



Lumbar Spine Injuries in the Young and not so Young athlete

CHRISTOPHER D. CHAPUT MD
CHIEF OF ORTHO SPINE UT HEALTH
PROFESSOR UTHSCSA
DIRECTOR OF THE SPINE CENTER AT UT HEALTH SA
SPINE SURGEON FOR UTSA ATHLETICS

- ▶ Low back pain is one of the most prevalent complaints of athletes at all levels of competition with maybe 10-15% of athletes having LBP
- ▶ Injuries often vary with the sport (increase in football and gymnasts/dancers)

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Open (2019) 5:26

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Minor soft tissue injuries: sprains, strains, and contusions are treated with rest, ice, NSAIDs, mobilization

- ▶ Focal tenderness
- ▶ No neuro deficits
- ▶ Low energy
- ▶ Lumbar vs cervical

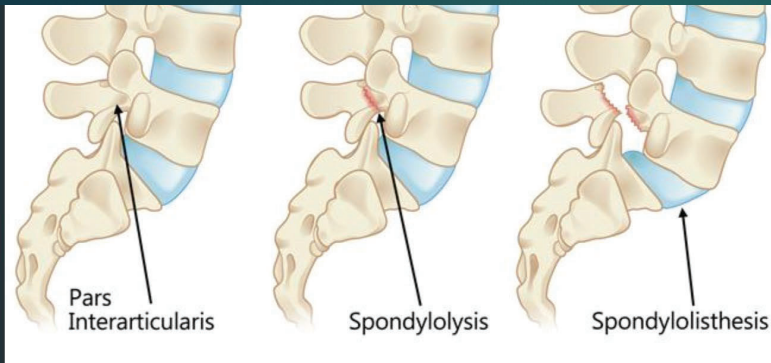


Fractures

- ▶ Outside of cervical fractures seen in football, in “flying” gymnasts, and occasionally in skiing, **unstable** spinal fractures are rare: snow boarding with high energy falls
- ▶ In the lumbar spine most fractures are stable and can be treated conservatively with or without a brace:
 - ▶ Spinous process fractures
 - ▶ Pars fractures
 - ▶ Facet fractures
 - ▶ Transverse process fractures
 - ▶ Compression fractures



Spondylolysis and Spondylolisthesis

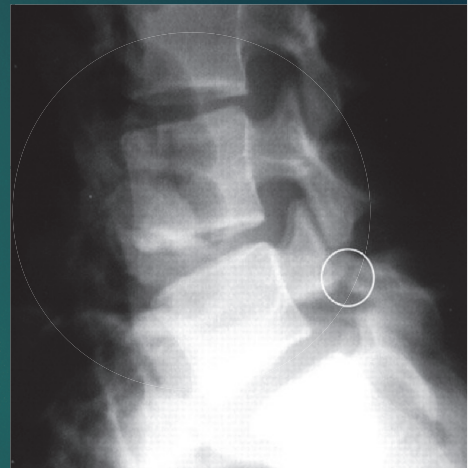


Micheli LJ, Wood R. Back pain in young athletes. Significant differences from adults in causes and patterns. Arch Pediatr Adolesc Med. 1995;149(1):15-8. Nitta A, et al. Prevalence of symptomatic lumbar spondylolysis in pediatric patients. Orthopedics. 2016;39(3):e434-7.

- ▶ the leading cause of low back pain in adolescent athletes,
- ▶ Up to 47% of low back pain in this population.
- ▶ up to 47% of young athletes with low back pain will ultimately be diagnosed with spondylolysis
- ▶ One study using MRI found that 39.7% of children younger than 19 who complained of LBP for more than 2 weeks had spondylolysis.
- ▶ Of the children who presented with LBP, 9.3% of elementary students, 59.3% of junior high schoolers, and 31.5% of higher schoolers were confirmed with MRI to have spondylolysis .
- ▶ 11 % of competitive gymnasts have lysis Jackson DW, Wiltse LL, Cirincione RJ. Spondylolysis in the female gymnast. Clin Orthop Relat Res. 1976;(117):68-73.

