CERVICAL DISORDERS IN THE PERFORMANCE HORSE

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BACKGROUND - EQUINE

- Cervical vertebral stenotic myelopathy is the leading cause of spinal ataxia
  - Reed et al, 2008

- Osteophyte formation of the articular facet joint is the most common cause of spinal cord compression in older horses.
  - Levine et al, 2007

- Growing interest in equine cervical spinal anatomy, function and dysfunction
BACKGROUND - EQUINE

- Enlargement of C5-6 is common in older horses and there is no correlation to breed, sex, discipline or clinical signs.
  - Down SS, Henson FMD; 2009 EVJ
- OA of the cervical facet joints has been found to be most severe at C3-4 and C5-T1. Severity increases with size and age of horse.
  - Rombach, Stubbs, Clayton; 2014 EVJ
- Periarticular proliferation invading the intervertebral foramina can cause cervical nerve root compression, neck pain, forelimb lameness.
  - Ricardi and Dyson; 1993 EVJ; Marks: 1999 J Eq Vet Sci
- Spinal stability in the horse under closer consideration.
  - Intervertebral disc disease.
  - Deep perivertebral musculature.
  - Rombach, Stubbs, Clayton: 2014 AJVR

BACKGROUND - HUMAN

- Spinal stability: the spine’s ability to maintain its alignment and to provide protection to the neural structures it encloses during physiologic loading.
  - “Injured facet joints do not a priori dictate that the spine is mechanically unstable. However, proprioceptive and nociceptive nerve endings in the facet joint can respond to overload, damage or injury to alter the musculature feedback and control for providing support to the spinal column.”
  - Injured nerves can become nonresponsive to loading or motion.
  - Leads to abnormal sensory feedback for the central nervous system’s coordination of spinal tissues and paraspinal muscles that may lead to mechanical instability.
  - Panjabi; 2003 J Electromyogr Kinesiol.

BACKGROUND - HUMAN

- Human literature.
  - Whiplash injury is a major focus of research.
  - Peripheral structures (cervical facet joints) are frequent sources of nociception.
  - Hyperalgesia occurs over the cervical spine, and remotely at unaffected body regions.
  - Globally reduced pain thresholds and pain tolerance seems to be a clinical manifestation.
BACKGROUND - HUMAN

- Chronic persistent neck pain has been reported in almost 50% of individuals who have had neck pain at some point in their lives
- 14% report grade II-IV neck pain with high pain intensity and disability
- Neck pain is well recognized as a source of disability in the working population
- Cervical facet joints have been implicated as a source of pain in the neck, head and upper extremities in 36-60% of patients
  - 32% of patients presenting for chronic pain remained undiagnosed
  - Medical imaging in vivo may fail to identify lesions found at post-mortem
  - Bogduk, N. 2011, Spine

CERVICAL FACET JOINT ANESTHESIA - HUMAN

- Good evidence to support intra-articular anesthesia for the diagnosis of cervical facet joint pain
- Criterion standard of 75% pain relief and the ability to perform multiple maneuvers which were painful prior to block
- Complications are “exceedingly rare”
  - Dural puncture, spinal cord trauma, subdural injection, neural trauma, injection into the intervertebral foramen and arteries, infectious complications
  - Falco FJ, Datta S; 2012 Pain physician
- Cervical facet anesthesia is also reported in the equine literature
  - Dyson S; 2011 Vet Clin North Am Eq Pract

ANATOMY

- 7 cervical vertebrae
- 25 Total joints
  - Articular process joints
- Large joint capsule
  - Many pain fibers
- Joints at 45 degree angle
- 8 Spinal nerves
CERVICAL FACET JOINT – ANATOMY AND PHYSIOLOGY

- 3D anatomy has been described in the horse
  - Claridge, Piercy et al.; 2010 EVJ

