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Thoraco-lumbar spine injuries – a retrospective study on 651 cases

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Abstract: *Introduction:* Thoracolumbar spine fractures are common injuries that can result in significant disability, deformity and neurological deficit. There are standard classification systems that have been described based on fracture morphology, injury mechanism, neurological deficit and injury to posterior ligamentous complex. The thoracolumbar junction (T10-L2) is uniquely positioned in between the rigid thoracic spine and the mobile lumbar spine. This transition from the less mobile thoracic spine with its associated ribs and sternum to the more dynamic lumbar spine subjects the thoracolumbar region to significant biomechanical stress. Hence, fractures of the thoracolumbar region are the most common injuries of the vertebral column. *Material and Methods:* This retrospective study was conducted on 651 cases with thoracolumbar spine fractures admitted in Emergency Clinical Hospital "Prof. Dr. N. Oblu", Neurosurgery, Iasi, Romania between Ian 2014- Dec 2017. *Conclusions:* Trauma to the thoraco-lumbar spine and spinal cord is potentially devastating injury an it can be accompanied by significant neurologic damage , including paraplegia . Patients with incomplete neurologic deficits may regain a large amount of useful function with early or rapid surgical treatment.Imaging studies are essential to confirm the exact location of lesion, to assess the stability of the spine.

Key words: Thoracolumbar spine fractures

Introduction

The thoracolumbar junction (T10-L2) is a biomechanical transition zone prone to injury because of an inherent susceptibility to the kinetic energy transfer from the stiff, rostral thoracic spine to the relatively more flexible, caudal lumbar spine(1). The most common mechanisms of injury are those of a high-velocity pattern; these include motor vehicle collisions, falls, occupational injuries, and sport injuries.(2) High-velocity bony injuries carry an additional 25% risk for accompanying spinal cord injury (SCI) and 30% risk for intra-abdominal injury. Further complicating this problem is the estimated rate of 50% of concomitant neurological injury that is associated with these fractures.(3). Estimates of the North American incidence of thoracolumbar traumatic injury ranges from 12 to 50 million patients annually, mostly occurring in the adolescent to young adult population aged 15 to 29 years. With the aforementioned 50% rate of neurological injury, 6 to 25 million new cases of neurological injury per year can be expected in a demographic whose subsequent lifelong disability results in a huge societal cost from an injury that occurred during their chief productive years.(1-5)