Pars fracture in the young athlete

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- ▶ Up to 47% of low back pain in this population.
- ▶ caucasian males are most commonly affected with a prevalence of 6.4%
- ▶ since adolescent female participation in competitive sports has increased, the prevalence of spondylolysis in females has increased four-fold
- ▶ When shear stress results in bilateral spondylolysis, studies have suggested increased risk of progression from spondylolysis to spondylolisthesis, or anterior, lateral, or posterior displacement of vertebral discs due to both a reduction in stability and an increase in mobility of the posterior spine.



Li N, Amarasinghe S, Boudreaux K, Fakhre W, Sherman W, Kaye A. Orthop Rev (Pavia). 2022 Aug 30;14(3):37470

- ▶ Prevalence in specific sports has also been studied, with up to 15% of college football players and 11% of female gymnasts developing spondylolysis
- ▶ rates have been observed in weightlifters (20–30%) and wrestlers (30–35%) [44]. Sport-specific rates likely vary due to differing levels of trunk rotation and hyperextension movements required in each sport
- ▶ IMAGING
 - ▶ Xray
 - ▶ Spect
 - ▶ CT
 - ▶ MRI: Cortical edema (high signal change, HSC) in the pedicle adjacent to the pars on MRI is one of the earliest indicators of spondylolysis and is a positive predictor of bony healing: HSC-positive defects have a higher rate of healing than HSC-negative defects
 - ▶ Lack radiation, high sensitivity and potential prognostic information (as well as evaluation of other causes of LBP) make MRI the modality of choice in athletes with LBP.
 - ▶ I think the biggest argument for early MRI in elite athletes is that it could show a stress reaction before fracture, and intervention at that point could prevent fracture and possible later listhesis

Current Reviews in Musculoskeletal Medicine (2022)
15:259–271 Hsu, Wellington, et al

Conservative care

- ▶ Bracing (bucket brace, tloso etc.)
 - ▶ No difference in healing right with or without. No theoretical reason why this would work in the first place.
- ▶ activity restriction
 - ▶ No evidence, but makes sense
- ▶ and therapeutic exercises
 - ▶ No evidence but makes sense in terms of return to play and preventing deconditioning

[Nonoperative treatment of spondylolysis and grade I spondylolisthesis in children and young adults: a meta-analysis of observational studies.](#) Klein G, Mehlman CT, McCarty M.J *Pediatr Orthop.* 2009 Mar;29(2):146-56.

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- ▶ significantly more than bilateral defects at 18.1% (n=446, $P < 0.0001$)
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- ▶ significantly more than progressive lesions (28.3%, n=224, $P < 0.0001$)
- ▶ terminal lesions (n=217, $P < 0.0001$), of which not one defect healed.

Bracing is often recommended. However, it has not been shown to improve healing.

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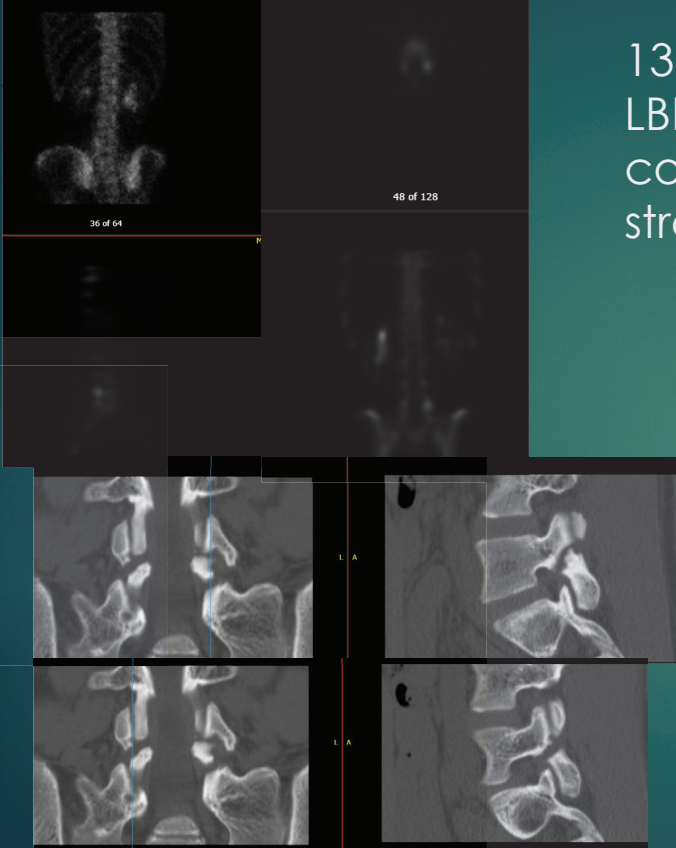
Surgical options

- ▶ Buck's open vs closed
- ▶ Pedicle based
- ▶ Hooks/wires etc..

