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Research Article

Management of thoracolumbar fractures based on TLICS guidelines

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Abstract

Introduction: The TLICS guidelines and anterior approach makes treatment of thoracolumbar fractures more definitive with better correction of sagittal coronal plane, kyphosis, adequate decompression of neural tissue. However, the thoracolumbar junction (T11, T12 and L1) poses an anatomical dilemma, due to diaphragm and the lower rib cage when performing anterolateral approaches[7].

Materials and methods: The purpose of this study is to determine the effectiveness of stabilising the thoraco-lumbar fractures by diaphragm sparing mini open thoracotomy as per TLICS guidelines. Our study presented here in presents a pure clinical series in the form of a prospective cohort study that was applied to 42 consecutive cases of thoracolumbar fracture who were treated between 2013 and 2016 in a tertiary care centre in India. Patients were randomised into observation and surgery groups based on the TLICS guidelines. The patients in the surgery cohort underwent single-level thoracolumbar corpectomies with expandable cage placement through a mini-open thoracotomy approach without any posterior instrumentation. The results of the 2 groups were tabulated and analysed.

Results: The primary outcome was measured by the American Spinal Injury Association Impairment Scale (AIS). This is the second paper to prospectively use the TLICS to guide surgical and nonsurgical care in the treatment of a consecutive series of patients with thoracolumbar spine trauma showing level II evidence according to evidence based medicine criteria proposed by Wright et al.

Keywords: *thoracolumbar fractures, instability, kyphosis, trauma, collapse, thoracotomy, spinal fractures*

Introduction

Thoracolumbar area is a common location for traumatic and nontraumatic pathologies[7]. The thoracolumbar junction (T11, T12 and L1) is biomechanically weak for stress and the most common location (90%) of all fractures of the spine[6]. There are many different thoracolumbar injury classifications tried to assess fracture patterns and prognosis objectively[2]. Among these, Denis and AO classifications were the most commonly used systems [2]. However these classification systems are complex and have limited utility in routine clinical practice[2]. Vaccaro et al proposed a new classification of thoracolumbar injuries in 2005, thoracolumbar injury classification and severity score (TLICS) [2,4]. This classification system considers the neurologic status of the patient as well as assessment of the integrity of the posterior ligamentous complex (PLC) [2,3,4]. Treatment of thoraco-lumbar fracture is controversial, mostly managed with the concept – no deficit, no surgery. The disrupted PLC has got poor healing ability and generally requires surgical intervention[2.]TLICS could help surgeons in the decision-making process, as an alternative to previous cumbersome classifications [2,4]. The literature review suggested that use of the TLICS is safe, especially with regards to neurologic status both in surgical and nonsurgical treatment[4]. To the best of the authors' knowledge only one article (by Andrei F. Joaquim et.al) prospectively evaluated the safety of the TLICS based on its clinical application [3,4]. Early mobilization and rehabilitation by restoring mechanical stability of fracture and inducing neurologic re-covery are the goals of treatment of thoracolumbar fractures.[6] Both conservative and posterior approach have showed deterioration in terms of late development of instability, implant failure.

The TLICS guidelines and anterior approach makes treatment more definitive and a single sitting operation with better correction of sagittal coronal plane, kyphosis, adequate decompression of neural tissue. However the thoracolumbar junction (T11, T12 and L1) poses an anatomical dilemma, due to diaphragm and the lower rib cage when performing anterolateral approaches[7]. The purpose of this study is to determine the effectiveness of stabilising the thoraco-lumbar fractures by diaphragm sparing mini open thoracotomy as per TLICS guidelines. Our study presented here in presents a pure clinical series of patients who underwent single-level thoracolumbar corpectomies with expandable cage placement through a mini-open thoracotomy approach without any posterior instrumentation. The primary outcome was the American Spinal Injury Association Impairment Scale (AIS). This is the second paper to prospectively use the TLICS to guide surgical and nonsurgical care in the treatment of a consecutive series of patients with thoracolumbar spine trauma showing level II evidence according to evidence based medicine criteria proposed by Wright et al.

Methods

A prospective cohort study was applied to 42 consecutive cases of thoracolumbar fracture who were treated between 2013 May and 2017 March at a tertiary care centre. The purpose of our study was to evaluate the safety, reliability, validity of TLICS guidelines in clinical practice and efficacy of its severity score component to help guide treatment decision. To determine the effectiveness of stabilising the thoraco-lumbar fractures by the author's innovative mini open diaphragm sparing thoracotomy approach. Insti-tutional ethics committee approval was taken for our study protocol prior to the study. Only single level traumatic fractures (T11, T12 & L1) and cases who were treated elsewhere without proper workup upto 3 months, Patients who were unwilling initially for surgery, who later developed instability up to one year on follow up were included in the study. All pathological fractures, concomitant fractures in the vertebral column, long standing fractures with pseudarthrosis, penetrating spinal injuries, isolated transverse/spinous process fractures, disabling comorbidities like lung pathology which would interfere with post op assessment of pulmonary function were excluded from our study group. Written informed consent was obtained from all eligible patients who were willing to participate in this prospective study.

Forty two (men and women) consecutive patients with thoracolumbar fracture were treated based on TLICS guidelines. Mean age of patients was 42 years. Detailed history and thorough physical examinations was performed including neurological status at admission assessed by ASIA impairment scale (AIS) which was published by the American Spinal Injury Association. The patients were grouped as with neurological deficit (ASIA A, B, C, and D) and without neurological deficit (ASIA E). All the patients were subjected to digital X ray, CT to characterise fracture morphology and MRI imaging to look for status of Posterior ligamentous complex. Clinical and radiological data were evaluated, classifying the patient's injury according to TLICS guidelines as follows:

1. CONSERVATIVE (TLICS score ≤ 3)
2. OBSERVANT (TLICS SCORE =4)
3. OPERATIVE (TLICS SCORE >4)

Patients with a TLICS of 5 or more points (operative group) underwent surgical treatment as soon as they were clinically stable. Those with a TLICS of less than 4 points were placed in conservative group, whereas TLICS of 4 were placed in observant group, underwent nonsurgical treatment compris-ing of rigid brace for 8–12 weeks and early ambulation but with activity restrictions. In case of failure of the initial treatment such as fresh/worsening neurological deficits, progressive kyphotic deformity, persistent pain or for comorbidities that would preclude treatment patients were allowed to cross over from one treatment group to the other. The neurological status, was assessed based on the AIS (American Spinal Injury Association Impairment Scale) grade, postoperative pain assessed by VAS score, both subjective and objective assessment of diaphragmatic movement using USG/Fluoroscopy.in addition, pulmonary function tests, correction of kyphosis, extent of canal decompression were the primary outcome measurements in surgical group. Our standard protocols for treatment included digital x-ray, C T & MRI scans on admission for all the patients.