Classification of thoraco-lumbar spinal injuries

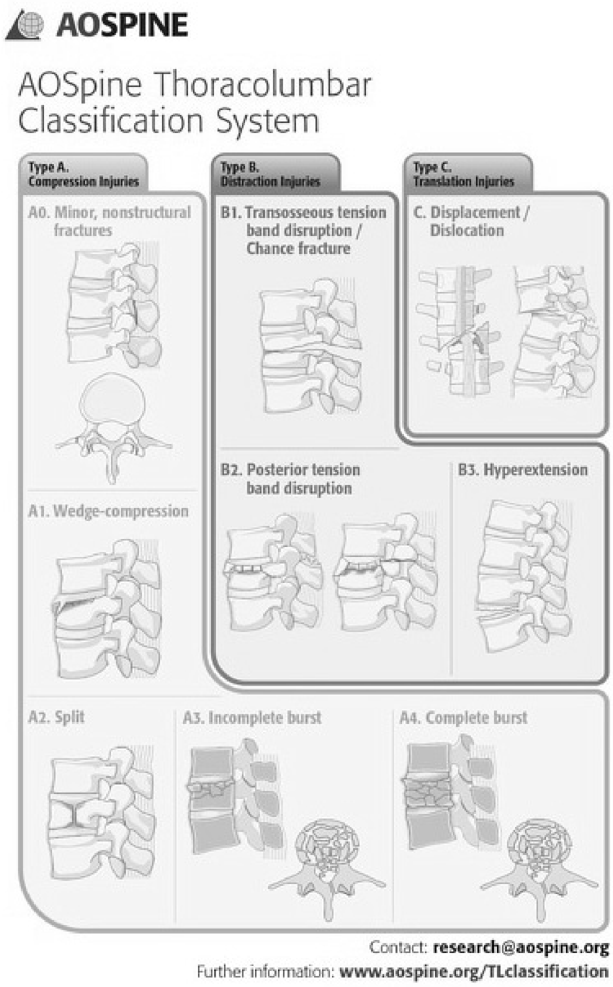
With the variety of fracture morphologies that can be seen at the thoracolumbar junction, multidisciplinary teams caring for the trauma population have sought for a simplified classification scheme for determining spinal stability and recommended management. The initial classification schemes have focused on fracture types. Because of the highly controversial status of the preferred management of thoracolumbar burst fractures, classifying thoracic and lumbar injuries has been a modern topic of research interest. One reason for the lack of consensus among health care providers is the presence of level I evidence supporting the management of stable thoracolumbar burst pattern fractures in patients without neurological deficit with the use of an orthosis. In this study, equivalent outcomes were found between bracing and arthrodesis. With the considerable number of fracture morphologies, a simplified algorithm for evaluating and organizing fractures gave birth to early thoracolumbar classification systems (1). Modern classification systems not only evaluate the fracture pattern but also have evolved with our understanding of the likelihood of a patient's need for surgery through our knowledge of factors that contribute to spinal instability. The extent of canal compromise and morphology of the thoracolumbar fracture type, presence of a neurological deficit, and radiographic findings that constitute a stable thoracolumbar spine are three major areas of confusion that play a major role in the newest classification system in use, the thoracolumbar injury classification and severity score (TLICS), a classification system put forward by the Spinal Trauma Study Group (STSG).(1, 3, 6, 7, 8)

AOSpine Thoracolumbar Spine Injury Classification System

In 2013, the TLICS was further expanded and developed into a newer AOSpine thoracolumbar spine injury classification system. This classification system was developed by an international panel of members evaluating three basic parameters: morphologic classification of the fracture, neurological status, and clinical modifiers. The morphologic classification is based on three main injury patterns: type A compression (including wedge impaction, split pincer, incomplete burst, or complete burst, type B tension band disruption (divided between osseous and osseoligamentous disruptions), and type C displacement-translation (hyperextension, translation, or separation) injuries. Eight subtypes were proposed (five in the A group, three in the B group, and one in the C group). Additionally, clinical modifiers were incorporated to address indeterminate injuries and patient-specific comorbidities such as ankylosing spondylitis and diffuse idiopathic skeletal hyperostosis. Unlike the TLICS, the updated AOSpine classification is based on CT scan, an imaging tool widely available at trauma centers worldwide. This classification adds clinical aspects that can better guide fracture management when combined with a severity score in the future. However, clinical validation requires large prospective observational studies.

Thoracolumbar Injury Classification and Severity Score

Proposed by the STSG, the TLICS set out to standardize the decision-making process for operative versus nonoperative management of thoracolumbar spine fractures. For this classification, the STSG evaluates the integrity of the PLC, the injury mechanism, and the presence of a neurological deficit..Disruption of the PLC is given special attention, creating conditions of near instability as detected by MRI. Hence, PLC injury provides enough points alone to warrant surgical correction.(6)



