RESEARCH ARTICLE

COMPARISON OF FUNCTIONAL AND NEUROLOGICAL OUTCOME OF CONSERVATIVE AND OPERATIVE MANAGEMENT IN PATIENTS WITH CERVICAL SPINE INJURY WITH COMPLETE QUADRIPLEGIA

Amit Patel, Bharat Sutariya
Department of Orthopaedics, Surat Municipal Institute of the Medical Education and Research (SMIMER), Surat, Gujarat, India

Correspondence to: Bharat Sutariya (drbharat_b20@yahoo.co.in)

DOI: 10.5455/ijmsph.2014.150320144 **Received Date: 10.03.2014** **Accepted Date: 15.04.2014**

ABSTRACT

Background: Cervical spine injury leads to significant functional impairment, one of them is quadriplegia. Debate between surgical versus conservative management of trauma to cervical spine has been going on since early 19th century.

Aims & Objective: This study has been conducted to compare functional and neurological outcome of conservative and operative management in patients with cervical spine injury with complete quadriplegia.

Materials and Methods: This was a retrospective study. Case records of 30 patients were analyzed. Patients were divided into 2 groups according to treatment given, i.e. Surgical and conservative. These two groups were compared retrospectively in terms of age, sex, type of injury, Mechanism of injury, mode of injury, stability, hospital stay, complications, neurological involvement and outcome. All patients were evaluated based on four parameters work, Functional independence measure, stability and neurological impairment. These parameters were measured and graded with appropriate modified scale.

Results: Mean age of patients in this study was 35 Yr. (Operative 31.88 Yr, Conservative 38.2 Yr.) With approximately 73 % belongs to 20 to 40 years group of young and active individual. Road traffic accident was the major culprit for cervical spine injury in this study. It accounts for 46.66% of total patients, followed by fall from height and fall of heavy object on patient. In operative group out of 15 patient 3 had stable cervical spine injury & 12 had unstable injury. In conservative group 5 had stable cervical spine injury and 10 had unstable cervical spine injury. Overall among 30 patient only 15 patient (50%) improve neurologically other remained same or worsened. Neurological improvement in conservative (46.66%) and operative (53.33%) group was found practically to be with negligible difference.

Conclusion: The ultimate neurological and functional outcome of cervical injury was probably decided at time of injury itself rather than by chosen management. Improvement in neurological function was independent of factor like type of surgery, Mechanism of injury (flexion-extension), spinal deformity and type of management. Surgical stabilization result in batter alignment and stability, early rehabilitation and probably decrease in length of stay but has its own complication and great economic burden to patients.

Key Words: Cervical Spine Injury; Quadriplegia; Conservative; Surgical Management

Introduction

The most important thing which mankind have achieved from evaluation is erect, strong, flexible skeleton. This includes spinal column. The cervical spine is extremely vulnerable to injury. The seven cervical vertebrae are attached on cephalic aspect with skull and on caudal aspect with relatively less mobile thoracic vertebrae enclosing spinal cord. Thus injury to cervical spine is almost always associated with neurological problems with their inherent risks.

It is important to evaluate the extent of injury and permanent cord damage, which may be due to primary mechanical insult or secondary to ischemic biochemical responses in the cord tissue as they are necessary in determining mode of therapy & eventual outcome.

Most common cause of cervical spine injuries is accidental trauma because significant force is necessary to produce this type of injuries. Cervical spine injury leads to significant functional impairment, one of them is quadriplegia.[1]

Debate between surgical versus conservative management of trauma to cervical spine has been going on since early 19th century when surgical school led by Sir Astley Cooper took on the conservative school led by Sir Charles Bell.[2-4] Whereas surgical treatment provides immediate stabilization early, rehabilitation, attendant risks but great economic burden. Complications must be weighed against non-operative alternatives.[5,6]

With this background in mind, this study has been conducted to compare functional and neurological outcome of conservative and operative management in patients with cervical spine injury with complete quadriplegia.

Materials and Methods

This retrospective study was carried out at Dept. of orthopedics, Sheth K.M. School of P.G. & Research, V. S.

Hospital, Ahmedabad. Case records of 30 patients were analyzed for cervical spine injury with quadriplegia. Patients having traumatic cervical spine injury from C1 toC7 with complete quadriplegia were included in study. Patients were divided in two group. 15 Patients who were given conservative management were assigned to first group, while 15 patients who were undergone surgical management were assigned to second group. Patients more than 18 years of age irrespective of gender were selected.

