

## Eustachian tube diverticulum chondroids and neck abscessation in a case of *Streptococcus equi* subsp. *equi*

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### ABSTRACT

A 12-year-old, grey, crossbred pony mare was presented with a swelling in the neck over the area of the 2nd cervical vertebra (C2), which was found to be painful on palpation. The neck was held stiffly. Radiography of the cervical region showed a focal area of increased radio-opacity over the dorsal, caudal and lateral aspect of the dorsal spinous process of C2. Ultrasound confirmed the presence of a hypoechoic area approximately 15 cm in diameter superimposed over the dorsal spinous process of C2. An aspirate was taken of the mass, which revealed purulent exudate confirming the diagnosis of an abscess. The abscess was lanced with a scalpel blade and samples of the purulent material revealed a pure culture of *Streptococcus equi* subsp. *equi*. The guttural pouches (Eustachian tube diverticulae (ETD)) were then evaluated endoscopically and multiple chondroids were seen filling most of the right ETD. Surgery was subsequently performed and 189 chondroids were removed *via* a right-sided hyovertrotomy. The ETDs were flushed and penicillin installed into both ETDs on 3 different occasions *via* a catheter introduced using a fibre optic scope. This procedure was repeated until a negative culture status was achieved in order to eliminate the carrier status.

**Key words:** carrier, chondroids, equine, *Streptococcus equi* subsp. *equi*.

Furniss C, Carstens A, Cilliers I **Eustachian tube diverticulum chondroids and neck abscessation in a case of *Streptococcus equi* subsp. *equi*.** *Journal of the South African Veterinary Association* (2007) 78(3): 166–170 (En.). Department of Companion Animal Clinical Studies, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, Onderstepoort, 0110 South Africa.

### INTRODUCTION

Strangles is a purulent pharyngitis and lymphadenitis of the upper respiratory tract caused by *Streptococcus equi* subsp. *equi*. It is host-adapted to Equidae and is an obligate parasite requiring a host to survive between interepidemic periods<sup>4,13,19,20</sup>. There are several reported complications of strangles, including Eustachian tube diverticulum (ETD) empyema, upper respiratory tract obstruction, pneumonia, purpura haemorrhagica and death<sup>14,15,18</sup>. This report describes the infection by *Streptococcus equi* subsp. *equi* resulting in abscessation in the cervical region in conjunction with the presence of multiple chondroids within the right ETD. The presence of chondroids acts as a reservoir of infection, resulting in prolonged carrier status of the infected animal<sup>10,11,21</sup>.

### CASE HISTORY

An 11-year-old, crossbred pony mare

was presented at the equine clinic of the Onderstepoort Veterinary Academic Hospital with the primary complaint of a 20 cm diameter soft tissue swelling over the area of the 2nd cervical vertebra on the left side of the neck. The swelling was of 3 weeks duration with no previous history of trauma known to the owner. The swelling had gradually increased in size.

### Clinical examination

On clinical examination of the pony a 20 cm diameter, soft tissue swelling was present over the area of C2 on the left side of the neck. The swelling was non-fluctuant and no heat was felt over the area. A pain response was elicited on deep palpation of the soft tissue swelling and the pony resisted lateral and dorsoventral flexion of the neck. On trotting the stiff neck carriage, seen at rest and at a walk, was accentuated. All vital parameters were within normal limits. Haematological examination revealed no obvious abnormalities.

### Radiological findings

On the day of admittance a lateral radiograph of the first 3 cervical vertebrae showed a single 2 × 3 cm oval area of increased radiopacity on the dorsal

caudal and lateral aspect of the dorsal spinous process of C2. This radio-opacity extended approximately 1 cm beyond the dorsal edge of the spinous process. The lesion was fairly well delineated and resulted in a patchy appearance of the spinous process (Fig. 1). The ETD is identified in the same lateral view seen superimposed over the caudal border of the mandible. Mineralised oval opacities were present in the ETD, suggestive of chondroids.

### Ultrasonography

Following the initial survey radiograph, the area was examined ultrasonographically with a 7.5 MHz linear transducer. (Aloka Prosound 4000). A well-margined hypoechoic area was identified superimposed over the dorsal border of C2. The lesion extended over an area approximately 15 cm in diameter. The dorsal surface of the spinous process was found to be diffusely irregular. There was no ultrasonographic evidence of a foreign body.

