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Pedicle screw fixation in the lower cervical spine: Case series

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Abstract
Background: Pedicle screw fixation of lower cervical spine is a new technique that provides an alternative to posterior lateral mass plating. Although biomechanical studies suggest the use of pedicle screws to reconstruct the cervical spine, placing screw in small cervical pedicle poses a technical challenge. Penetreation of screw in pedicle is a primary complication associated with screw insertion in the lower cervical spine.
Aim and Objective: To manage the cervical spine injuries by pedicle screw presented to department of Orthopaedics, BPKIHS, Dharan.
Materials and methods: This is retrospective interventional study done at the department of Orthopaedics, B.P. Koirala Institute of Health Sciences, Dharan, Nepal over a period of 2 years from March 2012 to April 20014. A total of 55 patients with cervical spine injuries were treated by pedicle screw. The patient's age ranged from 20 to 60 years and the mean follow-up was 12 weeks.
Results: The study comprised of 55 patients with cervical spine injuries were treated by pedicle screw The age incidence in this series ranged from 20 years to 60 years. 40 patients were males and 20 was female. All had fractures or fracture dislocation at different levels of lower cervical spine. The mechanism of injury included falls from height (80%), motor vehicle accidents (18%) and sports related injury (2%).
Discussion: Pedicle screw insertion into the pedicles in the lower cervical spine is technique that requires a solid knowledge of 3-dimensional anatomy of cervical spine and experience of pedicle screw fixation in thoracolumbar spine. The biomechanical advantages of pedicle screw fixation in cervical spine is obvious, but data are limited. However, safety and role of pedicle screw fixation in reconstruction in the lower cervical spine have not been defined.
Conclusion: It is indicated in patients with osteoporotic bone or when rigid internal fixation can not be achieved by conventional techniques.

Keywords: Cervical pedicle screw, lower cervical spine, lateral mass

Introduction
The indications for surgical stabilization of cervical spinal fractures and dislocations have been controversial. However, at the present time; in cases of neurological involvement most investigators recommend surgical reduction, decompression, and stabilization. For the traumatic unstable cervical spine, spinal instrumentation, e.g., anterior cervical plate, spinous process wiring, Luque SSI, posterior plate-screw fixation, and others are available for immediate stabilization of the unstable segment Pedicle screw fixation of lower cervical spine is a new technique that provides an alternative to posterior lateral mass plating. Although biomechanical studies suggest that use of pedicle screws to reconstruct the cervical spine, placing screw in small cervical pedicle poses a technical challenge but Biomechanically possible.Penetration of screw in pedicle is a primary complication associated with screw insertion in the lower cervical spine. Cervical pedicle screw should be indicated in patients who have osteoporotic bone or when rigid internal fixation cannot be achieved by conventional techniques. Indications include Trauma Unstable fracture, Reconstruction, Tumor, osteomyelitis, Inflammatory disease like rheumatoid arthritis, Degenerative conditions, Combined posterior decompression, Adjunct multilevel fixation, Pediatric spine, Congenital malformations.

Aim and Objective

To manage the lower cervical spine injuries by pedicle screw in patients presented to department of Orthopaedics, BPKIHS, Dharan and to report the early results in 55 cases of lower cervical spinal injuries treated by transpedicular screw fixation, to describe our indications and techniques, and to recommend this procedure for more extended cervical disorders in addition to traumatic lesions

Materials and methods

It is retrospective interventional study. The Study period 2 years from March 2012 to April 2014. A total of 55 patients with lower cervical spine injuries attending B.P. Koirala Institute of Health Sciences, Dharan were included in the study and treated by pedicle screw. The patient's age ranged from 20 to 60 years and the mean follow-up was 12 weeks. The Mean follow-up: 12-24 weeks.

