Axial Skeleton Pathology - The Neck and Back of It
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Introduction

In recent years, greater attention has been paid to the equine axial skeleton and how pathology in this region relates to lameness and poor performance. However, despite advances with imaging of the axial skeleton, identification of pathology and correlation with clinical signs remains a challenge. In this program, we will review the anatomy of the axial skeleton, components of the lameness examination that are used to evaluate the neck and back, and relevant pathology of the axial skeleton that contribute to performance issues. Diagnostic options and treatment modalities for neck and back pain will additionally be discussed.

Anatomy of the Axial Skeleton

Neck

The equine neck is composed of seven cervical vertebrae which support the spinal cord and connect the skull to the trunk. The first (atlas) and second (axis) cervical vertebrae have unique shapes and functions. The atlantooccipital joint contributes flexion and extension of the neck with minimal lateral movement, and the atlantoaxial joint functions as a pivotal point for the head. The third through fifth cervical vertebrae are very similar in size, shape, and function. The sixth cervical vertebra is slightly shorter than the preceding vertebrae, and the seventh cervical vertebra has a small dorsal process. The dorsal aspect of the neck is primarily supported by the nuchal ligament, and musculature primarily supports the cervical vertebral column on each side and ventrally.

Back

The equine back is composed of 18 thoracic vertebrae, six lumbar vertebrae, five fused sacral vertebrae, and an average of 18 coccygeal vertebrae. Congenital variations can occur at the cervicothoracic, thoracolumbar, and lumbosacral junctions as well as variations in the number of vertebrae in each spinal segment. The vertebral bodies in the thoracic and lumbar regions are similar in anatomy. Each has a dorsal spinous process, cranial and caudal articular processes, vertebral body, vertebral canal, and transverse processes. The transverse processes are much longer in the lumbar vertebrae than thoracic vertebrae. Intervertebral foramina are sites of exit for nerves, blood vessels, and lymphatics.

The thoracolumbar region is well supported by epaxial musculature and ligamentous structures. The supraspinous ligament inserts on the summits of the dorsal spinous processes (DSPs) and has fibers that course ventrally between the DSPs to become continuous with the interspinous ligament. The interspinous ligament attaches to the cranial and caudal margins of adjacent DSPs. The ventral longitudinal ligament provides additional support. The overall mobility of the spinal column is fairly minimal; thus, visually detecting changes in range of motion can be difficult. The lumbosacral junction is the most mobile region of the back.

Sacroiliac Region

The articulation between the dorsal aspect of the wing of the sacrum and the ventral aspect of the wing of the ileum forms the sacroiliac (SI) joint and serves as the attachment of the pelvis to the axial skeleton. The SI joint, along with the sacroiliac and sacrosciatic ligaments, provide support during weight bearing of the pelvic limbs and transfer forces from the hindlimbs to the axial skeleton. The sciatic nerve is directly adjacent to the SI joint and runs through the greater sciatic foramen in the sacrosciatic ligament.

Clinical Presentation

Back and neck pain can be significant contributors to poor performance, both as primary and secondary sources of lameness. Axial skeleton involvement should be considered if a horse with forelimb or hindlimb lameness fails to respond to treatment as expected. Additionally, clinical complaints including poor behavior under saddle, difficulty picking up or maintaining canter leads, difficulty with lateral movements, or poor engagement of the hind end should also tip off the examiner to possible axial skeleton discomfort.

Examination

As complaints associated with neck and back pathology have substantial overlap with primary forelimb and hindlimb lameness, a thorough lameness examination should be performed. Examination should begin with an assessment of overall conformation and condition of the horse. Dynamic assessment should then be performed in hand, on the lunge line, and under any specific circumstances in which the behavior is exhibited by the horse. Horses that buck or rear under saddle and are not safe for a rider can be examined with a weighted surcingle. However, if the horse is safe to be ridden, additional information regarding the interactions between the horse and rider can be gained. Other important factors to consider are saddle fit and overall fitness of the horse. Following dynamic lameness assessment, the back and neck should be evaluated for sensitivity to palpation and range of motion.