The hypoechoic area was aspirated, revealing purulent material and thus identified as an abscess. This abscess was lanced under ultrasound guidance. A size 20 blade was used to make a deep incision into the most ventral aspect of the abscess to allow the copious amounts of thick, yellow, purulent material to drain freely from the incision site. Samples of the purulent material were taken for aerobic and anaerobic culture as well as an antibiogram. On digital exploration the abscess was smooth-walled. The abscess was found to extend to either side of the dorsal spinous process. No foreign body was found in the region after a careful digital exploration.

### TREATMENT

The abscess was thoroughly lavaged with sterile water and a stent soaked in acriflavine glycerine 0.1% (Kyron Laboratories) was placed deep into the cavity. The mare was placed on a course of procaine benzylpenicillin at 22 mg/kg bid intramuscularly (Depocillin, Bayer) and phenylbutazone at 2.2 mg/kg bid *per os* (Phenylbutazone, Kyron labs). The culture results revealed a pure culture of *Strepto-*

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Received: February 2006. Accepted: August 2007.

*coccus equi* subsp. *equi* sensitive to penicillin, ampicillin, doxycycline, and trimethoprim/sulpha. Owing to the high morbidity associated with *Streptococcus equi* subsp. *equi* infection the mare was placed under quarantine and moved into an isolation unit. The procaine benzylpenicillin dosage was increased to 25 mg/kg bid intramuscularly<sup>20</sup>. The antibiotic treatment was given for a total of 10 days and thereafter discontinued. The acriflavine glycerine-soaked stent was removed from the lesion after 3 days and the existing cavity further flushed with 0.1 % acriflavine glycerine. The discharge slowly decreased but did not resolve completely. After 2 weeks of treatment with no resolution of infection, further diagnostics were carried out.

## FURTHER DIAGNOSTICS

### Follow-up radiographs

Follow-up lateral-centred radiographs were taken 11 days following drainage of the abscess. The lesion noted over the 2nd cervical vertebra was similar to the previous radiographs described. A lateral radiograph of the ETD revealed multiple, well defined, superimposing, round to oval mineral opacities up to 2 cm in diameter, suspected of being chondroids were present in one or both ETDs (Fig. 2).

### Endoscopy

The mare was sedated with a combination 20 micrograms/kg body weight detomidine hydrochloride (Domosedan, Novartis) and 0.01 mg/kg butorphanol tartrate (Torbugesic, Fort Dodge Animal Health) intravenously and an endoscopic examination was performed.

The lateral compartment of the right ETD was filled with chondroids varying from 1–2 cm in diameter (Fig. 3). The wall of the guttural pouches appeared macroscopically normal. There were no abnormalities detected in the left ETD. A sample for bacterial culture was taken from both ETDs by infusion followed by aspiration of 50 ml of sterile water into the diverticulae. Hereafter the right ETD was flushed with a mixture of 25 g of bicarbonate of soda added to 1 l sterile water. Neither the flushing nor manipulation of the chondroids helped to break the chondroids up to aid in their elimination and surgical removal was proposed.

### SURGERY

Routine presurgical haematology was performed and a mild neutropaenia of 1.48 units (ref range 1.8–3.6 units) was seen. The mare was given 40 micrograms/kg detomidine hydrochloride intravenously (Domosedan, Novartis) as an anaesthetic premedication and induced with 400 ml



Fig. 1: Lateral cervical radiograph showing a mottled mineralised opacity over the dorsal and caudal aspects of the 2nd cervical vertebra spinous process. Note the increased opacity of the ETD seen in the left lower corner of the image.

