DOI: 10.14260/jemds/2015/1974

ORIGINAL ARTICLE

POST TRAUMATIC INSTABILITY OF SUB-AXIAL CERVICAL SPINE - REDUCTION AND INTERNAL FIXATION BY LATERAL MASS SCREWS: A LONG TERM FOLLOW-UP STUDY

Godagu Bhaskar[1], Ambarapu Mastan Reddy[2], Akyam Lakshman Rao[3], Sharath Kumar Maila[4]

HOW TO CITE THIS ARTICLE:
Godagu Bhaskar, Ambarapu Mastan Reddy, Akyam Lakshman Rao, Sharath Kumar Maila. "Post Traumatic Instability of Sub-Axial Cervical Spine - Reduction and Internal Fixation by Lateral Mass Screws: A Long Term Follow-Up Study". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 79, October 01; Page: 13856-13862, DOI: 10.14260/jemds/2015/1974

ABSTRACT: AIM: We present here the clinical results of 24 patients who were operated for cervical instability following trauma by lateral mass fixation at our institution between July 2010 and Dec 2013 and to assess the stability of the construct at 2yr follow-up study. **MATERIALS AND METHODS:** Between July 2010 and Dec 2013 a total of 24 pts. Were operated by lateral mass fixation for cervical spine instability following trauma to subaxial cervical spine between C3-C6. Presenting with posterior element injury like facet locking and subluxation injuries were included in the study. All these patients were evaluated postoperatively for neurologic improvement, complications and Results were analyzed. **RESULTS:** A total of 104 screws were placed in to the lateral masses during the study. There were 8(33.3%) deaths in this series not related to the surgical procedure. There were no immediate complications related to the procedure. There was no evidence of neurovascular injury either during the procedure or immediately following the surgery. There was CSF leak in one case of badly traumatized cord injury during the procedure. Neurological improvement was seen in 13(81.2%) out of surviving 16 cases of trauma at the end of 3m to the extent of self-ambulation and the rest three did not show any improvement and remained quadriplegic. **CONCLUSION:** In this study we report good long term stability achieved by the lateral mass fixation with rods and screws with least morbidity and the safety of the procedure compared to other methods of posterier elements fixations. Both Roy Camille and Magerl technique can be followed for screw placement, where in Magerl technique has slight advantage of avoiding the nerve root injury and a longer screw can be placed to achieve a good bony purchase. Over all it is very safe and efficacious procedure in the hands of an experienced surgeon.
KEYWORDS: Post traumatic instability, Lateral mass Screws, Reduction and internal fixation.

INTRODUCTION: Posterior cervical spine arthrodesis by lateral mass fixation is a popular method for the past three decades.[1,2] Initial attempts at posterior cervical fixation by spinous process wiring was done by Harda in 1891. This system was modified by figure of eight wiring by Roger in 1942 and then by Bohlman with triple wiring technique. In 1980s Roycamille introduced the technique of lateral mass fixation of cervical spine. Later Grob & Magerel modified the drilling trajectory of lateral mass of cervical spine in a divergent orientation. Since then lateral mass fixation by plates and screws has become the most popular technique for treating cervical spine instability by posterior approach of various etiologies.[2,3]

MATERIALS AND METHODS: Between July 2010- Dec 2013 a total of 24 pts. Were operated by lateral mass fixation for cervical spine instability following trauma to sub axial cervical spine between C3-C6 presenting with posterior element injuries like facet locking and subluxation injuries were included in

DOI: 10.14260/jemds/2015/1974

the study. There were 18(75%) males and 6 (25%) female pts. with age group ranging from 18 to 54yrs. and the mean age being 36.

Neurological examination showed total loss of neuronal function below the level of the lesion in 7(29.1%) patients immediately following trauma, Grade 2-3/5 power in 11(45.8%) patients and 6(25%) patients were neurologically intact and presented with severe neck pain with restriction of neck movements.

