Atlantooccipital fracture with intrathecal haematoma- a novel treatment method

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Abstract

This case report describes successful conservative management of a comminuted fracture of the atlas. To the authors knowledge, fracture of the atlas in the horse and intrathecal corticosteroid injection in the standing sedated patient has not been previously reported. Clinical signs included acute onset ataxia, proprioceptive deficits and neck stiffness; which developed immediately post trauma during assisted recovery from general anaesthesia. Radiographic examination was not diagnostic immediately post trauma and computed tomographic (CT) imaging subsequently identified a fracture of the atlas. Treatment included ultrasound guided intrathecal medication of the cerebrospinal fluid and intra-articular medication of the atlantooccipital joint under standing sedation. Medication resulted in a marked improvement in clinical signs (grade 4 ataxia to grade 1 ataxia).

Atlantooccipital fracture with intrathecal haematoma- a novel treatment method- standing CSF medication - diagnosis, treatment and outcome.

Summary

This case report describes successful conservative management of a comminuted fracture of the atlas. To the authors knowledge, fracture of the atlas in the horse and intrathecal corticosteroid injection in the standing sedated patient has not been previously reported. Clinical signs included acute onset ataxia, proprioceptive deficits and neck stiffness; that developed immediately post trauma during assisted recovery from general anaesthesia. Radiographic examination was not diagnostic immediately post trauma and computed tomographic (CT) imaging subsequently identified a fracture of the atlas. Treatment included ultrasound guided intrathecal medication of the cerebrospinal fluid and intra-articular medication of the atlantooccipital joint under standing sedation. Medication resulted in a marked improvement in clinical signs (grade 4 ataxia to grade 1 ataxia).

History

An 11-year-old warmblood gelding weighing 540 kg presented as a tertiary referral to a UK referral hospital with an 8 month history of ataxia and neck pain.

Eight months previously, the patient was considered clinically well with no neurological abnormalities and subsequently underwent general anaesthesia for surgical resection of a melanoma from the sheath with assisted recovery. During recovery the patient ventroflexed the neck and impacted the head. Following recovery, the patient was markedly ataxic in all limbs. Reported clinical examination findings immediately post recovery found no localising swelling or pain. Analgesia and anti-inflammatories (phenylbutazone, morphine and dexamethasone) as well as Vitamin E were administered post-operatively. The patient's condition reportedly improved over the following days', however a mild degree of ataxia remained. Radiographic examination of the neck did not detect any significant abnormalities. The ataxia improved with conservative management and physiotherapy.

Re-examinations found an improvement of clinical signs in the following 3 months but the owner reported the neck felt intermittently hot and uncomfortable. Medication of the C4-C5, C5-C6 and C6-C7 articular process joints was performed during this time.

Upon presentation to the Liphook Equine Hospital, 8 months following onset of clinical signs, findings from clinical and neurologic examination included; bilateral muscle loss surrounding the caudal cervical spine as well as loss of left gluteal musculature. There was no pain on palpation throughout the neck or the epaxial musculature. A marked restriction of neck motion was found in every direction, particularly in the dorso-ventral plane. Cranial nerve examination was normal. Dynamic neurological examination found bilateral weakness during tail pull tests with a severe weakness when pulled to the right side. When walking in a straight line, tight circling, up and down a slope and on serpentines, the patient was hypermetric, particularly in the hind limbs, with circumduction during circling. This was consistent with grade 4 hind limb ataxia and grade 1 fore limb ataxia . Given the clinical presentation a lesion within C1-C7 was most likely leading to the ataxia and therefore a CT was considered the most appropriate diagnostic modality.

CT examination of the head and entire cervical spine was performed under general anaesthesia. Both plain and positive contrast myelographic CT studies were acquired. A 16 slice multidetector CT (GE Lightspeed Modified CT) with a helical acquisition at 120kV, 300mA and 1.25mm slice thickness, field of view 60cm, reformatted using both a bone and soft tissue algorithms to 0.625mm and 3mm slice thicknesses, matrix size of 768 x 768.

Positive contrast myelogram was performed via atlantooccipital cisternal puncture with an 8.3cm needle. A short extension tube was attached and 10ml cerebrospinal fluid per 100kg bodyweight was removed over a 3 minute period. The same volume of iohexol (Omnipaque 300mg I/ml GE Healthcare) was then injected over a 3 minute period. Once needle withdrawal had occured, the head was elevated for 3 minutes to allow caudad flow of contrast material. The head and neck were then lowered and repeat CT imaging was performed.