Conservative group: Managed with 4 weeks strict bed rest followed by partial mobilisation with Taylor's brace for next 8 weeks. Guarded mobility without Taylor's brace later. Imaging for parameters of instability has been done at 3 and 6 months and then yearly.

Observant group: Managed with strict bed rest for 4 weeks followed by partial mobilisation with Taylor's brace after 4 weeks. The parameters of instability were assessed after 4weeks of assuming erect posture or on neurological deficits. Full weight bearing with Taylor's brace allowed after 12 weeks. Digital x ray repeated at three months and if no deterioration in the form of progressive kyphotic deformity then subjected to physiotherapy.

Surgical group: All patients with TLICS score 5 or more underwent diaphragm sparing mini open-thoracotomy, corpectomy with end plated expandable titanium cage and screw rod construct fixation. Patient mobilised on the same post -op evening and bedside portable x ray post op evening to confirm implants placement. Intravenous antibiotics administered till drains are removed. Chest tube maintenance and removal was done according to standard guidelines. Peri-construct drain removed once output became less than 20 ml/day.

VAS (Visual Analogue Scale) score for postoperative pain assessment documented from post-operative day 1 to 10 days. Intravenous analgesics given till VAS score became 5 or less. Then switched over to oral analgesics which were stopped on 14th post-operative day. Digital x-ray, bed side assessment of pulmonary function test by spirometer was done on 3rd postoperative day. Diaphragmatic movements assessed by USG on 7th postoperative day. Mechanical spirometer and fluoroscopic assessment were repeated on 12th postoperative day. CT and MRI done for all operated patients on 14th postoperative day. All the patients were discharged on 14th post op day. After hospital discharge, patients were seen in the outpatient clinics after 15 days then monthly for next three months. Quarterly for a year. Half yearly for 2 years. Yearly thereafter. Parameters of instability was measured on all occasions by digital X ray/CT and MRI. Instrumentation status, fracture reduction, and spinal alignment were assessed.

OPERATIVE TECHNIQUE

The authors' innovative diaphragm sparing mini-open thoracotomy incision of about (7cm) is placed diagonally form midaxillary region extending beyond the posterior axillary line at the level of fractured vertebra. Underlying rib and one above it excised subperiosteally and mobilising the pleura extracoelomically. Fibres of external oblique was cut (when required) and Gerota's fascia and retroperitoneal structures were retracted anteriorly. After localising the fractured vertebra by fluoroscopy a plane was developed between left crus of the diaphragm and medial margin of psoas, and extended subperiosteally anteriorly up to anterior longitudinal ligament. Trough was created in fractured vertebra after corpectomy and adequate decompression of the spinal cord. The construct was made using expandable cage with endplate (screw jack mechanism).

STATISTICAL ANALYSIS:

Data was entered into Microsoft excel data sheet and was analysed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions.

Chi-square test or Fischer's exact test (for 2x2 tables only) was used as test of significance for qualitative data. Continuous data was represented as mean and SD.

ANOVA (Analysis of Variance) or Kruskal Wallis test was the test of significance to identify the mean difference between more than two groups for quantitative and qualitative data respectively.

Paired t test or Wilcoxon Signed rank test is the test of significance for paired data such as before and after surgery for quantitative and qualitative data respectively.

Graphical representation of data: MS Excel and MS word was used to obtain various types of graphs such as bar diagram.

p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Statistical software: MS Excel**,** SPSS version 22 **(**IBM SPSS Statistics, Somers NY, USA) was used to analyse data.

RESULTS

Forty two consecutive patients with thoracolumbar fracture were treat-ed during the period of this study. All patients were followed for up to 4 years (range is from 5 months to 4 years).

		Age	
		Mean	SD
Group	Operative	42.14	14.52
	Conservative	38.70	12.60
	Observant	49.00	15.63
	P value	0.250	

Table 1: Age distribution comparison between three groups

In the study 21 subjects were in operative group, 10 subjects were in conservative group and 11 subjects were in observant group.

Mean age of subjects in Operative group was 42.14 ± 14.52 years, in Conservative group was 38.70 ± 12.60 years and in Observant group was 49.00 ± 15.63 years. There was no significant difference in mean age between three groups.

Figure 1: Bar diagram showing Age distribution comparison between three groups

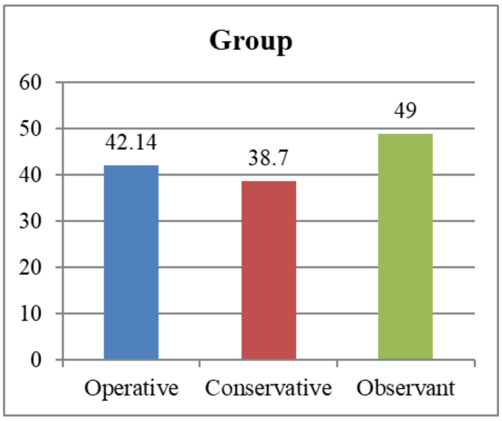

Table 2: Gender distribution comparison between three groups

		Group					
		Operative		Conservative		Observant	
		Count	%	Count	%	Count	%
Gender	Female	8	38.1%	3	30.0%	5	45.5%
	Male	13	61.9%	7	70.0%	6	54.5%

χ 2 =0.531, df = 2, p =0.767

In Operative group, 38.1% were females and 61.9% were males, in conservative group, 30% were females and 70% were males and in Observant group, 45.5% were females and 54.5% were males. There was no significant difference in gender distribution between three groups.