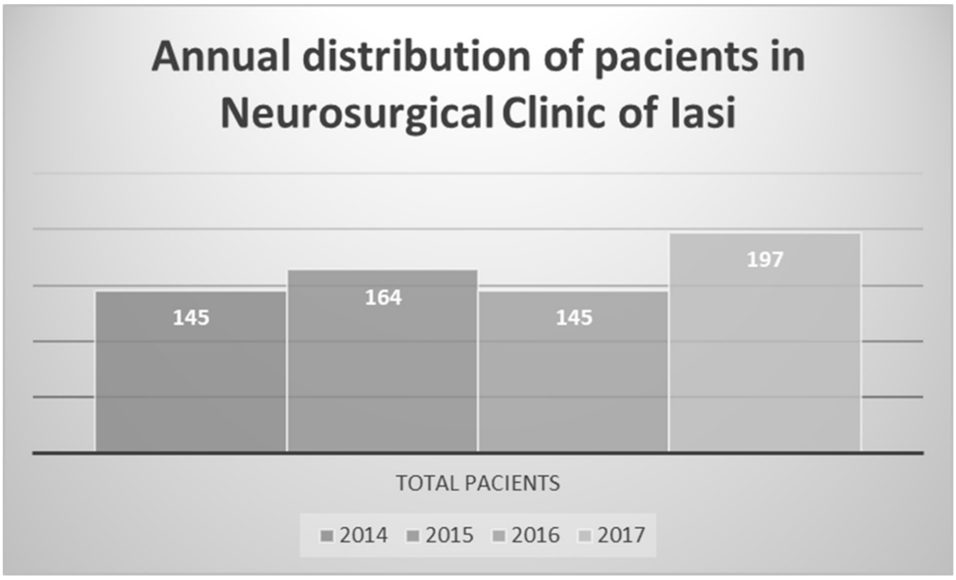
The Thoracolumbar Injury Classification and Severity (TLICS) Score

Injury Category	Point Value
Injury morphology	
Compression	1
Burst	2
Translation or rotation	3
Distraction	4
PLC status	
Intact	0
Injury suspected or indeterminate	2
Injured	3
Neurologic status	
Intact	0
Nerve root involvement	2
Spinal cord or conus medullaris injury	
Incomplete	3
Complete	2
Cauda equina syndrome	3

Scores: <4 non operative, 4 non operative or operative, >4 operative; PLC- posterior ligamentous complex

Material and Methods

This retrospective study was conducted on 651 cases with thoracolumbar spine fractures admitted in Emergency Clinical Hospital "Prof. Dr. N. Oblu", Neurosurgery, Iasi, Romania between 2014-2017.



Inclusion criteria: patients diagnosed with T-L injuries, recent injuries(<30 days) regarding the neurological status.

Exclusion criteria: minor injuries, pathological fractures.

Sex distribution

In all 3 studies we can see that the majority of the patients were males (60%).

