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ORIGINAL ARTICLE

A STUDY OF FUNCTIONAL OUTCOME OF UNSTABLE THORACO LUMBAR SPINE INJURIES TREATED WITH MOSS-MIAMI (PEDICLE SCREWS) INSTRUMENTATION

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ABSTRACT: With the increased incidence of road traffic accidents and industrial trauma, there has been a significant increase in the number of thoraco- lumbar spinal injuries. Decompression and early fusion with instrumentation is a generally accepted treatment method for patients with unstable injuries and with a neurological deficit; it helps in early mobilization, and avoids the complications of prolonged recumbency. The pedicle screw-rod system is versatile in that it stabilizes the three columns of the spine. The pedicle is the strongest part of the vertebra and is the force nucleus of the vertebral body. Through the pedicle all forces are transmitted from posterior elements to the vertebral body. Therefore, by fixation of the vertebral body through the pedicle, significant strength of the entire vertebral complex is possible. In our study we operated on 28 patients of unstable thoraco-lumbar injuries, where we performed Moss-Miami instrumentation (pedicular screw rod fixation). All the cases were followed up for a minimum of one year. In all these cases we had favorable results. There was a reduction of an average pre-op kyphotic angle of 15.8º to an average post-op kyphotic angle of 6.6º. We also noted significant neurological improvement as assessed by Frankel grading. In this study, we found that the transpedicular fixation with screws and rods system is effective in the treatment of unstable thoracolumbar spinal injuries. Although the prognosis of the neurological injury seems to be largely determined at the time of trauma, surgical decompression will definitely improve the neurologic deficit in incomplete cord injuries. Cases where there is complete neurologic deficit with no hope for recovery, will also be benefited from surgical fixation in terms of early mobilization and rehabilitation.

KEYWORDS: Thoraco-Lumbar Spine, Pedicle, Screw Fixation.
MeSHTERMS: Thoraco-Lumbar Spine, Pedicle, Screw Fixation.

INTRODUCTION: With the advent of increased incidence of road traffic accidents and industrial trauma, there has been a significant increase in the number of thoraco- lumbar spinal injuries.[1] Management of these spinal fractures is one of the most controversial areas in modern spinal surgery. Decompression and early fusion with instrumentation is a generally accepted treatment method for patients with unstable injuries and with a neurological deficit; it helps in early mobilization, and avoids the complications associated with prolonged recumbency, of conservative regimen.

The goals of surgical treatment are to get effective decompression of the spinal canal with adequate reduction, healing of the spine without deformity, limitation of movement, instability and pain, with early mobilization and rehabilitation.[2]

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The pedicle screw-rod system is versatile in that it stabilizes the three columns of the spine. The pullout strength of the pedicle screws depends on the diameter of the screw and its cortical purchase within the pedicle. Hence pre-operative assessment of the screw length and diameter, is very essential. CT and MRI have proved invaluable in the evaluation of thoracolumbar injuries, CT -helps in assessing the integrity of the posterior aspects of the vertebral body and posterior osseous elements. Retropulsion of bone fragments into the spinal canal can be clearly seen on traverse sections. Sagittal and coronal reconstructions are helpful in evaluating the alignment of the spinal canal.

MRI is indicated in all cases with neurologic deficit to access both intrinsic and extrinsic cord injuries. MRI differentiates among the various types of intrinsic cord injuries, such as edema, hematoma, and the much less frequent cord transection.

MATERIALS AND METHODS: From 2010 to March 2015, 66 patients with dorso-lumbar spine injuries were admitted in our hospital. Among these 66 cases, 28 cases of unstable thoraco-lumbar injuries were selected for posterior stabilization, where we performed Moss-Miami instrumentation (pedicular screw rod fixation). All the cases were followed up for a minimum of one year.

20 patients were males and 8 were females. The most common age group affected was 30-40 yrs. Fall from height was the most common cause of injury (19 patients) followed by road traffic accidents (9 patients). Regarding the level of injury, the most common was D12- L1.

The fractures were classified according to the Denis classification and included 16 unstable burst fractures, 4 unstable flexion-distraction (chance) fractures, 3 unstable fracture dislocations and 5 unstable wedge compression fractures. Neurological function was determined on initial examination, postoperatively, and at follow-up based on the system suggested by Frankel et al.

The lapse of time between trauma and surgery ranged from 1to 4 weeks with an average of 10 days.

Indirect decompression via ligamentotaxis was done for 12 patients. Direct decompression via laminectomy was done for the rest of our patients.

