

NEUROLOGICAL IMPROVEMENT AFTER CERVICAL TRACTION IN PATIENTS WITH CERVICAL SPINE INJURY

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ABSTRACT

Objective: To estimate frequency of neurological improvement after cervical traction in patients with cervical spine injury.

Methodology: This observational study was conducted at Department of Neurosurgery, Lady Reading Hospital, Peshawar - Pakistan from December 2010 to November 2011. The medical record of all cases, in which cervical traction was applied for cervical spine injury, was checked from record room. Documentation was done according to proforma designed, indicating age, sex, neurological status before and after cervical traction and investigations with findings on X-rays, CT and MRI. The data was analyzed from different angles in SPSS software.

Results: A total of 30 patients were included in this study. There were 20 males and 10 females. The age of the patients ranged from 13 to 80 years (mean= 31.07±15.45). Majority of the patients (83.3%) were young, in the age range of 13- 40 years. Neurological improvement was noted in 14 (46.7%) patients. It was more in age group of 13-20 years (66.7%) and in those who presented with weakness of Frankle grade "B" and "C" (66.7% each). The improvement was more in patients in whom anatomical alignment of spine was achieved.

Conclusion: Skeletal cervical traction is safe and effective means of early decompression of spinal cord with neurological improvement. It is more effective in young individuals and those presenting with Frankle grade B and C weakness.

Key Words: Cervical traction, Cervical spine, Reduction, Neurological improvement.

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INTRODUCTION

Cervical traction is the longitudinal pull along the cervical spine that reduces deformity, restores normal anatomic alignment, and provides stabilization. It is the surest way of stabilizing an unstable fracture or fracture dislocation, or occasionally of releasing locked facets. In fracture dislocation, it draws the fragments of the spine apart, restores the diameter of cervical canal, and reduces the danger of pressure on cord¹.

Cervical traction is indicated for; (a) Temporary stabilization to preserve neurologic function in trauma patients. (b) Preoperative reduction in patients with deformity or displaced fractures. (c) Intraoperative stabilization and interspace distraction for anterior grafting. (d) Pain relief for patients with radiculopathy or muscle spasm.

Closed reduction with skull tongs should only be

performed in the awake, cooperative patient whose neurologic status can be monitored during the traction² because in closed reduction, there is risk of spinal cord compression due to an intervertebral disc. Periodic neurological examination and radiologic imaging is mandatory during traction to avoid over distraction. A magnetic resonance imaging (MRI) should be performed after all successful or unsuccessful closed reductions or in case of any neurologic deterioration during the traction procedure².

Various studies have shown that frequency rate of neurological improvement after cervical traction is 43.6%, 68% and 78%³⁻⁵. There was limited national data on the topic. Therefore, the objective of this study was to generate local data on success rate of cervical traction in terms of improvement in neurological status. If it proved to be effective, it may be recommended to improve quality of life in patients with cervical spine injury.

MEHTODOLOGY

We conducted a retrospective observational study at Department of Neurosurgery, Lady Reading Hospital, Peshawar - Pakistan from December 2010 to November 2011 in all those patients in whom cervical traction was applied. All patients presenting with signs and symptoms of unstable cervical spine injuries and cord compression were included in the study. Application of cervical traction was decided on the basis of radiological findings. In all cases, Gardner wells tongs were applied because of easy application and availability. Patients with intact neurology, complete cord transection or seriously ill with respiratory distress that died within 24 hours of cervical traction, were excluded from study. All of these patients had presented in emergency and cervical traction was applied on the same day.

Medical record of the patients was collected according to designed proforma indicating age, sex, neurological status before and after cervical traction and investigations with findings on X-rays, computerized tomography (CT) and MRI. Sampling was done according to consecutive random sampling method. The data was analyzed using SPSS software.

Any change in neurological status immediately after applying cervical traction, weight increment and then every 24 hours till patient was discharged, died or operated, was noted. An increase of at least one grade in neurological status, based on Frankle grading system (Table 1), was considered a neurological improvement.

