

Case Report

Computed tomography in the diagnosis of malignant sinonasal tumours in three horses

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Summary

Malignant tumours are uncommon in horses, but when they do occur, they are most frequently found in the head. Clinical findings, such as facial swelling and nasal discharge, are frequently encountered but are nonspecific. To highlight the usefulness of a computed tomography (CT) examination in malignancy in the equine head, this Case Report describes the CT features of a leiomyosarcoma, an osteosarcoma and a sarcoma in 3 horses. CT of the equine head was able to provide more information about the extent and severity of lesions than conventional radiography in these cases.

Introduction

Malignant tumours are uncommon in horses (Hance and Bertone 1993; Head and Dixon 1999), but the head is the most frequently affected site (Hance and Bertone 1993; Bush *et al.* 2007). The most common malignant neoplasms may originate from the soft tissues of the head, such as squamous cell carcinomas, sarcoids and fibroblastic neoplasia or fibrosarcomas, from the bones, such as osteosarcomas, or have an odontogenic origin (Barber *et al.* 1983; Schmotzer 1987; Hance and Bertone 1993; Bush *et al.* 2007).

Nasal discharge, facial swelling or deformation, and masticating problems are the most frequently seen clinical signs in cases of neoplasms of the sinonasal structures or ethmoid haematomas but are also commonly encountered in infectious and traumatic lesions such as alveolitis, sinusitis, tooth fracture and skull fracture (Dixon and Head 1999). This may be a reason why neoplasia of the head is often in an advanced stage before it is diagnosed. Radiography of the head is usually the first imaging modality used to evaluate the lesion (Barbee

1987), but the precise location and extent of the lesion are often difficult to assess. Computed tomography (CT) of the head lacks superimposition, has better contrast resolution and therefore provides an improved visualisation of the anatomic structures and evaluation of the extent and location of lesions, than conventional radiography (Barbee 1987; O'Brien and Biller 1998; Solano 2004). The possibility of 3D reconstruction of the obtained images is another advantage that allows a better visualisation of lesions and can be used in surgical planning in less advanced cases (Henninger *et al.* 2003).

The present paper describes the computed tomographic findings of malignant sinonasal tumours, one leiomyosarcoma, one osteosarcoma and a sarcoma, in 3 horses.

Materials and methods

Between January 2004 and January 2008 114 equine patients underwent CT examination of the head. The complete medical records of 102 patients were retrieved from the files. The medical records of the other 12 patients were incomplete and, therefore, excluded. Inclusion criteria for this study were defined as CT examination of the head revealing a neoplastic lesion with histopathological confirmation of the findings. This resulted in a selection of 3 cases with sinonasal tumours.

Radiography of these cases was performed and included a laterolateral radiograph of the head and dorsolateral-ventrolateral oblique projections of the affected area, made on the unsedated standing horse.

Computed tomography examination was performed with a single slice helical CT scanner (Philips Secura)¹, with each horse anaesthetised and positioned in lateral recumbency on a custom built table that was connected with the original patient support. CT examinations of the head, starting at the interdental space and ending at the occipital area, were made in all patients with 10 mm thick contiguous slices, 120 kV, 100 mA, scan field of view (FOV)

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of 430 mm in *Horse 1*, 380 mm in *Horse 2* and 459 mm in *Horse 3*, and a matrix of 512 x 512 mm. In addition, areas of interest were rescanned with 5 mm thick slices, 120 kV, 220 mA, scan FOV 430 mm in *Horse 1* and with 2 mm thick slices, 120 kV, 260 mA, scan FOV 459 mm in *Horses 2* and *3*.

Samples for histopathology were taken during *post mortem* examination in *Horses 1* and *2* and as a surgical biopsy in *Horse 3*. The samples were fixed in 4% neutral-buffered formaldehyde (formaldehyde solution 37–38%)². After fixation, samples were trimmed and paraffin embedded. Subsequently 3–5 µm sections were made and routinely stained with haematoxylin and eosin. Sections were examined and neoplasms diagnosed based on criteria published in the World Health Organisation International Classification of Tumours of Domestic Animals series (Slayter *et al.* 1994; Hendrick *et al.* 1998).

