

Rib fracture as a cause of hindlimb lameness in a horse

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Abstract

A 2-year-old racing Thoroughbred gelding in training was presented with moderate (6/10) right hindlimb lameness unresponsive to regional anaesthesia of the right hind limb. Gamma scintigraphic examination revealed severe, focal, increased radio-pharmaceutical uptake over the dorsal aspect of the right 18th rib, which had an abnormal contour. Ultrasonographic examination of this area confirmed the presence of a complete, displaced fracture of the proximal aspect of the right 18th rib. Local infiltration with local anaesthetic around the 18th right rib (10ml cranial and 10ml caudal to the fracture site) abolished the right hindlimb lameness. A diagnosis of rib fracture causing moderate ipsilateral hindlimb lameness was made. The horse returned to walking exercise after 12 weeks of rest and was reported to be sound on the same limb 12 months after presentation. Caudal rib fractures should be considered as possible cause of hind limb lameness. Local diagnostic anaesthesia around the fracture site can aid localise the origin of lameness.

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Summary

A 2-year-old racing Thoroughbred gelding in training was presented with moderate (6/10) right hindlimb lameness unresponsive to regional anaesthesia of the right hind limb. Gamma scintigraphic examination revealed severe, focal, increased radio-pharmaceutical uptake over the dorsal aspect of the right 18th rib, which had an abnormal contour. Ultrasonographic examination of this area confirmed the presence of a complete, displaced fracture of the proximal aspect of the right 18th rib. Local infiltration with local anaesthetic around the 18th right rib (10ml cranial and 10ml caudal to the fracture site) abolished the right hindlimb lameness. A diagnosis of rib fracture causing moderate ipsilateral hindlimb lameness was made. The horse returned to walking exercise after 12 weeks of rest and was reported to be sound on the same limb 12 months after presentation. Caudal rib fractures should be considered as possible cause of hind limb lameness. Local diagnostic anaesthesia around the fracture site can aid localise the origin of lameness.

Introduction

Rib fractures have an estimated incidence of 13.9% and account for 37% of life-threatening fractures in neonate foals. Rib examination including palpation of the thoracic cavity is therefore an important part of the routine clinical examination of new-born foals. Rib fractures are less frequently reported in adult horses and have a traumatic origin. A recent retrospective study described the presentation of 73 adult horses with

rib fractures to 4 equine referral hospitals in the UK over a period of 16 years . Poor performance was the owner’s complaint in 56% (41/73) and lameness was reported in 64% (47/73) of the horses. The most common clinical sign observed in adult horses affected with rib fractures included pain on palpation of the fractured area in 38% (18/47) (Hall *et al.* 2022).

Diagnosis of rib fracture is achieved by a combination of clinical examination and diagnostic imaging . Palpation is a subjective technique and varies between horses and examiners, only 18/47 horses where palpation was recorded, showed signs of pain or discomfort. Swelling associated with the fracture site is not always noticeable (Hall,*et al.* 2022). Ultrasound examination is often the preferred imaging technique used for diagnosis of rib fractures, especially in foals. In foals, ultrasound was associated with sensitivity of 95% and specificity of 100%, whilst radiography had sensitivity of 25% and specificity of 100% for diagnosis of rib fractures . In adults, radiographic examination was associated with low sensitivity of 41% and un-reported specificity; whereas ultrasound examination was deemed reliable with sensitivity of 98% and specificity of 95% . Ultrasound examination also allows inspection of the lung surface and any associated damage to the pleural space. Therefore, it can be concluded that, regardless of the animals age, ultrasound examination is a sensitive imaging modality. An ipsilateral laterodorsal-lateroventral oblique “skyline” radiographic projection has been described for the imaging diagnosis of rib fractures in adult horses (Hall *et al.* . 2022); this projection has not been reported in foals.

Gamma scintigraphy is not performed in foals but has been reported as the main diagnostic tool to diagnose rib fractures in adult horses. Severe, focal increased radio-pharmaceutical uptake is typically associated with the fracture rib site and was found in all horses with rib fractures that underwent this diagnostic modality (59/59) . It is relevant to note that increased radiopharmaceutical uptake typically remains at the fractured rib site even after healing of the fracture is completed

In human medicine, the clinical signs and description of the symptoms, in combination with different imaging modalities are often deemed sufficient to achieve a diagnosis of rib fracture. The use of regional analgesia is therefore often described as a therapeutic, rather than a diagnostic technique In veterinary medicine, however, the lack of descriptive symptoms, regional analgesia is often required to determine the clinical significance of both clinical and imaging findings .

This case report describes the clinical presentation, management, and outcome of a horse with moderate right hind limb lameness that was localised to a fracture of the ipsilateral 18th rib with use of regional anaesthesia.

Case description

A two-year-old colt Thoroughbred racehorse in training was reported to have a sudden onset of right hindlimb lameness. No abnormalities were noted on the affected limb, but the horse resented passive flexion of the right hindlimb.