RESULTS

A total of 30 patients were included in the study. There were 20(66.7%) males and 10(33.3%) females. Majority of patients in our study belonged to central districts of the province particularly, Peshawar, making 40.0% of the study population followed by hilly areas like Swat, Buner, Dir etc comprising 30.0% of the sample size. There were 3 patients from the southern districts like Tank, Lukki Marwat Kohat, 3 from FATA and 3 from Afghanistan (Table 2).

The age of our study population ranged from 13-80 years (mean=31.07+15.45). The bulk mainly consisted of young active individuals with 25 (83.3%) patients having age of 40 years or less. There were 4 patients making 13.4% of the whole lot in the age range of 41-60 years and just 1 patients in the age range of 61-80 years.

Most of the patients in our series (40%) had presented with motor and sensory function of Frankle grade D. There were 9 (30.0%) patients who were having dense quadriplegia (Frankle grade A). Six (20.0%) patients had Frankle grade C and 3 patients had Frankle grade B weakness on presentation.

Overall neurological improvement was observed in 14 (46.7%) patients while there was no improvement in 16(53.3%) patients but no further deterioration was noticed in any case.

As a whole, complete radiological alignment was achieved in 17 (56.7%) patients with cervical traction while in 11(36.7%) patients; there was no evidence of reduction of subluxation. In 2(6.6%) patients, partial reduction was observed (Figure 1 & 2).

Neurological improvement was noted in 40.0% of male patients and 60% of female patients.

The success rate of cervical traction in terms of neurological improvement was excellent (66.7% each) in patients presenting with Frankle grade B and C weakness while it was poor in patients having presenting neurological status of Frankle A (22.2%). It was 50% in patients with Frankle grade D weakness (Table 3).

According to our study, reduction was achieved in 17 patients amongst whom neurological status was improved in 9 out of 17 patients making 52.9%. In situation where radiological alignment was not gained, there was neurological improvement in 45.5% of patients. There was partial reduction of cervical subluxation in 2 patients but neurology was unchanged with no improvement.

Table 1: Frankle grading system

Grade A	No motor or sensory function clinically detected below the level of the injury.
Grade B	No motor function clinically detected below the level of the injury; sensory function remains below the level of the injury but may include only partial function (sacral sparing qualifies as preserved sensation).
Grade C	Some motor function detected below the level of the injury, but is of no practical use to the patient.
Grade D	Useful motor function detected below the level of the injury; patient can walk with or without aid, but does not have a normal gait or strength in all motor groups.
Grade E	Normal motor, sensory and sphincteric function; abnormal reflexes and subjective sensory abnormalities may be present.

Table 2: Demographic distribution of patients

	Frequency	Percentage
Peshawar, Mardan, Sawabi, Charsadda	12	40
Tank, Lucky Marwat, Kohat	3	10
Swat, Buner, Dir	9	30
Bajawar, Khyber agency	3	10
Afghanistan	3	10

Table 3: Improvement in Frankle grading system: Before and after cervical traction

GRADE	BEFORE TRACTION (%)	IMPROVEMENT AFTER TRACTION (%)
Grade A	9 (30)	2 (6.66)
Grade B	3 (10)	2 (6.66)
Grade C	6 (20)	4 (13.33)
Grade D	12 (40)	6 (20)
Grade E	-	-

Figure 1: MRI spine showing C5-C6 subluxation before reduction



Figure 2: X-ray spine showing reduction of subluxation after traction



DISCUSSION

In patients with a spinal cord injury, early application of traction is recommended but in cases of a neurologically intact or cognitively impaired patient, early reduction is controversial. Recent literature supports the safety of early reduction before magnetic resonance imaging (MRI) is done^{6,7}.

Cervical traction is indicated for; (a) Temporary stabilization to preserve neurologic function in trauma patients. (b) Preoperative reduction in patients with deformity or displaced fractures. (c) Intraoperative stabilization and interspace distraction for anterior grafting.

(d) Pain relief for patients with radiculopathy or muscle spasm.