Immunohistochemistry was performed on paraffin embedded sections in *Horses 1* and *2*, applying markers SMA³ and S100⁴ according to standard protocol. The teeth in this paper are numbered following the Triadan system (Floyd 1991).

Case history and clinical signs

Horse 1

Horse 1 was a 2-year-old Dutch Warmblood mare that was referred with a history of increasing inspiratory and expiratory snoring sounds during exercise or stress after having been treated by the referring veterinarian with trimethoprim sulphates for 3 weeks without effect. Rhinoscopy was performed at 3 and 1 weeks before referral. A pharyngeal swelling was noted at the first rhinoscopy, and a left mandibular lymphadenopathy was noted during the physical examination. Two weeks later, the left nasal passage showed some food debris and a decrease in lumen. At presentation the head of the horse was asymmetric with exophthalmia and epiphora of the left eye, and rhinoscopy revealed a soft tissue mass that occupied almost the entire left nasal passage. The differential diagnoses included an inflammatory process, a mass-like lesion such as a nasal or sinus cyst, an ethmoid haematoma and a neoplastic lesion.

Horse 2

Horse 2 was a 13-year-old Warmblood mare with a swelling of the head in the region of the right maxillary sinuses. There were no other clinical complaints. Sinusitis was suspected and the horse was referred. A solid, warm, slightly painful swelling was noted in the region of the right maxillary sinus. No abnormalities of the dental structures were noted on oral inspection. The differential diagnoses included an inflammatory process such as sinusitis possibly due to alveolitis, a mass-like lesion in the sinus such as a progressive ethmoidal haematoma, sinus cyst or a malignant neoplastic process.

Horse 3

Horse 3 was a 5-year-old Dutch Warmblood stallion presented with a swelling of the left maxilla and difficulties with mastication. Oral inspection revealed a pocket filled with blood and food lateral to 208 and 209. The differential diagnoses included a severe alveolitis of 208 and/or 209, a maxillary osteomyelitis and a neoplastic lesion.

Radiographic and CT findings and outcome

Horse 1

Radiography of *Horse 1* revealed a homogenous increase in soft tissue opacity in the left nasal passages and frontal sinus. An ill-defined and irregular radiolucent zone was