- ▶ "The best outcomes were seen with the Buck repair. The favorable outcome rate for the minimally invasive Buck repair was better than that for the open Buck repair"
- ▶ Highest healing rate of defect but slightly worse outcomes to buck's
- ▶ Worse outcomes, higher failure of hardware

A comparison of the techniques of direct pars interarticularis repairs for spondylolysis and low-grade spondylolisthesis: a meta-analysis
Nasser Mohammed MD, MCh, [Devi Prasad Patra MD, MCh](#), JNS Jan 2018

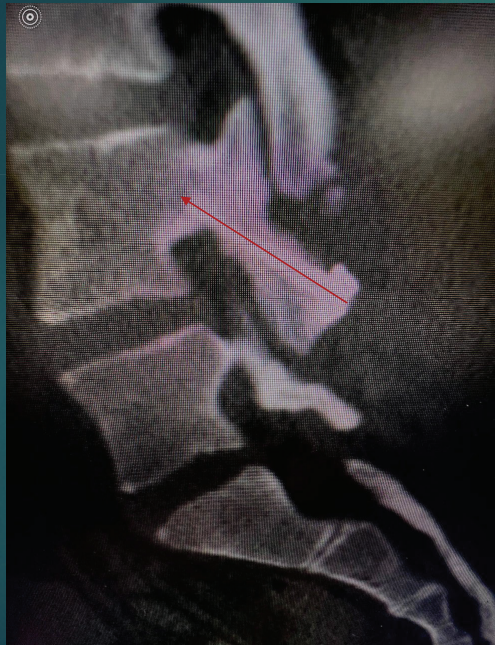
13 yo female club V-ball player with LBP pain. Failed brace, rest, and core strengthening/hamstring stretching etc.....



16-year-old male, down lineman (center) with college prospects

- ▶ dead lifting back in February and felt a snap in his lower back. He had immediate pain in his lower back. he is able to do full rest for a few months after COVID closed everything. He then returned to football and June in January but was still having severe lower back pain.
- ▶ He has also undergone physical therapy. He is still having continued pain. He had an MRI obtained that showed bilateral pars defects at L4. He denies any numbness tingling. He also denies bowel or bladder incontinence. Both sides light up on spect.



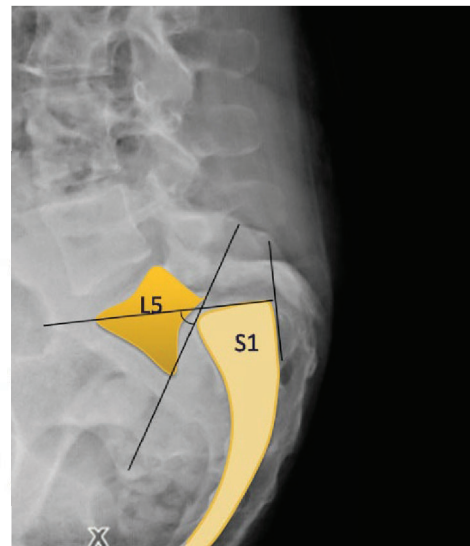
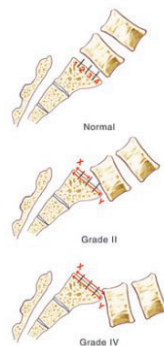


6 month CT scan prior to return to full play. Healed.