Recovery from anaesthesia was unassisted and graded as excellent. Post-operatively the patient was given 4.4mg/kg phenylubutazone intravenously as a single dose.

Results from cytological examination of the cerebrospinal fluid were within normal limits (mildly xan-thochromic, Protein 10 g/l)- Table 1.

CT findings revealed a complete, chronic, moderately displaced articular fracture of the left ventral tubercle of the atlas. A saucer fracture of the caudodorsal articular margin of the left occipital condyle with an associated intraarticular osseous fragment. The atlantooccipital joint was moderately effused. Soft tissue proliferation was present within the left half of the vertebral canal, extending from the occiput to the caudal aspect of the atlas, narrowing the vertebral canal by approximately 50% and causing right dorsal displacement of the spinal cord. This was causing marked extra-dural compression of the contrast column at the left side in the myelographic images. Gas attenuating material was present within this soft tissue material in post myelographic images, likely iatrogenic and secondary to injection Figures 1-5).

Moderate osteoarthropathy of the atlantooccipital joint was present, most markedly left sided. Enthesous new bone was present at the insertion of the joint capsule and associated ligaments at the caudal aspect of the occiput.

Treatment

The patient was sedated with acepromazine (0.02 mg/kg bodyweight intravenously), detomidine (0.01 mg/kg bodyweight intravenously) and morphine (0.1mg/kg bodyweight intravenously) with the horse restrained in stocks. A C1-C2 ultrasound guided injection was performed. A total of 120mg of methylprednisolone sodium succinate (Solu-medrone 40mg/ml, Pfizer) was injected into the cerebrospinal fluid. In addition,

40mg methylprednisolone sodium succinate (Solu-medrone 40mg/ml, Pfizer) was injected into the atlantoocciptal joint under ultrasound guidance.

The following day a repeat neurological examination showed that the patient was grade 1 ataxic in all four limbs, the tail pull response was markedly better with only some weakness on tail pull to the right whilst the patient had an increased range of motion of the neck.

Follow up 4 months post treatment (October 2018)

Physical examination findings included no evidence of neurologic abnormalities within either the fore or hind limbs and no cranial nerve deficits. A reduced range of motion within the neck both laterally and dorso-ventrally remained, although this was improved compared to previous examinations.

A standing sedated CT examination was performed of the poll region which found continued remodelling of the comminuted fracture of the atlas and similar degenerative joint disease within the left atlanto-occiptal joint.

Repeat ultrasound guided injection of the atlanto-occiptal joint was performed with 80mg methylprednisolone (Depo-Medrone 40mg/ml Injection, Pfizer) under standing-sedation.

The horse resumed ridden exercise and remains on a controlled ascending exercise regime.

Discussion

Diseases affecting the atlanto-occipital joint have been rarely documented in the horse and their diagnosis can be a considerable challenge. Craniovertebral junction (CVJ) trauma is a difficult clinical condition. Being a highly mobile functional unit at the junction of the skull and the vertebral column, traumatic events in this area may produce devastating neurological complications and death. Additionally, many of the CVJ traumatic injuries can be left undiagnosed or even raise difficult treatment dilemmas.

In human literature it is considered that the combination of clinical and radiographic examination when indicated (using the National emergency X-Radiography Utilization study criteria) is inadequate for fracture detection of the cervical spine following blunt trauma compared to CT imaging .

Again in human literature, when comparing radiography to CT imaging the lateral view radiograph alone had only a 73% sensitivity (95% CI, 50–89%) and 92% specificity (95% CI, 87–95%) for cervical spine abnormalities compared with MDCT findings. The addition of other radiographic views did not change the sensitivity of radiography but rather marginally decreased its specificity to 91% (95% CI, 86–94%).

Although radiographic examination of the entire cervical vertebral column had been performed at the time of initial onset of clinical signs, the fracture had not been identified. Retrospective review of the radiographic examination allowed identification of the ventrally located linear osseous fragment, however definitive diagnosis of the extent of the atlas and occiput fractures was not possible, nor was the identification of any compression of the spinal cord.