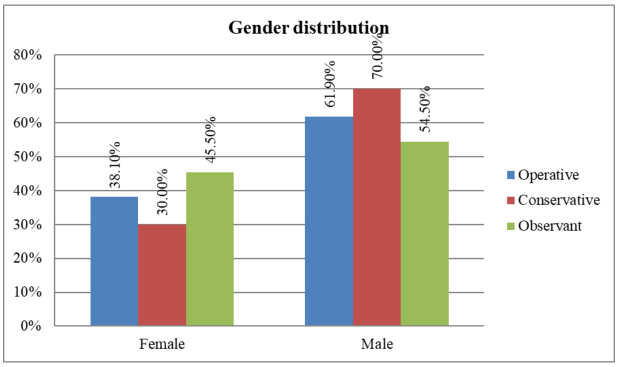

Figure 2: Bar diagram showing Gender distribution comparison between three groups

Table 3: Level distribution between three groups

		Group					
		Operative		Conservative		Observant	
		Count	%	Count	%	Count	%
Level	DV11	2	9.5%	1	10.0%	0	0.0%
	DV12	7	33.3%	2	20.0%	5	45.5%
	LV1	12	57.1%	7	70.0%	6	54.5%

χ 2 =2.335, df = 4, p =0.674

In Operative group, 9.5% had DV11 level, 33.3% had DV12 level and 57.1% had LV1 level. In Conservative group, 10% had DV11 level, 20% had DV12 level and 70% had LV1 level.

In Observant group, 0% had DV11 level, 45.5% had DV12 level and 54.5% had LV1 level. There was no significant difference in Level of vertebra between three groups.

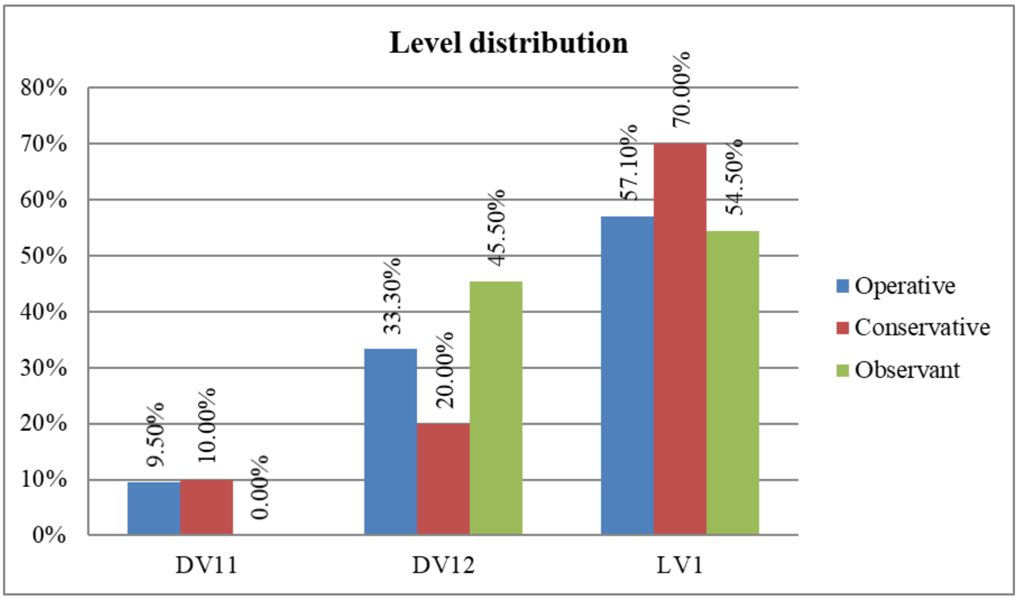

Figure 3: Bar diagram showing Level distribution between three groups

Table 4: Morphology distribution between three groups

		Group					
		Operative		Conservative		Observant	
		Count	%	Count	%	Count	%
Morphology	Burst #	16	76.2%	1	10.0%	11	100.0%
	Chance #	4	19.0%	1	10.0%	0	0.0%
	Compression#	0	0.0%	8	80.0%	0	0.0%
	Lt. lat translation	1	4.8%	0	0.0%	0	0.0%

χ 2 =35.77, df = 6, p <0.001*

In Operative group, 76.2% had Burst #, 19% had Chance # and 4.8% had Lt. lat translation. In Conservative group 10% had Burst #, 10% had Chance # and 80% had Compression #. In observant group, 100% had burst #. There was significant difference in morphology between three groups.

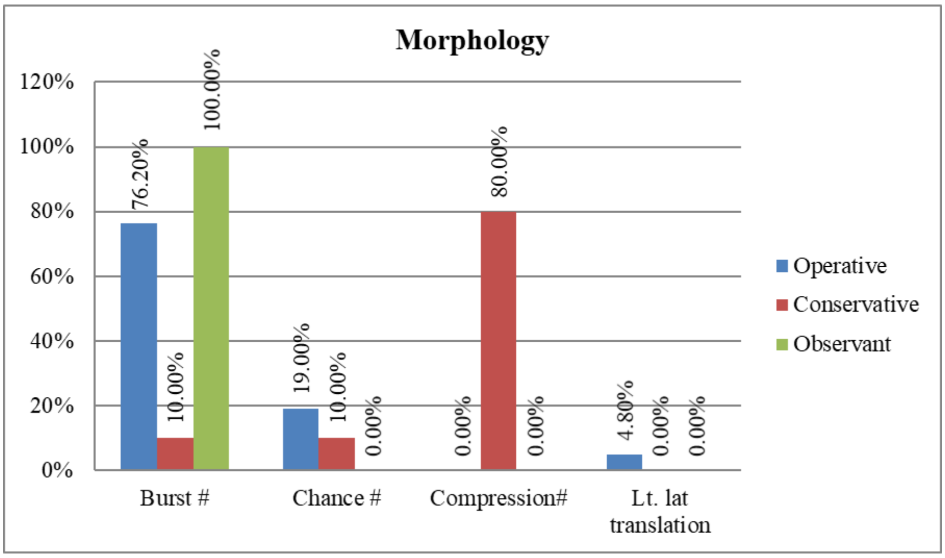

Figure 4: Bar diagram showing Morphology distribution between three groups

Table 5: Anterior and Posterior Body Compression comparison between three groups

		N	Mean	SD	P value
Anterior	Operative	21	38.767	18.7394	0.044*
	Conservative	10	22.490	11.5289	
	Observant	11	34.927	14.8158	
	Total	42	33.886	17.2679	
Posterior	Operative	21	11.929	13.0406	0.920
	Conservative	6	12.867	14.4231	
	Observant	8	14.125	11.9096	
	Total	35	12.591	12.6754	

In the study there was significant difference in mean anterior compression between three groups. Anterior compression was higher in Operative group and lower in conservative group. There was no significant difference in mean posterior compression between three groups.