VAS pain score 0/10

Spondylolisthesis

- Continuum of disease from spondylolysis in which there is anterior subluxation of a vertebral body, typically L5 on S1
- Meyerding grading system classically used to describe slip



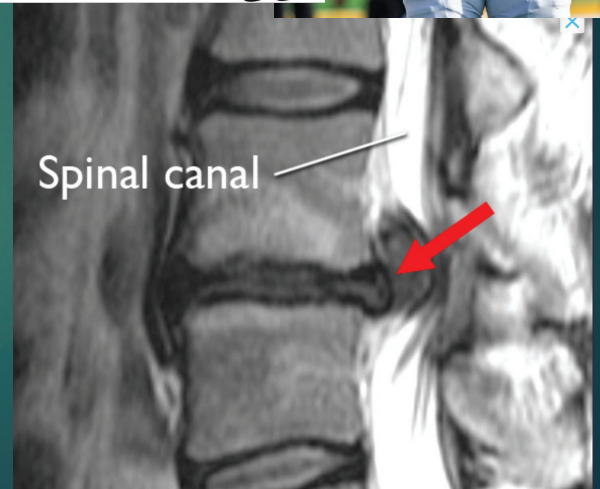
But What about adults?

- ▶ They often have lysis that has progressed to listhesis, and aggravate that
- ▶ Nonsurgical in most adult athletes post early college without nerve deficit until you have exhausted extensive PT/injections/core strengthening because it requires fusion usually
- ▶ Fusion has been associated with decreased return to play in the lumbar spine (single level ACDF may be different?)

Li Y, Hresko MT. Lumbar spine surgery in athletes:: outcomes and return-to-play criteria. Clin Sports Med. 2012;31(3):487-98.

Lumbar Disc Herniation

- ▶ NFL: 28% of all spinal injuries
- ▶ 81% returned to play after microdisc, (avg. 3.3 yrs of play), which was better than those with conservative care.
- ▶ In MLB, operative care had shortened careers compared to nonop



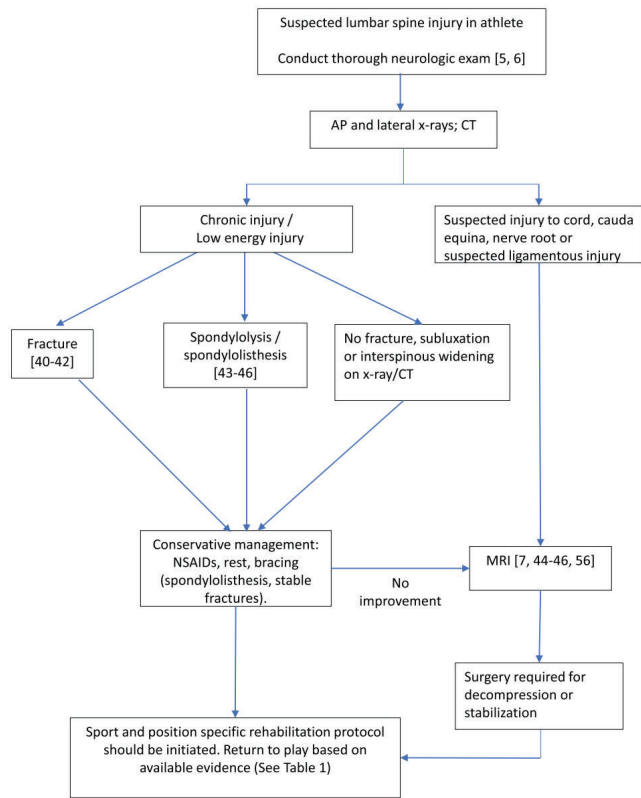


Fig. 1 Treatment algorithm for the athlete with a suspected lumbar spine injury

Xrays have low yield and have been supplanted by CT/ MRI

MRI very sensitive very Degen changes (perhaps too sensitive), HNP, Bone edema/stress reaction, acute fracture.

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Table 2 Common lumbar spine injuries in sports and their treatments