The referring veterinary surgeon had examined the horse. No abnormal findings were reported on the clinical examination, but a 6/10 right hindlimb lameness was noted at trot on a straight line over hard ground. A high plantar nerve block (Schumacher, 2011) was performed blocking the medial and lateral plantar and plantar metatarsal nerves at the level of the proximal metatarsal area in the right hind limb. This nerve block did not change the initial level of lameness. The horse was then rested, and on repeat examination one week later, there were no apparent changes on the initial level of lameness. The horse was subsequently referred for gamma scintigraphic examination.

On presentation to the hospital, the horse was bright alert and responsive, with all vital parameters within normal limits. Clinical examination revealed mild swelling over the dorsocaudal aspect of the right caudal hemithorax, but no other significant findings over the hind limbs or pelvic area. An intravenous 16g catheter (BD Angiocath11BD Angiocath: BD UK 1030 Eskdale Rd, Winnersh Triangle, Wokingham RG41 5TS. UK.) was aseptically placed in the left jugular vein. The horse was injected with Technetium-99m22Technetium-99: UN2915, Class 7. Batch No: 2602449. Southampton General Hospital, Radiopharmacy department. Tremona

Rd Southampton, SO16 6YD. UK. bound to methylene diphosphonate measuring 13.2 GBq with a 11.39 GBq of activity eluted. The horse was not lunged, but distal limb bandages and rugs were applied instead before administration of the radionuclide. Two hours after administration of Tcnetium-99, gamma scintigraphic images were obtained with the use of a Bartec AnyScan33Bartec AnyScan VS. Scintigraphy System. Bartec Technologies Ltd, Unit 14 Farnborough Business, Eelmoor Rd, Hampshire, GU14 7XA. UK. VS Scintigraphy camera. All images were acquired between 2 and 4 hours after administration of the radionuclide.

Gamma scintigraphic examination of the thoracolumbar spine, ribcage, pelvis, and hind limbs was performed. Severe focal increased radiopharmaceutical uptake (IRU) was present on the dorsal aspect of the right 18th rib (Figure 1). The course of the rib was also noted to be abnormal. The proximal aspect of the rib coursed cranioventrad towards the right 17th rib, where it changed direction to caudoventrad distal to the focal area of IRU. This can be appreciated when compared to the contralateral rib on the dorsoventral view.

Once cleared from radioactive isolation, lameness examination was performed, which revealed a mildly hypermetric gait and abnormal flight arc, abducting the RH limb was noted at walk. The horse showed 6/10 right hindlimb lameness when trotted in a straight line. Advancement and landing of the RH limb was associated with a marked head nod. A tibial and peroneal nerve block (J. Schumacher, 2011) was performed aseptically on the right hind limb with the use of a 21g needle administering 15ml of mepivacaine hydrochloride (20mg/ml, Mepidor44Mepidor. Animalcare Ltd. 10 Great North way, York Business Park, YO26 6RB. UK.) per site, which caused no significant changes to the initial gait and level of lameness.

Ultrasound examination of the right hemithorax was performed with the use of a linear probe at 8-15Mhz (Logic S8, GE55GE Medical Systems Ltd, Pollards wood, Nightingales Ln, Chalfont St Giles, Buckinghamshire, HP8 4SP. UK.) which confirmed the presence of a complete, displaced fracture of the proximal aspect of the right 18th rib (Figure 2).

Twenty millilitres of mepivacaine hydrochloride (20mg/ml, Mepidor®) were infiltrated into the intercostal muscles around the fracture site (10ml cranial and 10ml caudal to the fracture site). Complete resolution of the lameness was obtained after 10 minutes from the time of local anaesthetic infiltration. A diagnosis of a complete displaced fracture of the right 18th rib causing ipsilateral right hind limb lameness was made.

The horse was subsequently discharged with instructions to be rested for a period of 12 weeks, with daily hand grazing. Follow-up 12 weeks later revealed a persistent 3/10 right hindlimb lameness at the trot; due to the trainer's concerns of a lack of progress, the referring veterinarian, repeated the nerve block over the right 18th rib, which caused a 90% improvement on the initial lameness. The horse was subsequently instructed to resume walking exercise, starting with 4 weeks of walking exercise. No further imaging was performed by the referring veterinary surgeon. Twelve months after diagnosis, the horse was sound and had returned to training, showing no further signs of right hindlimb lameness.

Discussion

Rib fractures are common in foals but are less frequently reported in adult horses. Rib fractures have been found to be a cause of poor performance in adult horses. A review of the clinical signs and various imaging modalities such as gamma scintigraphy, ultrasonography and radiography in adults has previously been published , However, demonstration of the direct effect of rib fractures as cause of lameness or poor performance has not previously been reported. This case report describes the diagnosis of a right hindlimb lameness caused by a displaced rib fracture of the 18th rib with the use of local anaesthetic.