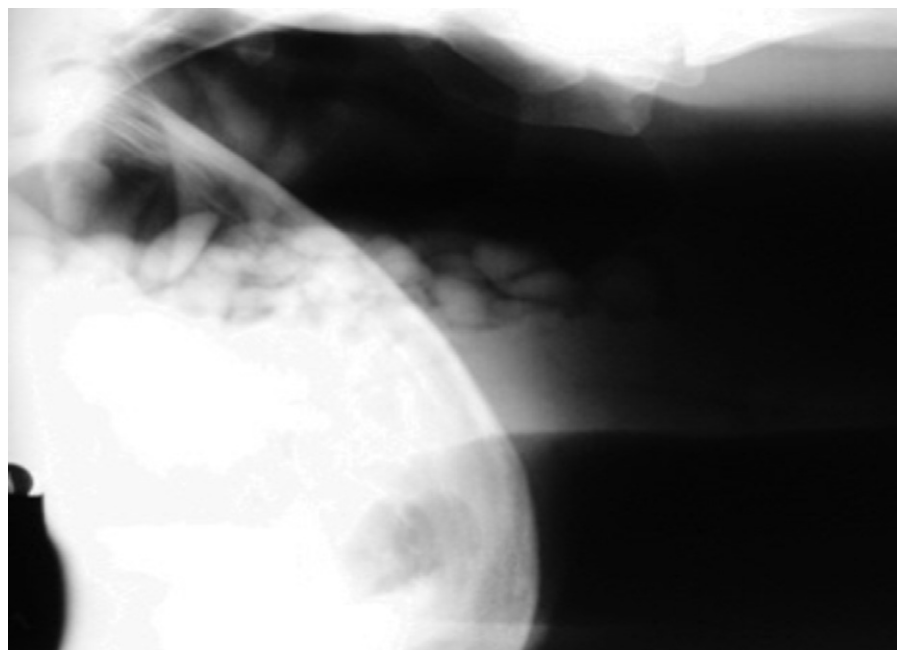


Fig. 2: Lateral radiograph of the pharyngeal area showing numerous round to oval mineralised opacities filling one or both Eustachian tube diverticula, suggestive of chondroids.

of a 5 % solution of glyceryl guaiacolate ether (GGE powder, Kyron) given to effect, followed by 2 mg/kg ketamine (Anaket-V, Centaur Labs) intravenously.

Butorphanol (Torbugesic, Fort Dodge Animal Health) was given intravenously as an analgesic at the dose of 0.02 mg/kg at the start and during the surgery. General anaesthetic was maintained by gas inhalation using halothane and assisted with a ventilator.

The mare was placed in left lateral recumbency with the affected ETD lying uppermost. The skin over the right

mandible and proximal neck area was shaved and surgically prepared. An endoscope was placed into the right ETD. The ETD was exposed through a 10 cm incision made 2 cm cranial to and parallel with the wing of the atlas – a hyovertebrotomy approach<sup>4</sup>. An incision was made in the right ETD. The chondroids were identified within the ETD. All chondroids were manually removed and the ETD flushed with 10 ml of penicillin (Novopen, Bayer). Prior to closure a balloon-tipped Foley's catheter was placed into the ETD through the surgical incision

site and sutured in place using 2-0 polyglactin 910 (Vicryl, Ethicon). This catheter would allow flushing of the site after surgery. The wall of the ETD was closed with 2-0 polyglactin 910 (Vicryl, Ethicon) using a simple continuous pattern followed by the subcutaneous tissue closed in the same manner.

The skin wound was closed with staples. The neck abscess site was re-explored and found to still extend over the dorsal spinous process of the axis. A 0.1 % acriflavine glycerine (Kyron Laboratories) soaked stent was again placed deep into the wound and sutured in place with 2 interrupted sutures using 2-0 nylon suture material. Three randomly chosen chondroids as well as swabs taken from deep inside the neck abscess were submitted for culture. A total of 189 chondroids were removed from the right ETD (Fig. 4). During recovery the Foleys catheter was dislodged. Both the samples taken during surgery cultured positive for *Streptococcus equi* subsp. *equi*.

After surgery the mare was placed on another course of procaine benzylpenicillin at 25 mg/kg (Depocillin) intramuscularly twice a day for 7 days. Endoscopic assisted lavage of the right ETD, using 100 ml sterile water, was repeated on 3 separate occasions 5 days apart. Lavage samples were taken for culture followed by infusion of the affected ETD with a mixture of 1 vial water-soluble penicillin (Novopen, Bayer) and gelatine<sup>21</sup>. The 1st culture result was positive for *Streptococcus equi* subsp. *equi* thereafter 2 negative culture results were obtained. The neck abscess cleared up dramatically after surgery. The mare was released from quarantine 23 days after surgery with instructions to isolate the mare until a 3rd negative culture from a lavage sample could be obtained to render the mare negative of strangles.

## DISCUSSION

*Streptococcus equi* subsp. *equi* infection more commonly known as strangles is a prevalent disease worldwide. It is a highly contagious disease with a morbidity rate of nearly 100 %<sup>4,13</sup>. Clinical signs are initial dullness, pyrexia and upper respiratory tract catarrh followed by suppurative lymphadenitis of the regional lymph nodes of the head and neck<sup>11,13,19,20,22</sup>. Many sequelae of strangles ranging from guttural pouch empyema to 'bastard strangles' can occur<sup>14,15,18</sup>. The latter complication is used to describe the condition where an abscess appears somewhere in the body other than the usual pharyngeal area. Rooney *et al.* mentioned the development of an aberrant abscess development close to the ventral surface(s) of the