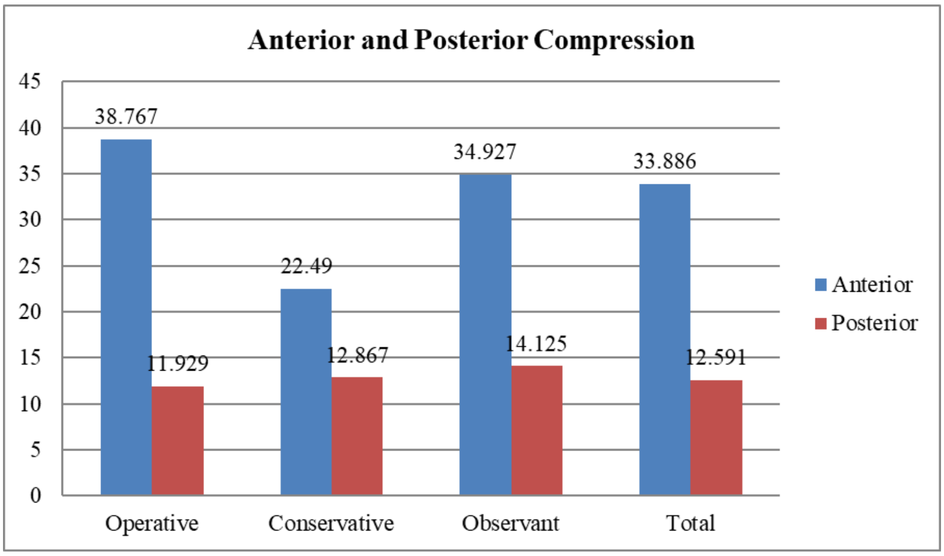

Figure 5: Bar diagram showing Anterior and Posterior Compression comparison between three groups

Table 6: % of canal compromise comparison between three groups

		N	Mean	SD	P value
% of Canal Compromise	Operative	20	38.450	15.8562	0.067
	Conservative	1	10.000	.	
	Observant	3	20.900	9.5252	
	Total	24	35.071	16.7043	

% of Canal Compromise in Operative group was 38.450 ± 15.8562, in conservative group was 10 and in observant group was 20.9 ± 9.5252. There was no significant difference in mean % of Canal Compromise between three groups. (I feel there is significance compromise in operative group)

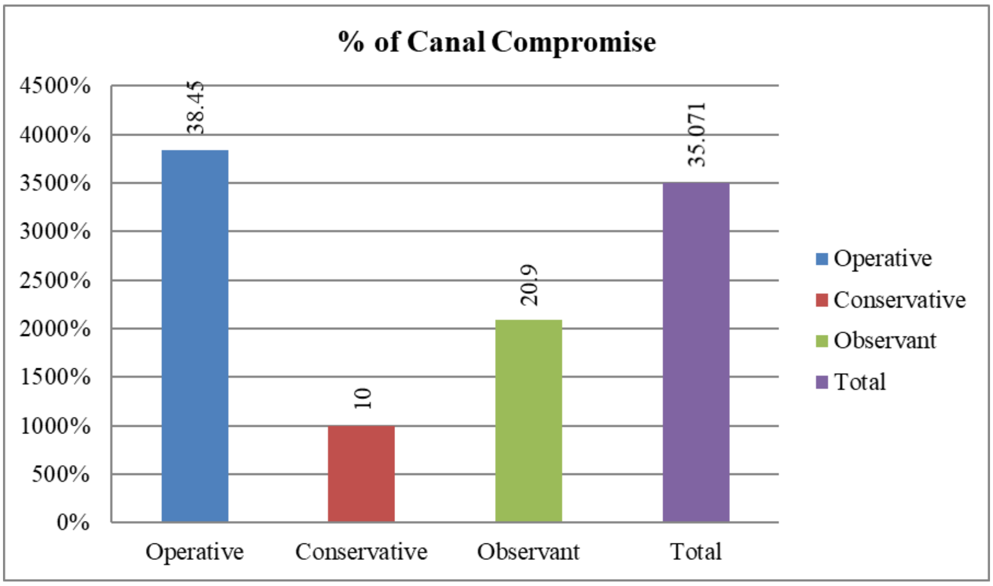

Figure 6: Bar diagram showing % of canal compromise comparison between three groups

Table 7: PLC Integrity comparison between three groups

		Group					
		Operative		Conservative		Observant	
		Count	%	Count	%	Count	%
PLC Integrity	Doubtful	2	9.5%	1	10.0%	10	90.9%
	Injured	18	85.7%	0	0.0%	0	0.0%
	Intact	1	4.8%	9	90.0%	1	9.1%

χ 2 =55.76, df = 4, p <0.001*

In Operative group, 9.5% had PLC integrity, 85.7% had injured and 4.8% had intact PLC integrity. In conservative group, 10% had doubtful and 90% had intact PLC integrity and in observant group, 90.9% had doubtful and 9.1% had intact PLC integrity.

There was significant difference in PLC integrity between three groups.