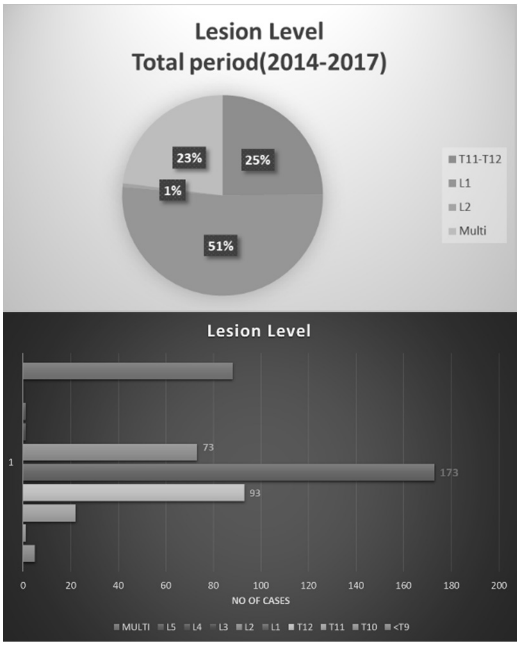
Age distribution

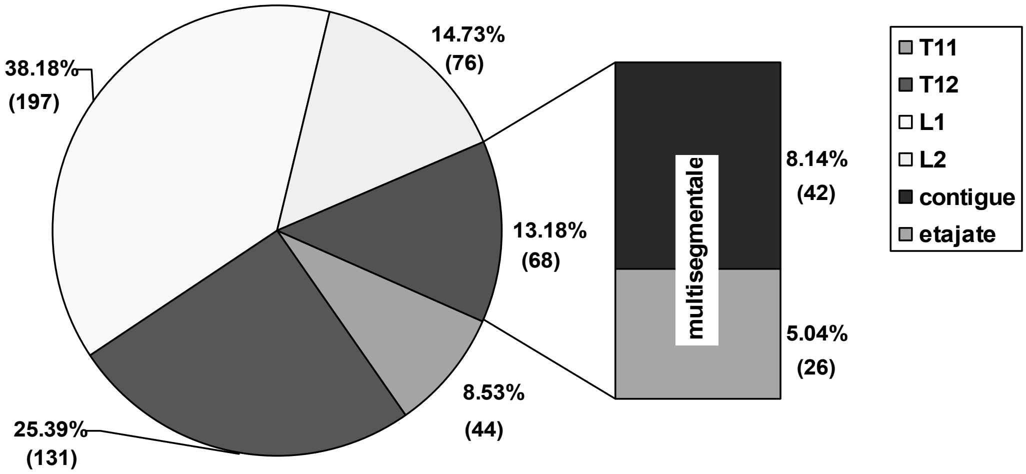
The average age was 52.26, between 8 and 86 years old with 2 peaks between 41-50 in men and 61-70 in women.

Mechanism

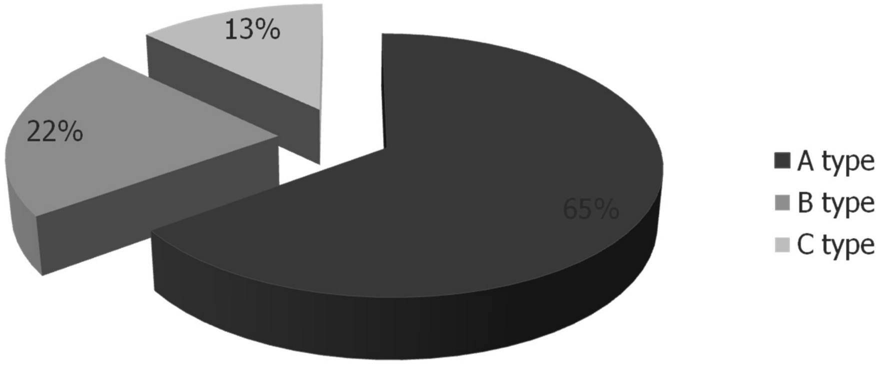
Regarding the mechanism the most frequent are falls from a height (41%), followed by car accidents (14%). Other mechanism implicated are falls form the same level (9%), from cart (6%), aggressions (7%) and unknown (23%).

