

SURGICAL OUTCOME OF PLATE AND HOOK FIXATION FOR CRANIO-VERTEBRAL JUNCTION INSTABILITY

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ABSTRACT

Objective: To determine the surgical outcome of patients undergoing plate and laminar hooks fixation for cranio-vertebral junction (CVJ) instability.

Methodology: This cross sectional study was conducted in Department of Neurosurgery, Lady Reading Hospital, Peshawar, from January 2014 to June 2017 on a sample of 13 patients enrolled with consecutive sampling. Those patients who underwent plates and laminar hook fixation for CVJ instability were included in the study irrespective of their age and gender. Clinical and radiological data of the patients were collected on preformed proforma. Pre-operative and post-operative Nurick grades at 6 months follow up were documented. Neurological improvement was taken as the main outcome variable according to change in Nurick score. The data were analyzed with SPSS version 22.

Results: Total number of patients was 13 and all of them were males. The mean age was 22.80 ± 17.55 years. Etiology was trauma in all the cases. The mean pre-op Nurick score was 2.46 ± 1.26 and the mean post-operative Nurick score was 1.85 ± 0.98 , with improvement of 0.6. Post operatively one (7.60%) patient developed wound infection. Restricted neck movements were present in 12 (92.31%) patients post-operatively.

Conclusion: Occipital plates and laminar hooks procedure was found effective in patients with CVJ instability in terms of neurological improvement.

Key Words: Cranio-vertebral junction instability, Surgical outcome, Plate and hook fixation

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INTRODUCTION

The cranio-vertebral junction (CVJ) is the transition zone between the cranium and cervical spine, having a complex anatomy, comprising of atlanto-occipital and atlanto-axial joints. These joints are responsible for the mobile nature of the region allowing flexion, extension and rotational movements^{1,2}. Various etiologies responsible for the CVJ instability are trauma, congenital, pediatric and destructive disease processes (including rheumatoid arthritis, infections and primary or metastatic tumors)³⁻⁵. Trauma is the leading cause of instability among all of them and can result in immediate fatality or delayed deterioration. Therefore, it requires a sound stabilization immediately⁶. In cases of pediatric instability, the presentation is usually delayed up to the 2nd or 3rd decade of life posing a diagnostic challenge for the physicians⁷.

Laminar and skull wires were the only options available for CVJ instability until the fusion was achieved, but now various options like anterior odontoid screw

fixation, posterior atlanto-axial fixation and posterior occipital-cervical fixation are available^{1,8,9}. The indications for posterior occipital-cervical fixation are atlanto-occipital dislocation, atlanto-axial dislocation and fractures of anterior or posterior elements of C1 and C2 vertebrae which makes the C1 and C2 screw placement difficult or impossible¹⁰.

Occipito-cervical fixation has undergone significant evolution due to advances in operative and instrumentation techniques. The various techniques include simple auto graft on lay fusion, sub laminar wiring, rigid occipital plating with bio cortical screws connected via rods to atlantoaxial or sub axial screw fixation and occipital plating with sub laminar hooks and rod fixation^{4,11-14}.

We conducted this study to evaluate the surgical outcome of plate and hook fixation for CVJ instability in terms of neurological improvement, post operative stability and its complications.

METHODOLOGY

This cross sectional study was conducted in Department of Neurosurgery, Lady Reading Hospital, Peshawar, from January 2014 to June 2017 on a sample of 13 patients enrolled with consecutive sampling. Those patients who underwent plates and laminar hook fixation for CVJ instability were included in the study irrespective of their age and gender. Clinical and radiological data of patients were collected on preformed proforma. Diagnosis was made by clinical evaluation and radiological imaging. Plain x-ray, 3D CT scan of CVJ and MRI were performed for all patients. Pre-operative Nurick grading was recorded (Table 1). Plate and hook fixation for CVJ instability was performed by consultant neurosurgeon.

After intubation the patient was positioned in prone. Midline incision extending frominion to the desired cervical level was given. Soft tissues were dissected and bony landmarks were identified. Decompression and instrumentation was done. Sub-laminar hooks were placed at C2-C3 level. Y-shaped plate was fixed on the occiput. Rods were placed to complete the fixation. Hemostasis was achieved and wash was done. Wound was closed in reverse fashion and dressing was applied. Post-operative Nurick grading at 6 months follow up was documented. Post-operative complications were also noted. All the data were recorded with the help of a specially designed proforma and analyzed with SPSS version 22. Descriptive statistics like mean \pm SD for numerical data, while frequency and percentage for categorical variables were calculated.