These two groups were compared retrospectively in terms of age, sex, type of injury, Mechanism of injury, mode of injury, stability, hospital stay, complications, neurological involvement and outcome. All patients were evaluated based on four parameters work, Functional independence measure, stability and neurological impairment. These parameters were measured and graded with appropriate modified scale. A grading system focused on working capability of patient was modified and used for working capability of patients for cervical trauma (Table 1). To assess physical and cognitive disability functional independence measure was used (Table 2). For stability of cervical injury white and Panjabi criteria were use (Table 3). In case of operative cases fusion of fracture was classified by modified criteria (Table 4). Neurological improvement in both groups was assessed by Modified Neurological improvement scale (Table 5).

Table-1: Modified Work scale[7]

Description	Original Score	Modifies Score
Returned to previous employment (heavy labour)	W1	4
Able to return to previous employment (sedentary) or return to heavy labour full time with lifting restrictions or Job modification	W2	3
Unable to return to previous employment but working full time at a new job	W3	2
Unable to return to previous employment working part time or frequently absent from work because of pain	W4	1
No work completely disabled	W5	

Table-2: Functional Independence Measure[8]

Description	Original Score	Modifies Score
Functionally independent (Timely & Safely)	7	4
Modified independence (device)	6	3
Modified dependence (Supervision required)	5	
Modified dependence with minimal assistance (subject = 75% + helper)	4	2
Modified dependence with moderate assistance (subject = 50% + helper)	3	
Complete dependence with maximum assistance (Subject = 25% + helper)	2	1
Complete dependence with Total assistance (Subject = 0% + helper)	1	

Table-3: Stability[9]

Description	Modifies score
Stable	2
Unstable	1

Table-4: Fusion grading (in operative cases only)[10]

Description	Original Score	Modifies Score
Trabecular Bridging & solid bony fusion	5	4
A lucent line at either end plate	4	3
The presence of bone graft but lucent line at either end plate	3	
Presence of bone graft fragmentation	2	1
No intervertebral bone graft seen	1	

Table-5: Neurological Improvement[11]

Description	Original Score	Modifies Score
Improvement of more than one level Frankle grade	5	4
Improvement of one grade	4	3
Improvement within same grade	3	2
No change	2	
Deterioration in Frankle grade	1	1

Results

Mean age of patients in this study was 35 Yr. (Operative 31.88 Yr, Conservative 38.2 Yr.) With approximately 73 % belongs to 20 to 40 years group of young and active individual. 86.66% (13) in operative group while 73.33% (11) in conservative group were male patients. Only 20% (6) were female patient in both groups.

As shown in figure 1, Road traffic accident was the major culprit for cervical spine injury in this study. It accounts for 46.66% of total patients, followed by fall from height and fall of heavy object on patient. 66% of Conservative Group & 33% of Operative (total 50%) of patients admitted on same day (< 24 Hr) of injury and overall 90% patients were admitted within 72Hr. (operative 80%, Conservative 100%) (Table 6). 3 Patients who had delay and admission more than 72Hr. are primary treated at elsewhere conservatively. Mechanism of injury is shown in Table 7.

In operative group out of 15 patient 3 had stable cervical spine injury & 12 had unstable injury. In conservative group 5 had stable cervical spine injury and 10 had unstable cervical spine injury. In case of conservative group Somi brace was used in 6 patient and four post collar was used in 3 patients. Mean application time after injury and application of hard cervical orthosis is 14 days. After achieving reduction of injury if spine found stable than early application of hard cervical orthosis was advised. Mean duration of application of hard cervical orthosis is 11 Wks.

Mean duration of hospital stay was 50 days in conservative group while it was 45 days in operative group. Complication related to recumbency (Bed sore) are more in the conservative group (6) as compare to operative group (4). 1 patient developed laryngeal nerve palsy and injury to esophagus in operative group otherwise. 1

patient having post operatively superficial infection in operative group. 3 patient in conservative group with fracture – dislocation were not reduce other patient having a well aligned spine after traction.