We theorised that the logical explanation for this lameness is intrinsically related to the anatomical and biomechanical features of the thorax, pelvis and hindlimbs. The caudal thoracic spine and caudal ribs are intrinsically related to the cranial extent of the upper hind limb musculature, which is responsible for the advancement of the hindlimb and flexion and extension of the coxofemoral joint. The major psoas muscle originates on the bodies and transverse processes of the lumbar vertebrae, as well as the last two ribs and inserts on the lesser trochanter of the femur. The iliac muscle originates on the shaft and wing of the ilium and inserts on the lesser trochanter of the femur. Both muscles have, however, the same function and are

responsible for the advancement of the limb by flexion of the hip joint and outward rotation of the stifle. During the stance phase, when the limb is fixed on the ground, both muscles cause flexion of the vertebral column (Konig & Liebich, 2020). It is likely that contraction of these muscles while weight bearing on the ipsilateral hindlimb will cause a caudal retraction of the fractured rib, which would therefore cause pain. During the swing phase the tensor of the *fascia lata* and the quadriceps are responsible of extending the stifle by retracting the patella proximally while the iliopsoas cause flexion of the coxofemoral joint, to advance the limb cranially, causing signs of pain and lameness during the swing phase.

In addition, there is direct relation between the transverse abdominal muscle and both internal and external abdominal oblique muscles and the caudal ribs and the pelvis (Boudras et al, 2009). The transverse abdominal muscle originates from the cartilage of the last 12 ribs and inserts on the iliac crest (Baldo et al., 2018). The external abdominal oblique muscle originates on the lateral aspect of the caudal ribs and inserts on the prepubic tendon (Liebig et al, 2020). The abdominal muscles sustain the weight of the viscera, which could cause in this case caudal retraction of the fractured rib during motion. In addition, the abdominal musculature is actively engaged during trot, and this may cause retraction of the fractured rib aggravating the signs of pain.

Hall et al, 2022 reported gammagraphy had sensitivity of 100% for detection of fractured ribs in their study. The renal clearance of the unbound T-99m, often reveal an undesired “uptake” in both kidneys and bladder. In the case of a caudal rib fracture, the over position with the right kidney may mask the presence of a fracture within the dorsolateral aspect of the rib. It is common practice that the kidney area is masked to reveal a better distribution of the radio-pharmaceutical uptake over the thoracic and lumbar vertebrae. A dorsal view obtained on cases of suspicion may be indicated. This view reveals a focal uptake abaxial to the caudoproximal thoracic cavity which allows both separation from the renal uptake and allows comparison with the contralateral rib in a single image.

Intercostal regional analgesia is well described in human medicine and is mainly used to control pain caused by either fractures or pleural drains, it is also used for diagnosis of fractures causing respiratory insufficiency. This procedure was guided ultrasonographically in this case, was well tolerated by the horse, inexpensive and relatively easy to do.

The retrospective study on rib fractures in adults reported that 88% of rib fractures were successfully treated conservatively, however, in this study they were not specific regarding the fracture types. For most cases, the required treatment is aimed at treating the complications caused by the fractures themselves (Lugo & Carr, 2019) such as haemothorax and/or pneumothorax, which are anyway, uncommon. In adults, most isolated fractures are thought to heal spontaneously and therefore internal fixation is rarely required and performed (Prange. T, 2019). Current fracture classifications or fracture types described do not describe an estimated healing time (D. G. Levine, 2022). Considering the principles of fracture healing (A. J. Nixon, 2020), a complete, closed, displaced fracture of the rib would require a longer healing time than any other closed fracture type. They involve secondary bone healing where several factors depending of the stabilization and gap conformation, make healing time unpredictable (C. E. Kawcak, 2022).

On displaced fractures, surgical correction may be required, with the goal of stabilising the fracture to minimise movement, promoting callus formation. In adult horses this is rare and perhaps only indicated when a displaced cranial rib fracture has occurred (Hance et al., 1992). In foals with a flail chest, surgical treatment may be indicated, for which both internal and external fixation system have been previously reported. External fixation has been, however, linked to secondary septic pleuritis and is therefore rarely used in horses. The goal of fracture reduction on ribs is providing stabilization, several techniques have been described in foals ; compression is often not required.

This is the first study describing the use of local anaesthesia to localise a right hindlimb lameness caused by the fracture of the 18th rib. Whilst imaging is required to achieve a diagnosis, local anaesthetic is fundamental to determine the significance of the findings. This procedure is inexpensive and can be easily performed as described in this case report. In conclusion, caudal rib fractures can be the cause of hindlimb lameness in

adult horses. Whilst a combination of clinical examination and imaging is required. Infiltration with local anaesthesia can be performed to achieve a definitive diagnosis.

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