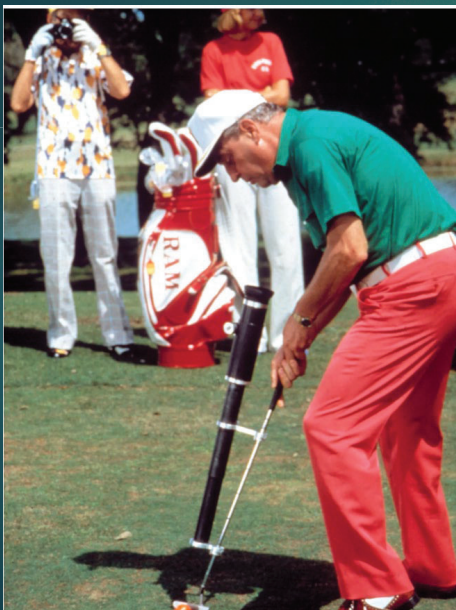
Injury type	Treatment
Fractures	Minor fractures are best treated with rest, NSAIDs, muscle relaxants, and bracing.
Spondylolysis and spondylolisthesis	Full-time Boston brace is the first line treatment for early spondylolysis [52]. Physical therapy alone that includes exercise programs and stretches is acceptable [53]. Posterior lumbar interbody fusion, posterolateral fusion, or anterior interbody fusion are used as surgical management [56, 57].
Disc herniation	Early activity and core strengthening are first-line treatments for conservative management. Laminotomy and disc fragment excision have an 81% return to play rate [10, 61]. NFL players benefited from undergoing surgical correction, but MLB players were less well off than players who underwent nonsurgical therapy [10, 62].

Table 1 Sport specific lumbar spine injuries and treatment outcomes

Sport	Epidemiology	Prognosis
American football	Up to 30.9% of injuries are lumbar spine related [8]. Twenty-eight percent of lumbar injuries are disc herniations [9]. Avulsions, spondylosis, and strains are also prevalent.	Surgical repair of disc herniation may have return to play advantages [10]. Similar outcomes with microsurgery and non-surgical treatments [11].
Ice hockey	Ninety-five percent of players report lumbar pain in final year of play [12]. Thoracolumbar and lumbosacral account for approximately 12% of on-ice spine injuries [13]. Lumbar spondylosis was diagnosed in 44% of youth ice hockey players complaining of lower back pain [14].	Surgical repair of disc herniations was associated with decreased return to play rates [15, 16]. Return to baseline level of performance during second and third season post-injury [16].
Basketball	10.2% of all injuries involve the lumbar spine [17]. Sprain and strain, lumbar disc degeneration, and lumbar contusions account for 7.9%, 0.9%, and 0.9% of the total injuries respectively [17].	Surgery for disc herniation resulted in decreased performance during the first season after injury. Pre-injury skill returned during second and third season post-surgery [15, 16].
Baseball	89.5% of players report lower back pain during career [18]. 35.1% and 22.8% of players showed signs of L5/S1 or L4/L5 disc degeneration respectively [18].	Hitters and infielders had faster return to play time with nonsurgical interventions whereas there was no difference for pitchers [19].
Soccer (European football)	76.6% of players report low back pain during career [18]. Three percent of injuries occurring in soccer are lumbar spine related [20]. Strains, sprains, spondylosis, and fractures occur in soccer. The most serious injuries are often the result of contact with another player which can lead to fracture.	Fractures resulted in the longest recovery time followed by bony and soft tissue injuries. Repetitive wear and tear type injuries also occur and tend to persist.
Dance	The lumbar spine is the second most commonly injured site [21]. Spondylosis is the most common injury type seen [22]. The combination of repetitive hyperflexion and poor technique contribute to injury [23]. Males are prone to injury due to lifts they perform [21].	Forty-six percent of injured dancers had to limit up to half of the activity and 5% needed to limit more than half of activity [24].
Gymnastics	Evidence of disc degeneration is as prevalent as 75% in elite athletes [25]. Studies demonstrate an 11% incidence rate of spondylosis [26].	In general, these injuries are well managed non-surgically, but there is not currently data specific to gymnasts.
Skating and snowboarding	Lumbar spine is the most common site injured, includes compression, burst, and transverse or spinous process fractures [27, 28]. In snowboarders, injury is associated with failed jumps and the subsequent axial loads. The mechanism of injury in skiers is associated with downhill falls forward at high velocities [27, 29, 30].	Spinal cord injuries are more commonly seen with cervical spine injuries, and less common with thoracic and lumbar spine injuries [31]. Most injuries are managed non-operatively.

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Wait a minute, what about.....



