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Management of Thoracolumbar Burst Fractures Without Neurological Deficit as per TLICS Guidelines-innovative Miniopen Thoracotomy Approach

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Introduction: Treatment of thoraco-lumbar burst fracture is controversial, mostly managed with the concept – no deficit, no surgery. Both conservative and posterior approach have showed deterioration in terms of development of instability, implant failure. The thoracolumbar injury classification and severity score (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. The purpose of this study is to determine the safety/efficacy of TLICS guidelines in the management of thoroaco-lumbar burst fracture without neurological deficit and the effectiveness of stabilising the thoroaco-lumbar fractures by mini open thoracotomy.
**Methods:** In this prospective cohort study the TLICS scoring system was applied to a consecutive series of 35 patients with thoracolumbar burst fracture without neurological deficit between 2013 May and 2017 March. Single level traumatic burst fracture (T11, T12 & L1) without neurological deficit were included. All pathological fractures, patients with disabling comorbidities like lung pathology were excluded. All patients underwent digital X ray, computed tomography (CT) and magnetic resonance imaging (MRI) scans at admission to identify the morphology of the injury as well as integrity (Fig.1) of posterior ligamentous complex (PLC). Fourteen patients (TLICS>4) underwent mini open-thoracotomy, corpectomy with end plated expandable titanium cage and screw rod construct fixation. Patients were examined for restoration of sagittal and coronal balance, kyphotic correction, neurological deterioration, pulmonary function tests and restoration of diaphragmatic movements.

**Fig.1**
Digital X ray / CT showing the presence of kyphotic angle greater than 20 ° and interspinous distance difference greater than 2 mm, facetial diastasis.

T2 wieghted/STIR image hyperintensity are evidences of PLC injury.

**OPERATIVE STEPS**

Position of the patient, author’s technique of localisation of surgical incision/corridor using C arm, 2 rib cutting technique one underlying the incision and a rib above it.

A plane was developed between left crus of the diaphragm and medial margin of psoas, and extended subperiostealy anteriorly upto 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).
RESULTS

Thirty five patients of single level burst fracture (D11, D12 or L1) without neurological deficits were included in the study. Patients were put into conservative, observant or surgical group based on Thoraco Lumbar Injury Classification and Severity (TLICS) score. All patients were followed for up to 4 years (ranging from 5 months to 4 years).

<table>
<thead>
<tr>
<th></th>
<th>TLICS score</th>
<th>PLC status</th>
<th>No deficit (ASIA E)</th>
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</thead>
<tbody>
<tr>
<td>Conservative</td>
<td>&lt;4</td>
<td>Intact</td>
<td>10</td>
</tr>
<tr>
<td>Observant group</td>
<td>4</td>
<td>Indeterminate</td>
<td>11</td>
</tr>
<tr>
<td>Surgical group</td>
<td>&gt;4</td>
<td>Injured</td>
<td>14</td>
</tr>
</tbody>
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TLICS- Thoraco Lumbar Injury Classification and Severity score
PLC – Posterior ligamentous complex
ASIA- American Spinal Injury Association

Patients in conservative group were managed by strict bed rest for 4 weeks followed by partial mobilisation with Taylor’s brace for next 8 wks. Guarded mobility without Taylor’s brace and parameters of instability were assessed at 3 and 6 months then yearly. Eleven patients had TLICS score 4, were placed in observant group. All of them were considered to have indeterminate PLC injury status. These patients management protocol was essentially same as conservative group except the parameters of instability were assessed after 4 weeks of assuming erect posture or on development of neurological deficits. All the patients in conservative (TLICS <4) and observant (TLICS=4) group had no deterioration in long term follow up of 4 years. Fourteen patients who had TLICS score of 5 points were surgically treated. All of them had radiological evidence of PLC injury. Regarding injury level, 9 patients (25.7%) had LV1 fracture, 3 (8.5%) had DV12 fracture and 2 (5.7%) had DV11 fracture. Follow-up period ranged from 6 to 52 months. Total operation time ranged from 160 to 360 minutes. Intraoperative blood loss varied from 650 ml to 1100 ml. There were no any intraoperative complications observed in this study. There were no conversions to conventional thoracotomy approach. Postoperatively there was no wound infection, or no named complications like compromise in pulmonary function, loculation-infection-empyema of the lungs, restrictive lung disorder, thickening of pleura were observed. In all the patients VAS score, pulmonary function tests, diaphragmatic movement was normalised by 12th post op day. There was no worsening of kyphotic angle, or subsidence of cage.
Methods of objective assessment of pulmonary function tests