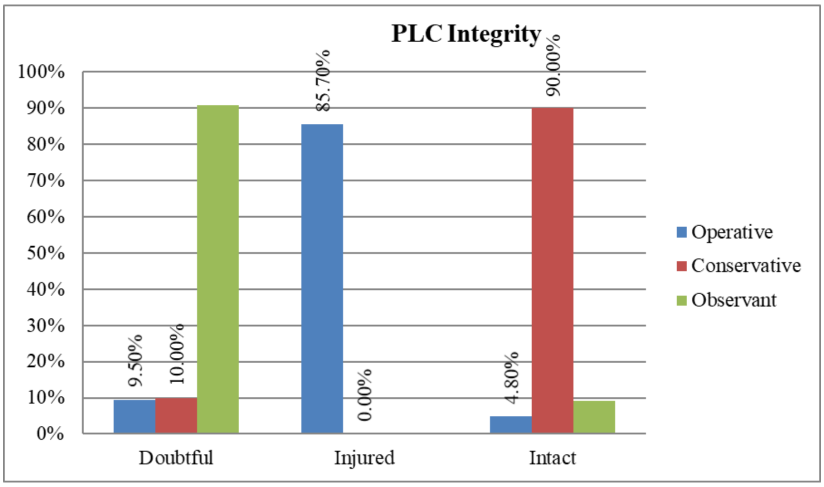

Figure 7: Bar diagram showing PLC Integrity comparison between three groups

Table 7b: TLICS score comparison between three groups

	N	Mean	SD	P value
Operative	21	5.86	1.389	<0.001*
Conservative	10	1.50	0.707	
Observant	11	4.00	0.000	
Total	42	4.33	2.056	

Mean TLICS score In Operative group, was 5.86 ± 1.389, in conservative group was 1.50 ± 0.707 and in Observant group was 4.00 ± 0.000. There was significant difference in mean TLICS score between three groups.

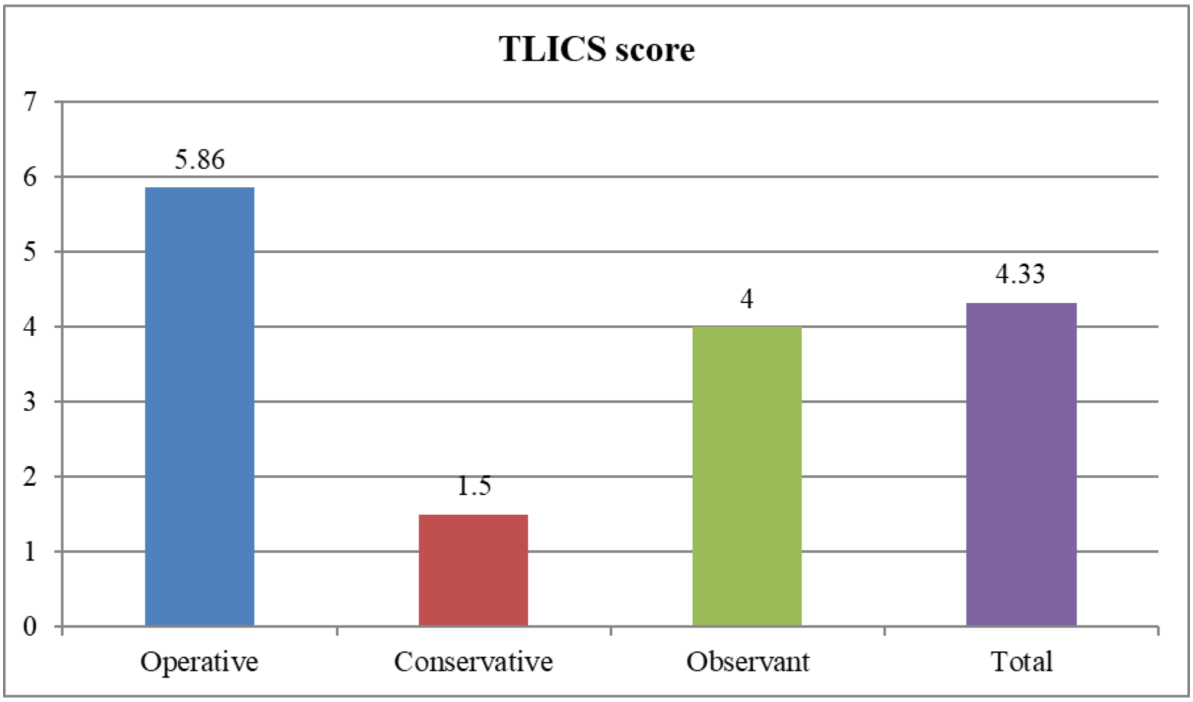

Figure 8: Bar diagram showing TLICS score comparison between three groups

Table 8: Diaphragmatic Movement By USG Pre op and Post op comparison in operative group

Diaphragmatic Movement By USG		Group		P value
		Operative		
		Mean	SD	
Right	Pre OP	5.93	1.43	<0.001*
	Post Op	5.47	1.38	
Left	Pre OP	5.99	1.49	<0.001*
	Post Op	5.50	1.38	

On Right side Mean Pre Op Diaphragmatic Movement By USG was 5.93 ± 1.43 and post op was 5.47 ± 1.38. There was significant decrease in mean Diaphragmatic Movement By USG at Post Op period compared to Pre op value.

On Left side Mean Pre Op Diaphragmatic Movement By USG was 5.99 ± 1.49 and post op was 5.50 ± 1.38. There was significant decrease in mean Diaphragmatic Movement By USG at Post Op period compared to Pre op value.