RESULTS

The total number of patients was 13 and all of them were males. The age of the patients ranged from 10-50 years with a mean age of 22.80 ± 17.55 years. The

etiology for CVJ instability was trauma in all the cases. The presenting symptoms of the patients are shown in Figure 1.

The comparison of the pre-operative and post-operative Nurick grading at 6 month follow up is shown in Figure 2. The mean pre-operative Nurick score was 2.46 ± 1.26 and the mean post-operative Nurick score was 1.85 ± 0.98 with improvement of 0.6.

Post-operative complications included restricted neck movements in 12 (92.31%) and wound infection in 01 (7.69%) patients. However, no case of pseudo arthrosis and implant failure was observed in six months follow up.

DISCUSSION

CVJ is a separate entity from sub-axial spine and holds its importance because of the vital vascular and neurological structures lying in this region. A range of movements including flexion, extension and rotations are possible because of the particular arrangement of joints and ligaments in cranio-vertebral junction. This region is a combination of motion and stability¹⁵. In our study all the cases were post-traumatic, which differed from the study of Rahman et al¹⁴ in which 20% of the cases were secondary to trauma. Similarly, in another study the traumatic cases were 43.75%¹². Our study also differed from other studies in terms of gender distribution. All of our patients were male, with a mean age of 23 years, while in other studies the number of female patients ranged from 33% to 56%, with age ranging from 13 to 74 years^{2, 4, 7, 10-12, 14}. The reason why all the cases in our study were male is because of the fact that the etiology was trauma which is more common in males in our society because of day to day exposure and vulnerability. In another study the mean age varied to a

Table 1: Nurick grading

Grade	Description
0	Signs or symptoms of root involvement but without evidence of spinal cord disease
1	Signs of spinal cord disease but no difficulty in walking
2	Slight difficulty in walking which did not prevent full-time employment
3	Difficulty in walking which prevented full-time employment or the ability to do all housework, but which was not so severe as to require someone else's help to walk
4	Able to walk only with someone else's help or with the aid of a frame
5	Chair bound or bedridden