Various risks and complications are associated with cervical traction⁸. Excessive manipulation can worsen neurology; improper positioning can pull out tongs; & infection at pin sites (osteomyelitis, subdural empyema), loosening of tongs, occipital decubitus ulcer and penetration of inner table.

Reduction of cervical dislocation may result in neurologic deterioration due to retropulsed disc that necessitate urgent Computed Tomography, myelogram or Magnetic Resonance Imaging⁹⁻¹².

The reported permanent neurological complication rate is less than 1.0% during closed reduction. The causes include over distraction¹³⁻¹⁵, failure to recognize a more rostral noncontiguous lesion^{15,16}, disc herniation¹⁷, epidural haematoma¹⁸, and spinal cord edema^{2,3}.

Closed reduction with skull tongs should only be performed in the awake, cooperative patient whose neurologic status can be monitored during the traction because in closed reduction, there is risk of spinal cord compression². Periodic neurological examination and radiologic imaging is mandatory during traction to avoid over distraction. A magnetic resonance imaging (MRI) should be performed after all successful or unsuccessful closed reductions or in case of any neurologic deterioration during the traction procedure².

Every year about 50 to 60 patients with stable or unstable cervical spine injuries present to our department who need admission and management on emergency basis. Out of 52 patients presenting to our unit in the last one year from December 2010 to November 2011, cervical traction was applied in 37 patients but just 30 patients met the inclusion and exclusion criteria of our study. Majority of our patients were males and young active energetic of 40 years or less which is consistent with published literature¹⁹.

The common mode of injury was fall from height followed by road traffic accident which is in contrary to the study of Nikunj D et al¹⁹ where 80% of the patients were having history of RTA. This contrast is probably due to the fact that a large part of our study population (30%) belonged to hilly areas where fall from mountains was the usual history. Similarly, 40% of our patients were resident of central districts like Peshawar, Mardan, Charsadda etc. In these patients, the common history of injury was fall from building during construction. Another common mechanism was hitting a stone while diving in water. In accordance with literature, injury occurred most commonly at C₅-C₆ level followed by C₆-C₇ subluxation.

Different studies have given different frequencies of neurological improvement after skeletal cervical traction. For example, study conducted by Kleyn et al³ showed 43.6% neurological improvement which is quite consistent with our study where overall neurological improvement is 46.7%. In our series, complete radiological alignment was achieved in 56.7% which is slightly lower as compared to that achieved in study of Kleyn et al (81.2%) but this may be due to the fact that in his study MUA (manipulation under anaesthesia) was done in many cases in addition to cervical traction which is not a favoured practice today due to potential risk of spinal cord damage³.

Furthermore, neurological improvement observed in our study was 22.2% in patients presenting with com-

plete spinal cord injury i.e., Frankle grade A weakness and 57.1% in patients with incomplete cord injury which is almost comparable to the result of Kleyn P³ where improvement is 12.5% and 82.2% respectively. The difference may be due to larger sample size (101 cases) and greater percentage of reduction by MUA in his study because it has been shown by our results and other series that in incomplete spinal cord injury, reduction is associated with better outcome.

As compared to Starr et al⁴ and Hadley et al⁵, our rate of overall neurological improvement is less. The series of Starr A has given overall improvement of 68% with one Frankle grade improvement in 45% and less substantial improvement in 23% of patients while in our study, overall improvement was noted in 46.7%. This difference may be due to late transfer of most of the patients to our hospital in contrast to the study of Starr A where late arrival to the hospital has been recorded for only one case. Other reason may be long follow up and the fact that in the study of Starr A, anatomical reduction has been achieved in 93% of patients. Hadley MN has given overall improvement of 78% which is quite higher than our result⁵. On the other hand, his percentage of spine reduction (58%) is fairly comparable to our study (56.7%). The difference in neurological improvement may be due to duration of follow up which was quite longer in his study. In our study there was no evidence of any neurological deterioration with cervical traction. The maximum weight used for traction was about 36 lbs aided with counter-traction.

So the results of our study are comparable to international series in spite of study limitations like small sample size and short duration of post traction assessment of patients. This indicates the efficacy and safety of skeletal cervical traction for unstable cervical spine injuries.

