

# Case Report

## Keratoma from the frog corium of a horse

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### Introduction

A keratoma is usually described as an aberrant, focal proliferation of cornified tissue produced by abnormal corium on the inner surface of the hoof wall (Honnas *et al.* 2003). Keratomas have been regarded as horn cysts (Boening 1982) and also as benign horn tumours (Wagner *et al.* 1986; Reeves *et al.* 1989), although no true neoplastic tissue has ever been identified (Honnas *et al.* 2003). It is proposed that keratomas may be produced in response to chronic irritation on the corium (Lloyd *et al.* 1988; Honnas *et al.* 2003). Surgical removal is the recommended treatment, and this usually carries a good prognosis (Bosch *et al.* 2004).

**This case describes a keratoma of the frog corium (cunei corium) in a horse.**

### Case details

#### History

A 12-year-old Warmblood stallion had been treated for the previous 5 months, whilst in Spain, for a hoof crack and recurrent abscess formation on the medial heel region of the



**Fig 1:** The oblique bar shoe used to treat the hoof crack in Spain. Note the excessive wear on the medial branch of the shoe induced by the mediolateral foot imbalance (a).

left hind foot. An oblique bar shoe had been used in the treatment (**Fig 1**) and the exposed areas of the frog and sole were covered with a hard acrylic compound, the formulation of which was not available.

Following arrival in Scotland the farrier removed the bar shoe and acrylic, and found a severe left hind mediolateral foot imbalance, with the medial side of the hoof being considerably higher than the lateral (**Fig 2**). Associated with the imbalance was a sheared heel conformation. A horizontal crack was present about one half of the way down the medial hoof wall (**Fig 2**). The foot was trimmed prior to shoeing with a normal stamp shoe. At the next shoeing, some 6 weeks later, the farrier noted in the central area of the frog an area of abnormal proliferative horn with adjacent purulent tracks. This prompted a request for veterinary attention.

### Clinical examination

The stallion was found to be in good bodily condition and no abnormalities were detected on examination except a 1/5 left



**Fig 2:** Removal of all the surrounding under-run and healthy frog horn revealed the presence of the keratoma (x). Note there is still considerable mediolateral imbalance as indicated by the excessive wear on the medial branch of the shoe (a). The crack on the medial heel is still present and has grown approximately half way down the wall (b).

hindlimb lameness. Examination of the foot revealed a significant mediolateral foot imbalance with the medial wall still being too high, resulting in excessive wear on the medial branch of the shoe (**Fig 2**). An increased strength of digital pulse was present. The application of hoof testers onto the middle of the central sulcus of the frog caused pain and the discharge of purulent material. Within this was an area of abnormal yellow coloured horn, which was where the oblique bar shoe had previously crossed over the central sulcus. The lameness was not affected by flexion tests and was abolished by an abaxial sesamoid nerve block.

Whilst the foot remained anaesthetised by the nerve block the horse was sedated with 30 µg/kg bwt romifidine (Sedivet)<sup>1</sup> and 12 µg/kg bwt butorphenol (Torbugesic injection)<sup>2</sup>. Using hoof knives and a scalpel all areas of under-run horn were removed leaving a discreet spherical mass of yellow horn approximately 20–25 mm in diameter (**Fig 2**). A small neck of horn attached the mass to the underlying tissues. The mass, neck and 2 mm (approximately) of the underlying frog corium was removed *en bloc*. The defect into the corium was circular in outline with a diameter of approximately 5 mm.

The incisional site was dressed with povidone iodine soaked swabs and covered with disposable nappies prior to bandaging. The dressing and bandage were changed every second day. The horse received a 5 day course of i.m. 12 mg/kg bwt procaine benzylpenicillin (Depocillin)<sup>3</sup> b.i.d. and 2 days treatment of oral phenylbutazone (Equipalazone)<sup>4</sup> therapy at 1 g b.i.d. *per os*. By Day 6 post operatively the area of exposed corium was covered with immature horn and the wound then treated with topical 2% iodine. The bandage was then changed every 4 days before being left open from Day 20 post surgery. Over the next 5 months the foot was regularly checked for development of abnormal horn. To assist in this assessment, at subsequent visits the farrier trimmed more horn than normal off the frog to expose young frog horn so any abnormality could be observed quickly and more easily. At no stage was there any evidence to suggest further keratoma development. The horse has since had no further episodes of left hindlimb lameness and the frog appears grossly normal two and a half years later.

### Histology

Histology of the mass revealed that it was composed of proliferating squamous epithelium with some orthokeratosis and parakeratosis and there were small rete ridges extending into the underlying corium that was inflamed. There was no evidence of neoplasia but a hamartomatous increase in keratin. Histologically it was identical to that described in the literature for keratomas found in the dorsal wall of the hoof (Lloyd *et al.* 1988; Honnas *et al.* 2003).

### Discussion

To the author's knowledge there has been no description in the literature of a keratoma from the corium of a horse's frog. The keratoma described in this paper was grossly and

histologically similar to those described from the dorsal laminae (Lloyd *et al.* 1988; Honnas *et al.* 2003) and the sole corium (O'Grady and Horne 2001). Keratomas are typically solitary, as in this case, although multiple masses have been recorded (Greet 2002). Two basic types of keratoma have been described, the cylindrical and the spherical forms (Greet 2002). This case would be described as a spherical keratoma.

