

Paranasal Sinus Pneumocoele in a Nine-year-old Warmblood gelding

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History

A 9-year-old Warmblood gelding presented with a slow-growing, bony mass of the nasal bone located left of midline and adjacent to the dorsal border of the conchofrontal sinus (Figure 1). It was hard, convex, and non-painful to palpation. The mass had been present for 4 years but recently epiphora from the left eye raised concern for impingement of the nasolacrimal duct.



Sinusotomy

The horse underwent standing sedation using intravenous methadone and detomidine. Using an oscillating saw, a threesided cut was made through the frontal and nasal bones around the perimeter of the bony swelling into the conchofrontal sinus. Prior to flap elevation, copious air bubbles of haemorrhage were seen exiting the saw cuts in the skull during normal breathing. The bone flap was reflected exposing a mucopurulent inflammatory lining on the underside. The bone had a dysmorphic, honeycomb appearance. A partially deflated cystlike structure was present beneath (Figure 3). This was considered to be the abnormally enlarged pneumatised dorsal conchal bulla observed on CT which was inadvertently penetrated with the oscillating saw during entry into the conchofrontal sinus. Approximately 50% of the dorsal conchal bulla was resected for submission for histopathology and to prevent continued pneumatisation. Grossly abnormal, reactive sinus mucosal tissue was removed and the sinus copiously lavaged. To enhance sinus drainage and allow passage of any accumulated air, a fenestration into the rostroventral wall of the dorsal concha was made. A gauze bandage was passed through this fenestration and used to pack the sinus and the trailing end was sutured to the nostril. The bone flap was then replaced and indwelling fenestrated drain inserted caudal to the flap incision for post-operative lavage. The wound was then sutured closed.

Clinical Outcome

Recovery from surgery was routine but mild complications occurred including mucopurulent nasal discharge and incisional drainage at 3 weeks after surgery. These responded to a course of oral trimethoprim-sulphadimidine and phenylbutazone.

Follow-up with the owner three months after surgery revealed the incisions were fully healed and no further expansion of the nasal bone was reported. From external observation the swelling appears to have flattened since the operation and the owner subjectively reports improvement in overall demeanour and comfort of the horse with a pleasing cosmetic result. No further reports of abnormal tear formation have occurred since surgery.

Figure 1: Image of nasal bone swelling

Clinical Examination & Diagnostic Imaging

Clinical examination: A hard, non-painful bony swelling was palpated over the left nasal bone. No active nasal discharge was present and both nasolacrimal ducts were flushed and considered patent, but increased resistance was felt through the left duct compared to the right.



Further investigation into the status of the partial excision of the dorsal conchal bulla would require sinoscopy or a repeat CT.

Discussion

The cause of the bone swelling in this case was shown to be a pneumocoele of the dorsal conchal bulla. The air-filled bulla created increased pressure on the undersurface of the nasal bones resulting in distortion and abnormal convexity in the bone.

The term 'pneumocoele' in the human literature is defined as a pathological air-filled expansion of the sinus that leads to deformation, in particular thinning, of the surrounding bony sinus walls (Teh *et al.*, 2012). The aetiology and pathogenesis behind pneumocoele formation is poorly understood. It is postulated that a one-way valve mechanism within the mucosa over the sinus results in progressive sinus expansion due to air filling the sinus but is unable to exit. An alternative hypothesis is the formation of a mucocoele within the sinus which then spontaneously drained leaving an air-filled cavity (Urken *et al.*, 1987).

Endoscopy: No obvious obstruction of the left nasal passage was identified.

Radiography: A circumscribed expansion of the nasal bone with thinning as well as a honeycomb appearance along the ventral margin of the bone was present.

Computed tomography (CT): Was performed using bone and soft tissue algorithms. An expansile, ovoid bony deformation was identified with thinning, of the left nasal bone over the left dorsal conchal sinus and rostral margin of the left conchofrontal sinus (Figure 2). Adhered to this bony irregularity were deposits of soft tissue material. Notably there was also eccentric dislocation of the dorsolateral wall of the left dorsal conchal bulla into the expansile part of the nasal bone. The suggested diagnosis based on these findings was pneumatisation of the dorsal conchal bulla resulting in the formation of a pneumocoele.

The CT scan provided a provisional diagnosis and assisted surgical planning due to the improved characterization of the structure.

Figure 3: Intra-operative view of left frontonasal bone flap. The yellow arrows point to the collapsed pneumocoele and the blue arrows point to the underside of the bone flap. **Figure 4:** Below image is a sagittal transection of the equine head from Froydenlund et al. (2015) highlighting the normal dorsal conchal sinus (DCS), dorsal conchal bulla (DCB), ventral conchal sinus (VCS) and ventral conchal bulla (VCB).



The incidence and documentation of sinus pneumocoeles is scarce in the equine clinical literature. In a case report by Breuer *et al.* (2005) a 20-year-old gelding was first detected at the age of 11 with a fist size protuberance of the right frontal sinus. A necropsy performed 9 years later showed the lesion had caused deformation of multiple sinuses and bone due to continued aggressive expansion of the pneumocoele.

Surgical intervention was indicated to make a definitive diagnosis, resect pathological tissues, reduce further the chance of more serious problems and improve cosmesis. As far as we are aware surgical treatment of this condition has not been documented. Partial resection of the dorsal conchal bulla and creating an enlarged opening into the nasal cavity via a fenestration of the ventrolateral floor of the dorsal concha was considered a rational approach to preventing pneumocoele formation post-surgery. So far, there has been no recurrence of the problem.



Figure 2: Transverse section CT image of the head showing the expansile diffusely thinned portion of the nasal bone (red arrows). Asterisk indicates the dislocated left dorsal conchal bulla (Liuti et al., 2015).

Histopathology

Histopathology of the tissue adherent to the ventral part of the nasal bone and of the cystic structure showed non-neoplastic reactive soft tissue changes. The material lining the nasal bone consisted mostly of extensive fibrous connective tissue associated with osteoclastic and osteoblastic bone remodelling of the adjacent nasal bone. The mucosa and submucosa covering this, which communicated with the sinus, appeared within normal limits. The hypertrophic bulla tissue contained extensive fibroblast proliferation, but little evidence of vascular proliferation. These changes did not support the diagnosis of an ethmoid haematoma or soft tissue tumour. From these findings it was concluded that the changes found on histology were more likely from reactive processes rather than neoplastic.

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