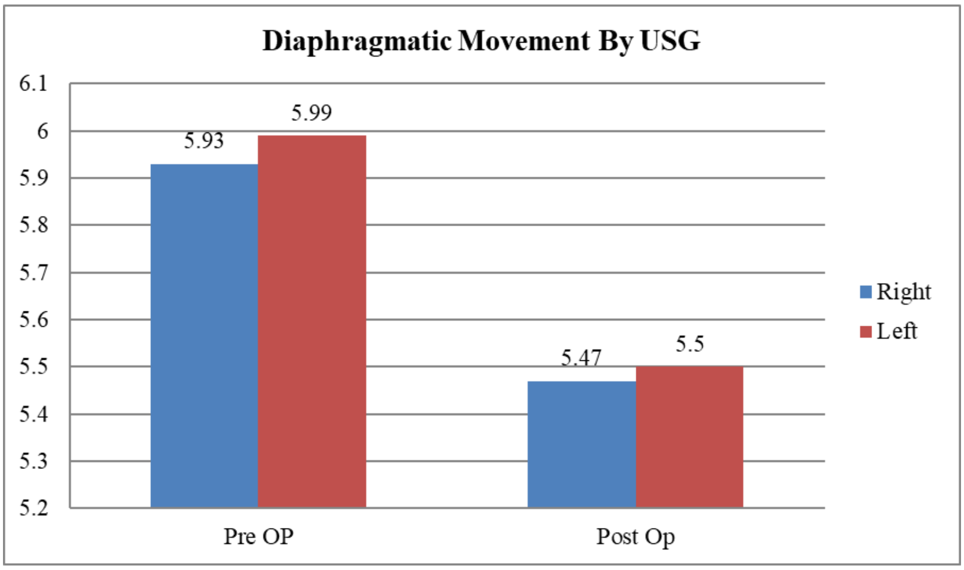

Figure 9: Bar diagram showing Diaphragmatic Movement By USG Pre op and Post op comparison in operative group.

Table 9: COBB's Angle Pre op and Post op comparison in operative group

	Group		P value
	Operative		
	Mean	SD	
Pre Op	23.19	10.93	
Immediate	9.24	4.13	<0.001*
3 Months	9.62	3.85	0.072
6 Months	9.50	2.89	0.028
1 Year	9.38	1.89	0.089

Cobb's angle at Pre Op was 23.19 ± 10.93, at Immediate post op was 9.24 ± 4.13, at 3 months was 9.62 ± 3.85, at 6 months was 9.50 ± 2.89 and at 1 years was 9.38 ± 1.89. There was significant decrease in Cobb's angle at immediate period compared to Pre Op. There was no significant deterioration in mean Cobb's angle at 3 months, 6 months and 1 year compared to previous visit value.

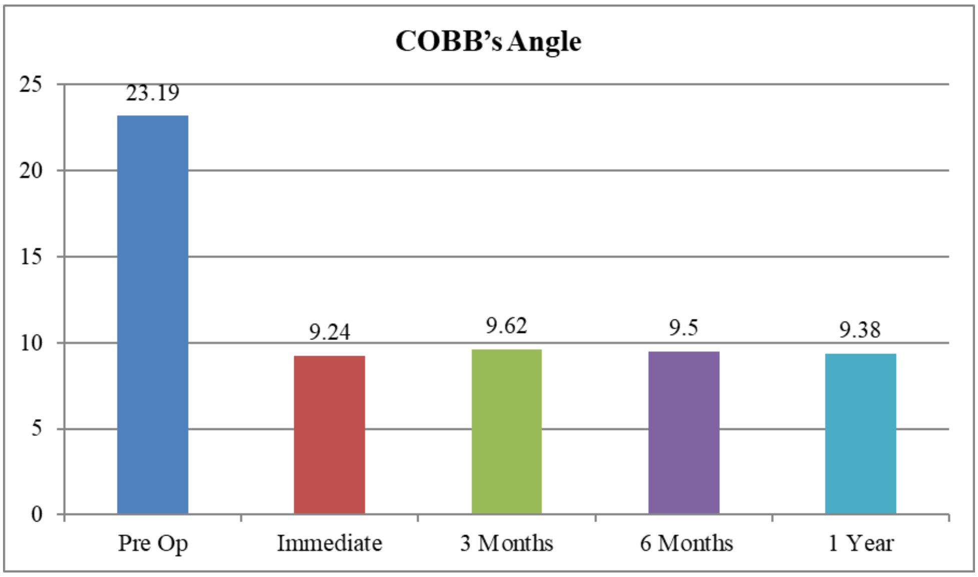

Figure 10: Bar diagram showing COBB's Angle Pre op and Post op comparison in operative group.

Table 10: VAS Score comparison in operative group

Post Op Day	Group	
	Operative	
	Median	P value
1st Day	7	
5th Day	3	<0.001*
10th Day	1	<0.001*

Median VAS score at 1st POD was 7, at 5th day was 3 and at 10th day was 1. There was significant decrease in Median VAS score at 5th day and 10th day compared to 1st Day VAS score.

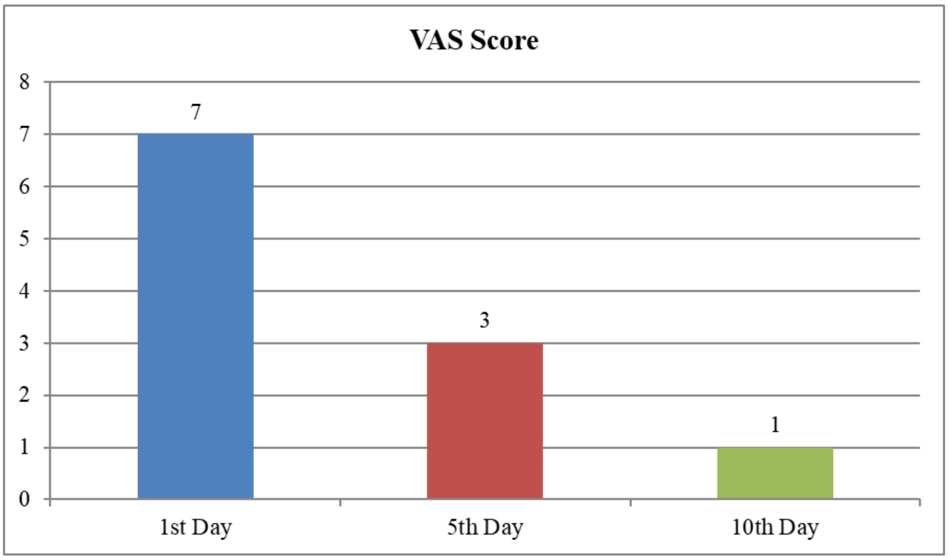

Figure 11: Bar diagram showing VAS Score comparison in operative group

Table 11: ASIA impairment scale in Operative Group at various intervals of followup

		Pre Op		Immediate post op		After 3 months		After 6 months	
		Count	%	Count	%	Count	%	Count	%
ASIA impairment scale	A	1	4.8%	0	0%	0	0%	0	0%
	B	1	4.8%	1	4.8%	1	4.8%	1	4.8%
	C	5	23.8%	2	9.5%	0	0%	0	0%
	D	1	4.8%	5	23.8%	6	28.6%	6	28.6%
	E	13	61.9%	13	61.9%	14	66.7%	13	61.9%

In the study there was improvement in ASIA impairment during follow-up compared to Pre op values.

