

**Practice Management Guideline: Thoracolumbar Spine Evaluation**  
**Updated February 23, 2012**

1 <sup>ST</sup> AUTHOR	YEAR	TITLE/REFERENCE	DATA CLASS	# OF PATIENTS	Study Design/ Results/Conclusions	Reviewers comments
Kim S	2010	A Comparison of the Diagnostic Performances of Visceral Organ-Targeted Versus Spine-Targeted Protocols for the Evaluation of Spinal Fractures Using Sixteen-Channel Multidetector Row Computed Tomography: Is Additional Spine-Targeted Computed Tomography Necessary to Evaluate Thoracolumbar Spinal fractures in Blunt Trauma Victims? J Trauma 2010 Aug;69:437-446	II	72 (420 vertebrae evaluated)	Retrospective Cohort Study. 72 patients AP-CT (16 slice, 1.5mm cuts) with Multiplanar Reformatted (MPR) images and TLS-CT (16 slice, 0.75mm cuts), blindly and independently evaluated by 2 radiologists and 1 spinal surgeon to determine the ROC curves for the different CT modalities. AOC for of AP-CT with MPR was 0.995 vs. 0.996 for TLS-CT; no significant difference between the two techniques. AP-CT with MPR is equivalent to TLS-CT for evaluation of TLS fractures.	AP-CT with 1.5mm slices targeted at identification of visceral injury found to be as sensitive and specific at detecting TL spine injuries as dedicated TLS-CT scan with 0.75mm slices Vertebral levels limited to T10-S4 (because based off AP-CT), but would expect results to be generalizable to thoracic spine based on Chest-CT.
Mancini JD	2010	Optimal Thoracic and Lumbar Spine Imaging for Trauma: Are Thoracic and Lumbar Spine Reformats Always Indicated?  J Trauma 2010 Jul;69:119-121	II	92	Retrospective Cohort Study. 92 patients (35 with fracture, 57 without) with AP-CT (16 slice, 5mm cuts) without MPR and TLS-CT (16 slice, 2.5mm cuts) were read by a blinded neuroradiologist. AP-CT without MPR correctly identified fractures in all 35 patients. Of 80 fractures in these 25 patients, 78 were correctly identified by AP-CT alone. AP-CT without MPR is 97.5% sensitive and 93.4% specific for identification of TLS fractures. AP-CT (16 slice, 5mm cuts) alone is sufficiently sensitive and specific to identify TLS injuries; additional imaging to evaluate for TL S injuries in patients who have already had AP-CT is not justified.	AP-CT (16 slice, 5mm cuts) without MPR identified 78/80 fractures identified by dedicated TLS-CT (16 slice, 2.5mm cuts); the two fractures that were missed were transverse process fractures and were felt to have limited clinical significance. In patients transferred from outside centers who have already undergone AP-CT which does not identify TLS injury, further imaging is not necessary
Gross EA	2008	Computed tomographic screening for thoracic and lumbar fractures: is spine reformatting necessary?	III	176/175	Retrospective chart review of blunt trauma patients with Chest CT and T spine CT (175) and those who received A/P CT as well as an l-spine CT (176) with identification of the fracture as gold standard. 14/175 false neg vs. 2/175 false neg TSCT and 9/176 FN of APCT vs. 3/176 FN of LSCT. p<0.001)	Routine reformatting improves sensitivity in detection of T/L spine fractures however; non-reformatted CTs also have high sensitivity. Retrospective chart review of readings. True sensitivity and specificity is unknown.
Smith, M	2009	The Reliability of nonreconstructed computerized Tomographic Scans of the Abdomen and Pelvis in Detecting Thoracolumbar Spine Injuries in Blunt Trauma Patients with Altered Mental Status  J Bone and Joint Surg Am 91 (2009) 2342-2349	II	59	Prospective cohort, 59 consecutive blunt trauma pts. Plain x-rays with non-recon CT scans of the chest and/or abd with a focus on the T&L spine vs. CT recon formatted scans of the T&L spine. CT reconstruction 89% sensitivity 85% specificity for detection of all fractures. X-ray 37% and 76% respectively. CT 100% sensitive and specific for detection any fracture at all. X-ray was 54% sensitive and 86% specific. No missed fractures on CT required surgery or other interventions.	Prospective study that compared x-rays and routine CT with gold standard CT recons in trauma pt's with altered mental status. . Routine CT was superior to x-rays, and allowed safe screening for injuries w/o any clinically significant missed injuries. CT recons can be used for injuries identified on screening CT.