At admission all the patients were evaluated by plain x-ray cervical spine AP and lateral views. In few patients where there were fracture of the posterior elements CT cervical spine was done. All the patients have undergone MRI examination with a standard protocol. All the patients presented following trauma had locked facet dislocations of which 16(66.6%) were bilateral and 6 (25%) were unilateral. There was fracture of the lamina and one side facet in 8 patients. All patients with locked facets were put on cervical traction pre-operatively.

Acceptable reduction was achieved in 11(45.8%) patients and in rest open reduction was tried on the table during surgery. In one case of cervico-thorasic junction instability pedicle screws were placed in to C7 and T1 along with lateral mass screws in to C6. Majority of the traumatic dislocations were found at C5-C6 in 14(58.3%) cases followed by C4-C5 in 7(29.1%) cases and C6 over C7 in 3(12.5%) cases. In 2 cases where the lateral mass was involved in fracture the adjacent level lateral mass was taken for fixation. For majority of the cases two level fixation was done.

SURGICAL TECHNIQUE: All the patients were operated in prone position with head in neutral position maintaining slight flexion with skull traction in situ. Vertical midline skin incision is given and dissection deepened by retracting the paraspinal muscles exposing the cervical lamina and the whole extent of the lateral mass laterally. For locked facets which could not be reduced preoperatively we try to manipulate the facets and achieve the reduction under vision.

Once reduction is achieved we maintain the neutral position of the head and lateral masses are prepared for screw placement. The entry point in to the lateral mass was 1mm medial to the centre of the lateral mass. We drill the bone from the entry point vertically and perpendicular to the surface of the lateral mass for about 2-3mm and then redirect the drill superiolaterally at an angle of 15-20 degrees till we penetrate the opposite cortex. This technique will avoid the breakage of the cortex at the entry point. The superiolateral trajectory can be easily achieved by resting the drill against the lower spinous process which is immediately below. Once drilling is done, we will tap the track and a screw is threaded in to the track.

Normally 12-14mm poly axial screw of 3.5 mm diameter will suffice in most of the cases to get a good bony purchase. Once all the screws are placed in position we open the facet joint, thoroughly decorticate the articulate surfaces and pack small pieces of bone chips retrieved from the excised spinous process. Finally we tighten the rods in neutral position maintaining the reduction. We use fluoroscopic check at the end of the procedure to look for the alignment of the screws and reduction achieved or not. (Fig-1)

All the pts were immobilized in a hard cervical collar post-operatively and we routinely perform neurological examination in the immediate post-op period to check for any neurological deterioration. Follow-up examination and x-rays were taken at discharge, at 3m, 6m and at 1year follow-up to assess the standard of bony fusion achieved and for any hardware failure.

DOI: 10.14260/jemds/2015/1974

RESULTS: A total of 104 screws were placed in to the lateral masses of the cervical vertebra between C3 and C6 excluding C7 where pedicle screws were placed to achieve fixation. Immediate follow-up x-ray in all the cases and CT scans were done for few patients in the immediate postop period to confirm reduction achievement and all the patients were immobilized in a hard cervical collar for three weeks. There were 8(33.3%) deaths in this series in the perioperative period, not related to the surgical procedure but due to the attendant medical problems and severe injury to the spinal cord. All deaths happened in trauma cases with profound neurological involvement with compromised respiratory function in the pre-operative period. No deaths were observed in any of the elective surgeries.

There were no immediate complications related to the procedure. There was no evidence of neurovascular injury either during the procedure or immediately following the surgery. There was CSF leak in one case of badly traumatized cord injury during the procedure. This was managed conservatively in the post-op period and he responded well. There was no complication post-operatively related to the hardware in the form of screw pull-out or breakage of the screw. Good fusion was achieved in all the cases at the end of 3months. There was no evidence of hard ware failure at the end of 2year follow-up. All the patients were followed at regular intervals of 3weeks for initial 3months later on for a period of 2years to assess the maintenance of reduction and achievement of solid fusion at the site. Six patients did not turn-up for follow up after one year.

Neurological improvement was seen in 13(54.1%). Out of surviving 16 cases of trauma at the end of 3months to the extent of self-ambulation and the rest three did not show any improvement and remained quadreplegic.