CERVICAL FACET JOINT – BIOMECHANICS

- Joint capsule
  - When the capsule is stretched, nerve afferents that innervate it are also stretched
  - Capsule contains afferents that respond to firing at both low and high thresholds of strain (15% and 47%)
  - Afferents responding to both types of strain exhibit persistent generation of after-discharge for up to 5 minutes after the strain stops
  - This could potentially have long-term affects to the CNS
    - Jaumard, Welch and Winkelstein; 2011 J Biomech Eng
  - In rats it has been shown that distraction at C6-7 results in a 3-fold increase in behavioral hypersensitivity
    - Lee, Davis et al; 2004 Slapp Car Crash J
EQUINE CERVICAL PAIN AND DYSFUNCTION

Clinical presentation
- Neck pain
- Neck stiffness
- Unwilling to work on the bit
- Gait abnormalities, not necessarily ataxia
- General decreased performance
- Forelimb lameness
- Abnormal head/neck posture
- Abnormal/changed behavior
- Abnormal sweat patterns

Possible diagnoses
- CVSM
- Fractures
- Nuchal ligament desmopathy/enthesopathy
- Intervertebral disk disease
- Costal osteoarthritis
- Cervical facet joint arthropathy
- Osteoarthritis
- Osteochondrosis

Ricardi et al 1993, Mattoon et al. 2004
FRACTURES

- May present for acute trauma
  - Radiography
  - Supportive care
    - Anti-inflammatory medications, limit motion
    - Surgery rarely indicated
  - Sequestra
- Not uncommon to present for neck stiffness and poor performance
  - Physical exam
  - Radiography
NUCHAL LIGAMENT DESMOPATHY

- Nuchal ligament
  - Bilobed, fans at the insertion
  - New bone formation may be incidental
  - 85% of 302 warmbloods, 5% of thoroughbreds

Dyson SJ; 2010

NUCHAL LIGAMENT DESMOPATHY

- History
  - May have history of trauma or excessive amount of lunging in side reins
- Clinical signs
  - Unwilling to stay straight in the bridle
  - Will not flex at the poll
  - Rearing/shaking the head
  - Hindlimb impulsion is usually normal
  - Not necessarily painful to palpation at the poll
- Evaluation
  - Muscle symmetry, radiographs and ultrasound
  - Local anesthetics have been described
  - Caution with proximity to epidural space

NUCHAL LIGAMENT DESMOPATHY

- 13 year old Dutch warmblood mare
- Prix St George
- Resistant to flex cranial cervical spine to the right
- "Head shy"
NUCHAL LIGAMENT DESMOPATHY

• Acupuncture
• Manual therapy
• Massage
• Shockwave
• Wide crown piece with padding
• Cut back crown piece

INTERVERTEBRAL DISK DISEASE

• Asymptomatic disk disease is reported in humans and horses
• 103 vertebral columns evaluated from horses birth to 23 years without signs of ataxia
• There appears to be an age related degenerative change of the disk in horses
• The changes noted worsened from cranial to caudal
  • Bollwein, Hanichen; 1989 Tierarztl. Prax
EQUINE INTERVERTEBRAL DISK DISEASE

Speltz, Olson, et al; 2006 J Eq Vet Sci

INTERVERTEBRAL DISK DEGENERATION


COSTAL OSTEOARTHRITIS

- Costovertebral joint: head of the rib with superolateral surface of the vertebral body
- Costotransverse joint: connects the angle of the rib to anterolateral aspect of the transverse process
- Cadaver study: 49% gross evidence of costovertebral OA
  - Nathan et al. 1964 Arthritis Rheum
- T4 syndrome: paresthesias of one or both upper limbs, referred pain into the neck and scapular regions. Case study reports of treatment with manipulation and exercise intervention
- Young, BA, Gill HE in 2008. Joint pain patterns in normal volunteers with injection of the costotransverse joint
  - Ipsilateral, deep, dull ache
  - T2 showed referred pain 2 segments cranially and caudally to the injection
- Not reported in equine literature
COSTAL OSTEOARTHRITIS

CERVICAL FACET JOINT ARTHROPATHY

CERVICAL ARTICULAR FACETS
CRANIAL ARTICULAR PROCESSES

C2-3 - 843945  C2-C3 - 844079

C3-C4 - Dorsocaudal View

Normal Remodelling

CAUDAL ARTICULAR PROCESSES

C3-C4 - 838905  C4-C5 - 843209

C6-C7 - 843209  C5-C6 - 838905

Dorsocaudal View

Normal Remodelling

ARTICULAR PROCESS OSTEOARTHRITIS

C6-C7 intervertebral joint

C6 joint capsule entheses

Normal articulation
C3 – OSTEOPHYTES

- Bony proliferation along ventral articular processes
- Irregular articular surface