Berry GE	2005	Are Plain radiographs of the spine necessary during evaluation after blunt trauma? Accuracy of screening Torso Computed Tomography in Thoracic/Lumbar Spine Fractures.  J Trauma.2005 Dec; 59(6): 1410-3	III	103	Retrospective chart review of patients who got CT chest abdomen and pelvis (CAP) and plain film of spine to evaluate the capability of CT to diagnosis fractures. CT was re-reviewed by a blinded radiologist. 25% had thoracolumbar fractures CAP CT: Sensitivity 100% Specificity 97% PPV 93% NPV 100% Plain Films: Sensitivity 73% Specificity 100% PPV 100 NPV 92%	CAP CT scans are a better modality than plain films to radiologically clear multitrauma patients. It's more rapid, accurate, sensitive, specific, and also costs less than plain radiographs.
Antevil JL	2006	Spiral Computed Tomography for the initial evaluation of spine trauma: A new standard of care?  J Trauma. 2006 Aug; 61(2): 382-7	III	573	Retrospective review comparing the institutional experience before (plain film radiography) and after adoption (spiral Computed tomographic scanning) of the practice guideline for spine imaging. 254 patients in x-ray group and 319 in CT group.CT: Sensitivity 100% Plain Films: Sensitivity 71% Time spent in Radiographic studies 50% less with CT instead of plain films	The study showed adapted practice guideline utilizing Spiral Computed Tomography decreased the amount of time spent in x-ray, equivalent costs and increased diagnostic accuracy compared to plain film radiographs.

Mejia	2005	Plain films vs. Helical CT for Thoracolumbar Spine Clearance  J Trauma 2004 Dec; 57 (6): 1376. Abstract presented at the 18 <sup>th</sup> Annual Scientific Meeting of EAST. Jan 2005.	II	1576	Prospective consecutive series of 1576 patients. All received Helical CT of chest/abd/pelvis and also posterior & lateral plain films of the T/L spine. Sensitivity for identifying thoracic and lumbar fractures for CT scans was .94 and .98 vs. plain films of .58 and .59 respectively. 12 patients with (+) CT findings and (-) plain film findings required treatment.	CT scan is superior to plain films in identifying thoracic and lumbar spine fractures.
Brandt MM	2004	Computed tomographic scanning reduces cost and time of complete spine evaluation.  J Trauma. 2004May;56(5):1022-6	III	55	Retrospective review of 55 trauma patients who received CT and plain films to evaluate for T/L spine fracture. 47 patients had T/L spine fractures, and 33 spine fractures in 13 patients were seen on CT that were not identified on plain films.	CT scan is superior to radiographs for diagnosis /screening of TL spine fractures in trauma patients. Mechanism of injury may be predictive of need for radiographic workup of TL spine.
Hauser CJ	2003	Prospective validation of computed tomographic screening of the thoracolumbar spine in trauma. J Trauma. 2003Aug;55(2):228-34	II	215	Prospective study of 215 trauma pts who received both CT C/A/P and XR of T/L spine. CT accuracy for identification was 99% and that of XR T/L was 87%. No fractures were missed by CT/CAP, but no fractures missed by XR T/L were unstable.	CT scan is more sensitive and specific than plain radiographs for the diagnosis of TL spine fractures. CT scan is also much faster than plain radiographs as it is usually done at the initial trauma evaluation.
