Magnetic resonance imaging features of progressive ethmoid hematoma in 2 horses

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Summary
Progressive ethmoid hematoma is frequently reported among the pathologies of the upper airways in horses. While several hypotheses have been proposed such as repeated trauma, inflammatory processes and/or chronic infections, congenital phenomena, complication of hemangiomas, and neoplastic processes, the aetiology of this condition is yet unknown. Clinical symptoms are non-specific and includes haemorrhagic nasal discharge, respiratory noise not related to physical exercise and, in most severe cases, phenomena of coughing. The purpose of this case report is to contribute to a correct diagnostic approach to this particular pathology of upper respiratory tract in horses. Magnetic Resonance allows for a very detailed imaging of the development of the disease and suggests appropriate therapeutic choices.

Risonanza magnetica per imaging *di due casi di ematoma progressivo dell'etmoide in cavalli*

Parole chiave
Cavallo,
Ematoma dell'etmoide,
Patologie delle prime vie aeree,
Prime vie respiratorie,
Rinorragia,
Risonanza magnetica,
Scolo nasale,
Testa di cavallo,
Turbinati.

Riassunto
Tra le differenti affezioni respiratorie del cavallo, le segnalazioni di ematoma progressivo dell'etmoide sono di frequente riscontro. L'eziologia è, a tutt'oggi, sconosciuta e le ipotesi proposte da numerosi autori sono diverse. Quali possibili origini vengono infatti indicate cause congenite, esito di più estesi emangiomi, infiammazioni e/o infezioni croniche, traumi con ricorrenti emorragie, oltre a fenomeni neoplastici non ancora chiariti. La sintomatologia clinica è aspecifica e include, oltre a scolo nasale prevalentemente emorragico, rumore respiratorio non correlato all'esercizio fisico accompagnato, nei casi più gravi, da accessi di tosse. Scopo del presente lavoro è quello di apportare un contributo per un corretto approccio diagnostico e terapeutico di questo particolare tipo di lesione nel cavallo. La risonanza magnetica consente di avere un quadro molto dettagliato dello sviluppo della patologia e di indirizzare verso le scelte terapeutiche più appropriate.

Progressive Ethmoid Hematoma (PEH) can be defined as an encapsulated slow-growing expansive mass of the ethmoidal mucosa with locally destructive properties that invades the nasal cavities. In severe cases, the growing mass deforms the profile of the fronto-nasal bones of the horse and can obstruct the corresponding nasal passage. Progressive Ethmoid Hematoma represents approximately 10% of the diseases of the nasal cavities (Dixon and Head 1999).

The aetiology of this condition is still unknown, as possible causes are assumed, such as repeated trauma, inflammatory processes and/or chronic infections, congenital phenomena, complication of hemangiomas, and neoplastic processes

(Bell *et al.* 1991, Bell *et al.* 1994, Sanna Passino *et al.* 1995). Histological finds of PEH include an ulcerated and haemorrhagic capsule of respiratory epithelium, degenerated red blood cells, hemosiderin deposits, lymphocytes, macrophages, and multinucleated giant cells (Platt 1975).

Symptoms are non-specific and include nasal discharge from 1 or both nostrils, composed by sero-mucous or muco-purulent materials, with intermittent bleeding, respiratory noises sometimes complicated by coughing.

After accurate anamnesis and evaluation of clinical signs, diagnosis of PEH has to be confirmed both by instrumental investigations [endoscopy, radiology, computed tomography (CT), and magnetic resonance imaging (MRI) (Arencibia *et al.* 2000, Gibbs and Hart 1992, Tessier *et al.* 2013) and by histological finds, in order to differentiate PEH from many other diseases that affect the same region, like fungal infection of the guttural pouches, nasal and paranasal sinus cysts, necrosis of turbinate, ethmoid abscesses, tumours, and infections of periapical teeth (Greet 1992, Sullivan *et al.* 1984).

Therapy is based on surgical removal of the mass, possibly after infiltration with formalin (Bonfig 1989, Greet 1992, Meagher 1986, Sanna Passino *et al.* 2003).