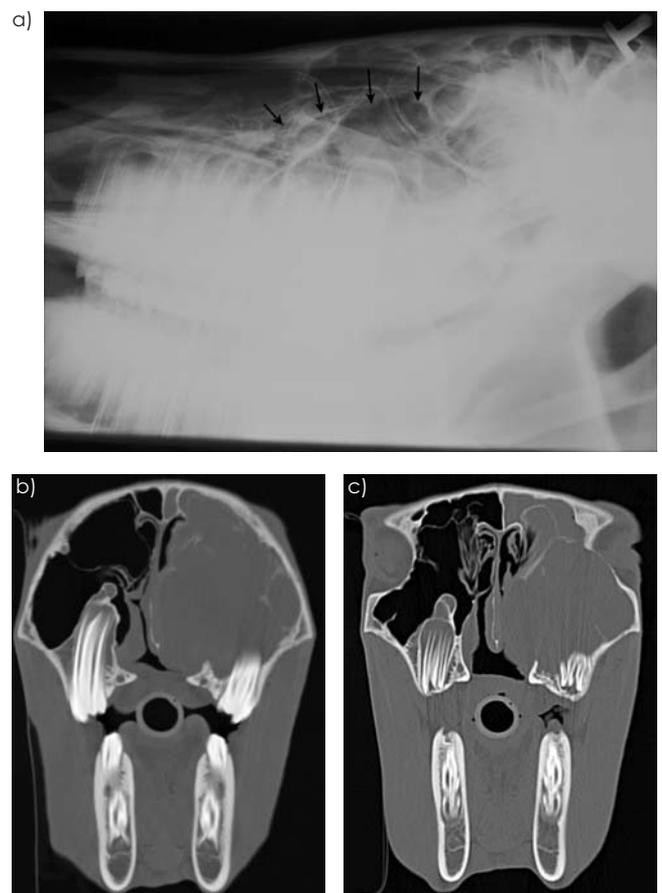


Fig 1: *Horse 1:* a) Dorsal right-ventral left oblique radiograph of the head. A soft tissue mass (arrows) is seen in the left maxillary sinuses. The maxilla surrounding the alveoli of 209 and 210 is irregularly shaped and vaguely defined. b) Transverse bone window CT image of the head at the level of 209 and 210. A soft tissue mass is noted in the left nasal passages and maxillary sinus, that is deforming the conchal structures and causes a shift of the nasal septum to the right. There is osteolysis of the maxilla surrounding the 209 and 210 and loosening of the cheek teeth roots. c) Transverse bone window CT image of the head at the level of 211. Deformation of the left axial orbital wall, the maxilla and the dental sac containing 211 is noted. The soft tissue mass fills almost the entire caudal nasal passages and maxillary sinus. On the right, a normal developing 111 is seen.

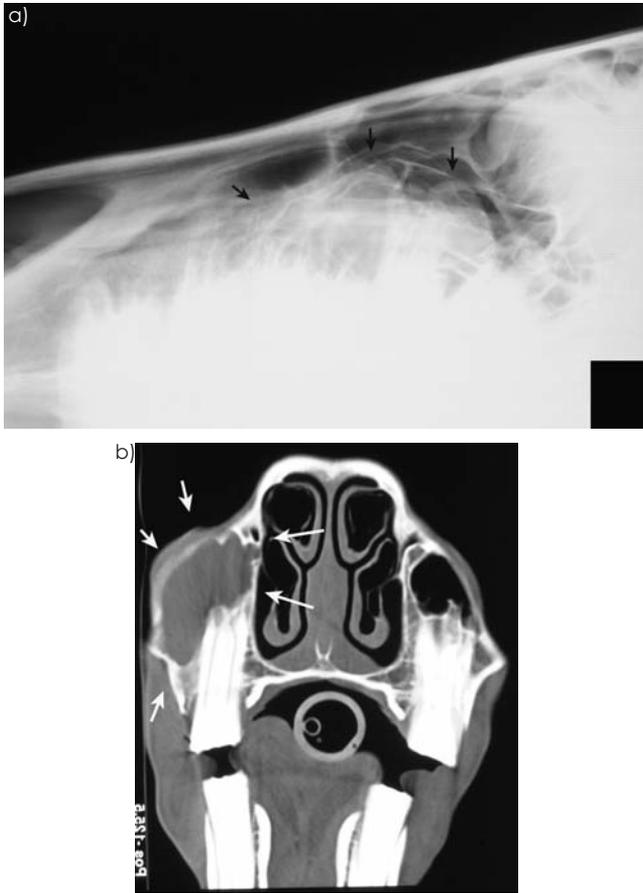


Fig 2: Horse 2: a) Lateral radiograph of the head. There is a lobulated soft tissue mass (black arrows) visible in the ventral part of the nasal passages and/or sinuses dorsal to 109/110. b) Transverse CT image of the head at the level of 109 and 110. A soft tissue mass (white arrows) is noted in the right maxillary sinus. The adjacent maxillary bone is thickened and somewhat vaguely outlined. The alveoli of 109 and 110 are widened and irregular outlined especially at the abaxial side. A mild thickening of the soft tissue adjacent to the maxillary sinus is noted.

present in the left maxillary bone surrounding the alveoli of 209 and 210. The vaguely defined apical region of the cheek teeth could be partially explained by the developmental stage of the teeth, but it remained unclear whether this was also partially due to the lesion (**Fig 1**). CT examination revealed a large soft tissue mass, which involved almost the entire left rostral and caudal maxillary sinuses and expanded rostrally into the nasal passages at the level of 207 and into the left frontal and sphenopalatine sinuses. Extensive bony lysis was noted at the level of the alveoli of all left maxillary molars and the orbit as well of the bony structures in the left nasal cavity and the infraorbital canal. There was an expansile aspect with lateral deformation of the left maxilla. Exophthalmus of the left eye due to the expansion of the soft tissue mass was noted (**Fig 1**). The horse was subjected to euthanasia and a full body *post mortem* examination was performed. Histological examination revealed a leiomyosarcoma, without any signs of metastases.