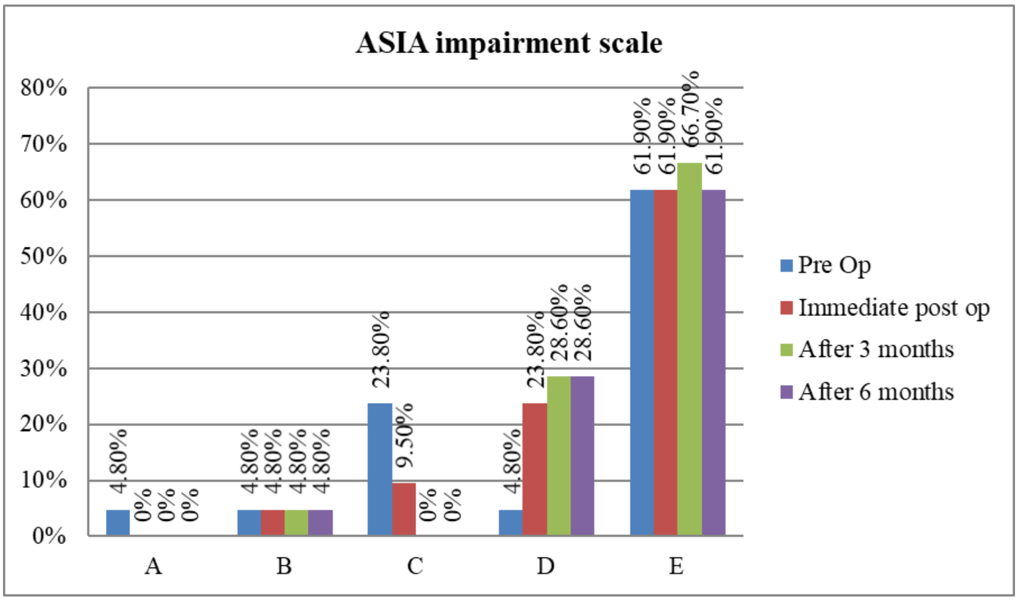

Figure 12: Bar diagram showing ASIA impairment scale in Operative Group at various intervals of follow-up

DISCUSSION

Treatment of thoraco-lumbar fracture is controversial, mostly managed with the concept – no deficit, no surgery. Age old teaching method is to fix thoracolumbar fracture with pedicle screw. But in our institute it's been observed that many of these patients who undergone pedicle screw fixation has deteriorated in terms of development of instability, implant failure subsequent follow up. Hence a departmental project was taken whereby we studied is there any minimal approach which can address all these issues effectively and is there any proper guideline for optimal management of thoracolumbar fracture.

Over the last 3 decades, multiple thoracolumbar injury classifications, such as Denis 1983, Magerl et al. 1994, McCormack et 1994, AO system, have been designed to help guide treatment and facilitate clear communication between treating physicians, researchers, and trainees[9,12].

Recent studies have raised concerns regarding the reliability of both the Denis and the AO systems, two of the more commonly referenced classification systems[12]. 9 subtypes in the AO system and 16 in the Denis system, has only fair reproducibility and has been unable to be clinically validated[9,12]. Furthermore, these systems fails to formally consider the neurological status of the patient, which is often a critical determinant in the need for surgical treatment[2,3,4,9,12]. The Spine Trauma Study Group (STSG) has developed a classification system that has prognostic significance and helps guide treatment decisions (Vaccaro et al. 2005)[2,12]. A severity score is used in conjunction with the classification system to help guide treatment decisions. This classification system has been shown to have good inter- and intra-observer reliability[2,12]. Since its inception in 2002, the Spine Trauma Study Group (STSG) has invested considerable energy in developing a comprehensive classification system for injuries of the thoracolumbar spine, called the Thoraco-Lumbar Injury Classification and Severity (TLICS) scale[12].

Thoracolumbar Injury Classification and Severity Score (TLICS) was devised based on three injury characteristics: 1) morphology of injury determined by radiographic appearance, 2) integrity of the posterior ligamentous complex, and 3) neurologic status of the patient[2,12]. The morphology of thoracolumbar injury is determined from a combination of radiographs, CT scans, and MRI[2,12]. Three morphologic descriptors similar to that described in the AO thoracolumbar injury classification: 1) compression, 2) translation/rotation, and 3) Distraction[2.]. Rotation or translation injuries result from shear or torsional forces on the spine[12]. Rotational instability is best demonstrated by horizontal rotation of the spinous processes and pedicles, visible on the anteroposterior radiograph and the axial CT images[12]. Distraction results in a circumferential separation of the spinal column and is thus an unstable injury[12]. Combinations of the above morphologies should be identified. It is the more severe component of the morphology that is used when determining appropriate treatment[12]. The PLC of the spinal column is comprised of left and right facet capsules, ligament flavum, and interspinous and supraspinous ligaments[2,11,12,13]. Collectively, this complex contributes to spinal stability, serving as the "posterior tension band" of the spinal column[2,12]. Various radiographic findings, including the widening of interspinous distance, transverse fracture of spinous process or lamina, increased local kyphosis, translational deformity, facet joint dislocation/subluxation, and fracture of the articular process, may suggest the presence of a PLC injury[11]. All these findings, however, are indirect signs of PLC injury[11].