Thoracolumbar Pathology

Fractured Dorsal Spinous Processes

Horses with fractured DSPs typically have a known history of falling or flipping over. They may show reluctance to walk, hold their head in hyperextension, and have significant stiffness through the neck and thoracolumbar musculature[1]. Radiography confirms the diagnosis. Treatment centers on anti-inflammatories during the initial post-traumatic phase, as well as stall confinement and time for stabilization of the fracture fragments. Prognosis for return to performance is generally quite good[2], but saddle fitting may need to be altered once healing is complete. Fracture fragments rarely migrate subcutaneously or sequester and require surgical removal.

Vertebral Body Fractures

Fractures of the vertebral bodies are generally associated with localized, marked muscle spasm, guarding of the back, and possible abnormal contour of their topline. Neurologic signs are variable and dependent on the degree of spinal cord compression. Nuclear scintigraphy can be helpful in identification of vertebral body fractures that are not immediately apparent on plain radiographs. Initial treatment generally involves non-steroidal anti-inflammatory drugs (NSAIDs) and stall confinement. Certain fracture configurations can be repaired with internal fixation. However, overall the prognosis is guarded owing to neurologic deficits and secondary ankylosis of the facet joints[3].

Overriding Dorsal Spinous Processes

Overriding dorsal spinous processes (ORDSP), or kissing spines, has been documented for many years and is likely the most common condition attributed to pain of the equine thoracolumbar region[4]. When the space between the dorsal spinous processes (DSPs) becomes narrowed or the DSPs are observed to be touching they are called impinged or overriding. The pathogenesis of this condition still remains unclear. While there seems to be a higher incidence in Thoroughbred horses and horses that are used for jumping and dressage, it has been documented in a variety of breeds and disciplines[5].

Clinical signs, age of onset of signs, and stage of career can be highly variable. Common clinical signs include general poor attitude, resistance to firm currying, behavioral issues under saddle (bucking,

rearing, reluctance to move forward), or non-specific poor performance. Aside from a thorough lameness examination and palpation of the axial skeleton, digital radiographs are the primary means of diagnosing overriding or impinged DSPs. It must be stressed, however, that clinically normal horses can have evidence of radiographic or other imaging abnormalities; without further investigation this can lead to false interpretation of anatomical changes as clinical pathology[6].

Diagnostic Imaging of the Back

Radiographic changes associated with ORDSP have been well described and numerous grading systems have been introduced[6]. However, there remains no significant evidence that the imaging grade correlates with clinical pain, with wide ranges of radiographic or scintigraphic abnormalities being identified both in clinically normal horses and those with back pain[4]. Nuclear scintigraphy, for identification of active bone remodeling associated with radiographic abnormalities, can provide additional support for a clinical diagnosis, and can offer further information about concurrent abnormalities which may need to be considered for long-term management[5].

Ultrasonography can be used to better evaluate the gap between the DSPs which can be falsely narrowed with two-dimensional radiographs[7]. Additionally, ultrasonography allows for objective evaluation of the size and symmetry of the epaxial musculature and evaluation of the surrounding ligaments[8].

Diagnostic Analgesia of the Equine Back

If diagnostic analgesia of the back is to be pursued, a specific clinical sign you are looking to eliminate must be identified. Radiographic or ultrasound guidance is recommended to ensure accuracy of needle placement and it should be understood that infiltration of the soft tissues around the interspinous spaces in question is typically all that is achieved. A 20g, 2.5 or 3.5" spinal needle is adequate. Horses with a positive response to diagnostic analgesia of the back may have better outcomes associated with surgical treatment for ORDSP[9].

