Thoracic Spine Injuries in Sport

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Hello. I'm Alex, and I'm going to talk to you about sports-related injuries of the thoracic spine. This presentation will be a summary of the PowerPoint that you will all have available.

So when we talk about thoracic spine injuries, in general, they are rather uncommon due to the anterior biomechanical support of the rib cage. In fact, if the rib cage is intact and so is the sternum, it will increase the stability of the thoracic spine in flexion-extension, and lateral bending, and axial rotation by up to 40%.

So the area that is most commonly affected by injuries is the T/L junction, so the area between T9 and about L3. This is due to the fact that the thoracic spine is rather rigid and the lumbar spine rather mobile, so this transition from rigid to mobile just makes it more prone to injury. And in addition, when you stand upright, the sagittal alignment of the spine between about T10, 11 and L2 is relatively straight, so the ideal center of mass is anterior to 10, 11. And that results in a flexion moment at the T/L junction, which then, again, creates greater risk of injury in this transitional region.

It's easy to think of many scenarios where we may encounter a patient with a thoracic spine injury. And it's really important to remember that, particularly if that patient was subjected to acute high-energy trauma, or if we encounter an unconscious patient, any such patient really has to be approached as having a coexisting catastrophic spinal injury. This means no unnecessary removal of athletes' equipment during the initial assessment.

It also needs to be remembered that, particularly if you have a T/L junction fracture, those patients are particularly vulnerable to any rotational movement, so log rolling should be performed with extreme care. When transporting the athlete from the field, spinal precautions should be implemented, so use a rigid backboard and cervical immobilization. In addition, any injuries of the thoracic spine may be accompanied by presentations such as pneumothorax, or diaphragmatic ruptures, or rib fractures, which may affect ventilation. And if that's the case, these things, of course, must be addressed with priority.

When it comes to the diagnostic work up, in elite sports in particular, the threshold for imaging should be very low. In fact, the teams I work with-- we literally MRI everything. Because if a bony injury is suspected, initial X-rays may actually fail to show the pathology, so follow-up by CT or MRI may be indicated in that case.

If you have a suspected muscular injury, there's an ideal imaging window of about 2 to 48 hours. That's the time frame in which the hematoma that has formed is usually located to the actual injury site. After that, it may actually extend outside the involved muscle, which then renders the diagnosis a little bit more problematic. MRI is usually the modality of choice. However, in recent

years, sonography is really on the march. And it's used more and more, particularly for initial on-site evaluation of the injury.

So let's talk about injuries then. We begin with musculo-ligamentous injuries. These may occur either acutely due to high energy mechanisms, or chronically due to overuse and high-repetition mechanisms, such as rowing. Acutely, these injuries are usually caused by violent rotational or bending forces in a fashion not unlike those encountered in whiplash injuries of the cervical spine.

The onset of symptoms is usually delayed about 12 to 24 hours due to the inflammatory cascade and may be accompanied by paravertebral muscle spasm. I see that a lot. Pain and tenderness are the most common symptoms. Injuries in the throwing athlete tend to involve excessive rotational, torsional stress. What is really interesting in this case is that the contralateral side is frequently found to be symptomatic and not the dominant throwing arm.

In addition to these acute presentations, chronic overuse injuries may also occur. Rowing, for instance, has high incidence-- about 22% of back injuries, 9% of rib cage injuries-- just from the continuous repetitive motion of the actual rowing. These athletes are also prone to stress fractures involving the posterior ribs. And that's because in that area, there's a particular pull of the serratus anterior, the pull from the rhomboids, and the latissimus dorsi, and the erector spinae at about T4 to T7. And that juncture area renders this area particularly susceptible also to strains and stress fractures.

As with any other region, disc herniations may also occur in thoracic spine due to axial loading and rotation on a flexed spine in particular. And then you have the traumatic herniation of the nucleus pulposus through the annular defect. However, these injuries are very rare in the thoracic spine. There's not a lot of data on it. One study from the NFL suggested that only about 2% of all disc herniations actually occur in the thoracic spine, 75% percent of those below the level of T8, most likely due to the biomechanical properties in that area that we just discussed.