Index case LV1 burst fracture without deficits (TLICS score- 5) anterior height loss of 50% & 6% posterior height loss, 40% spinal canal compromise, 20 degree Cobb’s angle

Index case DV12 burst fracture without deficits (TLICS score- 5)

Index case LV1 burst fracture without deficits (TLICS score- 5)

None of the patients required reoperation. Complications directly related to surgery included one patient with postoperative phantom hernia and another patient had cage collapse after 2 months of surgery because of unscrewing of expansion but rest did not have implant failure during postoperative period.
DISCUSSION: Thoracolumbar junction is the commonest site for traumatic fracture. Controversies still exist regarding the classification and scoring systems and their ability to guide for an ideal treatment strategy in thoracolumbar fractures. Arbeitsgemeinschaft für Osteosynthesefragen (AO) Spine System and Thoraco Lumbar Injury Classification and Severity (TLICS) score are the two widely accepted classification systems to guide surgeons in thoracolumbar spinal injury. AO System is a more complex classification system describing more than 50 subtypes of fractures. This complexity limits its clinical utility in daily practice. The AO system is criticized for not considering the severity of neurological damage and posterior ligamentous complex (PLC) injury. In 2005, Vaccaro et al suggested a new classification for thoracolumbar injuries that considered the neurologic status, and the PLC integrity. The authors proposed an injury severity score that could help in the surgical decision-making. The greatest controversy is for the ideal management of unstable burst fractures without neurological deficit. There is no well established data in the literature regarding the superiority of the classification systems for thoracolumbar burst fracture without deficits. Stability depends on the integrity of osseous and ligamentous components of the spine. The PLC is one of the main ligamentous structures that contribute to stability of the spine. It consists of the supraspinous ligament, the intraspinous ligament, the ligamentum flavum, and the facet capsules. The precise diagnosis of PLC status is required for the evaluation of the stability of the injured spine. MRI is most reliable imaging tool for evaluating PLC integrity associated with thoracolumbar fractures. The T2-weighted fat-suppressed MR imaging and Short Tau Inversion Recovery (STIR) sequences are the most useful sequence for diagnosing PLC injury. However radiological evaluation of the PLC status had been debated due to low specificity of abnormal MRI findings. Various radiographic findings in digital X ray and CT scan, like increased local kyphosis, the widening of interspinous distance, translational deformity, facet joint dislocation/subluxation, and fracture of the articular process gives indirect evidence of a PLC injury. The thoracolumbar junction (T11–L1) poses an anatomical dilemma, given the presence of diaphragm and the lower rib cage when performing anterolateral approaches. Formal thoracotomy requires a large skin incision, resection and opening diaphragm, lung retraction. These all can contribute to postoperative impairment of diaphragmatic contraction and pulmonary dysfunction. A diaphragm sparing, minimally invasive lateral extracoelomic approach has been used to approach the thoracolumbar junction by the author.
SUMMARY POINTS: TLICS is safe and effective guideline for treating thoracolumbar burst fractures without neurological deficit. The author’s technique of diaphragm sparing anterolateral approach to thoracolumbar fracture by this innovative miniopen thoracotomy is useful alternative to formal thoracotomy (anterior procedure). Mini open thoracotomy (Anterior approach) to the thoraco-lumbar fractures seems to be a safe therapeutic strategy for ideal stabilisation method.