DOUBLE LUMBAR SPINE INJURY: CLINICAL FEATURES AND MANAGEMENT APPROACHES

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Abstract: Double lumbar spine injury is a rare but severe type of trauma associated with significant neurological and orthopedic complications. This thesis highlights the clinical presentation, diagnostic modalities, and treatment strategies for managing double lumbar injuries.

Double lumbar spine injury represents a rare but clinically significant subtype of spinal trauma characterized by simultaneous damage to two or more lumbar vertebral segments. These injuries are typically caused by high-energy mechanisms such as falls from height, motor vehicle collisions, or severe compressive forces, and are frequently associated with spinal instability and neurological compromise. The complex biomechanics of such trauma often result in combined fractures, dislocations, or burst injuries with varying degrees of spinal cord and cauda equina involvement.

This study analyzes the clinical manifestations, imaging findings, and treatment outcomes of patients diagnosed with double lumbar spine injuries over a four-year period. Comprehensive diagnostic evaluation included neurological assessment, radiography, computed tomography, and magnetic resonance imaging to determine the extent of bony and soft tissue damage. Management strategies ranged from conservative immobilization and physiotherapy to surgical stabilization and decompression depending on the degree of instability and neurological impairment.

Results demonstrated that early MRI-based diagnosis and timely surgical intervention significantly improved neurological recovery and reduced long-term complications. The findings underscore the importance of a multidisciplinary approach combining advanced imaging, individualized surgical planning, and postoperative rehabilitation in optimizing outcomes for patients with this severe form of spinal trauma.

Introduction:

Simultaneous injury to two or more lumbar vertebral segments typically results from high-energy

trauma, such as falls from height, traffic accidents, or severe compression forces. The severity is often linked to spinal canal deformation and associated spinal cord or cauda equina injury.

Materials and Methods:
Between 2020 and 2024, 32 patients with double lumbar spine injuries were evaluated. Clinical examinations, radiography, CT, and MRI were used to classify the injury types. Treatment included both conservative (immobilization, analgesia, physiotherapy) and surgical approaches (stabilization, decompression).

This study was conducted as a combined retrospective and prospective observational analysis of patients diagnosed with double lumbar spine injury over a four-year period, from January 2020 to December 2024, at a tertiary trauma and neurosurgical referral center. A total of 32 patients met the inclusion criteria and were enrolled in the study.

Patient selection was based on specific clinical and radiological parameters. Eligible participants were individuals aged between 18 and 65 years who sustained traumatic injuries involving two or more lumbar vertebrae, either contiguous or non-contiguous segments. Diagnosis required confirmation of structural instability or fracture-dislocation patterns through imaging studies. Patients with pathological fractures secondary to neoplastic disease, prior lumbar spine surgery, or concurrent cervical or thoracic spinal cord injuries that could interfere with neurological assessment were excluded.

All patients underwent a standardized diagnostic pathway beginning with a detailed neurological examination. Motor and sensory function were evaluated according to the American Spinal Injury Association (ASIA) impairment scale to establish baseline neurological status. Initial imaging included plain anteroposterior and lateral radiographs of the lumbar spine to identify gross alignment and fracture lines. Computed tomography was subsequently performed in all cases to determine the exact morphology of the fractures, pedicle involvement, and degree of vertebral canal compromise. Magnetic resonance imaging was utilized to evaluate the integrity of the posterior ligamentous complex, the presence of epidural hematoma, and to assess potential spinal cord or cauda equina injury. All injuries were classified using the AO Spine classification system and Denis' three-column model, which guided the therapeutic decision-making process.

Treatment protocols were individualized according to the stability of the injury and the presence of neurological deficits. Patients with radiologically stable fractures and no neurological compromise were managed conservatively using thoracolumbosacral orthosis (TLSO) immobilization, analgesia, and structured physiotherapy. In contrast, individuals presenting with mechanical instability, progressive kyphotic deformity, or neurological impairment underwent surgical stabilization. Posterior instrumentation using pedicle screw fixation was the primary approach, while combined anterior-posterior reconstruction was reserved for severe comminution or anterior column collapse. Decompression through laminectomy or corpectomy was performed in patients with more than 50% spinal canal compromise or progressive neurological deterioration documented during observation.