We reserved the non-operative treatment in thoraco lumbar trauma for those injuries that are considered to be stable without the potential for progressive deformity or neural compression with ambulatory treatment and external immobilization.

Operative management is indicated in: 1. unstable fractures with the potential risk for further neurological compromise. 2. Patients with complete neurologic deficit where surgical Stabilization allows more rapid mobilization and early rehabilitation.[3,4,5]

OPERATIVE TECHNIQUE: All patients were operated in the prone position. Hips and knees were moderately flexed to prevent stretching of the nerve roots. The transverse process and the facet joint are clearly exposed. In the thoracic spine, the point of entry is just below the rim of the upper facet, 3mm lateral to the center of joint near the base of the transverse process. The screw should be angled 7° to 10° towards the midline and 10° to 20° caudally. In the lumbar spine the long axis of the pedicle pierces the lamina at intersection of 2 lines- a vertical line which

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is tangential to the lateral border of the superior articular process and a horizontal line which bisects the transverse process. This point of intersection lies in the angle between the superior articular process and base of the transverse process. The screws should converge by 5° at the dorso-lumbar junction and by 10 to 15° as one progress from L2 to L5.

Direct decompression was done for patients with severe neurological impairment and when the encroachment of spinal canal was more than 50%. Indirect decompression through ligamentotaxis was done for the rest of the patients. Rod contouring was done according to the level of fixation, which aids in correction of the deformity.

RESULTS: We had favorable results using Moss-Miami instrumentation. There was an average pre-op kyphotic angle of 15.8º (ranging between 6º to 30 º). Post operatively the average kyphotic angle was reduced to an average of 6.6º. On follow up kyphotic angle was maintained in most of the cases with an average loss of correction of only 2º.

Average canal diameter was 8.1mm which increased to 13.2 mm postoperatively.

In 6 cases where kyphotic angle was more than 20º with Frankel grade A, Post-operatively they were improved to grade E in 2 cases, grade D in 2, grade B in one case and one case remained at Frankel grade A without improvement. 2 cases where kyphotic angle was more than 20º with Frankel grade C, improved to Grade E.

In 10 to 20º group, there were 2 cases of Frankel grade A, one Frankel grade C and one Frankel grade D which improved to grade E in 2 patients and Grade B in one, and remained unchanged at grade A in one.

In <10º group there were 4 cases of grade C and one of grade A which improved to grade E in 3 and grade D in 2. We observed that there were more Frankel grade A patients in the >20º group and the maximum neurological improvement was observed in the < 10º group. This could be due to less severe cord injury initially.

Many complications of pedicular screw fixation are described in literature. In our series, we had screw misplacement in 2 cases. However we did not encounter complications of root irritation, CSF leakage. We had one case of screw loosening on follow up which presented with back ache. We removed this implant at 6 months. One case had superficial wound infection.

There was unavoidable delay of about 4 weeks in few cases for surgery, but even in these cases the correction of kyphotic angle was good with Moss-Miami instrumentation and neurological improvement was observed to be equally good as in early surgery.

DISCUSSION: Dorso lumbar spine injuries have become common in the last 2 decades. The concept of treatment of unstable thoraco-lumbar injuries has evolved from conservative to open reduction and internal fixation.

The pedicle is the strongest part of the vertebra and is the force nucleus of the vertebral body. Through the pedicle all forces are transmitted from posterior elements to the vertebral body. Therefore, by fixation of the vertebral body through the pedicle, significant strength of the entire vertebral complex is possible.[6,7]

In the treatment of fractures of the spine, pedicle screws allow easy manipulation and reduction of displaced vertebrae, even if the posterior elements are fractured. Their use facilitates

decompression of the neural elements by distraction, avoiding the need for laminectomy, and permits stabilization of the segments without the requirement to extend fixation much beyond the injured area. Moss-Miami system acts as a posterior tension band based on intact anterior and posterior spinal ligaments and intact facet joint acting as fulcrum in cases of burst fractures.

Since anterior spinal instrumentation involves more risk, the posterior stabilization has become more popular as it involves indirect reduction and fixation of the spine.[8,9]

Bio-mechanically double cortical purchase is better than unicortical purchase.[10] But, most of the surgeons avoid double cortical purchase in dorso-lumbar spine for the fear of injuring major vessels.