This case report describes MRI details of heads of 2 horses affected by PEH with evolution of the lesions on bone and soft tissue after surgery.

One anglo-arab 5 years old (case number 1) and 1 standardbred 11 years old (case number 2), both females, affected by PEH were admitted at Veterinary Teaching Hospital (University of Sassari, Italy). They showed haemorrhagic nasal discharge, respiratory noise with a moderate degree of dyspnoea. In both cases diagnosis of PEH was made by endoscopy later and confirmed by histological biopsy examination. Surgery was performed on both horses; 1 had recurrence after 6 months so it went under MRI twice.

A low field open magnet 0.23 Tesla (Paramed, Genova, Italy) was used. The horses were positioned under general anaesthesia on left lateral recumbence. The coil (shoulder coil) was applied on the frontal region with the eye of the horse placed in the isocenter of the magnet. The structural and anatomical aspects of the skull were examined by comparison of MRI scan planes and different sequences. The standard protocol included T2W fast spin echo in the sagittal plane, T1W spin echo in the sagittal plane, and transverse or dorsal plane. The following pulse sequences were obtained: Turbo fast spin echo T2 (TR 9000, TE 117, 5 mm slice thickness, 2 NEX, 192 x 192 matrix); Turbo spin echo T1 (TR 641-1314, TE 20-22, 5-7 mm slice thickness, 2 NEX, 224 x 224 matrix) and GFE (TR 1060, TE 14, 5 mm slice thickness, 2 NEX, 192 x 160 matrix). Mean scan time to complete the examination was 42 minutes (range 28-55 minutes). Images were reviewed using a DICOM workstation.

The resolution and the excellent contrast of the images allowed the clear identification of the anatomic details for a correct interpretation of the involvement of different sites and the infiltration of the neoplasia in the skull.

In the case number 1, the anatomical margins appear damaged (Figure 1). The nasal septum (indicated with a *) is not clearly distinguishable, the lateral nasal wall, and in particular the jawbone are threadbare. The tumour overflows invading the overlying soft tissue. The vault, made from the inner face of the nasal bone, is not clearly identifiable. The frontal sinuses bilaterally and the caudal right sinus are filled with liquid. Diffuse bone lysis is present (Figure 2).

Frontal and maxillary sinuses, meatus nasi (dorsalis, medius, ventralis, communis), dorsal and ventral choncae resulted deformed and not easily recognizable. In both horses lesions appeared expanded into the contralateral nasal cavity (Figure 3, case number 2). The signal was hyper-intense by a secondary sinusitis for airway obstruction and fluid accumulation. The most useful sequences was T1W in dorsal and transverse planes. The lesion develops up to the left caudal maxillary sinus with involvement of the sphenoid sinus (Figure 4, case number 2).

Table I. *Value references of sequences.*

	T2-weighted sagittal images	TI-weighted sagittal images	TI-weighted transverse images	TI-weighted dorsal images	GFE sagittal images
TR	9,501-10,000	641-1,520	1,060-1,314	754	1,060
TE	117	20-22	18-22	20	14
MATRIX	192x192	224x224	224x224	224x224	192x160
NEX	2	2	2	2	2
Slice thickness	5 mm	5-7 mm	6-7 mm	6 mm	5 mm
Interslice spacing	0.4 mm	0.4 -0.7 mm	0.5-0.7 mm	0.5 mm	0.4 mm