Cranial View

Dorsal View

C4-C5 – IVF OSTEOPHYTES

- Intervertebral foramen (IVF)
- Osteophytes

Caudal View

C5 – OSTEOPHYTES

- Bony proliferation along the ventral aspect of the C5 cranial articular processes

Cranial View

Right side

Left
C5-C6-C7 – ARTICULAR DEFORMATION

Left Cranioventral View

Mild Deformation Moderate Deformation

C6-C7 C5-C6

FACET JOINT ARTHROPATHY

• Physical exam
  • Abnormal posture
  • Muscle symmetry
  • Body condition
  • Conformation
  • Sweat patterns
• DAPE
• Motion exam
• Lameness exam
• Diagnostic imaging

CLINICAL EXAM

• Motion exam
  • Lateral bending, ventral and dorsal mobility
  • Lameness exam
• Diagnostic imaging
DIAGNOSTIC IMAGING

- Lateral-lateral radiographs are often acquired as initial diagnostic:
  - Neck pain
  - Myelopathies
  - Postural abnormalities
  - Forelimb lameness
  - Rider complaint of poor performance


DIAGNOSTIC IMAGING

- The symmetrical anatomy causes superimposition.
  - Potential to obscure lesions
- Little correlation of lateral radiographic findings with gross pathology in equids
- Oblique radiographic projections have been described to better visualize facet joints individually

Unt et al. 2008, Withers et al. 2009, Dimock et al. 2010

OBLIQUE CERVICAL RADIOGRAPHS

- Oblique projections
  - Left/right Dorsal-45-55° to left/right ventral oblique
WHAT SURFACES ARE HIGHLIGHTED?

LDRV
DIAGNOSTIC IMAGING

- Ultrasound

TREATMENT OPTIONS

- Acupuncture
- Chiropractic
- Strengthening
- Systemic joint support
- Shockwave
- Mesotherapy
- LASER
- IA joint support
CERVICAL FACET JOINT CORTICOSTEROID INJECTIONS

- Human literature:
- Facet joint injection is effective at reducing pain in patients with cervical radiculopathy secondary to disk herniation
- Compared to transforaminal injection: much safer
  - Bureau, Moser; 2014 Spine
- Not uncommon in the horse
- Ultrasound guided
- May be used as a diagnostic modality as well as therapeutic

CALUSAR

- 16 year old Holsteiner gelding
- Used for Dressage
- Left Coxo-femoral joint has been treated in the past
- Recently fell when being lunged and was acutely lame RF

BASELINE LAMENESS
INITIAL EXAMINATION

• Mild shortening of cranial phase of stride in the RF at the walk
• No pain, heat or swelling present in the distal limb.
• Firm palpation of right shoulder and lower neck elicits consistent painful response.
• Flexion of the right shoulder elicits significant discomfort.
• 2/5 lame in the RF when trotted in a straight line over hard ground, and 2+1/5 when circled to the right. Grade 1 of 5 left hind lameness

PLAN

• Blocking
  • Abaxial nerve block performed to rule out foot pain, although clinical exam provided strong indication that source of lameness was in the proximal forelimb
• Radiographs
• Ultrasound

RIGHT SHOULDER
POST CERVICAL BLOCK

TREATMENT AND REHABILITATION

- No articular medication was administered at this time due to the recent history of acute trauma and local anesthesia.
- Restricted to stall/run rest with 57mg oral firocoxib SID and topical Surpass application for the next 2 weeks.
- After initial inflammation has subsided, re-evaluation and medication of the right articular facet of C6-7 with corticosteroids will be performed if deemed necessary.
- Weekly acupuncture treatments
- Cervical stretches and individual mobilization of each cervical joint are also indicated to improve mobility and reduce muscle spasm.
- Soft tissue injury in this region may also be amenable to laser therapy or ESWT