Lesion level

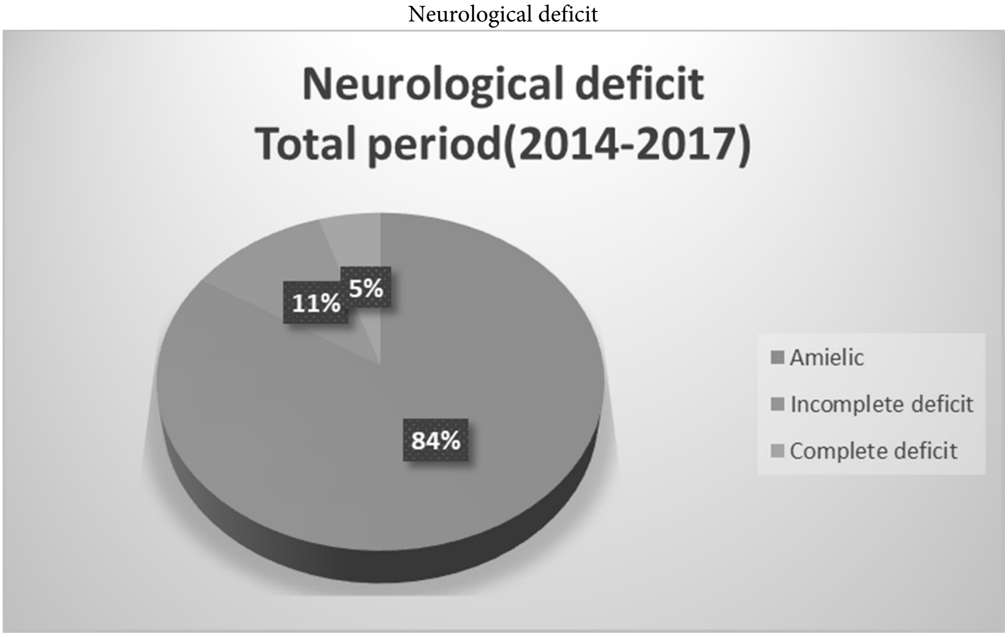




AO CLASSIFICATION

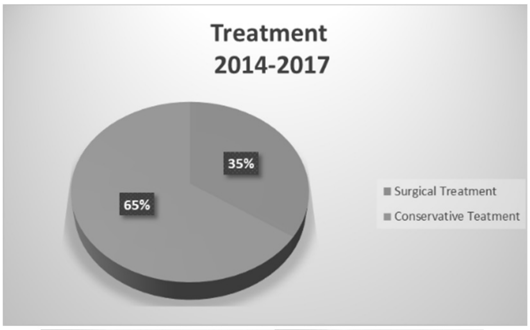


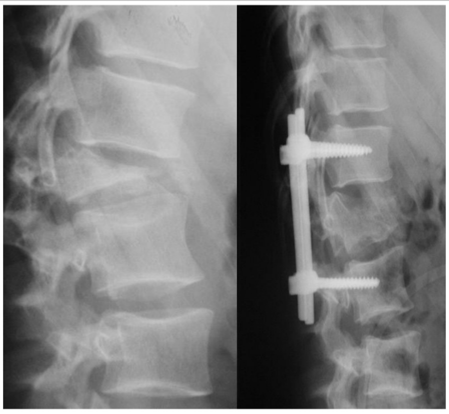
Neurological deficit

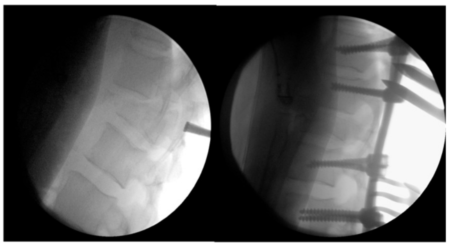


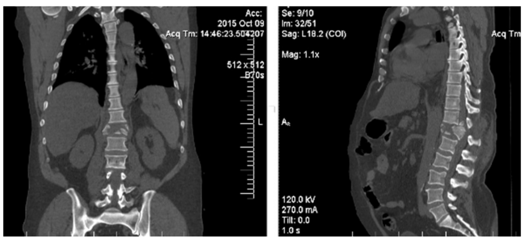
Treatament options

There are 2 options for treatament: conservative and surgical. We used a conservative treatment in 65% cases (stable lesions A-type). Indication for surgery: patients with neurological deficit, unstable lesions, TLICS >5. Regarding surgical treatment we use a posterior approach with a short or long instrumentation, an anterior approach or in selected cases a combined one (9).




Posterior approach with short instrumentation

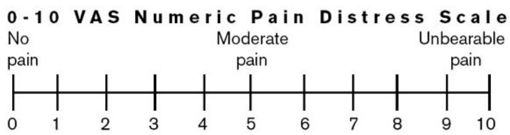

Posterior approach with long instrumentation




Burst fracture combined anterior-posterior approach

Results

Overall the results for surgical treatment have a good outcome for patients with A3, B1, B2 fractures because in this cases we use short instrumentation, one level above and one level below the lesion. For patients with A4 fractures the results were less satisfying with short instrumentation due to the degree of comminution (Load-sharing >6 points).In this cases we recommend anterior reconstruction and posterior fixation. Postop patients were clinical evaluated at 45 days, 3, 6, 12 months. For the evaluation of pain we used the Visual Analog Scale (VAS) (fig 1), ODI, kyphosis angle (KA) and vertebral body height (VBH).