In general distraction instrumentation is used for compression injuries with intact posterior elements and compression constructs are used for flexion-distraction injuries.[11,12]

Spinal canal intrusion by bone or soft tissue fragments requires surgical decompression. Most often compression occurs anteriorly in the spinal canal due to retropulsion of bone or disc fragments from the middle column. This can be addressed either directly or indirectly. Direct posterior decompression by laminectomy needs retraction of the dural sac to reach the fragments. This can cause damage to the spinal cord and conus medullaris. Hence, the safe region for this type of decompression is at the level of L2 and caudally.[13] Indirect decompression is done by distraction using pedicle screw and rod instrumentation in the thoraco- lumbar spine which uses the principle of ligamentotaxis.[14]

Posterior compression by lamina fragments can also occur which can be easily addressed by laminectomy.[15]

In our study the spinal canal encroachment of at least 50% was invariably associated with a neurologic deficit suggesting that there is a significant correlation between these two.

In this study, we found that the transpedicular fixation with screws and rods system is effective in the treatment of unstable thoraco lumbar spinal injuries. Although the prognosis of the neurological injury seems to be largely determined at the time of trauma, surgical decompression will definitely improve the neurologic deficit in incomplete cord injuries. Translational and rotational injuries resulting in complete neurologic deficit with no hope for recovery,will also be benefited from surgical fixation in terms of early mobilization and rehabilitation.

BIBLIOGRAPHY:

1. Denis, Francis: the three-column spine and its significance in the classification of acute thoracolumbar spinal injuries. Spine, (1983), 8: 817.
2. Aebi, M; Etter, C.; Kehl, T and thalgott. J.: the internal skeletal fixation system. A new treatment of thoracolumbar fractures and other spinal disorders. Clin. Orthop., (1988), 227: 30.
3. Steffee, D.: Biscup, R.S. and sitkowski, D.J.: spine plates with pedicles screw fixation. Clin. Orthop., (1986),203: 45.126.
4. Roy- Camille, R; Saillant G. and Mazel, C: internal fixation of the lumbar spine with pedicle screw planting. Clin. orthop. (1986), 203; 7.

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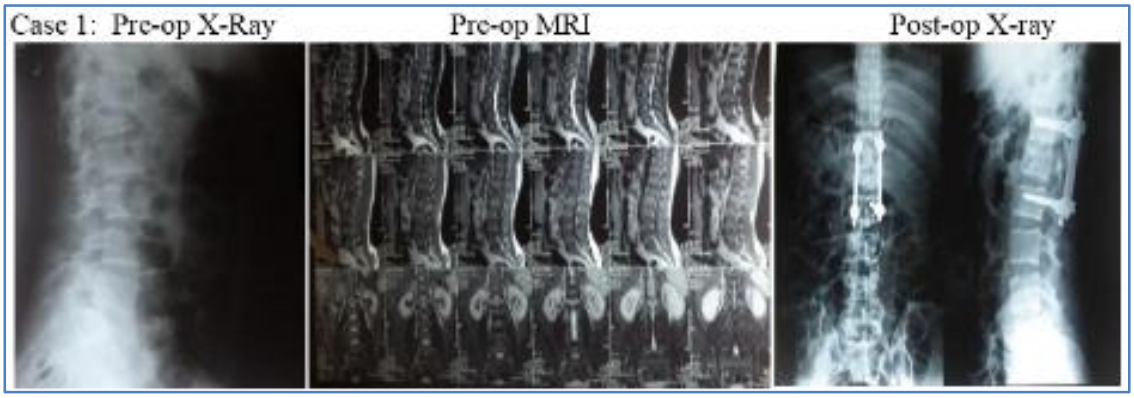
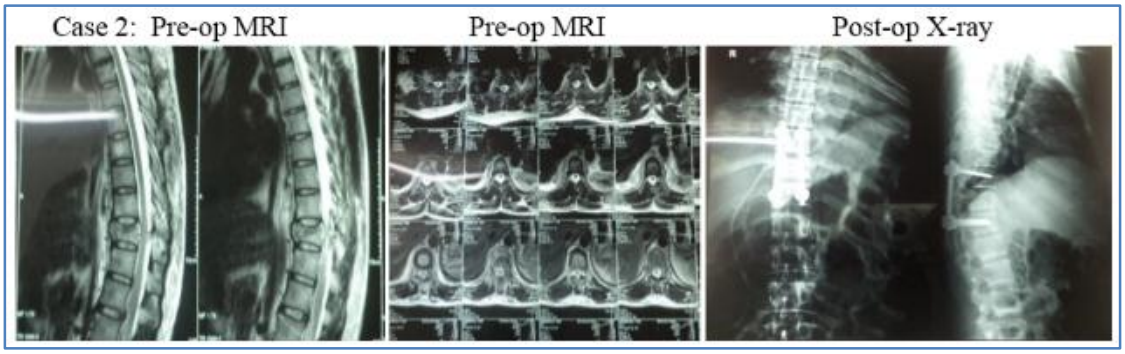
5. Roy-Camille, R; Saillant G.; and Mazel, C: Planting of thoracolumbar and lumbar injuries with pedicle screw plates. Orthop. Clin. North Am., (1986), 17: 147.
6. Sanderson, P.L.; Fraser, R.D.; hall, D.J; et al.: short segment fixation of thoracolumbar burst fracutes without fusion. Euro. Spine. J., (1999), 8(6): 495.
7. Aebi, M.; Mohler, J.; Zach, G. and Morscher, E: analysis of 75 operated thoracolumbar fracture dislocation with and without neurological deficit.Arcives of orthoprdic and traumatic surg., (1986), 105: 100.
8. Sjostrom L., Karlstorm J., Pech p, and rausching w.: indirect spinal canal decompression in burst fractures treated with pedicle screw instrumentation. Spine (1996), 21: 113.
9. Rohlmann A.; Bergann G.; Graichen F.: abd Neff G.: braces do not reduce loads on internal spinal fixation devices. Clin. Blomech., (1999), 14(2); 97.
10. Liu C.L; Wang S.T.; Lin H.j.; et al>: AO fixateur interne in treating burst fractures of the thoracolumbar spine. Chungas. Hua. L. hsueh. Tsa. Chih. Taipei., (1999), 62(9): 619.
11. American Spinal Injury Association (ASIA), 2006. American Spinal Injury Association. 2006.
12. Botte et al., 1996. Botte MJ, Byrne TP, Abrams RA, et al: Halo skeletal fixation: techniques of application and prevention of complications. J Am Acad Orthop Surg 1996; 4: 44.
13. Bracken, 2001. Bracken MB: Methylprednisolone and acute spinal cord injury: an update of the randomized evidence. Spine 2001; 26(24 suppl): S47.
14. Broom and Jacobs, 2002. Broom MJ, Jacobs RR: Update 1988: current status of internal fixation of thoracolumbar fractures. J Orthop Trauma 2002; 3: 148.
15. Chipman et al., 2004. Chipman JG, Deuser WE, Beilman GJ: Early surgery for thoracolumbar spine injuries decreases complications. J Trauma 2004; 56: 52.