It is thought that keratomas develop as a result of chronic irritation on the sensitive dorsal laminae or sole corium of the foot through pressure, injury or chronic abscessation. This leads to abnormal horn production (Honnas 2003). To the author's knowledge, however, there is no publication describing the exact cause of the irritation. There are 2 possible causes for the irritation in this case, either irritation from the oblique bar shoe or from the chronic abscessation and pododermatitis of the frog corium. The oblique bar used in this case would have created considerably more pressure on the middle third of the frog tissue than a normal stamp shoe (S. Beveridge, personal communication). This could possibly be why the keratoma developed at the point where there was contact between the oblique bar shoe and the central sulcus of the frog. However, horses are also frequently shod with heart bar shoes, which can create excessive pressure on the frog tissue (Hickman and Humphrey 1988) and the author is not aware of any reports of heart bar shoes inducing keratoma formation. Chronic mediolateral foot imbalance creates abnormal forces through the central sulcus of the frog often, as in this case, resulting in the formation of sheared heels (O'Grady and Poupard 2003). Manipulation of the heels of an affected foot results in separation of the heel bulbs and abnormal shearing through the central sulcus. In this case the rigid oblique bar positioned over the site of the abnormal shearing forces could have caused irritation on the frog corium and resultant keratoma formation. However, in the past, it has been recommended that horses should be shod with diagonal bar shoes to treat sheared heels (Moyer and Anderson 1975) and no record is available to suggest this has induced a frog keratoma. Chronic irritation may also have been caused to the frog corium by the long-standing nature of the inflammatory and infective pododermatitis. Unfortunately, a relatively poor history was available for the stallion's treatment in Spain so it is not possible to determine the historical nature and duration of the pododermatitis.

Lameness associated with a dorsal wall keratoma is thought to occur secondary to the gradual enlargement of a keratoma in the confined space between the distal phalanx and the hoof capsule (Honnas *et al.* 2003). This creates pressure on the sensitive laminae and the underlying distal phalanx. The space occupying keratoma also creates abnormal structure to the horn that allows access for bacteria and resultant abscesses may develop (Wagner *et al.* 1986; Honnas 2003). The lameness often becomes apparent or more severe with the developing abscess (Bosch 2004), as occurred here. Due to the restraints of working at a busy stud, selective perineural anaesthetic tests, such as a medial plantar digital nerve block, were not undertaken in this case. These may have resulted in a more specific diagnosis as to the relative

contribution of the crack or the keratoma to the source of the lameness. Having undertaken the abaxial sesamoid block and finding the purulent tracks, the author elected to commence treatment and removed the keratoma.

Quarter and heel cracks appear to be more common in Southern Europe (Goldstein 2002). They are usually treated with a straight bar shoe with the heel floated (Stashak 1987) but in this case it is assumed that the oblique bar shoe was used to take the loading off the medial heel crack.

The radiographic change classically noted with keratomas of the dorsal hoof wall is a focal circular area of radiolucency within the distal phalanx resulting from the effect of pressure of the solid tumour on the bone (Wagner *et al.* 1986). The corium of the frog is not close to the surface of the distal phalanx nor the distal sesamoid (navicular) bone and the frog horn is not as rigid as the dorsal laminae so no osseous pressure would have been expected and therefore radiography of the foot was not thought to be of any benefit.

The prognosis for a return to soundness after complete surgical excision of a keratoma is favourable to excellent. Lloyd *et al.* (1988) found no recurrence of the keratoma in 7 cases 1–11 years after resection. Bosch *et al.* (2004) had an 83% return to the same or higher level of performance in horses that had undergone surgical treatment. If a keratoma is not removed entirely, regrowth is possible (Wyn-Jones 1988). Recurrence occurs particularly if the keratoma originates at the coronary band where it is difficult to resect the mass completely without damaging the coronary corium and risking the production of weak horn that will be predisposed to hoof crack formation. Similarly, stabilisation of the hoof wall is important following removal of dorsal wall keratomas (Honnas 2003). In this case, removal of some of the frog corium was not viewed as a short- or long-term problem, as this is frequently undertaken to gain access to deep foot infections (for example navicular bursae infections) without any recorded problems. A hospital plate shoe and/or the use of silicone filler was considered, but as the horse was a working stallion it was viewed to be safer to undertake regular bandage changes. Six months following the surgery the original medial hoof crack had grown out and it was not possible to determine grossly by observation of the frog that surgery had been undertaken on the underlying corium.

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Mr Alasdair Nimmo DipWCF, the farrier who referred this case and Trevor Whitbread BSc, BVSc, DipECVP, MRCVS for undertaking the histopathology.

## Manufacturers' addresses

<sup>1</sup>Boehringer Ingelheim, Bracknell, Berkshire, UK.

<sup>2</sup>Fort Dodge Animal Health, Hedge End, Southampton, UK.

<sup>3</sup>Intervet UK Ltd, Cambridge, UK.

<sup>4</sup>Arnolds Veterinary Products, Shrewsbury, Shropshire, UK.

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