Golf has changed



Is Golf a Contact Sport? Protection of the Spine and Return to Play After Lumbar Surgery [Global Spine J. 2022 Mar; 12\(2\): 298–307. Hadda...Guyer et al](#)

- ▶ Golf has traditionally been thought of relatively low impact
- ▶ 1997 Masters introduced many to a high torque, high rotation swing
- ▶ Enabled TW to win by 12 strokes and avg 23 yds longer on drives (with a steel shaft and small head driver)
- ▶ "8 times an individual's body weight and found to be similar to the stress a college football lineman places on his body during full-contact practice.
- ▶ The Titleist Performance Institute also describes the importance of the pelvis-lumbar spine relationship by demonstrating the appropriate parameters for pelvic tilt during a golf swing. At address, the pelvis is resting in approximately 25-30 degrees of flexion, and eventually, the pelvis finishes in approximately 3 degrees of flexion at the completion of the swing also known as pelvic rollback. When pelvic rollback occurs, the energy generated from the lower body is transferred into the upper body to allow for generation of swing speed. The oblique abdominals are contracting to provide this appropriate pelvic rollback and extend the pelvis from its resting position in flexion.
- ▶ enormous amount of rotation that occurs over a fixed base and the extraordinary torque it generates in the spine. In other sports in which an implement is swung around the body, the athlete's body is in constant motion. Golf is the only sport that requires the athlete to be very still prior to unleashing a sudden explosion of rotation. The sudden explosion of rotation in a flexed posture repeated several hundred times per day exposes the lumbar spine to significant compression, anterior-posterior shearing, torsion, and lateral bending forces during the golf swing ^{32 33}

Fast forward on TW

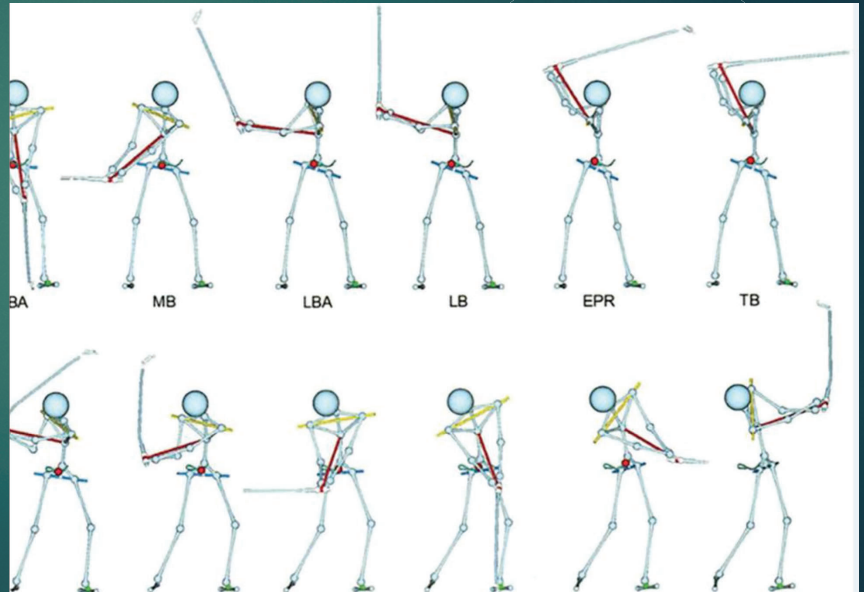
- ▶ In 2014 he withdrew from tournaments and had a microdiscectomy for a pinched nerve in March
 - ▶ He continued to withdraw from tournaments before having a second microdiscectomy to remove a disk fragment in September 2015. In October 2015,
- ▶ 2017 has 4th spine surgery:
 - ▶ "searing pain down my hip to my foot would just never leave", and my "foot wouldn't work"
 - ▶ Has stand alone ALIF Guyer
- ▶ Goes on to win first major in 11 years



Summary for Golf

Is Golf a Contact Sport? Protection of the Spine and Return to Play After Lumbar Surgery [Global Spine J. 2022 Mar; 12\(2\): 298–307.](#) Hadda...Guyer et al

- ▶ forces through the lumbar spine in the modern-era golf swing are like other contact sports.
- ▶ Methods of protecting the lumbar spine include:
 - ▶ proper swing mechanics that respect physiologic ROM limits (shorter backswing etc)
 - ▶ Abdominal and paraspinal musculature strengthening, but only WITH fixing swing mechanics
 - ▶ flexibility? and conditioning



Summary

- ▶ Unlike injuries in the cervical spine, Lumbar injuries (excluding extreme sports) are almost always stable and usually treated conservatively, no matter what the source
- ▶ Surgery is indicated for disc herniations that fail to respond or have neurologic deficit that is progressive
- ▶ Surgery can be an option for pars repair in the setting of an acute injury, but after the early collegiate career, most pars fractures are chronic and may require fusion, which can affect RTP

Thank you you!