DISCUSSION: The anatomy of cervical lateral mass has been described by Roy-Camillie et al. and Ebraheim et al. The area of lateral mass is the part lateral to the lamina and between the inferior margins of adjacent inferior facets. The superior, inferior diameters of the lateral mass range from 11-15mm from C3 down to C6 and the thickness varies between 11-13mm.[5,6]

Anatomical relations between the screw trajectories and neuro vascular structures

Lateral mass is solid quadrangular piece of bone roughly measuring about 10mm in thickness.

Among the previously mentioned techniques Roy Camille and Magerl techniques are the leading techniques of posterior plating of cervical spine.[7,8] If the lateral mass is divided in to 4 quadrants the supero medial and inferomedial quadrants immediately overlie the vertebral artery.

The infero-lateral quadrant over lie the exiting nerve root which is coursing obliquely behind the lateral mass.[8,9] The supero lateral quadrant is devoid of any neuro-vascular structure and ideally suits the screw placement. (Fig-2). The Roy Camille technique employs placement of screw from the center of lateral mass in a perpendicular manner and angled 10 degrees lateral in transverse plane. Magerl technique involves placing the entry point 1-2mm medial to the center of the lateral mass and directing the screw in a superior-lateral manner about 25 degrees laterally and parallel to superior articular surface in to the superior-lateral quadrant which is devoid any neuro-vascular structures behind. Hence this technique of screw placement requires little longer size in view of the oblique trajectory and offers better strength to the construct.[10,11] Anderson et al modified Magerl technique.

They recommended that the starting point for screw insertion be 1mm medial to the center of the lateral mass and direction be 30-40 degrees cephalad (parallel to facet joint) and 10 degrees lateral. (Fig-3) Lateral mass fixation increases segmental stability in flexion by 92% and in extension by 60% whereas spinous process wiring improves stability in flexion by 33% but fails to prove stability in extension.[11] In our experience also they have proven safe and effective.

DOI: 10.14260/jemds/2015/1974

Complications related to the insertion of lateral mass screws are generally limited to injury to neuro vascular structures. Heller et al predicted a maximum of 3.6% incidence of nerve root injury with screw placement by using Roy Camille and Magerl technique. In our series there were no complications related to neuro vascular structures.

CONCLUSION: This study reviews a clinical series of 24 patients operated by lateral mass fixation with poly axial screws and rods for cervical instability due to posterior element injury with good long term results and very less morbidity. This procedure has several advantages over traditional wiring techniques. This procedure can be performed in the absence of posterior elements also without any violation of spinal canal, good anatomical reduction is possible by slight manipulation of the screws. However a sound anatomical knowledge of lateral mass is very essential for correct placement of screws and to avoid injury to the neuro vascular structures behind the lateral mass. We conclude that both Roy Camille and Magerl technique can be followed for screw placement, Magerl technique has slight advantage of avoiding the nerve root injury and a longer screw can be placed to achieve a good bony purchase. Over all it is very safe and efficacious procedure in the hands of an experienced surgeon.