Moment of evaluation	**Conservative treatment**	**Surgical treatment**
Admission	9,1 (8 – 10)	9,2 (8 – 10)
At 3 months	5,3 (4 – 7)	4,1 (3 – 6)
At 6 months	4,4 (3 – 6)	2,4 (1 – 3)
At 12 months	3,4 (2 – 4)	1,8 (1 – 3)

It is seen an important decreasing pain at 3 months after the injury regardless of the type of treatment. Though patiens who underwent surgery had less pain at 12 months.

KA and the reduction of the VBH in the anterior segment of the vertebral body for the patients treated conservately are represented in the next table:

	Admission	At 6 months	At 12 months
KA	13,80	16,53	17,42
VBH %	73,8	65,4	63,7

For this patients we can see an increase in local kyphosis with aprox 4 degrees and a reduction of VBH with 10% at 1 year after the injury.

Surgical treatment

	Admission	At 6 months	At 12 months
KA	14,22	11,2	13,8
VBH %	67,4	63,5	62,7

For the patients treated surgically the local kyphosis decreased with 0,4 degrees and the VBH decreased with 5% at 1 year after surgery.

Statistically the KA decreased significant in the group of patients treated surgically (p<0,01).

ODI

Evaluation moment	**ODI conservative**	**ODI surgical**
Admission	82,5 (73 – 88)	84,3 (69 – 92)
At 3 months	48,4 (33 – 53)	39 (28 – 47)
At 6 months	30 (21 – 38)	21 (16 – 28)
At 12 months	23 (17 – 32)	18 (9 – 28)

We can see an important decrease with 50% of the disability at 3 months after the treatment but at the final evaluation we can't see any significant difference between this 2 groups.

Discussion

In spine surgery, there is an ongoing effort to increase the knowledge of spinal surgery with the generation of well-designed, prospective, randomized trials. Wood and colleagues, in a randomized prospective trial comparing operative and nonoperative treatment of thoracolumbar burst fractures, found no clinically significant advantage of surgery. In the surgical arm, the choice of an anterior, posterior, or combined approach was left to the discretion of the surgeon (3,10). Siebenga and associates in a multicenter prospective randomized study of operative versus nonoperative treatment of thoracolumbar burst fractures, concluded that surgery resulted in fewer deformities at the mean 4-year follow-up but in superior functional and pain outcome scores (11). Gnanenthiran and colleagues in a meta-analysis comparing operative and nonoperative outcomes for thoracolumbar burst fractures, found four prospective studies, only two of which were randomized. They concluded that patients who underwent surgery tended have lower rates of kyphosis, but these patients did not statistically differ in terms of functional and pain outcomes at 4 years. However, because thoracolumbar burst fractures are not all the same with regard to their likelihood of developing kyphosis or instability, future prospective studies should incorporate the TLICS system into the inclusion and exclusion criteria.(12)

Operative planning is a multifactorial decision-making process. Arguably, the most important factor for determining anterior or posterior approach is the location of the pathology. The most common pathologies at the thoracolumbar junction are anterior and middle column (axial compression mechanisms, e.g., compression or burst). One other pitfall in prospective studies is the heterogeneity of treatment plans with regard to combining anterior, posterior, or combined approaches. . However, modern techniques allow for all three columns to be addressed by the posterior approach (14). Also, less invasive techniques such as percutaneous pedicle screw instrumentation and lateral interbody placement allow for stabilization as needed, with minimal disruption. For specific pathology, such as retropulsed fragments into the canal, some authors argue that an anterior, retroperitoneal approach allows for the greatest ease of neural decompression. However, many advocate for the benefits of a posterolateral approach in the ability to access all three columns, decompress retropulsed anterior pathology, and provide three-column stabilization through an anteriorly placed graft as well as a pedicle screw-rod construct. Lin and colleagues compared anteroposterior with posterolateral decompression and instrumented fusion, finding no statistically significant difference between the two groups with respect to all functional and radiographic outcomes scores.(13)