Preoperative Management

Patients were immobilized with a Philadelphia collar initially in Emergency. Cervical traction with tongs was applied once patients shifted to ward. Plain X-rays anteroposterior (AP) and lateral films and MRI were performed in all cases. Myelography was not done

Surgical Procedure

After intubation, patients were put into the prone position. The head was taped to the headrest with the cervical spine maintained in a neutral position, and the shoulders were pulled caudally by a heavy bandage for intraoperative lateral radiograph imaging of the lower cervical spine. A posterior midline skin incision was made, and the paravertebral museles were dissected latera1ly to expose the lateral margins of the compromised facet joints. Because the insertion angle of the screw was intended to be 30-40 degree medially to the midline in the transverse plane, a longer skin incision was required than for a standard spinous process wiring procedure. The point of screw penetration at the posterior cortex of the articular mass was determined slightly lateral to the center of the articular mass and close to the posterior margin of the superior articular surface, taking into consideration. the location of the vertebral artery, the spinal cord, and the pedicle (Fig. IA). Before inserting the screws, the cortex at the point of insertion was penetrated with a high-speed burr and the entrance hole was enlarged to proper size to bury the screw anchor into the articular mass. After creating the screw insertion hole, the entrance of the pedicle was visible directly (Fig. 2A). A small nerve retractor was used for a pedicle probe, and the inner wall of the pedicle cavity was palpable with the retractor. The direction and the insertion depth of the retractor and the screw were confirmed by the intraoperative lateral image intensifier. In the patients with facet interlocking and those with articular process fractures, the infero medial portion of the upper pedicle and the superomedial portion of the lower pedicle were palpable with the nerve retractor through the defect created by excision of the articular processes. The intended angle of the screws based on measurements of preoperative CT images was 30-40 degree medial to the midline in the transverse plane (Fig. IB), and parallel to the upper end-plate in the sagittal plane. Drilling of the pedicle was not performed to avoid neurovascular injuries. Decortication of the lamina and spinous processes was performed after completion of the instrumentation. Finally, capped bones were routinely placed between the spinous processes and on the remaining exposed facet joint and laminae.

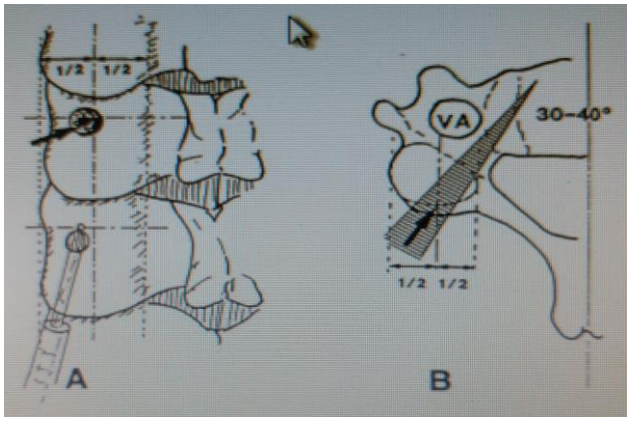


Fig 1A-B: Landmark for placement of screw insertion holes. Direction of Screw showing its relation to the articular facet

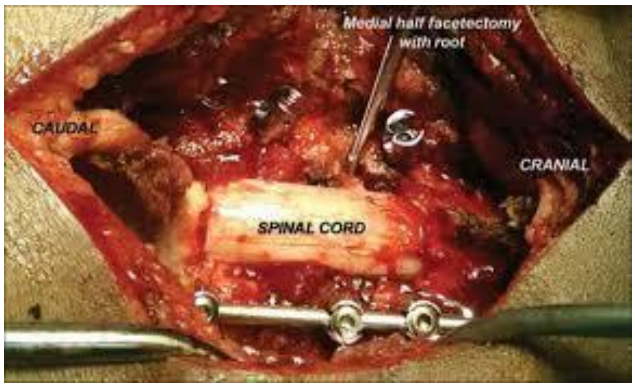


Fig 2A-B: Direct exposure of pedicle cavity in screw insertion Hole. Completion of instrumentation and bone graft.