James, et al. noted on the basis of their experimental data that the condition of the posterior column, not the middle column, is a better indicator of burst fracture instability[11]. Magnetic resonance imaging is a powerful and reliable diagnostic tool for evaluating PLC injury associated with thoracic and lumbar fractures[11,13]. In terms of the grading system of the American Spinal Injury Association (ASIA) for neurological injury, complete neurological deficits are those defined by ASIA A criteria, while incomplete deficits are those defined by ASIA B, C, or D criteria[12]. The incomplete spinal cord injuries are considered American Spinal Injury Association (ASIA) B, C, and D, while the complete injuries are considered ASIA A[2]. In the presence of multiple contiguous or non-contiguous injuries, only the most severely involved level is scored, the highest one when multiple morphologic features are present[2,12]. However, the most controversial fracture, a thoracolumbar burst fracture with a possible PLC disruption in a neurologically intact patient, is awarded 4 points, leaving no definitive treatment recommendation[9]. The interobserver reliability of identifying an injury to the PLC, a crucial factor in the need for surgery in borderline cases, remains poor[9]. The ability of TLICS to provide guidance for these patients has been criticized as the major flaw of the system as well as other contemporary classification systems[9].

The TLICS system is also helpful in guiding the surgical approach[12]. The two most important categories to consider when planning the surgical approach are integrity of the PLC and neurologic status[2,12]. The general principles are: 1) an incomplete neurologic injury generally requires an anterior procedure if neural compression from the anterior spinal elements is present following attempts at postural or open reduction; 2) Because of the poor healing capability PLC disruption generally requires a posterior procedure; and 3) a combined incomplete neurologic injury and PLC disruption generally requires a combined anterior and posterior procedure[2,12]. Although one aim of this protocol for surgical treatment is to decompress neural elements in the presence of neurological deficit, the need to do so remains a matter of debate[12]. Principles of surgical approach cannot be substituted for a surgeon's experience with a given approach as it is conceded that various approaches may be used successfully to treat injuries to the thoracolumbar spinal column[2,12]. Traditional open anterior approaches to the lumbar spine are associated with significant morbidity[1]. Complications associated with open anterior approaches include major vascular injury, pulmonary embolism, postoperative ileus, retrograde ejaculation, incisional hernias, and superficial and deep wound infections[1].

Lin et al(2011) reported many more complications in the anterior approach group than in the posterior group, including twenty-seven cases of hemopneumothorax, two cases of respiratory tract infection, three cases of intercostals neuralgia and thirteen cases of abdominal distension and constipation[10]. Thus, the use of less-invasive and alternative anterior approaches to the lumbar spine has gained popularity[1]. Ozgur et al. First described the effectiveness and safety of the mini-open, extreme lateral, transpsoas approach for access to the lumbar interbody space[1]. A recently described technique for this region is the lateral retro pleural approach that avoids entering into the chest cavity[5].

Radiographic signs of vertebral instability include widening of the interspinous and interlaminar distances, translation of more than 2 mm, kyphosis of more than 20 degree, dislocation, height loss of more than 50 % and articular process fractures[10]. Changes in the kyphotic angle may indicate the degree of instability of the injured spinal segment and progression of deformity[19]. Increasing vertebral body height loss has the potential to contribute to and enhance this instability, which can result in changes in the treatment plan[19]. In the thoracolumbar spine, various studies have shown a kyphotic angle of 15–30 degree or vertebral body height loss of more than 50 % to be associated with instability[19]. Short-segment posterior stabilization are not always satisfactory as predicted[21]. Reported recurrent kyphosis with or without material failure is not uncommon after implant removal[21]. However, studies on this issue are relatively scarce, and the clinical significance of recurrent deformity is uncertain[21]. No consensus has been reached about the ideal treatment approach[10]. The majority of the included trials were small studies with between 25 and 63 participants[10]. Surgical intervention can decompress neural elements, restore vertebral body height, correct angular deformity and stabilize the spine[10]. Stabilization of these injuries has many advantages such as early mobilization and the potential for neurological improvement[8,10]. Anterior and anterolateral decompression and reconstruction have been reported to improve the recovery of patients with neurological deficits due to unstable burst fractures[8].

Increased structural stability has been presented as the justification for the use of higher-risk procedures[8]. The contact areas of the expandable cages were, in general, higher than those of the fixed cages[18]. Corpectomy is performed to restore the load-bearing capacity of the anterior and middle column (in the case of trauma)[18]. Historically, structural autograft has been the material of choice to reconstruct the anterior column, with the most common material being tricortical iliac crest or rib[18]. However, autografts are limited by availability and are frequently associated with complications and donor-site morbidity[18]. Titanium cages (mesh or expandable) are commonly used devices to restore anterior column continuity following vertebral body corpectomies[18]. The main advantage is the ease of insertion because the cage can be expanded to the desired length following initial insertion in a smaller size[18]. Expansion allows compression across the endplate, there is no need to perform a second manoeuvre (either anterior or posterior) to compress the construct[18]. Expandable cages are currently emerging as a viable alternative option for vertebral body replacement in the thoracolumbar spine[18]. Endplate subsidence remains a problem, and several related variables include bone quality, regional anatomy, pre-existing deformity, endplate preparation, and cage alignment, the first two of which the surgeon unfortunately has no control over[18]. Theoretically, the anterior approach offers some benefits such as better canal decompression[5,10]. In contrast, the posterior approach can only support indirect decompression[10]. Gui Jun Xu et.al (2013) meta-analysis showed that canal remodelling was better in the anterior approach group than in the posterior approach group at the final follow-up[10]. However it was not associated with a greater improvement in Frankel scores or a higher incidence of return to work[10]. The anterior approach group was associated with longer operative times, greater blood loss and higher costs; thus, use of the posterior approach could potentially decrease the risks associated with long operative times and greater blood loss and transfusion[10].

CONCLUSION

Our study is the second paper to prospectively use the TLICS to guide surgical and nonsurgical care in the treatment of a consecutive series of patients with thoracolumbar spine trauma. What is currently lacking in the literature is a multicentre prospective analysis with large numbers of patients, comparing the TLICS system to previous classification systems such as the AO or Denis system[12]. Further validation and estimation of reliability will help objectively define how the TLICS will perform in everyday practice[2].

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