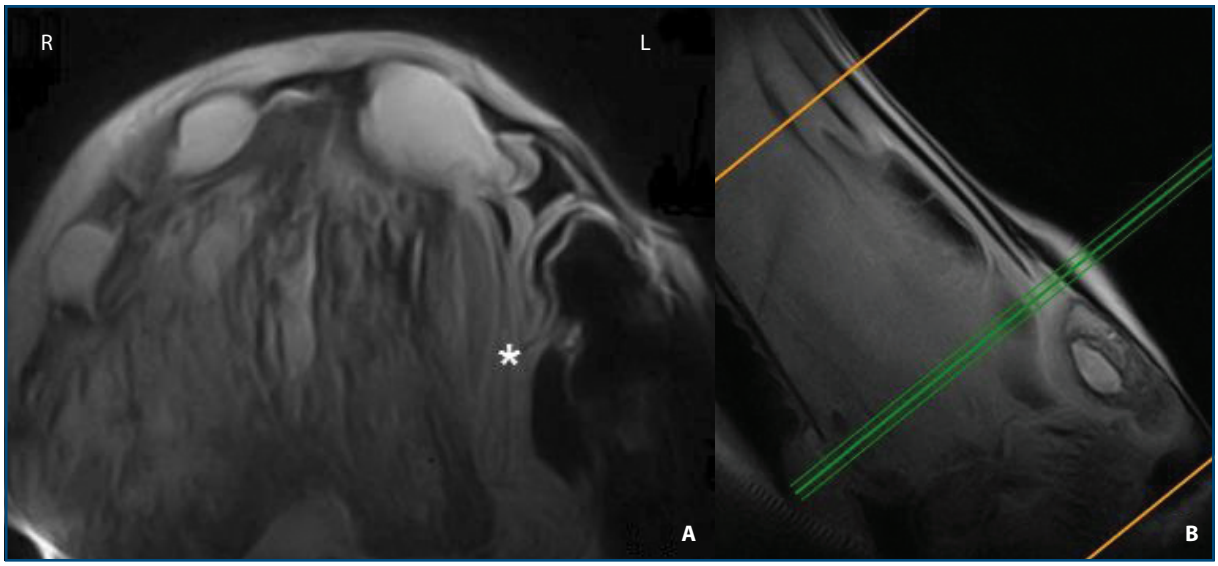

Figure 1. *Case number 1, T1W transverse section at the level of the last upper molar (**B.** sagittal plane, the green line shows the slice cut).* The neoformation appears inhomogeneous for signal intensity and conformation; it expands within the right nasal cavity, deflecting and compressing the nasal septum and deforming the contralateral nasal cavity.