One systematic review of posterior versus anteroposterior decompression and fusion for thoracolumbar burst fractures found a greater degree of restoration of the sagittal anatomic alignment at the higher cost of blood loss, extended hospital stay, longer intraoperative durations, higher morbidity, and higher monetary costs for anterior – posterior approach.

In our cases we had less satisfying results in patients with A4 fractures who had a short fixation due to the degree of comminution in comparison with the other spine units.

Conclusion

The management of thoracolumbar junction pathology remains controversial. The TLICS represents the latest advancement in classification, providing a standardized guide for possible surgical management of thoracolumbar junction fractures. Using both AO spine revised classification and TLICS score we can establish more accurately the surgical indication.

The conservative treatment is a reliable solution for patients with simple stable fractures and no neurological deficit. Surgical treatment is the best solution for patients with unstable fractures, complex fractures and neurological deficit.

Trauma to the thoraco-lumbar spine and spinal cord is potentially devastating injury and it can be accompanied by significant neurologic damage. Patients with incomplete neurologic deficits may regain a large amount of useful function with early or rapid surgical treatment.

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References

1.Youmans and Winn NEUROLOGICAL SURGERY, SEVENTH EDITION, Vol 3:2482 – 2564
2.Liu YJ, Chang MC, Wang ST et al. Flexion-distraction injury of the thoraco-lumbar spine.Injury 2003;34 920-923
3.Wood KB, Li W, Lebl DS, Ploumis A. Management of thoracolumbar spine fractures. Spine J. 2014;14:145–64. [PubMed]
4.Inamasu J, Guiot BH. Vascular injury and complication in neurosurgical spine surgery. Acta Neurochir (Wien) 2006;148:375–87. [PubMed]
5.Looby S, Flanders A. Spine trauma. Radiol Clin North Am 2011;49:129–163
6.Rihn JA, Anderson DT, Harris E, et al. A review of the TLICS system: a novel, user-friendly thoracolumbar trauma classification system. Acta Orthop 2008;79:461–466
7.Sethi MK, Schoenfeld AJ, Bono CM, Harris MB. The evolution of thoracolumbar injury classification systems. Spine J 2009;9:780–788
8.Vaccaro AR, Lehman RA Jr, Hurlbert RJ, et al. A new classification of thoracolumbar injuries: the importance of injury morphology, the integrity of the posterior ligamentous complex, and neurologic status. Spine 2005;30:2325–2333
9.Schmidek and sweet operative neurological techniques indication, methods and results, 6th edition, vol 2, Alfredo Quifnones- Hinojosa 2030 – 2033.
10.Wood KB et al Management of thoracolumbar spine fractures. Spine 2014;14: 145-164
11.Siebenga J et al Treatment of traumatic thoracolumbar spine fractures:a multicenter prospective randomized study of operative versus non surgical treatment. Spine 2006;31:2881-2890
12.Gnanenthiran SR et al Non operative versus operative treatment for thoracolumbar burst fractures without neurological deficit: a methanalysis . Clean Orthop Relat Res 2012; 470:567-577
13.Lin B et al Anterior aprroapch versus posterior approach with subtotal corpectomy, decompression and reconstruction of the spine in the treatment of thoracolumbar burst fractures: a prospective randomize controlled study.Spinal Disort Tech 2011
14.Popescu CE Tratamentul fracturilor toraco-lombare. Teza de doctorat. 2007