CONCLUSION

Skeletal cervical traction is safe and effective means of early decompression of spinal cord with resulting neurological improvement. It is more effective in young individuals particularly those presenting with Frankle grade B and C weakness. It can be used safely for temporary stabilization of cervical spine or as definitive treatment in selected patient.

REFERENCES

1. King M. The spine. In: King M, Bewes P, editors. Primary surgery trauma. New York: Oxford University Press; 1987. p. 187-91.
2. Riaz S, Kortbeek FB, Mahood JK. Flexion-distraction injuries of the cervical spine. J Pak Med Assoc 2007;57:103-4.
3. Kleyn P. Dislocations of the cervical spine: closed reduction under anaesthesia. Paraplegia 1984;22:271-81.

4. Starr A, Jones A, Cotler J, Balderston R, Sinha R. Immediate closed reduction of cervical spine dislocations using traction. *Spine* 1990;15:1068-72.
5. Hadley MN, Argires PJ. The acute/emergent management of vertebral column fracture dislocation injuries in neurological emergencies. Park Ridge, IL: The American Association of Neurological Surgeons; 1994.
6. Grant GA, Mirza SK, Chapman JR, Winn HR, Newell DW, Jones DT, et al. Risk of early closed reduction in cervical spine subluxation injuries. *J Neurosurg* 1999;90:13-8.
7. Vaccaro AR, Falatyn SP, Flanders AE, Balderston RA, Northrup BE, Cotler JM. Magnetic resonance evaluation of the intervertebral disc, spinal ligaments, and spinal cord before and after closed traction reduction of cervical spine dislocations. *Spine* 1999;24:1210-7.
8. van Middendorp JJ, Slooff WB, Nellestein WR, Oner FC. Incidence of and risk factors for complications associated with halo-vest immobilization: a prospective, descriptive cohort study of 239 patients. *J Bone Joint Surg Am* 2009;91:71-9.
9. Crutchfield W. Skeletal traction in treatment of injuries to the cervical spine. *J Am Med Assoc* 1954;155:29.
10. Doran S, Papadopoulos S, Ducker T, Lillehei K. Magnetic resonance imaging documentation of coexistent traumatic locked facets of the cervical spine and disc herniation. *J Neurosurg* 1993;79:341-5.
11. Lee AS, Maclean JC, Newton DA. Rapid traction for reduction of cervical spine dislocation. *J Bone Joint Surg Br* 1994;76:352-6.
12. Maiman D, Barolat G, Larson S. Management of bilateral locked facets of the cervical spine. *Neurosurgery* 1986;18:542-7.
13. Burke D, Berryman D. The place of closed manipulation in the management of flexionrotation dislocations of the cervical spine. *J Bone Joint Surg Br* 1971;53:165-82.
14. Lu K, Lee T, Chen H. Closed reduction of bilateral locked facets of the cervical spine under general anaesthesia. *Acta Neurochir* 1998;40:1055-61.
15. Rosenfeld J, Vaccaro A, Albert T, Klein G, Cotler J. The benefits of early decompression in cervical spinal cord injury. *Am J Orthop (Belle Mead NJ)* 1998; 27:23-8.
16. Shapiro S. Management of unilateral locked facet of the cervical spine. *Neurosurgery* 1993;33: 832- 37.
17. Farmer J, Vaccaro A, Albert TJ, Malone S, Balderston RA, Cotler JM. Neurologic deterioration after spinal cord injury. *J Spinal Disord* 1998;11:192-6.
18. Key A. Cervical spine dislocations with unilateral facet interlocking. *Paraplegia* 1975;13:208-15.
19. Nikunj D, Maru MS. The functional and neurological outcome in cervical spine injuries. *Internet J Orthop Surg* 2009;17:2-7.

CONTRIBUTORS

MA conceived the idea, planned and wrote the manuscript of the study. RA helped in planning of the study and writing the manuscript. KK, MU, NH and MI helped in the data analysis and write up of the manuscript. All the authors contributed significantly to the research that resulted in the submitted manuscript.