Benefits of Panorama HFO’s openness in studying contortionists

Dynamic whole-spine imaging in contorted positions yields information on fractures

Contortionism involves dramatic twisting of the body into positions that most humans cannot attain. In the first study of its kind, the NIC team led by William W. Orrison, Jr, MD, MBA, imaged five contortionists from a circus school in Mongolia to better understand the pathological conditions within their spines that might be associated with their art. Researchers also wanted to establish the total range of motion in their spines, and to look at injuries in more detail. This included the so-called “anterior limbus fractures,” in which a tiny segment of bone separates from the edge of the vertebral ring.

Panorama accommodates contorted positions

Whole-spine MR images were first obtained on a Philips Achieva 3.0T system, with participants in a supine position. Then, using the Philips Panorama High Field Open (HFO) scanner and its unique, integrated quadrature body coil, dynamic whole-spine imaging was performed in contorted positions. While the contortionists are comfortable in flexion positions (bending forward), they can’t hold the extension positions (bending backward) for more than a few minutes. Panorama HFO’s wide space accommodates the contortionists during imaging both flexed and extended. “This study would have been very difficult to complete in any other scanner and was only possible because of the wide, movable table and the large aperture of the Panorama,” says Dr. Orrison. The images showed a remarkable range of motion of 238 degrees between full flexion and full extension. The imaging also showed that all patients in this study had extremely straight spines in the sagittal plane, without the normal cervical and lumbar curvature, which could be due to genetics or to their training from a very young age. However, they all demonstrated a mild dextro-scoliosis, presumably due to their training. Three of the five contortionists had anterosuperior limbus vertebrae at T-11 and the upper lumbar levels.

The researchers hypothesize that the anterior limbus fractures in contortionists are likely related to hyperextension. One possibility is that when these contortionists hyperextend, the ligaments pull hard enough to actually cause the limbus fractures. Dr. Orrison explains that there appears to be very little stress on the spinal column of the contortionists during flexion, with most of the flexion occurring at the hips (more than 180 degrees) and with the contortionists able to hyperflex for long periods of time comfortably. However, they can maintain hyperextension for only a few minutes and experience back pain when holding the hyperextended positions for a longer period of time. Thus, it appears that the major
Contortionist in extension position in Panorama HFO

Spine extension image using FFE, 400 mm FOV, 12 mm slice thickness, 128 x 256 matrix and TR/TE 7.3/3.7 with a 45° flip angles and a scan time of 0.96 sec. per slice.

3.0T whole spine

The sagittal T2-TSE image (left) shows lack of normal cervical and lumbar curvature. The coronal T2-TSE image (center) demonstrates a mild dextroscoliosis.

Anterior limbus vertebrae

Sagittal 3.0T T2-TSE image of a contortionist with anterior limbus vertebrae at T-11 and L-1 (arrows).
stress on the spine occurs during hyperextension in these remarkable individuals. Since this study, the troupe has altered its training regimen and other exercises to minimize these types of injuries.

**Whole-spine dynamic imaging a valuable tool**
In this study, whole-spine MRI was very valuable in evaluating the spinal anatomy and pathological conditions of the contortionists. The dynamic real-time imaging during active contortion in the Panorama HFO provides a unique opportunity to demonstrate the severe stressors imposed by extreme extension of the spine. Advantages offered by the Panorama HFO’s wide-open patient space include the ability to examine the entire spine in full motion through flexion and extension, improved resolution, and direct visualization of the spinal cord, intervertebral discs, and paraspinous soft tissues. In the future this method may also be used in other applications involving limited spinal motion and vertebral, disc or spinal cord displacement, such as pain management and traumatic spine injuries.

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“The Panorama provides unique access to a variety of patients who would otherwise be difficult or impossible to image with MRI. This not only includes patients with claustrophobia, but also patients who are unable to enter other MRI systems due to size, body habitus, or a requirement for unusual positioning such as this extreme example during contortion.” Dr. Orrison stated.

**Reference**