Horse 2

Radiography of *Horse 2* revealed a lobulated soft tissue mass occupying the right rostral and caudal maxillary sinuses. The alveoli of 108, 109 and 110 were ill-defined. Sclerosis of the right maxilla at the level of 110 was noted. CT examination confirmed the lobulated soft tissue mass in the right maxillary sinus which was expanding up to 111. The adjacent bony structures were displaced laterally and were irregular due to bone destruction and local new bone formation (**Fig 2**). The horse underwent surgery and the soft tissue mass was removed. Histopathology revealed a sarcoma, most likely to be an osteosarcoma. The horse returned to its former use of recreational sports for 2.5 years and was then readmitted with nasal discharge and enlarged regional lymph nodes. Radiographic examination in the standing horse revealed a soft tissue density at the right maxillary sinuses with irregular delineated adjacent bone. The owner did not want to pursue any further diagnostics and the horse was subjected to euthanasia. No *post mortem* examination was performed.

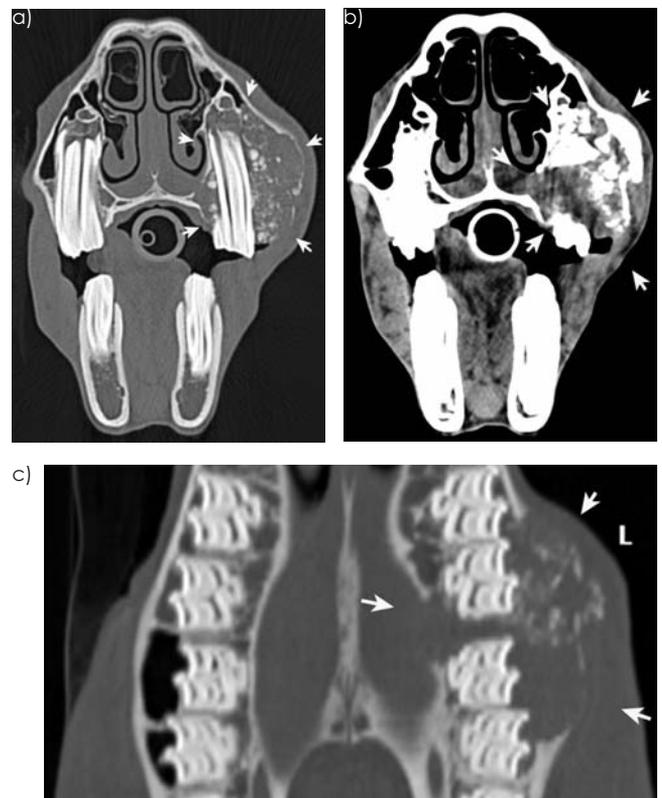


Fig 3: Horse 3: a) Transverse CT image of the head at the level of 208. There is an increase in soft tissue (arrows) with small mineralised structures on the left at the level of the alveolus of 208. The adjacent maxilla is deformed with bone loss and new bone formation mostly lateral to 208. A clear facial deformation is caused by this process. b) Transverse soft tissue window CT image of the head at the level of 208/209. The soft tissue mass (arrows) is visible in between 208 and 209 with displacement of the adjacent teeth. c) Reformatted CT image in the dorsal plane. The extent of the mass (arrows) and the bony changes are clearly seen, as is the gap in between 208 and 209.