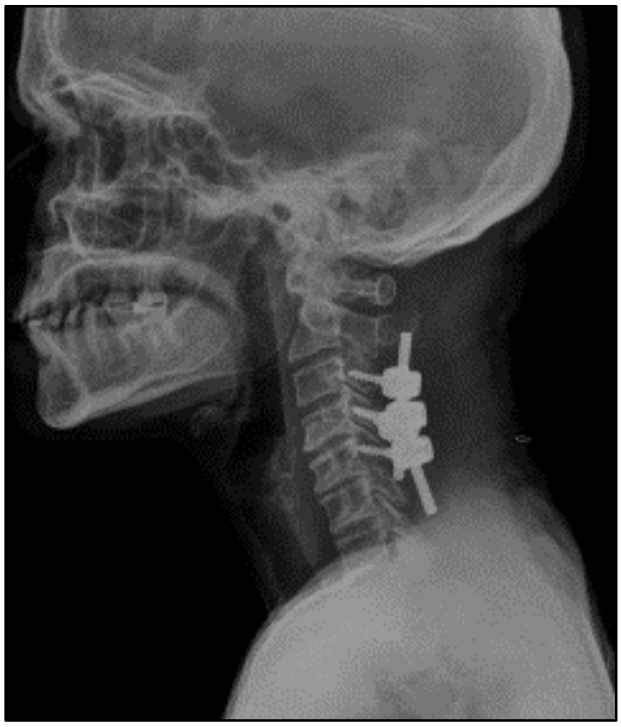

Figure 1

DOI: 10.14260/jemds/2015/1974

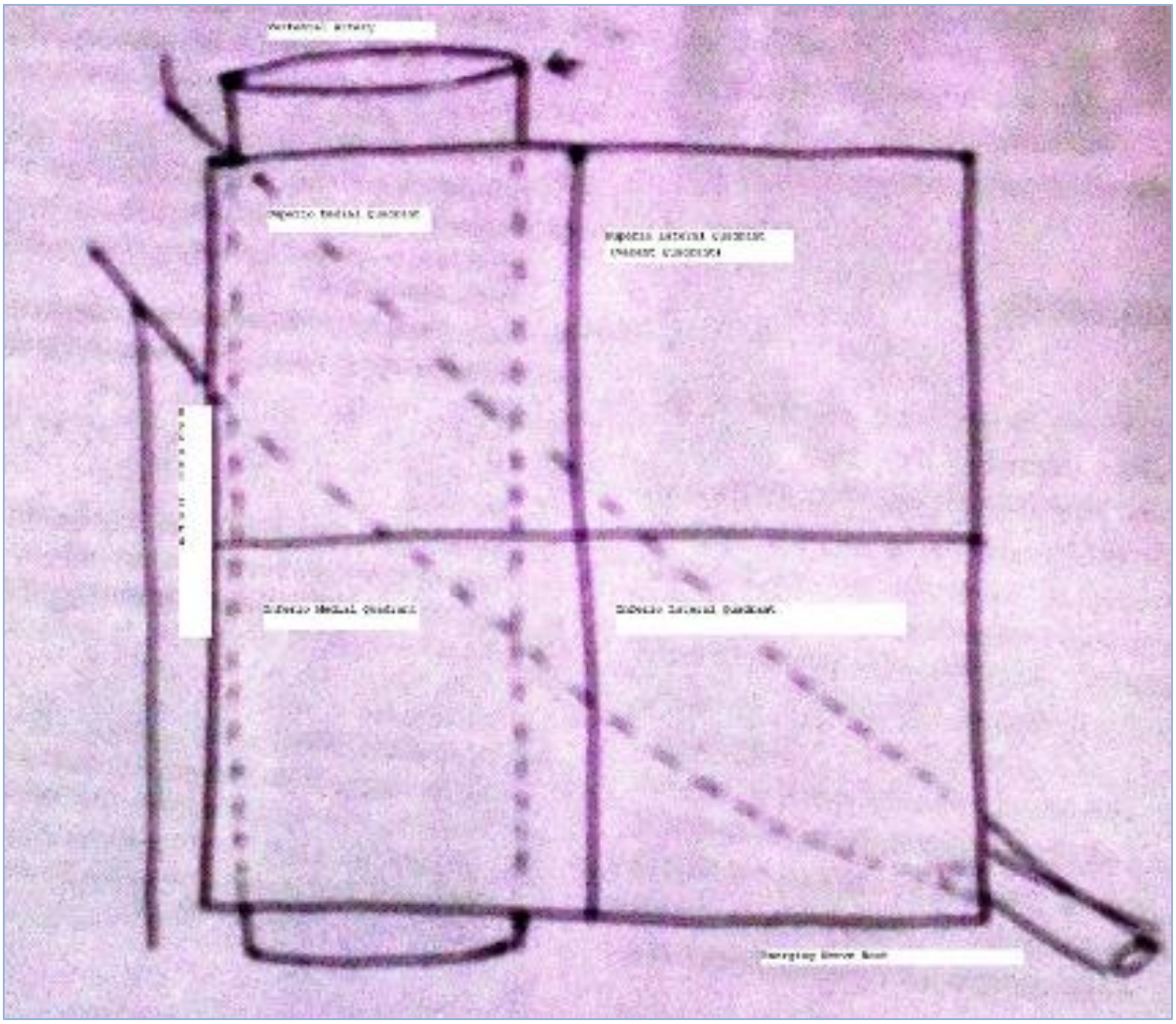

Fig. 2: Lateral Mass Quadrants and Anatomical Relations of Neurovascular structures