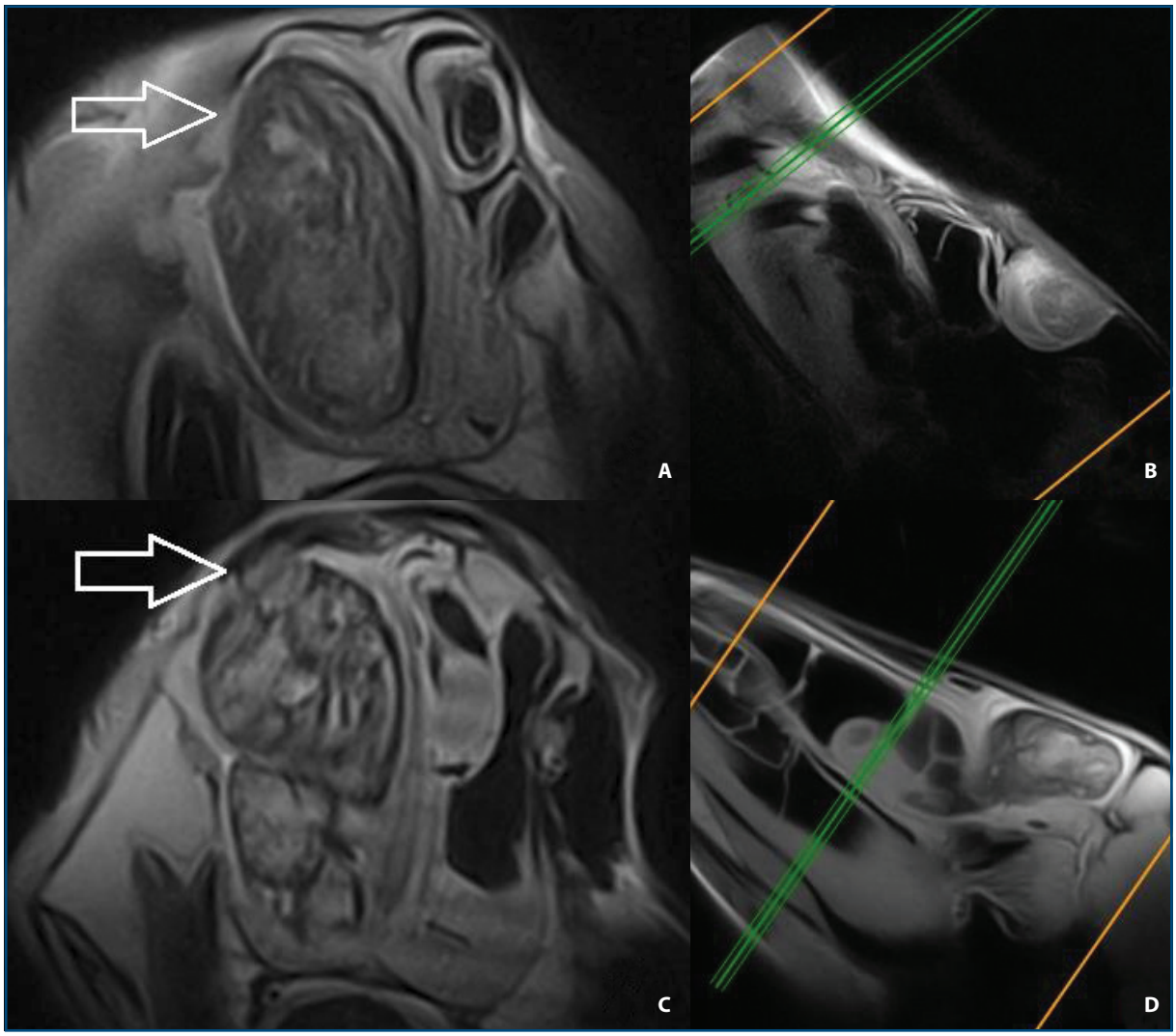

Figure 2. *Case number 1, T1W transverse section (**A**) and sagittal plane to the green line (**B**) (cranial to the rostral maxillary sinus) and transverse section T1W (**C**) and sagittal plane with the green line (**D**) at the level of the maxillary rostral sinus.* The bone has been eroded (arrow) by the invasiveness of the mass.