Figure 1: Presenting symptoms of patients

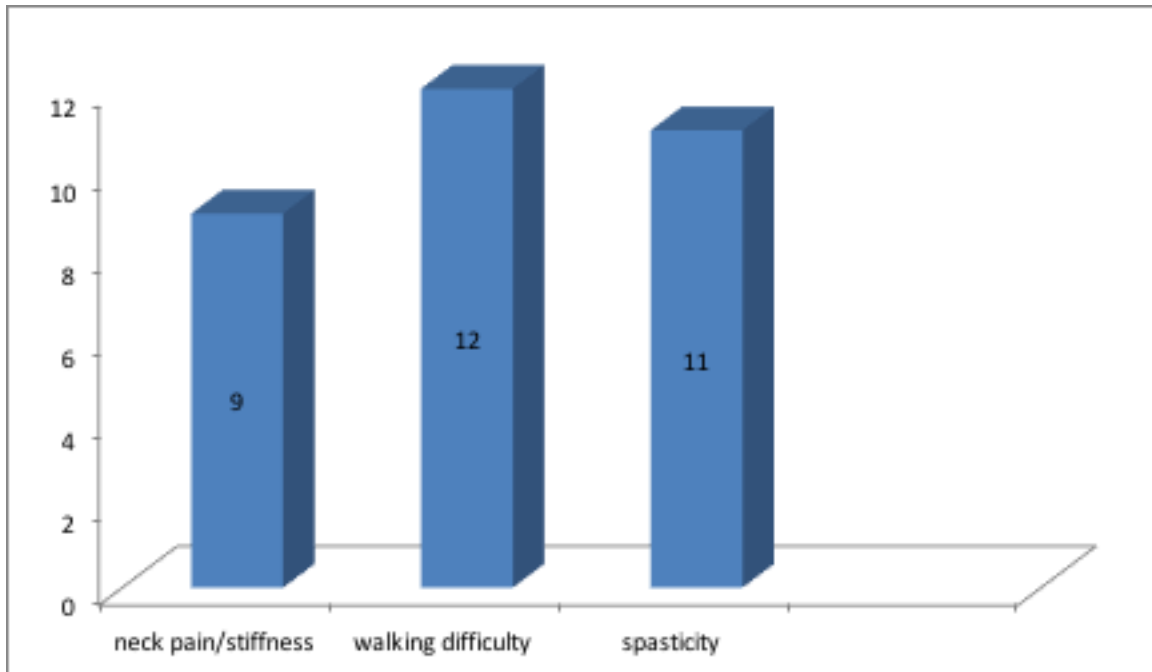
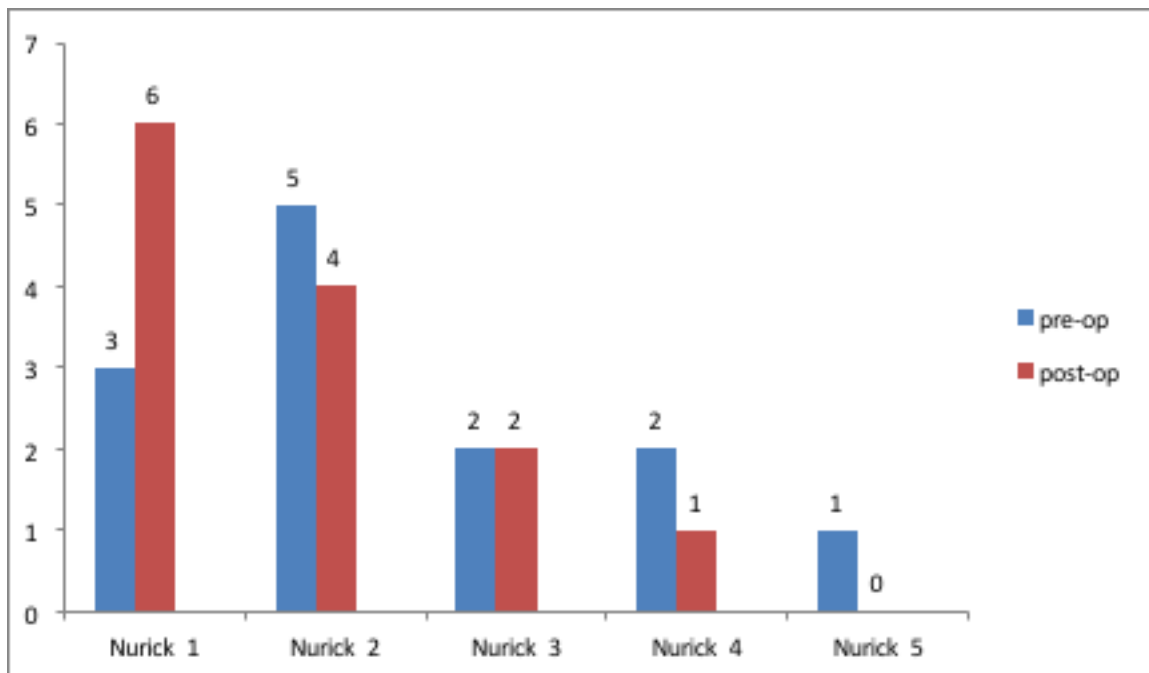


Figure 2: Comparison of the pre-operative and post-operative Nurick grading at 6 month follow up



greater extent because it included cases of different etiologies like congenital which happens at young age and degenerative, which occurs at a relatively older age. The presenting complaints of neck pain, walking difficulty and spasticity, in our study were similar to other studies^{11,12,14}. In our study the mean pre-op Nurick score was 2.46 and the mean post-op Nurick score was 1.85, with improvement of 0.6 on Nurick scale; while Hsu et al¹¹ reported an improvement of 0.9 on Nurick scale, with a mean pre-op and post-op score of 3 and 2.1, respectively. Similarly another study showed improvement in 80% of patients on Japanese orthopedic association scale¹⁴. Another study showed improvement in Nurick grade in 36 out of 45 patients¹⁶.