Treatment of Overriding Dorsal Spinous Processes

There are a variety of treatment options for back pain associated with ORDSP. The general aim of therapy is reduction of inflammation. This can be achieved with direct injection of the back (radiographic or ultrasound guided), rest and NSAIDs, physiotherapy, extracorporeal shockwave therapy (ESWT), acupuncture, or mesotherapy. Surgical intervention may be warranted in severe cases or in cases that show truncated response to other treatments. Surgical options include interspinous ligament desmotomy or ostectomy (subtotal or cranial wedge)[10-13]. The interspinous ligament desmotomy is performed as a standing procedure with reported success rates of 72-95% [5,9-10]. The ostectomy can be performed standing or under general anesthesia, and success with the wedge ostectomy is reported to be 79% with regards to ability to return to full work[13].

Complications with medical treatment include incomplete or failure to respond, local injection site reaction, or systemic side effects from the administered medications (i.e. corticosteroid-induced laminitis). Complications with interspinous ligament desmotomy are generally rare, but include intraoperative hemorrhage due to variations in vascular patterns in this region, white hairs at the incisions along the back, and raised bumps or focal depressions at the incisions[10]. More recently, it has been described that horses can develop neurogenic muscle atrophy following the desmotomy procedure[14] which does not appear to affect overall performance. An ostectomy requires a larger incision than a desmotomy which increases risks of incisional complications, adds inherent risks of general anesthesia if performed anesthetized, and is more associated with abnormal topline contour[13].

Other Conditions of the Equine Thoracolumbar Region

Osteoarthritis of the articular facets of the thoracic and lumbar spine has been identified as a possible source of back pain. Post-mortem studies on racehorses have identified degenerative changes in the thoracolumbar region with relatively high frequency, though the clinical significance is not fully understood[15]. Ultrasound of this area can be helpful in identifying new bone formation, and diagnostic analgesia using ultrasound guidance can be used for lesion localization[3]. Treatment for articular facet osteoarthritis includes rest, NSAIDs, corticosteroid +/- sarapin injections, mesotherapy, or potentially retirement depending on the severity of pathology and exercise expectations of the horse. ESWT and physiotherapy may be beneficial, but there are no published studies to support their efficacy.

Other, less common conditions include vertebral spondylosis, degenerative disk disease, diskospondylitis, and neoplasia. Spondylosis in horses is generally considered clinically insignificant; however, if associated with increased radiopharmaceutical uptake on nuclear scintigraphy and clinical evidence of back pain, it may be considered an early form or variation of osteoarthritis[3]. Degenerative disk disease, diskospondylitis, and neoplasia are generally associated with significant pain, potentially neurologic or laboratory abnormalities, and a poor prognosis.

Soft Tissue Abnormalities

Abnormalities of the soft tissue structures in the back are generally associated with trauma. The supraspinous ligament can be traumatized from tensile forces (i.e. acute neck flexion or thoracolumbar ventroflexion)[16] as well as direct compressive forces from saddling, other tack, or direct trauma[3]. Pathology of the supraspinous ligament can also be secondary to other conditions such as ORDSP[17]. However, the clinical importance of injury or abnormality of the supraspinous ligament may be overestimated as surgical treatment of ORDSPs, which has the potential to contribute significant iatrogenic trauma, does not seem to cause recognized postoperative complications.

Pelvis

Lameness associated with the equine pelvis can be traumatic or degenerative in nature with the SI joint commonly implicated as a source of discomfort or non-specific hindlimb lameness. Horses with pain or injuries in this area vary in clinical presentation. Following an acute injury (i.e. slipping or falling), significant lameness, swelling, and sensitivity to palpation are common. If asymmetry of the tuber sacrale is present, pelvic fracture should be considered. Chronic SI injuries are more degenerative in nature and typically have a prolonged history of reduced performance, poor croup muscling, unwillingness to work or lack of impulsion, toe dragging, and reluctance to stand on one hindlimb[18]. Clinical signs are often worse under saddle. The greatest amount of motion in the lumbosacral region occurs in the canter, thus horses with pain in this area may have poor quality canter or inability to maintain the canter. Sensitivity to palpation of the croup with buckling of the stifles may be noted during palpation.