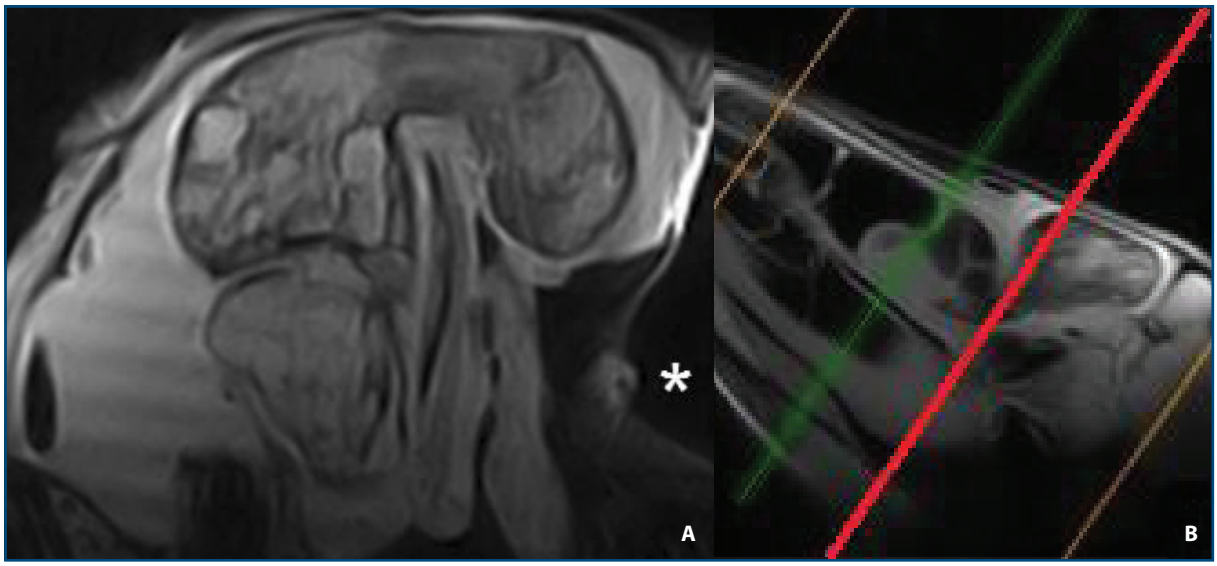

Figure 3. *Case number 2, T1W transverse section (**A**) and sagittal plane to the red line (**B**).* The lesion from the nasal cavity of the right portion invades the contra lateral sinus at the fronto conchal level.

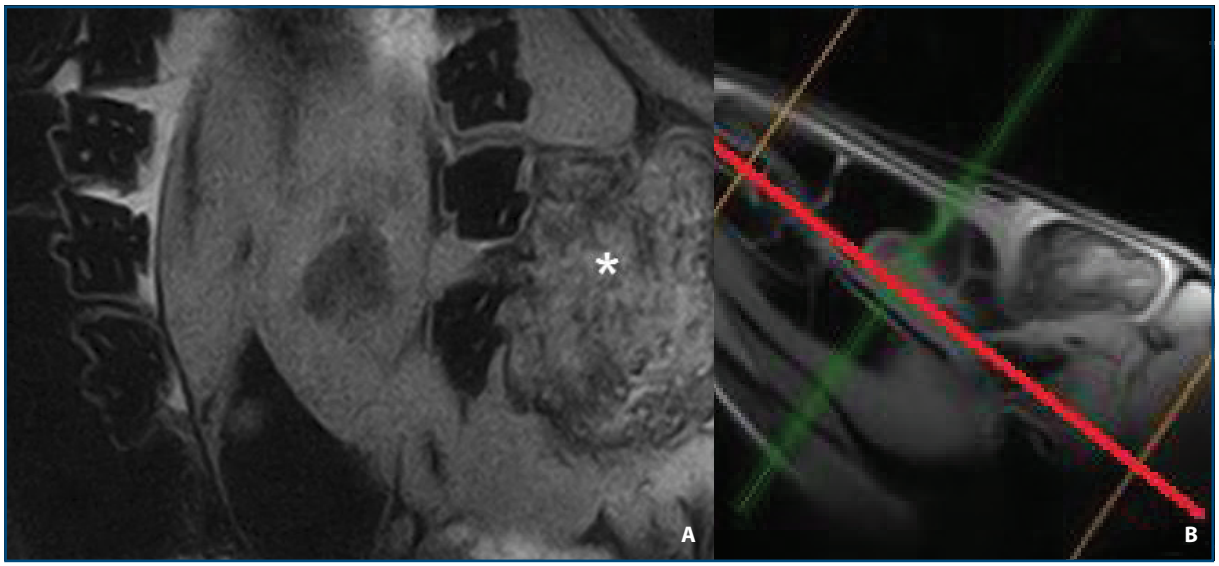

Figure 4. *Case number 2, T1W dorsal plane (**A**) and sagittal plane to the red line (**B**).* The lesion develops up to the left caudal maxillary sinus with involvement of the sphenoid sinus (*).

Commonly, PEH features include masses originating within the ethmoid turbinates with encapsulated contents clearly visible and distinguishable. The particular appearances of both cases reported here can be explained by the clinical status of the horses, *i.e.* the presence of fluid and/or blood and also for the size, the severity and the chronicity of the lesions. In such case, MRI is crucial to discover the real extension of the pathology, including its complications, such as severe destruction of bone tissue and invasion of nearby cavities, before planning eventual surgery (Arencibia *et al.* 2001, Chaffin *et al.* 1997, Vázquez *et al.* 2001).

Other diagnostic techniques, *e.g.* CT scans, are a great tool to assess the alterations of the bony structure, although such techniques have limitations in the visualization of soft tissue, for which MRI is more useful. The role of MRI is particularly important also in all cases with doubtful clinical symptomatology and in which endoscopy does not ensure a comprehensive diagnosis.

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