Postoperative Management and Clinical Evaluation

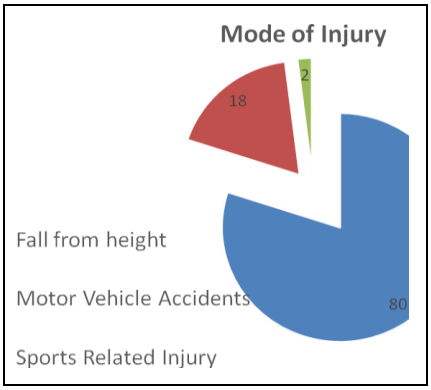
Postoperative immobilization varied according to the patient's neurological status, general condition, and type of employment. Patients with severe spinal cord lesions (Frankel grade' A or B) started their rehabilitation 5-10 days after surgery without any external support. Patients with mild nerve lesions (Frankel grades C and D, and radiculopathy) were allowed to ambulate with a soft neck collar the day after surgery. Frankel B patients returned to their original jobs 3-6 weeks after surgery, before bony union was complete. The collar was worn for 8 weeks who returned to heavy work. However, the collar was worn only for 2-3 weeks in patients who returned to light work. Follow-up physical examinations and radiographic evaluations were performed on all patients. To assess stability and deformity, flexion-extension and oblique x-ray films were obtained in all patients 3, 6, 9, and 12 months after surgery and if possible at 18 and 24 months Bony union was evaluated independently. An assessment of solid union was made on the basis of the presence of a homogeneous fusion mass on lateral x-ray film

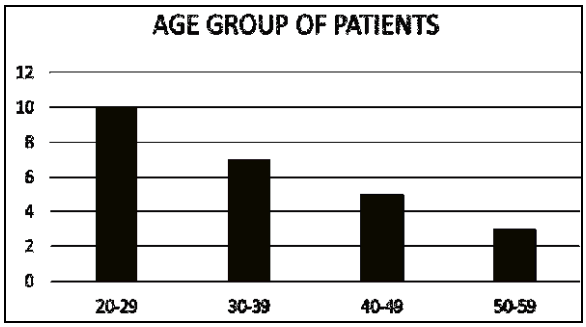
Results

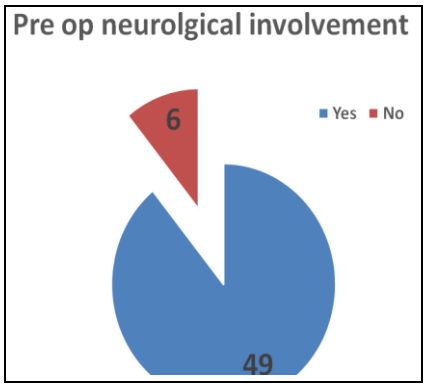
The study comprised of 55 patients with cervical spine injuries were treated by pedicle screw. The age incidence in this series ranged from 20 years to 60 years. 40 patients were males and 20 was female. All had fractures or fracture dislocation at different levels of lower cervical spine. The mechanism of injury included falls from height (80%), motor vehicle accidents (18%) and sports related injury (2%). deficit 49 had neurological deficit at the time of injury, 6 had no neurological involvement Pre op.

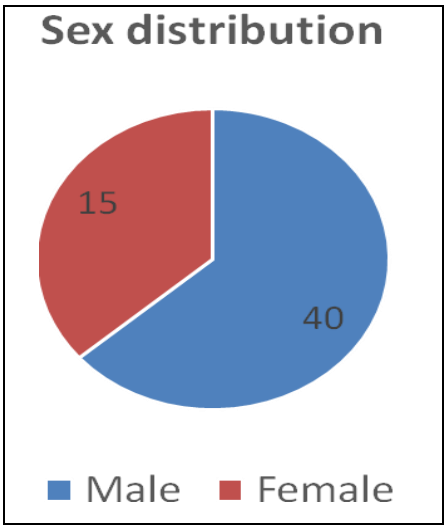
47% had static neurological status, 53% had documented improvement post op recovery

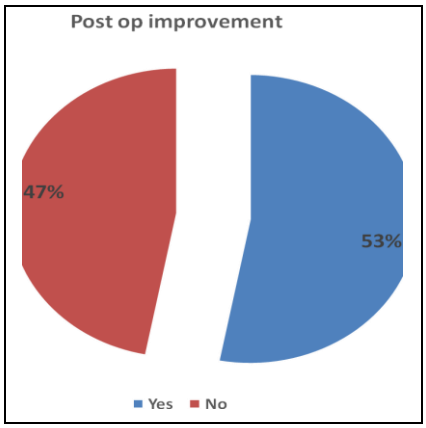
At the latest follow-up, all cases had solid bony union. There were no cases of implant component, connection, or bone interface failure. Kyphotic and translational deformities were satisfactorily corrected, and the correction was maintained in FIG.3. There were no complications involving the spinal cord, nerve roots, or vertebral artery. Assessment of screw placement into die pedicle by postoperative CT images was difficult because of the metal artefacts, but the direction of the inserted screw could be assessed. The angle of the inserted screws ranged from 25° to 45° medial to the midline in the transverse plane.