Horse 3

Radiography of *Horse 3* revealed an increase in soft tissue opacity and possible sclerosis surrounding 208 and 209. On CT examination a heterogeneous soft tissue mass with multiple small focal areas of mineralisation was found at the level of the left maxilla extending from the middle part of 207 to the rostral part of 210. The soft tissue mass occupied the entire rostral and partially the caudal maxillary sinus and extended into the middle nasal passage via the *apertura nasomaxillaris* and in a diastema between 208 and 209. There was destruction of the maxilla and lateral displacement of the cortical margin from the caudal part of 207 to 210 and of the infraorbital canal at the level of 209 (**Fig 3**). A surgical biopsy specimen revealed osteosarcoma and the horse was subjected to euthanasia. No further necropsy was performed.

Discussion

Computed tomography of the equine head has been described in alveolitis, sinusitis, traumatic lesions, odontoma and an adenocarcinoma (Heufelder *et al.* 1994; Tietje *et al.* 1996; Davis *et al.* 2002; Solano 2004). The CT features of malignant tumours such as sarcoma, osteosarcoma and leiomyosarcoma in the equine head have not been described previously to the authors' knowledge.

Osteosarcoma has been described as a solitary lesion in the equine head (Bush *et al.* 2007). No full body *post mortem* examination was performed in our case and it is possible but less likely that multiple sites were affected. Leiomyosarcoma of the head has only been described as a multicentric lesion in the maxilla and mandibula of a young male horse (MacGillivray *et al.* 2003). In the other known cases of leiomyosarcoma, the gastrointestinal tract or testes were the place of origin (Livesey *et al.* 1986; Clem *et al.* 1987; Mair *et al.* 1990; Boy *et al.* 1992; Allison and Moeller 1999). In the case described here, there was a solitary mass that was located in the left nasal passages and sinuses and did not seem to derive from the maxilla or mandibula as described in the previous report.

Facial swelling and distortion, air outflow obstruction and interference with normal mastication are the most frequent clinical signs presented with tumours of the head and were also noted in our patients (Dixon and Head 1999; Bush *et al.* 2007). However, these signs are also commonly encountered in infectious and traumatic lesions of the equine head and as in our patients the neoplasm is quite extensive before further diagnostics such as radiography or biopsy are performed. Thus far the surgical treatment of malignant sinonasal tumours in horses has not been very successful in the long term due to the well advanced stage of the tumour when diagnosed (Dixon and Head 1999). However, *Horse 2* underwent surgery and was free of clinical signs for 2.5 years, during which it was used for recreation and sport. Thus an early detection of the lesions can make a

difference in treatment and possibly long-term outcome in equine head neoplasia.

In all 3 patients in the present report, CT provided additional information on the position and extent of the neoplastic tissues, compared to conventional radiography. After the CT examination, *Horses 1* and *3* were subjected to euthanasia because of the extent, and hitherto grave prognosis, of the lesions. Surgical planning, based on the CT findings, was possible in *Horse 2*.

The CT findings differ from the radiographic findings mostly due to the lack of superposition and the visibility of both soft tissues and bony structures due to the possibility of choosing window width and level. CT proved to be better than conventional radiography for the detection and characterisation of nasal tumours in dogs and cats (Thrall 1989; Schwarz 1995; Saunders *et al.* 2003), and appears to have the same advantages for detection and characterisation of these lesions in horses. When comparing conventional radiography with CT examination in our patients, the radiographs revealed increase in soft tissue in all patients but additional information on the extent of the abnormal tissues was seen with CT. In all patients, the alveoli of the adjacent teeth were vaguely and irregularly defined on the radiographs but the severity of local bone destruction was hard to assess. The extent and character of the bone destruction was revealed with CT and in all 3 cases was more severe than assumed in the radiographs. CT was of great assistance in these patients to outline the severity and extent of the lesions.

Manufacturers' addresses

¹Philips NV, Eindhoven, The Netherlands.

²Klinipath B.V., Duiven, The Netherlands.

³Biogenex, San Ramon, California, USA.

⁴Dako Denmark A/S, Glostrup, Denmark.

Acknowledgement

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