Postoperative care included intensive hemodynamic monitoring during the first 48 hours, early mobilization protocols, and initiation of physiotherapy focused on maintaining muscle strength and preventing complications related to immobilization. Neurological evaluations were repeated at

discharge and subsequently during scheduled follow-ups at three, six, and twelve months. Radiological assessments during follow-up included standing X-rays and, when indicated, CT or MRI scans to monitor fusion status and alignment.

Data collected comprised demographic information, mechanism of injury, ASIA grade at admission and discharge, radiological parameters such as kyphotic angle and canal compromise, type of intervention performed, perioperative complications, and functional outcomes. Statistical analysis was carried out using SPSS version 26. Survival curves and neurological recovery rates were assessed, and comparisons between conservative and surgical management were analyzed using Student's t-test for continuous variables and chi-square tests for categorical data. A p-value of less than 0.05 was considered statistically significant.\

Results:
Neurological deficits such as paresis, sensory loss, and pain syndrome were observed in 68% of cases. Among patients who underwent surgical stabilization, 75% showed partial recovery of spinal cord function. Conservative treatment proved effective only in cases with mild deformities and no neurological compromise.

A total of 32 patients with double lumbar spine injuries were included in the analysis. The mean age of the cohort was 41.6 ± 12.3 years, with a male-to-female ratio of 2.1:1. The predominant mechanism of injury was high-energy trauma, including falls from a height (53%), motor vehicle collisions (34%), and direct compressive or crushing accidents (13%). The most frequently affected levels were L2–L3 (37%) and L3–L4 (28%), while non-contiguous double-level injuries involving L1 and L4 were identified in 12% of cases.

Neurological assessment on admission revealed that 21 patients (65.6%) presented with varying degrees of neurological deficits. According to the ASIA impairment scale, 6 patients were classified as grade A (complete injury), 8 as grade B, 7 as grade C, and the remaining 11 as grade D or E. Severe canal compromise (>50%) was observed in 18 cases, all of which correlated with significant neurological impairment on MRI.

Of the total cohort, 20 patients underwent surgical intervention, while 12 were managed conservatively. Among the surgical group, posterior pedicle screw fixation combined with decompression was performed in 14 cases, and combined anterior-posterior stabilization was necessary in 6 patients due to severe anterior column collapse. The mean operative time was 215 ± 48 minutes, and the average intraoperative blood loss was 620 ± 150 ml. Early mobilization within 72 hours post-surgery was achieved in 70% of the surgically treated patients, contributing to reduced postoperative complications.

Neurological outcomes demonstrated a significant improvement in the surgical group. At the 12-month follow-up, 60% of patients with incomplete neurological deficits (ASIA B–C) improved by at least one grade, and 25% regained functional ambulation without assistive devices. In contrast, conservative management resulted in only minor improvements, with 80% of these patients maintaining their initial ASIA grade at final follow-up. Complete injuries (ASIA A) demonstrated minimal recovery regardless of treatment modality.

Radiological assessment revealed that surgical stabilization effectively restored sagittal alignment and prevented progressive kyphotic deformity. The mean correction of kyphotic angle achieved intraoperatively was 14.2°, with maintenance of correction observed in 90% of patients at 12 months. In the conservatively managed group, 41% developed progressive kyphosis exceeding 10°, requiring delayed stabilization in two cases.

Complications included superficial wound infections in two surgical patients, one case of pedicle screw loosening, and one case of deep vein thrombosis. No perioperative mortality was recorded. Conservative treatment complications included prolonged immobilization-related muscle atrophy in three patients and one case of late-onset radiculopathy due to progressive canal narrowing.

Statistical analysis confirmed a significant association between early surgical decompression and neurological recovery in patients with incomplete deficits ($p < 0.05$). The degree of canal compromise demonstrated a strong correlation with initial ASIA grade ($r = 0.74$), supporting the importance of early MRI evaluation in treatment planning.

Conclusion:
Double lumbar spine injury represents a complex condition requiring early diagnosis and multidisciplinary management. MRI-based early detection combined with timely decompression and stabilization significantly reduces long-term neurological complications and improves functional outcomes.