Herzog C	2004	Traumatic injuries of the pelvis and thoracic and lumbar spine: does thin-slice multidetector row CT increase diagnostic accuracy? Eur Radiol. 2004 Oct;14(10):1751-60	II	70	Prospective evaluation of 70 patients with conventional XR and CT with 3mm, 5mm and 3mm/5mm multiplanar reconstruction. Imaging compared to surgery, autopsy, and clinical course. Fractures identified in 57.1% by XR, 100% by 3mm/5mm MPR, 95% by 5mm CT, and 90% by 3mm CT.	Multidetector CT scan superior to plain radiographs for diagnosis of TL spine fractures. 3mm slices may be superior to 5mm for detection of unstable fractures, but no fractures missed with multiplanar reformation using 3mm/5 mm cuts.
Sheridan R	2003	Reformatted visceral protocol helical computed tomographic scanning allows conventional radiographs of the thoracic and lumbar spine to be eliminated in the evaluation of blunt trauma patients. J Trauma. 2003Oct;55(4):665-9	II	T=35 L=43	Prospective evaluation of 78 patients out of 1915 trauma patients found to have T/L spine fractures. Sensitivity of Helical CT as screening test was 97% for thoracic fxs and 95% for lumbar spine fx as compared to sensitivity for conventional XR of 62% and 86% respectively.	CT scan (particularly helical reformatted 2.5mm cuts) is more sensitive and specific for diagnosis of TL spine fracture than plain radiographs. One noted advantage was a decreased time to clearance or diagnosis. There is potentially less radiation exposure with plain radiographs than CT.
Wintermark M	2003	Thoracolumbar spine fractures in patients who have sustained severe trauma: depiction with multi-detector row CT. Radiology. 2003 Jun;227(3):681-9	II	100	Prospective evaluation of 100 consecutive trauma patients CT C/A/P and T/L spine XR. 67 fractures in 26 patients, 12 patients had unstable fractures. Median sensitivity for identification of unstable fractures was 97.2% for MDCT and 33.3% for XR.	Multi-row detector CT scan is superior to plain radiographs for diagnosis and/or screening of TL spine fracture in trauma patients. Patients in this study underwent both conventional radiography as well as CT scanning for evaluation.
Pauw M	2009	Is a pelvic fracture a predictor for thoracolumbar spine fractures after blunt trauma? J Trauma. 2009 Nov. 67(5):1027-32.	II	620	Prospective evaluation of 620 consecutive patients with high energy blunt trauma. All had XR T/L and Pelvis followed by CT Abdomen/pelvis. No correlation found between pelvic fractures and T/L fractures. Sensitivity of TL plain films 22%, specificity 84%.	No statistically significant correlation found between spinal fractures and pelvic fractures. However, plain films for T/L spine diagnosis are inferior to CT imaging.
Sava J	2006	Thoracolumbar fracture in blunt trauma: Is clinical exam enough for awake patients?  J Trauma 2006 July; 61(1):168-71.	II	537	Prospective evaluation of "slightly altered" blunt trauma patients with signs and symptoms of TLS fracture with radiographs. Patients classified as reliable (GCS >13) or unreliable for reporting back pain. Bedside clinical exam 80% sensitive. Ten patients classified as reliable without s/s of fracture were found to have a fx by radiographs, four treated with a brace, none required surgery.	Recommend that any patient with even slight alteration in mental status should undergo thoracolumbar imaging as may harbor occult fractures that may require surgery/therapy. Study did not evaluate patients with negative clinical exams; therefore true incidence of T/L fracture in asymptomatic patients is not studied.
Inaba K	2011	Clinical examination is insufficient to rule out thoracolumbar injuries  J Trauma 2011 Jan; 70(1):174-9.	II	884	Prospective observational study of all evaluable (GCS 15, not intoxicated, and no distracting injury) blunt trauma patients admitted over 6 months for possible TL spine injury. Nine percent had an injury. Sensitivity and specificity of clinical exam for injury was 48% and 85% for all fractures and 79% and 83% for only those that were clinically significant.	Examination as the sole screening tool for evaluation is inadequate. Patients with normal mentation and no signs or symptoms were excluded therefore true incidence of missed fractures on asymptomatic patients is not evaluated.

