered in cases of chronic apical disease. This pathology is readily identified on standard radiographic projections of the head. CT imaging allows more precise determination of dorsal and/or ventral conchal involvement which guides the surgeon to accurately excise all diseased tissues following dental extraction. It often necessitates using a less conventional nasal bone flap approach, the boundaries of which are dictated by the correct interpretation of the CT data.

Differentiating between possible causes of sinusitis is very challenging but of great importance for the success of any treatment. Inspissated pus most frequently accumulates in the ventral conchal sinus, and is regarded as the main reason for persistence of infection in cases of primary sinusitis despite repeated sinus lavage and long-term antibiotic treatment. Dental disease, the number one reason for secondary sinusitis, can remain undiagnosed despite performing a thorough dental exam using a dental mirror or dental scope, and making standard radiographic projections. The introduction of sinoscopic techniques has facilitated minimal invasive exploration of different sinus compartments. However, computed tomography of the paranasal sinuses allows more readily and detailed identification of any pathology relevant to the underlying disease process. Measuring density differentiates fluid from soft tissue. When the extent and localization of the disease process is precisely defined, the surgeon can make a choice between conservative or surgical treatment, between minimal or more invasive approaches, between transnasal approaches, simple transcortical sinus lavage or sinus bone flap surgery (maxillary and/or fronto(nasal)). Without this knowledge the surgeon can do more harm than to achieve beneficial effects if his/her actions.

The prognosis after surgical treatment for sinonasal neoplasie is greatly dependent upon the benign or malignant characteristics of the tumor mass. Biopsy and histopathology remain the gold standard for proper identification of tissue characteristics of any neoplasia. However, CT analysis of tumor location, extent and invasiveness will determine the practicability of any surgical attempt.