When it comes to symptoms, these often include some form of axial pain, radiculopathy, and/or myelopathy. Axial pain is the most common symptom, and it's usually localized to the mid or lower thoracic region near to the actual level of injury. When it comes to radicular pain-- radicular pain referring to this band-like discomfort radiating anterior in a dermatomal distribution-- usually the level of T10 is affected regardless of the actual disc level involved.

What we really must not miss is myelopathic signs, such as muscle spasm, weakness in the lower extremities; long track signs, such as wide-based gait, spasticity, or positive Babinski. Also, as with the other regions, thoracic spine lumbar pathologies are usually treated non-surgically, and symptoms will remit over the course of several weeks to months, depending on the severity.

Thoracic spine fractures may be classified into four broad categories. You have the anterior wedge compression injury, the burst injuries, Chance fractures, and fracture-dislocations. Axial

loading with flexion produces the anterior wedge compression injury, whereby the amount of wedging is usually quite small, and the anterior portion of the vertebral body is rarely more than 25% shorter than the posterior body. And because of the rigidity of the rib cage, these type of fractures are usually stable.

Burst injuries are caused by vertical axial compression. Chance fractures are these fractures where you have a transverse fracture through the entirety of the vertebral body. These are caused by flexion about an axis anterior to the vertebral column and are also associated with retroperitoneal and abdominal visceral injuries. So that's also something to keep in mind.

Fracture-dislocations are relatively uncommon in the thoracic spine because of the orientation of the facet joints, and these injuries almost always are due to extreme flexion or blunt trauma-- which has to be severe-- to the spine. And that then causes disruption of the posterior elements, such as the pedicles, and the facets, and the lamina of the vertebra. Also, because the thoracic canal is pretty narrow in relation to the spinal cord, any fracture-subluxation in the thoracic spine commonly results in complete neurological deficits.

Simple compression fractures are usually stable and can be treated with a rigid brace. Burst fractures, Chance fractures, and fracture-dislocations, on the other hand, are extremely unstable and almost always require internal fixation.

Sternal fractures and dislocations are pretty rare due to the elastic recoil of the ribs, which suspend the sternum. And they usually are associated with contact sports, such as hockey, or football, or rugby. The problem's not necessarily the sternal fracture itself, but the potentially associated injuries, such as spinal injuries, injury to the central nervous system, cardiac contusion, dysrhythmias Diagnosis is pretty easily done by a chest X-ray. Ultrasound or CT may also play a role. And cardiac monitoring is actually important in this case.

We distinguish two different types. The type I, which is the posterior dislocation of the body due to the direct force, such as a kick. Type II is posterior dislocation of the manubrium due to direct force to the manubrium itself. Cervical hyperflexion is the mechanism here, for example, during a tackle in rugby or football.

Rib fractures are also most commonly resulting from trauma, but as we said, we can also have fatigue fractures. They usually heal very quickly and without any complications, but there's also the likelihood that there may be accompanying features. So if you have a rib fracture, be aware of hemothorax, lacerations of the lung parenchyma and the intercostal artery. Also, if you have a fracture of the ribs 1 to 3, always consider vascular or neurological injury. If you have a fracture of ribs 9 to 12, you want to consider liver, spleen, or renal injuries.

In conclusion, the anatomical and biomechanical characteristics of the thoracic spine and the rib cage are very important in understanding and recognizing injury patterns. And although the incidence of thoracic spine injuries in sports is low compared to the cervical and the lumbar spine, it really is still a region that is vulnerable to injury. I work in ice hockey, and I see a lot of injuries in that area, some of them really nasty. So a thorough knowledge of the biomechanics, and the anatomy, and the mechanism of injury really will help you to get the most successful medical care to the athlete.

I hope you find this presentation interesting.