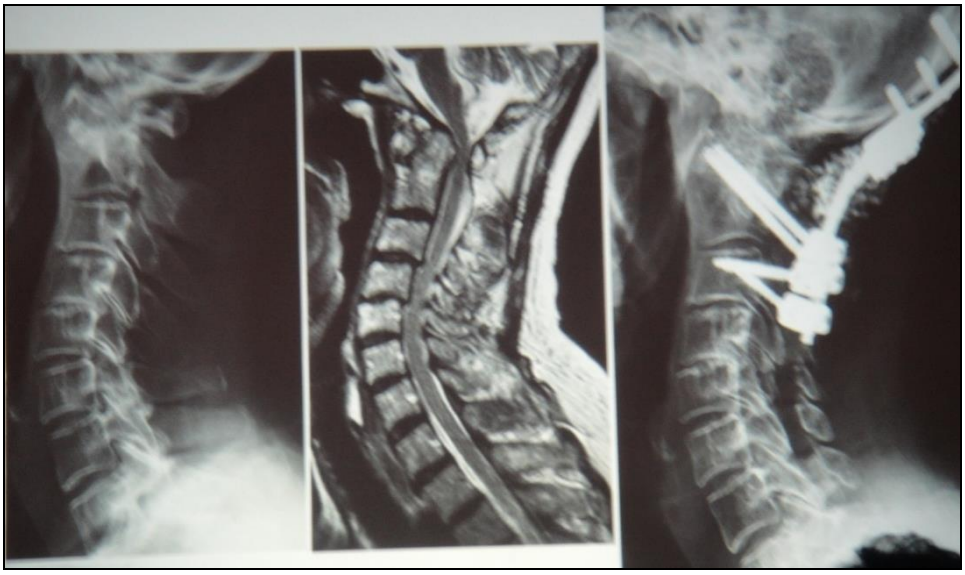


Fig 3: Pre –Operative and Post Operative Pics

Fig 4

Discussion

Surgical decompression and stabilization is required to treat most of the cases of cervical spinal injuries with neurological impairment. The decompression and stabilization procedure should differ depending on the pathology in each case.

At the present time, spinous process wiring, posterior plating, Luque SSI, and other techniques are available to stabilize the unstable cervical spine posteriorly. However, based on biomechanical studies, none of these fixation devices provides adequate stability in the combined anterior and posterior disco ligamentous cervical injury model, except for flexural stability results provided by posterior hook-plate. According to the results of the biomechanical studies of posterior plate fixation by Gill *et al*. [8] and Montesano *et al*. [16], bicortical screws provide the better stabilizing effect than did unicortical screws. However, the stiffness provided by bicortical screws did not exceed that produced by spinous process wiring. Furthermore, screw insertion into the lateral portion of the articular mass exposes the spinal nerves or vertebral artery to injury and sublaminar wiring places the cervical spinal cord at risk, especially in cases of narrowed spinal canal. Based on biomechanical studies, among established stabilizing procedures, only the combination of anterior and posterior instrumentation can be expected to provide sufficient stability for an extremely unstable cervical spine without major external support. Transpedicular screw fixation systems have been developed for the thoracic and lumbar spine, and their excellent stability and strength allows the patients to walk immediately after surgery without any external support. Despite the perceived risks of thoracic and lumbar transpedicular screw placement, exact knowledge of the anatomy of the pedicle and careful surgical techniques allow safe placement. Except for pedicular screwing of C2 by Roy-Camille transpedicular screw fixation in the cervical spine has not been performed for fear of injuring the vertebral artery, spinal cord, and nerve roots. Roy-Camille stated that screwing into the C3 to C6 pedicle would be an unacceptable risk. However, the pedicle of the cervical spine is a strong structure of the vertebra, as in the thoracic and lumbar spine. Thus, the stability obtained by transpedicular screw fixation in the cervical spine should be equal to or greater than that achieved by combined anterior and posterior instrumentation. However, further comparative biomechanical study is needed to assess the stabilizing effect by this procedure precisely.

The most severe complication of transpedicular screw fixation of the cervical spine is injury of the vertebral artery or spinal cord. Such complications, which could be fatal, should be completely prevented by exact screw placement into the pedicles. In some patients, especially in females, the diameter of the pedicles is too small to insert a screw.