Dai L-Y	2009	Assessment of Ligamentous Injury in Patients With Thoracolumbar Burst Fractures Using MRI  J Trauma 2009;66:1610-1615	III	61	Retrospective review of 61 consecutive patient's MRI of thoracolumbar junction for isolated T11-L1 burst fractures. Evaluated inter-observer agreement between 3 different radiologists, correlation between imaging and neurologic exam. No correlation between ligamentous injury on MRI and neurologic function or fracture severity. MRI is reliable for detecting posterior ligamentous injury in TL burst fractures.	Retrospective study of only T11-L1. Did not look at intraop correlation of injuries with MRI findings and MRI was not done with fat suppression which may be necessary for accurate visualization of ligamentous injury. MRI useful to identify ligamentous injury of isolated regions of the spine.
Vaccaro AR	2009	Injury of the posterior ligamentous complex of the thoracolumbar spine: a prospective evaluation of the diagnostic accuracy of magnetic resonance imaging.  Dvorak MF, Fisher C. Spine (Phila Pa 1976). 2009 Nov 1; 34(23):E841-7.	II	42	A prospective diagnostic imaging study to determine the accuracy of magnetic resonance imaging (MRI) in diagnosing injury of the posterior ligamentous complex (PLC) in patients with thoracolumbar trauma. The sensitivity for the various PLC components ranged from 79% to 90%. The specificity ranged from 53% to 65%. MRI sensitivity for PLC ranged from 79% to 90%. The specificity ranged from 53% to 65%.	This study only looks at patients with surgical intervention and not all comers. Lower MRI sensitivities and specificities than previously reported in the literature. Accuracy of MRI is less for less severe injuries. MRI should not be used as the only imaging for treatment; MRI should be used with other imaging methods to evaluate the integrity of the PLC.
Pizones J	2011	Impact of magnetic resonance imaging on decision making for thoracolumbar traumatic fracture diagnosis and treatment.  Eur Spine J. 2011 Aug; 20 Suppl 3:390-6. Epub 2011 Jul 21.	II	30	Prospective study evaluating MRI in fracture diagnosis and influence on treatment decisions. 30 patients with traumatic thoracolumbar fracture, osteoporotic or pathologic fractures were excluded. 41 fractures identified with plain films and CT; MRI diagnosed 50 fractures and 9 vertebral contusions. MRI modified diagnosis in 40%, classification of fracture pattern in 24% and therapeutic management in 16% of patients. MRI useful in evaluating acute thoracolumbar fractures.	MRI allows a better visualization of the PLC integrity, one of the key components to thoracolumbar spine stability and determination of need for operative intervention.
Bernstein MP	2006	Chance-type fractures of the thoracolumbar spine: imaging analysis in 53 patients.  AJR Am J Roentgenol. 2006 Oct; 187(4):859-68.	III	53	Retrospective single institution review over 8 years (1995-03) to find associated intra-abdominal injury when flexion-distraction injuries of the T-L spine present. 72% MVA, 17% fall, 6% assault/bike. 72% T12-L2 40% had intra-abdominal injuries; bowel and mesentery were most common.	Chance type fractures account for relatively small number of total spinal fractures. Associated with seat belt injuries. "Dissolving pedicle" sign can be seen on CT.
Ertürer E	2005	Evaluation of vertebral fractures and associated injuries in adults.  Acta Orthop Traumatol Turc. 2005; 39(5):387-90. Turkish.	III	372	Single institution retrospective review of T-L spine fx from 88-03. 57% compression fx, 39% burst fx, 2% seat belt fx, 2% fx-dislocations. 41% involved two or more levels. Most frequent at thoracolumbar junction (T11-L1 57%), second lumbar (31%), and third thoracic (12%). Mechanism: 57% fall, 39% MVA, 4% direct trauma. 30% had other skeletal fractures. 10% had other organ trauma. 19% required surgery.	Most frequent T-L spine fxs were compression fxs, most common place is T11-L1, and high energy mechanisms such as falls and MVC's should warrant further investigation for T/L spine fractures.