How to Obtain Digital Radiographs of the Thoracolumbar Spine in the Standing Horse

Susan Johns, DVM; A. Kent Allen, DVM; and Laurie A. Tyrrell, DVM

1. Introduction

The accessibility of digital radiography (DR) provides a means for equine practitioners to obtain high-quality diagnostic images of the back in the standing horse. In the past, the use of conventional films has discouraged many equine veterinarians from performing comprehensive radiographic examinations of the back, because their size and thickness restricted the quality of the image. DR systems have facilitated detection of lesions in the thoracolumbar spine in horses with clinical manifestations of back pain by enhancing specific viewing areas. This allows for more effective diagnosis. It is important to evaluate the thoracolumbar vertebrae in their entirety, because several radiographic abnormalities can concurrently result in the existence of back pain. In a practice setting with DR and high-output X-ray equipment, it is technically feasible to gather quality diagnostic views of the first thoracic vertebrae to approximately the fourth lumbar vertebrae, which includes the dorsal spinous processes, articular processes, and vertebral bodies.1 At our private practice, we have radiographed the thoracolumbar spines of 386 horses since 2004.

Radiographic findings in horses with back discomfort often include the following:

1. Dorsal spinous process impingement
2. Osteoarthritis of the articular processes
3. Spondylosis
4. Supraspinous ligament trauma
5. Interspinous ligament trauma
6. Fractures
7. Congenital defects

2. Materials and Methods

Radiography of the thoracolumbar spine of the horse’s back is best accomplished with the use of adequate sedation. We typically use a combination of butorphanol1 (0.004–0.007 mg/kg) and detomidine2 (0.02–0.04 mg/kg) to encourage the horse to stand squarely and bear weight evenly on all four limbs. This insures that true lateral views of the back are obtained. The horse’s head is allowed to hang unsupported or rest on a flat cart so that the handler is at a substantial distance from the X-ray beam. A high-output X-ray machine capable of up to 150 kv(p) and 500 mA is advised. We use a vertically oriented mobile stand constructed of a square metal base and PVC piping with a direct-capture digital X-ray sensor3 holder to help facilitate proper positioning and limit movement (Fig. 1). The sensor panel could also be secured to a fixed stand or a wall mount. The X-ray sensor panel...
should be oriented perpendicular to the ground, and the X-ray beam should be aligned horizontally with the center of the sensor panel. The sensor panel should be positioned as close to the horse’s body as possible (Fig. 2). We do not use a filtration system, but close collimation to the area of interest reduces radiation scatter and improves image quality. A lead marker may be placed on the midline of the horse’s back to facilitate correct orientation along successive radiographs.

In our practice, we have two sizes for the direct-capture digital X-ray sensor panels: 9 × 11 in and 14 × 17 in (Fig. 3). We typically acquire 4–6 images of the thoracolumbar spine using the 9 × 11-in sensor panel, depending on the size and thickness of the patient. We begin by positioning the sensor panel just above the highest point of the withers and centering the X-ray beam. Next, we position the panel caudally and focus on the summits of the dorsal spinous processes of the mid-thoracic, caudal thoracic, and first few lumbar vertebrae successively. For these images, the X-ray beam is centered ~3–4 in below the dorsal midline of an adult horse’s back (Fig. 4). The next series of images focuses on the vertebral bodies and their articulations, and the X-ray beam is centered 6–8 in below the dorsal midline of the horse (Fig. 5). Our larger 14 × 17-in sensor panel allows us to view the dorsal spinous processes, articular processes, and vertebral bodies in three overlapping radiographs. Detail and contrast is preserved, because our DR system
enables us to adjust the contrast on the same view rather than performing multiple exposures to account for the considerable difference in tissue attenuation between the summits of the dorsal spinous processes, articular processes, and vertebral bodies.

On our DR unit, we also use a software stitching program to align the adjacent radiographic images. This allows us to assess the entire length of the dorsal spinous processes, articular processes, and vertebral bodies in alignment. For best results, the exposure should be made during end expiration to limit motion. Our radiographic exposures vary depending on the size of the horse and the part of the thoracolumbar spine being imaged.

3. Results

The DR system facilitates high-quality diagnostic images of the thoracolumbar spine in a practice setting. This allows us to accurately correlate radiographic findings and clinical significance of back discomfort in our equine patients. In 2007, our clinic imaged 81 patients with back pain after comprehensive clinical and moving evaluations. Of the 81 horses radiographed with signs of back discomfort, 28 horses had evidence of dorsal spinous process impingement, and 15 horses had evidence of articular process (facet joint) arthritis (Figs. 6 and 7). Sixteen horses had concurrent radiographic findings of dorsal spinous process impingement and facet joint arthritis. Seventeen horses had no abnormalities noted radiographically, and three...
horses had evidence of spondylosis (Fig. 8). One horse had numerous fractures of his dorsal spinous processes, and one horse had a fracture of an articular process of a thoracic vertebrae. These findings influenced the prognosis and therapeutic options for these patients.

In many of these cases, ultrasonography and/or nuclear scintigraphy were concurrently performed to assess the clinical significance of the radiographic findings. Radiographic changes that are scintigraphically active or have corresponding ultrasonographic lesions are likely to be clinically active in our equine patients. In our practice, we use DR to view the thoracolumbar spine in its entirety in a short period of time. The ultrasound is of great benefit to identify such findings as enthesiopathies of the dorsal spinous processes and supraspinous ligament desmopathies. However, we have found a comprehensive ultrasonographic examination of this region to be more time consuming than radiographs, and primarily, we use it as an adjunct to specifically guide our interspinous injections of the dorsal articular processes. Some therapeutic options we routinely use to address back pain include extra-corporeal shockwave therapy, ultrasound-guided interspinous injections of the dorsal spinous processes and dorsal articular processes with corticosteroids, and mesotherapy of the thoracolumbar spine.

4. Discussion

With traditional radiography, only the summits of the dorsal spinous processes of the back were considered diagnostic. However, with direct DR units and high-output radiographic equipment, we have been able to more accurately evaluate the thoracolumbar spine in its entirety. Although the DR system and special high-output radiography equipment is a substantial financial investment, we have found at our practice that the long-term benefits, both diagnostically and monetarily, offset the initial expense. The ability to obtain more detailed images of broader regions of the back has more specifically guided our treatment to areas that were formerly difficult to view. Therefore, after a clear diagnosis of back pain is established by digital radiography, more precise and immediate treatment techniques may be applied to help manage back discomfort.

Reference and Footnotes


2. Torbugsic, Fort Dodge Animal Health, Fort Dodge, IA 50501.
4. Eklin Medical Systems, 1605 Wyatt Drive, Santa Clara, CA 95054.
5. Sedecal Mobile X-ray Generator, Tallent Images, Atlanta, GA 30329.
6. Eklin Medical Systems, 1605 Wyatt Drive, Santa Clara, CA 95054.