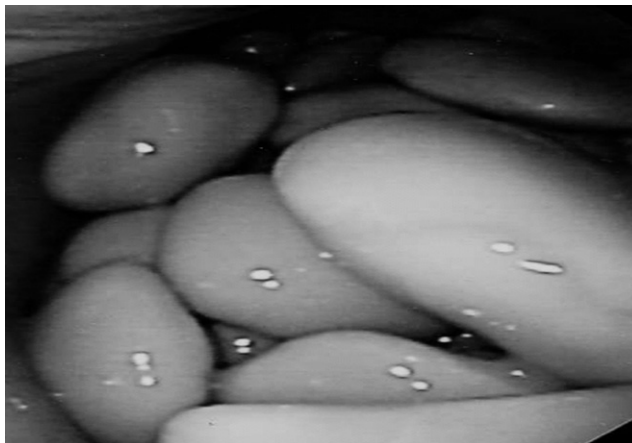


Fig. 3: Endoscopic view of the chondroids identified filling the right Eustachian tube diverticulae.



Fig. 4: A total of 189 chondroids was retrieved surgically through a right-sided hyo-vertebrotomy incision.

last 2 or 3 cervical vertebrae<sup>14</sup>. In these cases clinical signs of ataxia and pain on manipulation of the neck are described. Some of these symptoms were identified in this case. Although a full neurological examination was not completed on the present case the animal did not appear ataxic.

It is possible to identify chondroids in the ETDs using radiography as seen in this case<sup>13</sup>. Radiography with the aid of contrast media placed into the ETDs has been previously used to demonstrate ETD disease in strangles outbreaks<sup>2,11</sup>.

Endoscopic removal of chondroids has been successfully used in the past. Endoscopy-assisted irrigation and aspiration using 50–200 ml of phosphate buffered saline can be used to macerate and flush out chondroids. Solid chondroids may be grasped entirely with endoscopically guided grabbing forceps, a basket snare or a memory-helical polyp retrieval basket<sup>10,21</sup>. In this case, endoscopic manipulation of the chondroids was unsuccessful due to a lack of instrumentation. The large number of chondroids present also precluded this technique.

In a study of 22 outbreaks of strangles in the United Kingdom 23 % of horses tested were found to be persistently infected after clinical signs of strangles had resolved. The average duration of carriage was found to be 10.3 months with the longest period of detection being 56 months. There was evidence of endoscopically visible ETD disease in 86 % of these persistently infected horses<sup>10</sup>. This evidence ranged from slight empyema to multiple chondroids present in one or both ETDs. Of all these persistently infected horses without clinical signs of strangles at the time of presentation, 88 % were treated successfully. These cases were treated by endoscopic manipulation of chondroids while 1 patient underwent surgery to remove the chondroids present<sup>10</sup>.

In the present case the horse presented with a neck abscess and was found to be a chronic carrier of strangles due to the fact that multiple chondroids were present within the right ETD that served as a continuous reservoir for bacteria.

The mare was treated successfully through surgical removal of the chondroids using a hyovertibrotomy ap-

proach. This approach follows a 10 cm skin incision made cranial to and parallel with the wing of the atlas. Underlying the skin the parotid gland and parotidoauricularis muscle are identified and reflected cranially as to expose the areolar tissue covered lining of the ETD. The ETD lining is grasped with rat-toothed or Allis tissue forceps, punctured and the opening enlarged allowing visual assessment of the ETD<sup>1,10,21</sup>. The chondroids were removed through this incision using a sterilised tablespoon to scoop them out.

Antibiotic treatment of horses infected with *Streptococcus equi* subsp. *equi* is controversial. In acute cases, antibiotic treatment may slow the development of abscessation. Where abscessation is already present treatment will only delay ripening of the abscess. The reason for failure of antibiotic treatment following the establishment of abscessation is probably due to a lack of vascularity and thus decreased bioavailability of the antibiotic at the site of infection. Sub-therapeutic levels are unable to eliminate the bacterial population present and thus the infection is not eliminated<sup>7</sup>. Treatment can inhibit the development of protective immunity<sup>17</sup>. In the case under study 2 courses of intra-muscular procaine benzylpenicillin were used with no substantial improvement of the condition. To allow greater bio-availability of the antibiotic at the site of infection, the ETD was infused with a water-soluble penicillin (Novopen, Bayer) combined with a gelatine mixture on 2 separate occasions<sup>21</sup>. The gelatine, in theory, allows greater contact time for the infused antibiotic. This procedure was carried out following the endoscopically guided lavage procedure.