- ▶ When deemed necessary by onsite medical personnel, removal of the helmet and shoulder pads may be performed before transport, eliminating the need for separate face mask removal.

Best Practices and Current Care Concepts in Prehospital Care of the Spine-Injured Athlete in American Tackle Football

March 2–3, 2019; Atlanta, GA

Ron Courson, ATC, PT, NRAEMT, CSCS;

James Ellis, MD, FACEP;

Stanley A. Herring, MD, FACSM, FAMSSM;

Barry P. Boden, MD;

Glenn Henry, MA, EMT-P;

Darryl Conway, MA, AT, ATC;

Lance McNamara, MS, ATC, EMT-I;

Timothy L. Neal, MS, AT, ATC, CCISM;

Margot Putukian, MD, FACSM, FAMSSM;

Allen K. Sills, MD, FACS;

Kimberly P. Walpert, MD

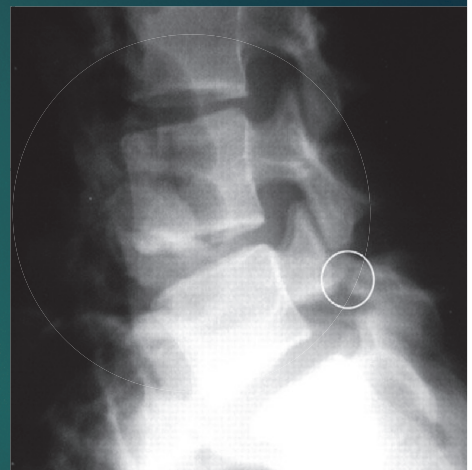
J Athl Train (2020) 55 (6): 545–562.

<https://doi.org/10.4085/1062-6050-430-19>

Technique	Athlete Position	No. of Rescuers Needed	Comments
Supine log roll	Supine	Minimum of 5	In some instances, the log roll may be completed with fewer rescuers. ²³
Prone log-roll-push	Prone	Minimum of 5	If available, additional rescuers positioned on both sides may use a hybrid prone log-roll push-pull technique.
Prone log-roll-pull	Prone	Minimum of 4	Advantageous in confined spaces
Multiperson lift (field)	Supine	Minimum of 8	
Multiperson lift (ED)	Supine	Minimum of 7	May not require rescuer for spine board in ED
Scoop stretcher	Supine	Minimum of 3	
Airway-access techniques			
Face-mask removal	Supine	Minimum of 2	Combined-tool approach Access to airway must be obtained before transport regardless of respiratory status.
Helmet removal	Supine	Minimum of 2	
Helmet-removal techniques			
Anterior-posterior stabilization	Supine	Minimum of 2	May require helmet cheek-pad removal
Medial-lateral stabilization	Supine	Minimum of 2	
Shoulder pad-removal techniques			
Multiperson lift (field)	Supine	Minimum of 9	Additional rescuer positioned near head and trunk removes the shoulder pads once the athlete is elevated.
Multiperson lift (hospital)	Supine	Minimum of 8	May not require rescuer for spine board in ED
Elevated torso or tilt	Supine	Minimum of 3	Should not be used with suspected concomitant thoracic or lumbar spine injury
Flat torso	Supine	Minimum of 2	
Supine log roll	Supine	Minimum of 5	In some instances, the log roll may be executed with fewer rescuers. ²³
Over the head	Supine	Minimum of 4	May be used when it is not possible to cut shoulder pads in front; should not be used with suspected concomitant thoracic or lumbar injury