In our study, 92.31% patients had post-op restricted range of movement of the neck and 7.60% had superficial wound infection and no mortality was reported. While in another study 4.09% of the patients had superficial wound infection, 4.09% had pseudo arthrosis and 9% mortality¹⁶.

LIMITATIONS

The limitation of our study is the limited number of cases. Further studies with larger sample of patients are needed to see the efficacy and safety of the procedure.

CONCLUSION

Occipital plates and laminar hooks procedure was found effective in patients with CVJ instability in terms of neurological improvement, at the cost of restricted range of movements of the neck.

REFERENCES

1. Takayasu M, Aoyama M, Joko M, Takeuchi M. Surgical intervention for instability of the craniovertebral junction. *Neurol Med Chir* 2016; 56:465–75.
2. Zidan I, Fouad W. Occipitocervical fixation in the management of craniocervical instabilities. *Alexand J Med* 2011; 47:185–92.
3. Inamasu J, Kim DH, Klugh A. Posterior instrumentation surgery for cranio-vertebral junction instabilities: An update. *Neurol Med Chir* 2005; 45:439–47.
4. Zou J, Yuan C, Zhu R, Zhang Z, Jiang W, Yang H. Effect of occipitocervical fusion with screw-rod system for upper cervical spine tumor. *Biomed Cent Surg* 2014; 14:30.
5. Richter M, Wilke HJ, Kluger P, Neller S, Claes L, Puhl W. Biomechanical evaluation of a new modular rod-screw implant system for posterior instrumentation of the occipito-cervical spine: In-vitro comparison with two established implant systems. *Eur Spine J* 2000; 9:417–25.
6. Debernardi A, D'Aliberti G, Talamonti G, Villa F, Piparo M, Ligarotti G et al. Traumatic injuries to the craniovertebral junction: A review of rare events. *Neurosurg Rev* 2014; 37:203–16.
7. Kale SS, Ailawadhi P, Yerramneni VK, Chandra PS, Kumar R, Sharma BS et al. Pediatric bony craniovertebral junction abnormalities: Institutional experience of 10 years. *J Pediatr Neurosci* 2011; 6:S91–5.
8. Lieberman IH, Webb JK. Occipito-cervical fusion using posterior titanium plates. *Eur Spine J* 1998; 7:308–12.
9. Bongartz EB. Two asymmetric contoured plate-rods for occipito-cervical fusion. *Eur Spine J* 2004; 13:266–73.
10. Cappuccio M, De Iure F, Amendola L, Paderni S, Bosco G. Occipito-cervical fusion in post-traumatic instability of the upper cervical spine and cranio-cervical junction. *Eur Spine J* 2013; 22:900–4.
11. Hsu YH, Liang ML, Yen YS, Cheng H, Huang CI, Huang WC. Use of screw-rod system in occipitocervical fixation. *J Chin Med Assoc* 2009; 72:20–8.
12. Song GC, Cho KS, Yoo DS, Huh PW, Lee SB. Surgical treatment of craniovertebral junction instability: Clinical outcomes and effectiveness in personal experience. *J Korean Neurosurg Soc* 2010; 48:37–45.
13. Kim YJ, Yoo CJ, Park CW, Lee SG, Son S, Kim WK. Traumatic atlanto-occipital dislocation (AOD). *Korean J Spine* 2012; 2:85–91.
14. Rehman L, Bokhari I, Afzal A, Ahmad S. Posterior occipito cervical decompression with fixation and fusion in cranio vertebral junction compression. *Pak J Med Sci* 2017; 33:1194–8.
15. Lopez AJ, Scheer JK, Leibl KE, Smith ZA, Dlouhy BJ, Dahdaleh NS. Anatomy and biomechanics of the cranio-vertebral junction. *Neurosurg Focus* 2015; 38:1–4.
16. Winegar CD, Lawrence JP, Friel BC, Fernandez C, Hong J, Maltenfort M et al. A systematic review of occipital cervical fusion: Techniques and outcomes. *J Neurosurg Spine* 2010; 13:5–16.

CONTRIBUTORS

ZK conceived the idea, designed the study and supervised the project. SS wrote the manuscript, analyzed the data and kept liaison among the authors. SA collected the data, reviewed the draft critically and carried out subsequent changes. All authors contributed significantly to the submitted manuscript.