Proceedings of the 12th International Congress of the World Equine Veterinary Association
WEVA

November 2 - 5, 2011
Hyderabad, India

Reprinted in IVIS with the Permission of WEVA Organizers
Ultrasonographic examination of the back and sacroiliac region in horses

Denoix J-M, 1,2
1 CIrale, Université Paris Est, Ecole Nationale Vétérinaire d’Alfort, F-14430 Goustranville, France
2 INRA, USC 957 BPLC, F-94700 Maisons-Alfort, France

Introduction
Back and pelvis problems are a major cause of poor performance and gait abnormalities in sport and race horses. Although it is often possible with the anamnesis and clinical (physical and dynamic) examination to objective or suspect pain or functional abnormalities of the vertebral column, the definitive diagnosis of the cause of the pain requires further investigations in which imaging procedures are essential. The purpose of this paper is to demonstrate how ultrasonography is essential for the diagnosis and documentation of multiple back and pelvis conditions.

I- Ultrasonographic Examination of the thoracolumbar area

A- Equipments and techniques
Before ultrasonographic examination, the hair over the spinal processes and on both sides of the median plane is clipped short and the skin is generously cleaned with warm water. Imaging of the spinal processes and associated ligaments is performed with 7.5 MHz to 10 MHz linear probes. A stand off pad is useful to improve visualisation of superficial structures. Longitudinal, median and paramedian, scans as well as transverse scans are combined to image the supraspinal ligament and top of the spinous processes. An longitudinal dorsolateral-ventromedian oblique approach is used to image the lateral aspect of the spinous processes.

Imaging of the articular and transverse processes is performed with 3 to 6 MHz convex probes. Transverse sections are made in the area presenting clinical manifestations on each side of the vertebral axis for immediate comparison between the left and right. The objective of this approach is to evaluate the caudal and cranial articular processes as well as the joint space of each intervertebral joint on both sides. The multifidus muscle is more echogenic than the longissimus muscle.

B- Abnormal findings and Lesions

1- Spinal processes and associated ligaments

a- Kissing spines
Ultrasonographic examination demonstrates easily the contact and/or remodeling between two following spinal processes, transverse thickening of the processes as well as abnormal alignment between them. With a dorsal approach, this procedure is useful to assess concomitant supraspinal ligament lesions including: insertion desmopathies (enthesopathies) on the top of the spinal processes, and recent, old or chronic desmopathies of the supraspinal ligament. Using a dorsolateral-ventromedian oblique approach of the spinous processes, bone proliferation and remodeling can be demonstrated on the lateral aspect of the interspinous spaces, increasing the potential clinical incidence of the lesions.

b- Desmopathies : Supraspinal ligament injuries
Injuries of the supraspinal ligament (SSL) have rarely been reported in the literature. They were described as being most commonly observed in the cranial lumbar region and inducing thickening and pain. Ultrasonographic examination of clinical cases with back pain confirmed the occurrence of SSL injuries in sport and race horses.
The normal SSL is thicker in the lumbar spine than in the thoracic spine. On transverse sections it is located between the thick and echogenic left and right thoracolumbar fascia. On longitudinal sections the linear architectural pattern of the ligament can be assessed: as the deep fasciculii are oblique ventrocaudally to insert on the following spinous process, they appear less echogenic than superficial fasciculii on median sections. The interspinous spaces are regular and several millimeters wide. In the withers, the SSL is wide and thin; it is in contact with the irregular apophyseal centers of ossification of the cranial thoracic spinous processes.

Abnormal ultrasound images were obtained from clinical cases presenting local deformation (elevation of the dorsal profile or transverse thickening) or pain. The most common location of these findings was the vertebral segment between T15 and L3. As for any desmopathy or enthesopathy, abnormal findings include: thickening, changes in echogenicity, modifications of the architectural pattern and/or abnormal bone surface of the top of the spinous processes. The sensitivity and specificity of the ultrasonographic evaluation of the supraspinous ligament increases when the suspected area is compared with the adjacent cranial and caudal ones, using the same probe positioning.

**2- Articular processes-synovial intervertebral articulation complexes**

The articular processes-synovial intervertebral articulation (AP-SIVA) complex is located dorsally to the vertebral canal. It is composed of:
- the caudal articular process of one vertebra,
- the synovial joint (with articular cartilage, synovial fluid and membrane, articular capsule) located at the base of the interspinal space
- the cranial articular process of the following vertebra.

The AP-SIVA complexes can be imaged on transverse ultrasonographic images performed with 3 to 6 MHz convex probes. On normal images, the joint space separating the cranial and caudal AP can be identified. A complete cross-section of the intervertebral joint can be made when the left and right sides are displayed symmetrically on the screen of the machine. The AP-SIVA complexes are covered by the multifidus muscle, separated from the thick longissimus muscle by an echogenic fascia.