FLORYAN - HISTORY

- 8 year old castrated male Hanoverian
- Presented for back pain, worse in the thoracolumbar area
- 7 year history of neurological signs, progressively worse in the past year
- "Shivers" like behavior: strange behavior when backing and picking up his feet for the farrier
- Muscle biopsy - normal muscle with mild vasculitis
- Owner notes that he drags his toes, but doesn’t have problems going over cavalletti rails
- No other medical problems noted
- Bloodwork within the past year, was WNL
- Bruxism under saddle no change with Gastrogard
FLORYAN – NEUROLOGIC EXAM

- Generalized poor muscling
- No ataxia noted
- Moderate weakness in the hindlimbs (3/5) bilaterally symmetric
- Knuckling both hind limbs walking downhill
- Occasionally hitting himself or curb with front limbs
- Cranial ren WNL
- Sway: moderate paresis bilaterally (standing and walking)

FLORYAN – NEUROLOGIC EXAM

- Summary:
  - Symmetrical moderate hind end paresis
  - Symmetric mild forelimb paresis
  - Shiver's like signs while backing, but not while having his feet picked up.
  - The hindlimbs are more severely affected than the forelimbs
  - Shivers can partially explain Floryan's neurological signs, it does not explain all of them.

FLORYAN - MUSCULOSKELETAL

- 2+ of 5 left hindlimb lameness
  - Moderately positive to stifle flexion
  - Mild positive to phalangeal flexion
  - No change with tarsal flexion.
  - Mild effusion of the femoropatellar joint on the left hindlimb.
  - Significant back pain elicited with palpation and motion
  - Normal lateral bending of the cervical spine
FLORYAN – NUCLEAR SCINTIGRAPHY

- Moderate right sacroiliac
- Mild to moderate diffuse left and right caudal thoracic spine dorsal articulations
- Spinous processes of the caudal thorax and to a lesser extent the mid thorax
- Mild, diffuse, distal right tarsus
- Mild hind left hind fetlock
- Mild, medial aspect of mid MC3/MC2, bilateral
- Mild medial palmar process left front distal phalanx.

FLORYAN – ULTRASOUND: T/L AND PELVIS

- Conclusions
  1. Moderate right sacroiliac osteoarthrosis.
  2. Mild osseous remodeling of the left sacroiliac articulation.
  3. Lumbosacral disc fibrosis versus mineralization and mild L6 end plate remodeling, of questionable clinical significance.
  4. Mild arthrosis of the articular process joints at T16-17, T17-18 and very mild at T18-L1

FLORYAN - CERVICAL

- Ultrasound: mild OA left C6-7
- Radiology: Mild enlargement of C6-7. Mild peri-articular osteophytosis and sclerosis of the cranial articular facets of C7 on the oblique views. Sagittal ratios 51-53%
FLORYAN - TREATMENT

- 7/8/15: The left and right sacroiliac regions were injected from cranial and caudal approaches with methylprednisolone and Amikacin.

- 7/30/15: Left and right T16-17, T17-18, and T18-L1 articular facet joints treated with Methylprednisolone and Amikacin.

- The rDVM treated with one dose of OsPhos.
Shrunken neurons and Hypercellular foci
Sacral DRG with hypercellularity, neuronal vacuolation and periganglionic hemorrhage

FLORYAN - HISTOLOGY

1. Dorsal root ganglia (DRG), T9-T18: ganglionic neuronal degeneration and necrosis, multifocal loss with minimal lymphohistiocytic ganglionitis.
2. Lumbosacral DRG and dorsal spinal nerve roots: ganglionic neuronal degeneration and necrosis, multifocal loss with epineural and perineural hemorrhage.
3. C4-C6 dorsal root ganglia: neuronal vacuolation, necrosis and minimal lymphohistiocytic ganglionitis.

SUMMARY

- The grumpy horse is likely trying to tell you something
- Cervical disease must be considered in cases of decreasing performance
- Assess for cervical pain critical
- Evaluate for proper function
- Diagnostic imaging is important but does not necessarily answer all the questions
- Complex in the human model, increased level of difficulty in the horse because of diagnostic limitations
- Integrative modalities as diagnostic and therapeutic options extremely valuable