Pars fracture in the young athlete

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- ▶ Up to 47% of low back pain in this population.
- ▶ caucasian males are most commonly affected with a prevalence of 6.4%
- ▶ since adolescent female participation in competitive sports has increased, the prevalence of spondylolysis in females has increased four-fold
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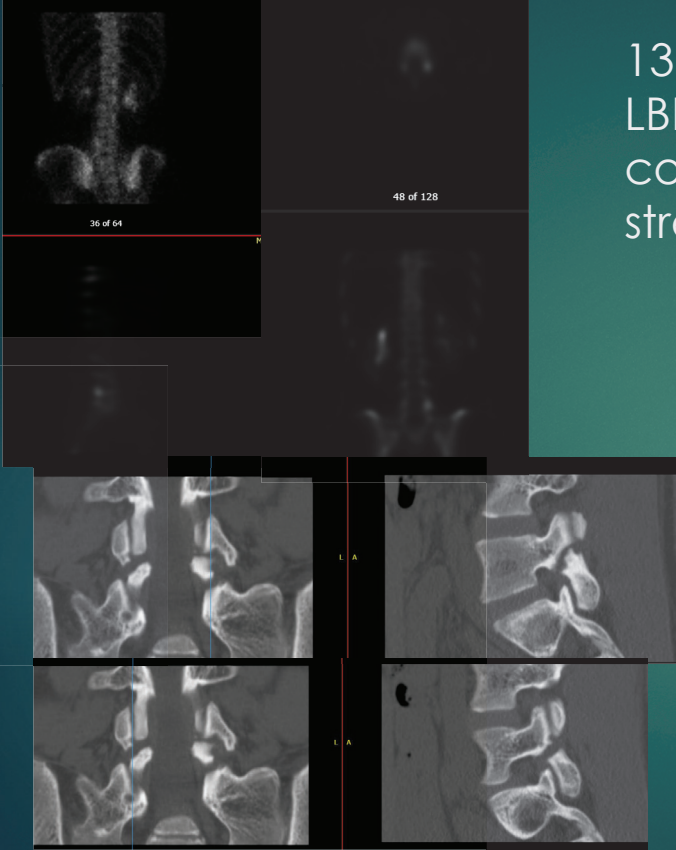
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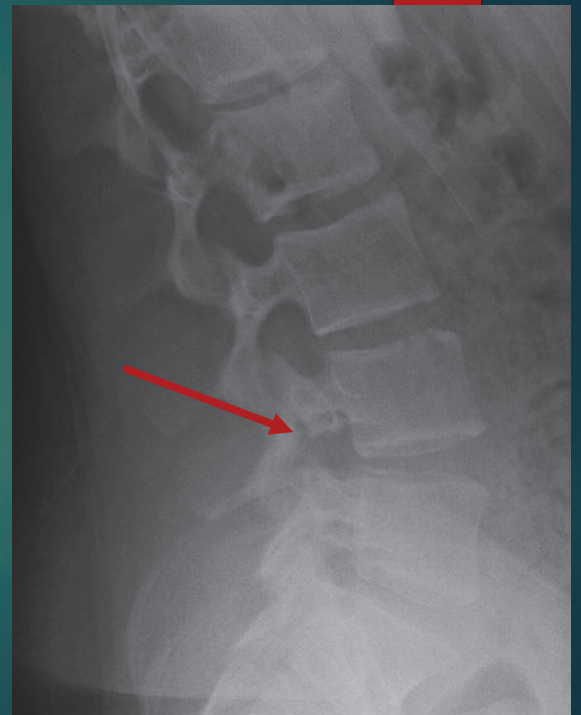
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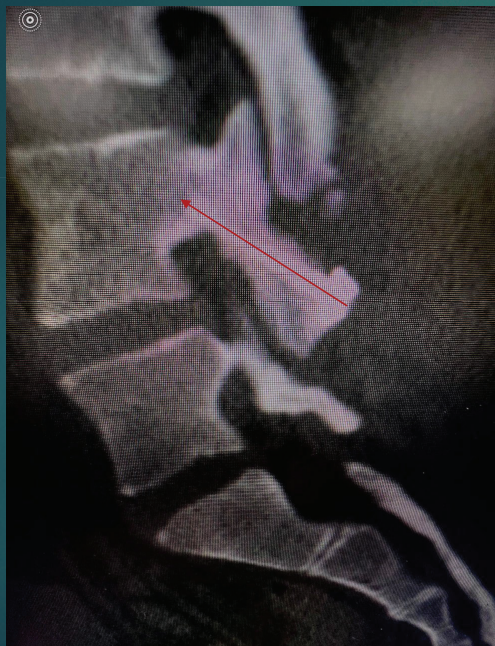
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6 month CT scan prior to return to full play. Healed.

VAS pain score 0/10