Abnormal findings include: left to right asymmetry of the AP-SIVA complexes, loss of the joint space because of periarticular osteophytes, and dorsal periarticular proliferation. With this procedure it is possible to determine if the proliferation is symmetrical or, if not, which side is the most affected. Moreover, ultrasonography is essential for improving the treatment of osteoarthrosis of the AP-SIVA complexes through ultrasonographic guided injections allowing a precise control of the procedure.

**II- Examination of the Lumbosacroiliac area**

Informative radiographic examination of this region requires a dorsoventral projection, the horse being placed on dorsal decubitus under general anesthesia. Thus, this procedure is not routinely used in our patients and our routine approach to diagnose the cause of low back or sacroiliac pain is mainly based on transrectal ultrasonography. With this approach, the ventral aspect of the sacroiliac and lumbosacral joints can be evaluated.

**1- Equipments and techniques**

Ultrasound scans of the ventral aspect of the lumbosacroiliac area can be performed with a portable machine and 5 or 7.5 MHz linear endorectal probes. On a regular basis no stand off pad is required. The ultrasonographic technique used consists in performing longitudinal, median or paramedian, ultrasound scans not only of the lumbosacral junction and sacroiliac joints, but also of the last lumbar vertebrae and intervertebral foramen and segmental nerve roots of the sciatic nerve.
2- Lumbosacral junction

a- Lumbosacral disc

On normal ultrasound scans performed in the median plane, the ventral bone surface of L6 and S1 is regular and smooth. On a average standing position the lumbosacral angulation ranges between 15° and 25°. Between the vertebral fossa of L6 and the vertebral head of S1, the intervertebral disc (L6D) is a 2 to 4 mm thick homogenous echogenic structure. The triangular ventral part of this disc is moderately convex and limited by the ventral longitudinal ligament. Dorsally, the disc is separated from the vertebral canal by the dorsal longitudinal ligament.

The clearer abnormal finding is the absence of lumbosacral disc. In that circumstance, the ventral hyperechogenic profiles of L6 and S1 are in continuity and the limit between these 2 vertebrae is only indicated by the lumbosacral angulation. There is no movement during dynamic examination, but an increased mobility can usually be observed in the last lumbar intervertebral joint. These findings are indicative of congenital lumbosacral ankylosis or sacralisation of L6. Lumbosacral ankylosis has been observed in horses demonstrating low back pain and it is likely than the last lumbar intervertebral joints are overstressed when the higher mobile joint of the area is fused.

Other abnormal findings of the lumbosacral junction detected with ultrasonography include:
- congenital intervertebral ankylosis between L5 and L6;
- disc degenerative lesions especially of the lumbosacral disc. These lesions include fissuration or cavitation of the disc, dystrophic mineralisation and/or ventral herniation (confirmed at post mortem examination);
- avulsion fracture of the vertebral fossa of L6;
- Intervertebral malalignement (spondylolisthesis) of the lumbosacral joint or the joint between L5 and L6;

Differential diagnosis between lumbar, lumbosacral, and sacroiliac conditions is based on radiographic examination of the lumbar spine, per rectum ultrasonographic examination of the ventral aspect of the caudal part of the lumbar spine as well as sacroiliac joints and, in same cases, nuclear scintigraphic information.

b - Lumbosacral intertransverse joints

As the lateral part of this joint is covered by the psoas muscles, examination of its medial part is easier.

The normal ventral profile of this joint is imaged as a sharp vertical anechogenic gap separating 2 horizontal hyperechogenic lines which correspond to the transverse processes of L6 and S1.

Three types of abnormal findings can be observed:
- absence of the joint space indicative of ankylosis between the transverse processes of L6 and S1;
- elevation or irregularity of the margins indicative of ventral periarticular osteoporiferation;
- enlargement and echogenicity of the joint space compatible with subchondral bone lysis.

3- Sacroiliac joint

The normal sacroiliac joint has smooth articular margins and the ventral sacroiliac ligament fills a triangular periarticular space. The ventral profile of the sacroiliac joint is flat in females and the bone surface of the sacrum and ilium is curved in males. The ventral aspect of the joint is crossed by the cranial gluteal artery and vein.

Abnormal ultrasonographic findings seen at the ventral aspect of the sacroiliac joint in clinical cases include:
- bone modelling of the sacrum and/or ilium with elevation of the joint margins;
- narrowing of the joint space;
- remodelling or periarticular osteophytes of the caudal border of the auricular surface of the sacrum;
- remodelling or periarticular osteophytes of the caudal auricular margin of the ilium,
- periarticular bone fragmentation;
- ventral sacroiliac ligament desmopathy with thickening and heterogeneous appearance of the ligament;
- ventral sacroiliac ligament enthesopathy with irregularities at the insertions.
- non displaced fractures of the sacral wing have also been demonstrated. They are imaged as an echogenic line interrupting the hyperechogenic bone surface of the wing. Post-mortem examination of horses having sustained pelvic trauma or fracture demonstrated VSIL rupture or injury associated to sacral wing fracture. Tearing of the interosseous sacroiliac ligament has been reported at post-mortem examination.
A better diagnosis of sacroiliac pain and lesions can be made in the field practice with the combination of clinical examination and ultrasonography.