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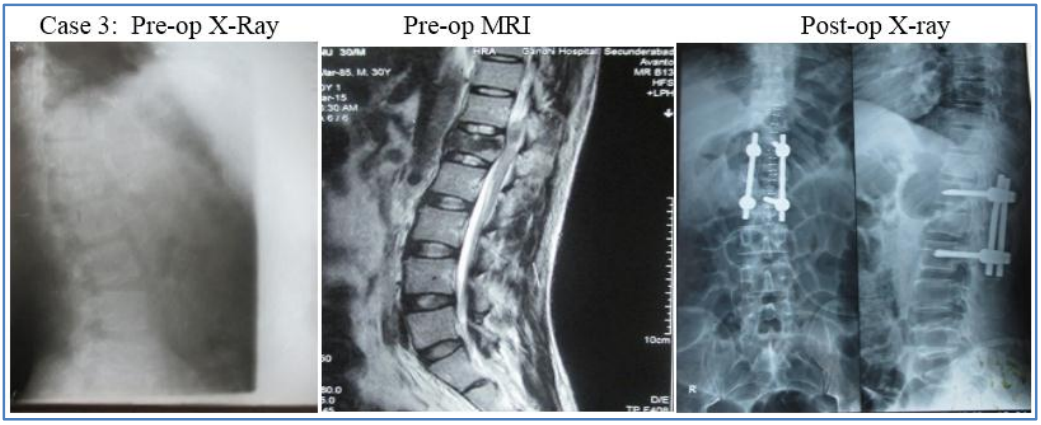