Similar to other locations in the back, confirmation of diagnosis of SI joint injury is difficult. After lameness examination and palpation, imaging is often the next step. Nuclear scintigraphy is used to identify active bone turnover. However, asymmetry in gluteal muscle mass may attenuate radiopharmaceutical uptake from an affected SI joint[19]. Ultrasonography (transcutaneous and transrectal) of this area can be performed and allows visualization of the dorsal surface of the iliac wing and the caudal margin of the SI articulation, the dorsal sacroiliac ligament, the ventral sacroiliac ligament and ventral joint margins. Diagnostic analgesia can be performed, though even with ultrasound

guidance is generally assumed to be a periarticular infiltration rather than true intraarticular administration[20].

A multitude of treatment options for both acute and chronic injury exists including rest, NSAIDs, stretching and mobility exercises, ESWT, acupuncture, pulsed electromagnetic field therapy (PEMF), massage, methocarbamol, gabapentin, bisphosphonates, and direct injection (periarticular infiltration). Several approaches to injection of the SI joint have been described with advantages and disadvantages to each[21].

Equine Neck Pain

Neck discomfort, much like any other anatomical region, can be secondary to trauma or degenerative pathology. Performance-related issues tend to be more degenerative in nature and clinical signs may include an unwillingness to work on the bit, mild or intermittent forelimb lameness unable to be localized to the limb, and unsteady or abnormal head carriage. Cervical compressive lesions should also be considered with subtle tripping or weakness in the hind end even in the absence of overt ataxia. Following lameness assessment, imaging of the cervical region can be accomplished with plain radiographs, ultrasonography, nuclear scintigraphy, and CT (+/- myelography). Adequate sedation and careful positioning are required for diagnostic imaging, and a variety of normal variations in the cervical region have been reported.

Equine Cervical Pathology

Cervical facet osteoarthritis is commonly diagnosed on plain radiographs by identification of enlarged or remodeled cervical facets, with older horses being more likely to have higher grades of enlargement[22]. Aside from osteoarthritis, vertebral body fractures can occur in the cervical region, as well as osteochondral lesions, congenital malformations, and CVSM. Fractures and luxations of the cervical vertebrae are generally trauma-related with sudden onset of clinical signs. Prognosis is highly dependent on the location of injury and degree of spinal cord trauma.

Congenital malformations are rare – the most common of which is occipitoatlantoaxial malformation (OAAM). This is a well described malformation that has been identified in numerous breeds, but is most commonly noted in Arabians[23]. An abnormal contour of the neck is frequently identified with variable neurologic signs, and imaging confirms the diagnosis[24]. Neoplasia and diskospondylitis can similarly occur in the cervical spine and are associated with a poor prognosis.

Soft tissue injuries in the cervical region are primarily associated with nuchal ligament injuries. Mineralization at the attachment to the occiput is frequently identified as an incidental finding on radiographs[24]. True desmopathy of the nuchal ligament typically occurs after some type of local trauma to the base of the skull, including pulling back when tied, or repetitive strain due to excess work in side reins or draw reins. Unfortunately, because incidental mineralization of this area is common, CT is needed as a more sensitive imaging aid to evaluate lesions in the nuchal ligament[24]. Diagnostic analgesia of the poll region can be performed, and following infiltration of the region, clinical signs should resolve within 15-30 minutes. Nuchal bursitis can be infectious or noninfectious and the incidence is overall rare[25]. These horses will be painful to palpation and have focal soft tissue swelling over C1-C2. Surgical debridement may be needed to produce complete resolution.

Treatment for Neck Pain

The relevance of local muscle pain can be difficult to interpret. Many horses that have muscle soreness, particularly at the base of the neck, often have forelimb lameness and the muscle soreness is secondary

to guarding of that limb. In those cases, the forelimb lameness must be resolved before the neck soreness can be resolved. In the absence of forelimb lameness, muscle pain is generally well managed with physiotherapy, shockwave, or acupuncture. However, treatment of underlying pathology and secondary muscle soreness is often necessary.

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