The endoscopic lavage was done repeatedly until 2 successive lavage samples 3 days apart were found to be negative. A lavage sample has been found to be more sensitive than a nasopharyngeal swab (88 % vs 45 %)<sup>11</sup>. For this reason guttural pouch lavages were favoured in this case over nasopharyngeal swabs. Although the mare would only be considered negative after 3 consecutive culture samples taken preferably a week apart<sup>11</sup>, the mare was released from the hospital due to financial constraints. Instructions were given to isolate the animal and to repeat the lavage sample for a 3rd time before exposing the mare to other susceptible animals<sup>16</sup>.

*Streptococcus equi* subsp. *equi* is spread via direct contact with nasal or lymphoid secretions as well as through exposure to contaminated fomites<sup>13</sup>. Basic actions required to stop the spread of strangles in an outbreak are: quarantine the premises,

identify symptomatic and asymptomatic carriers and isolate and treat infected horses. The quarantine can be lifted once 3 consecutive negative culture results have been obtained from each horse<sup>3,21</sup>. *Streptococcus equi* subsp. *equi* is known for its resilience in a moist environment. Disinfectants such as povidone iodine (Betadine; Faulding Pharmaceuticals), chlorhexidine gluconate (Hibitane; Coopers (Pitman Moore)) and glutaraldehyde (VH Parvocide Plus; Arthur Webster) at their lowest recommended concentrations were found to be effective in eliminating this bacteria<sup>8</sup>. Inter-epizootic maintenance is not only influenced by the environmental persistence of *Streptococcus equi* subsp. *equi* but also by the development of a carrier status.<sup>10</sup> An hypothesis has been put forward that chondroids in the ETD are often associated with sub-clinical inflammation which stimulates an immune response resulting in a modified profile of the antibody response compared to non-carriers. This may pave the way for a design of a diagnostic assay to identify carriers<sup>22</sup>.

The development of an effective and safe vaccine has been slow. In a study done of 179 studs in New South Wales, vaccination had no effect on the likelihood of a strangles outbreak<sup>9</sup>. Many different types of vaccines are available. Equilis StrepE (Intervet) is a modified live vaccine that has recently been launched in South Africa. It is injected sub-mucously in the inside of the upper lip, stimulating a mucosal and systemic antibody response. The vaccination protocol is 2 vaccines 4 weeks apart followed by re-vaccination every 3 months for high-risk horses and every 6 months for medium-risk horses. An effective immune response takes 7–10 days. The vaccine has been shown to protect 50 % of horses from the development of lymphnode abscessation and a further 25 % had reduced clinical signs<sup>22</sup>.

Following vaccination, injection site reactions have been recorded as well as clinical signs such as nasal discharge, lymphadenitis, submandibular abscessation and occasional purpura haemorrhagica<sup>22</sup>. One study suggested that most of these clinical signs are attributable to infection with the wild type of *Streptococcus equi* subsp. *equi* and not a reversion to virulence of the vaccine strain<sup>12</sup>. Vaccination during an outbreak has been associated with the development of an aseptic vasculitis: purpura haemorrhagica<sup>12,13,18,20</sup>.

Live attenuated vaccines in use, such as Equilis StrepE, offer a short-lived immunity and injection site reactions do occur. Multi-component subunit vaccines based on several immunogenic *streptococcus equi*

subsp. *equi* surface proteins offers an alternative to live attenuated vaccines. These multi-component vaccines not only use many proteins to stimulate an immune response but also are safer as back-mutation to virulence is not possible<sup>6</sup>.

Although strangles is not a notifiable disease and there are no restrictions on the international movement of horses that have strangles, it is an important disease in South Africa. The outbreak of this highly contagious disease has great repercussions on the horse/yard owners due to loss of days in training, cost of treatment as well as occasional mortality. Some prevalence data were obtained from the Chief State Veterinarian in the Department of Agriculture. A search of strangles outbreaks in South Africa was performed going back as far as 1992. The 1st cases recorded were in 1999 in the Eastern Cape and since then outbreaks have been recorded from all provinces of South Africa (C Pienaar, National Department of Agriculture, pers. comm., 2006). Although these records are not official they provide a measure of the prevalence of strangles in South Africa.

## CONCLUSIONS

Strangles caused by *Streptococcus equi* subsp. *equi* is a common disease worldwide and its occurrence in South Africa is well known. Although this disease usually affects the upper respiratory tract, unusual cases of strangles do occur as seen in this case. The carrier status in outbreaks has been recorded as high as 23 %<sup>10</sup>. Carrier animals can act as a source of infection. It is important to identify carriers, preferably by taking an ETD lavage sample for culture and attempt to eliminate the carrier status in order to control strangles in our equine industry.

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