Definitive diagnosis was achieved by CT myelography of the cervical vertebral column, performed under general anaesthesia. This allowed detailed analysis of the fracture configuration and visualisation of extradural compression caused by soft tissue swelling associated with the atlanto-occiptal fracture site. In addition, general anaesthesia allowed CT imaging of the entire cervical spine providing the ability to rule out the presence of injury in the rest of the neck. Magnetic resonance imaging would have theoretically allowed improved soft tissue assessment and more accurate determination of the nature of the soft tissue material within the vertebral canal however the practical application of Magnetic Resonance Imaging for imaging the neck in the live horse is limited due to patient size and practical application. CT imaging was chosen due to availability of the imaging modality. Whilst general anaesthesia was an increased risk to the patient, this was considered justifiable in order to determine a diagnosis.

General anaesthesia is not always possible if horses are displaying severe neurological signs or for economical reasons. Practical application of CT imaging a neurological case under standing sedation is based upon level of neurological deficits and risk assessment would be performed on a case by case basis due to the increased difficulties of positioning a neurological patient for standing sedation. In neurological patients, initial treatment and monitoring has been performed prior to anaesthestic in order to reduce risk to the patient during recovery. In this case, general anaesthesia allowed positive myelogram acquisition and also to assess the entirety of the neck however standing CT could be performed for lesion monitoring once the primary diagnosis had been made.

Considered treatment options for this case included (1) conservative management, (2) fracture fixation, (3) dorsal hemilaminectomy or (4) local infiltration of steroids into the cerebrospinal fluid and left atlanto-occipital joint.

Continued conservative management was considered inappropriate by the owner due to ongoing clinical signs, pain and neurological deficits displayed by the patient. Both clinician and owner felt interventional therapy was justified.

Option (2) fracture fixation was considered. Atlantoaxial arthrodesis is described in humans and is a technically difficult and invasive procedure. Internal fixation of a fractured axis in an adult horse has been successfully performed but fixation of an atlas has not been described in the horse. Given the comminuted conformation and chronic nature of the fracture site, it was considered this would be challenging surgery with a high risk recovery for the patient from general anaesthesia.

Option (3) dorsal hemilaminectomy in order to release the pressure within the spinal column and improve ataxia. Nixon and Stashak (1988) have described successful laminectomy for relief of compression caused by atlantoaxial subluxation in four horses. Two horses recovered fully, one horse had residual grade 1 neurologic deficits and the fourth horse was euthanised due to limb fracture 6 weeks after surgery. Laminectomy and hemilaminectomy has been reported as a successful treatment for relieving spinal compression in dogs. In canines this procedure is commonly associated with postoperative neurological deterioration (. Given the increased risk to the patient this option was not chosen.

Finally, option (4) infiltration of corticosteroids into the cerebrospinal fluid and left atlantooccipital joint medication. Intra-thecal steroid use is widespread for a variety of reasons in humans but to the authors knowledge, has not been reported in equines. Personal communication with colleagues had suggested positive response to intrathecal corticosteroids following traumatic spinal injury in equines. It was thought this could be successfully performed in the standing patient using the technique described by and therefore eliminate any further anaesthetic risk for the patient. Medication of both the atlantoccipital joint and the cerebrospinal fluid was performed sequentially under the same sedation, therefore it is not possible to definitively determine which of these procedures provided a greater contribution to improvement in the clinical signs.

The technique for medication of the cerebrospinal fluid and the atlanto-occiptal joint was performed under ultrasound guidance. This technique was a quick procedure to undertake and repeatable without side effect. However, this case report describes only one case whereby no adverse side effects were found following subarachnoid space injection of corticosteroids under standing sedation. A larger number of cases is required in order to ascertain the safety of this procedure.

This case report describes a fracture to the atlanto-occiptial joint which had been refractory to conservative management and presented with chronic remodelling of the fracture site. Local medication of the atlanto-occiptal joint and cerebrospinal fluid resulted in significant improvement in ataxia and clinical signs almost immediately post treatment.

Table 1. Cytological examination of the cerebrospinal fluid

Gross Appearance- mildly xanthochromic,

Viscosity- Low, Protein- 10 g/l, TNCC- 0 c/mm, RBC- 0 c/mm.

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Figure 2 Atlantooccipital fracture with intrathecal haematoma- a novel treatment method.docx available at https://authorea.com/users/646481/articles/658367-atlantooccipital-fracture-with-intrathecal-haematoma-a-novel-treatment-method

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Figure 3 Atlantooccipital fracture with intrathecal haematoma- a novel treatment method.docx available at https://authorea.com/users/646481/articles/658367-atlantooccipital-fracture-with-intrathecal-haematoma-a-novel-treatment-method

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