Direct exposure of the pedicle cavity by creation of a hole at the insertion points and the use of pedicle probe and image intensifier are essential to the safety and success of cervical pedicle screw placement. In addition, we recommend confirmation of the location of the medial, superior, and inferior surfaces of the pedicles with a small nerve retractor, if possible, in cases in which facetectomy and or laminotomy has been performed

Transpedicular screw fixation with its stability and strength, appears to be a useful stabilizing procedure for the reconstruction of the injured cervical spine without destruction of the pedicle or vertebral body

From a review of this study, the stiff internal stabilizing effect of transpedicular screw fixation precludes the need for additional anterior surgery and postoperative external support even for extremely unstable cervical spines. The procedure allowed easy nursing care, early ambulation and rehabilitation, and early return to the patient's previous job. There were no pseudarthroses or complications involving the vertebral artery, spinal cord, or nerve roots. Direct exposure of the pedicle cavity before screw placement and the help of an image intensifier adequately confined screw insertion. However, this surgical procedure is associated with some risks of major neurovascular injuries. Therefore, it requires precise knowledge of the anatomy of the cervical spine and meticulous surgical techniques, and should be performed only by the surgeons experienced both in transpedicular screw fixation in the thoracic and lumbar regions and in surgery of the cervical spine.

Pedicle screw insertion into the pedicles in the lower cervical spine is technique that requires a solid knowledge of *3*-dimensional anatomy of cervical spine and experience of pedicle screw fixation in thoracolumbar spine. Based on technique described by Abumi and colleagues and Abumi and Keneda, Pedicle screw in lower cervical spine can be performed under fluroscopy. Although pedicle screw is strongest construct - 5 time stronger than LMS & he biomechanical advantages of pedicle screw fixation in cervical spine is obvious, but data are limited. However, safety and role of pedicle screw fixation in reconstruction in the lower cervical spine have not been defined.

Conclusion

As our results are very promising, it may be indicated in patients with osteoporotic bone or when rigid internal fixation cannot be achieved by conventional techniques.

References

1. Abumi K, Itoh H, Taneichi H, Kaneda K. Transpedicu1ar screw fixation for traumatic lesions of the middle and lower cervical spine: Description of the techniques and preliminary report. J Spinal Disord. 1994; 7:19-28.
2. An HS, Gordin R, Renner K. Anatomic considerations for plate screw fixation of the cervical spine. Spine. 1991; 16(10):S548-S55 I.
3. Coe JD, Warden KE, Sutterlin III CE, McAfee PC. Biomechanical evaluation of cervical stabilization methods in a human cadaveric model. Spine. 1989; 14:1122-1131.
4. Cotterill PC, Kostuik JP, D' Angelo G, Maki BE. The anatomical comparison of the human and bovine spine. J Orthop Res. 1986; 4:298-303.
5. Daniels DL, Hyde JS, Kneeland JB. The cervical nerves and foramina: Local-coil MRl imaging. Am J NeuradioI. 1986; 7:129-133.
6. Esses SI, Sachs BL, Dreyzia V. Complications associated with the technique of pedicle screw fixation. A selected survey of ABS Members. Spine. 1993; 18:2231-2239.
7. Fredrickson B, Yuan H. The Lumbar Spine: Internal Fixation: Indications, Technique, and Results. The International Society for the Study of the Lumbar Spine. Vo12. Philadelphia, WB Saunders, 1996, 12-18.
8. Gurr KR, McAffee PC, Shih CM. Biomechanical analysis of posterior instrumentation systems after decompressive laminectomy: An unstable calf-spine model. J Bone Joint Surg. 1988; 70A:680-691.
9. Jovanoic MS. A comparative study of the foramen transversarium of the sixth and seventh cervical vertebrae. Surg Radiol Anat. 1990; 12:167-172.
10. Kotani Y, Cunningham BW, Abumi K, McAfee PC. Biomechanica1 analysis of cervical stabilization systems. An assessment of transpedicular screw fixation in the cervical spine. Spine. 1994; 19:2529-2539.
11. Krag MH. Biomechanics of Transpedicular Screw Fixation. In Weinstein IN, Wiesel SW (eds). The Lumbar Spine. Philadelphia, WB Saunders, 1990, 916-940.