DOI: 10.14260/jemds/2015/1974

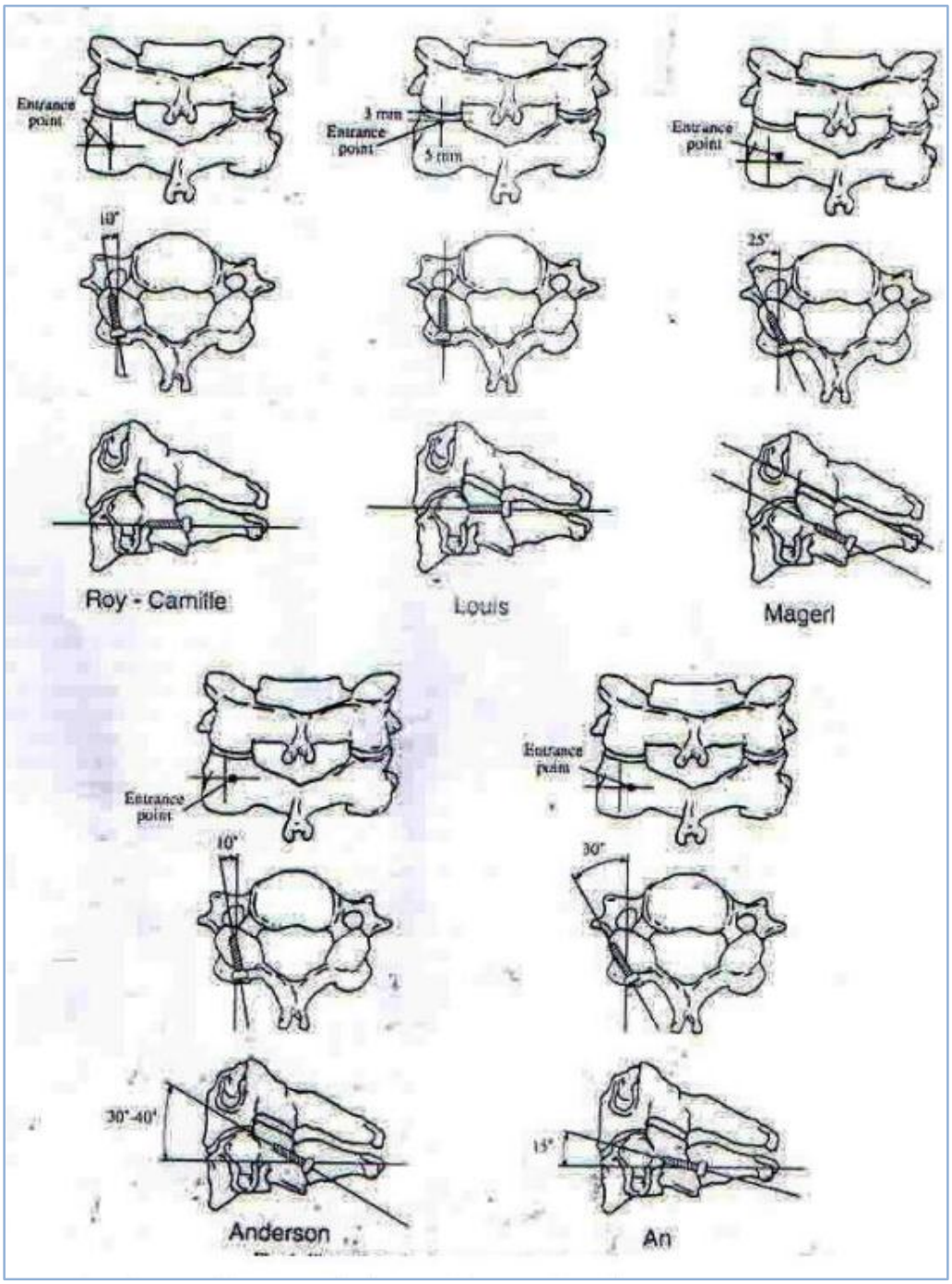

Fig. 3: Various Techniques for Lateral Mass screw

REFERENCES:

1. Cooper PR, Cohen A, Rosiello A, koslow M. Posterior stabilization of cervical spine fractures and subluxation using plates and screws. Neurosurgery 1988; 23:300-6.

2. Fehlings MG, Cooper PR, Errico TJ. Posterior plates in the management of cervical instability: Long-term results in 44 patients. J Neurosurg 1994; 81:341-9.
3. Nazarian SM, Louis RP. Posterior internal fixation with screw plates in traumatic lesions of the cervical spine. Spine 1991; 16(3 Suppl); S64-71.
4. Wellman BJ, Follett KA, Traynelis VC. Complications of posterior articular mass plate fixation of the subaxial cervical spine in 43 consecutive patients. Spine 1998; 23: 193-200.
5. Ebraheim NA, Klausner T, Xu R, Yeasting RA. Safe lateral mass screw lengths in the Roy-Camille and Magerl techniques. An anatomic study. Spine 1998; 23: 1739-4211.
6. Fehlings MG, Cooper PR, Errico TJ. Posterior plates in the management of cervical instability: Long term results in 44 patients. J Neurosurg 1994; 81: 341.
7. 7 Heller JG, Carlson GD, Abitbol JJ, Garfin SR. Anatomic comparison of the Roy-Camille and margerl techniques for screw placement in the lower cervical spine. Spine 1991; 16(10Suppl): S552-7.
8. Xu R, Haman SP, Ebraheim NA, Yeasting RA. The anatomic relation of the lateral mass screws to the spinal nerves. A comparision of the Magerl. Anderson, and techniques. Spine 1999; 24: 2057-61.