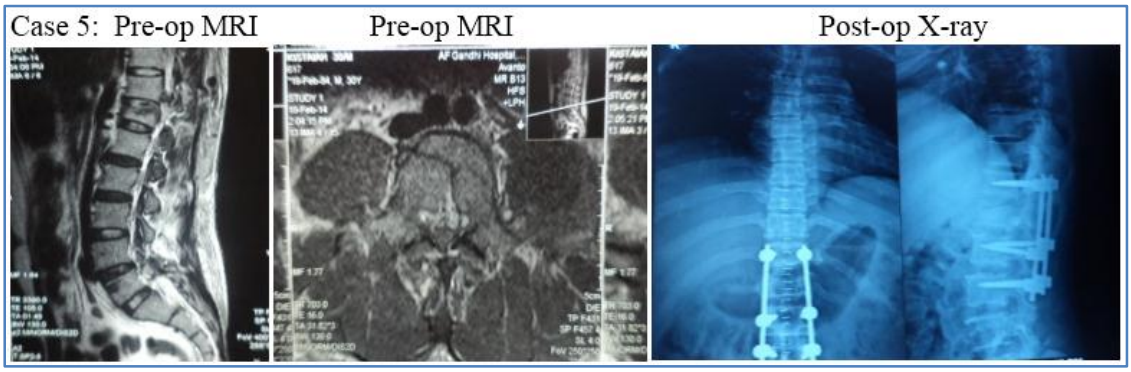

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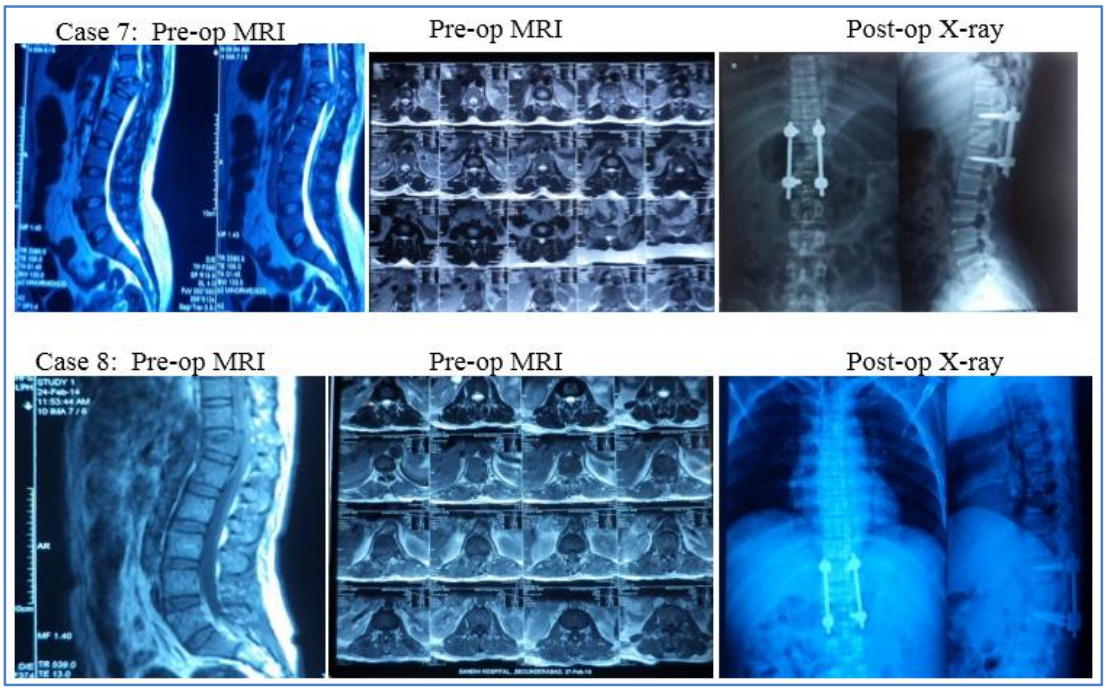

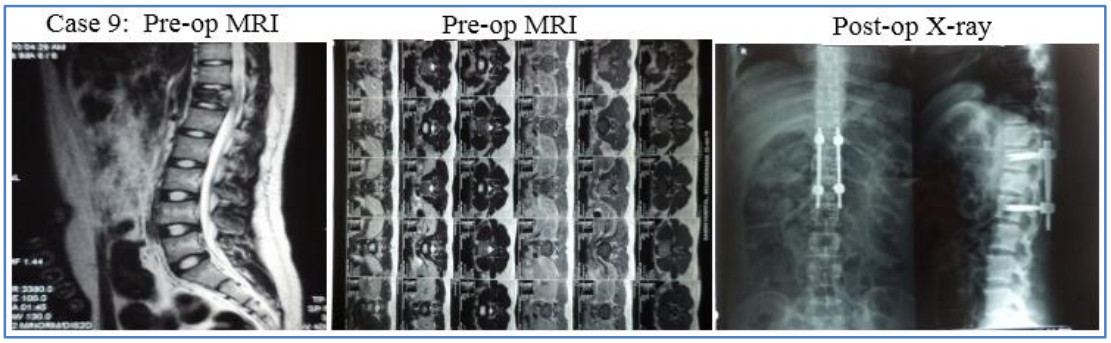

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