9. An HS, Gordin R, Renner K. Anatomic considerations for plate- screw fixation of the cervical spine. Spine 1991; 16(suppl):S548-51(Medline –Abstract).
10. Ebraheim NA, An HS, Jackson WT, Brown JA. Internal fixation of the unstable cervical spine using posterior Roy-Camille plates. Preliminary report. J Orthop Trauma 1989; 3:23-8(Medline-Abstract).
11. Roy-Camille R, Saillant G, Mazel C.Internal fixation of the unstable cervical spine by a posterier osteosynthesis with plates and screws. In: Sherk HH, Dunn Ej, Eismont FJ et al eds. The cervical spine 2nd ed. Philadelphia: J.B. Lippincott Co, 1989; 390-403

AUTHORS:

1. Godagu Bhaskar
2. Ambarapu Mastan Reddy
3. Akyam Lakshman Rao
4. Sharath Kumar Maila

PARTICULARS OF CONTRIBUTORS:

1. Professor, Department of Neurosurgery, Osmania Medical College and Hospital, Hyderabad.
2. Associate Professor, Department of Neurosurgery, Osmania Medical College and Hospital, Hyderabad.
3. Assistant Professor, Department of Neurosurgery, Osmania Medical College and Hospital, Hyderabad.
4. Assistant Professor, Department of Neurosurgery, Osmania Medical College and Hospital, Hyderabad.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Godagu Bhaskar,
Professor,
Department of Neurosurgery,
Osmania Medical College and Hospital,
Hyderabad.
E-mail: godugubhaskar7@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None

Date of Submission: 11/09/2015.
Date of Peer Review: 12/09/2015.
Date of Acceptance: 23/09/2015.
Date of Publishing: 01/10/2015.