Table-6: Type of injury

Level of Injury		Conservative	Operative	Total
Upper Cervical Spine	C1	0	1 (6.66%)	1 (3.33%)
	C1-2	0	0	0
	C2	0	0	0
Lower Cervical Spine	C2-3	0	0	0
	C3	0	0	0
	C3-4	0	1 (6.66%)	1 (3.33%)
	C4	0	0	0
	C4-5	4 (26.66%)	4 (2.66%)	8 (26.66%)
	C5	0	2 (13.34%)	2 (6.66%)
	C5-6	4 (26.66%)	5 (33.33%)	9 (30%)
	C6	0	1 (6.66%)	1 (3.33%)
	C6-7	3 (20%)	0	3 (10%)
	C7	2 (13.34%)	1 (6.66%)	3 (10%)
	C7-1	0	0	0
Which Injury		2 (13.34%)	0	0
Total		15 (100%)	30 (100%)	15 (100%)

Table-7: Mechanism of injury

Mechanism of Injury		Conservative	Operative	Total
Flexion	CF DF	6 (40%)	9 (60%)	15 (50%)
Extension	CF DF	5 (33.33%)	4 (26.66%)	9 (29.98%)
Vertical Compression		2 (13.33%)	1 (6.66%)	3 (10%)
Other (SCIWORA), C1-2		2 (13.33%)	1 (6.66%)	3 (10%)
Total		15 (100%)	30 (100%)	15 (100%)

Table-8: Type of Surgery

Type of Surgery	No. of patient
Ant. Decompression BG + Fixation	13
Ant. + Post Fusion	1
Post fusion with instrumentation	1

Table-9: Entry & Final follow-up Frankle

Entry Frankle			Final follow-up Frankle					
Grade	A	B	A	B	C	D	E	Exp.
Conservative	9	6	5	3	4	2	1	6
Operative	10	5	7	0	4	2	2	5
Total	19	11	12	3	8	4	3	11

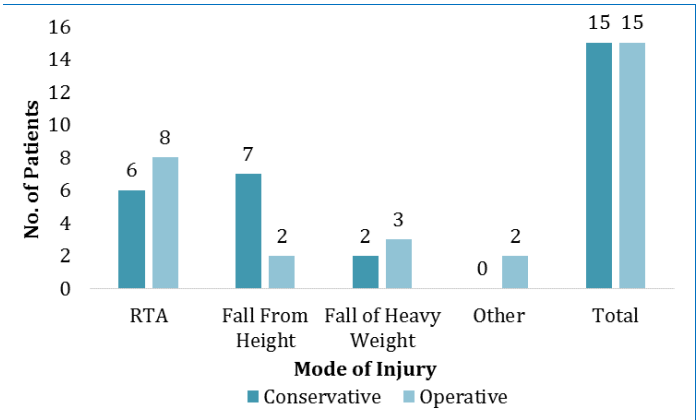

Figure-1: Mode of Injury

Overall among 30 patient only 15 patient (50%) improve neurologically other remained same or worsened. Neurological improvement in conservative (46.66%) and operative (53.33%) group was found practically to be with negligible difference. Overall mortality was 11 out of 30 (36.66%). Mortality was similar in booth operative and non-operative group. (Operative 33.33%, Non operative-40%). Longest duration of follow-up in conservative group was 28 months and in operative group was 34 months and average duration of shortest conservative group was 5 months and in operative group was 1 ½ months.

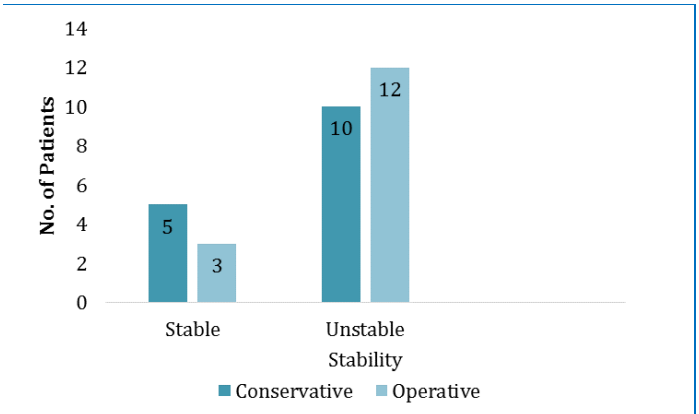

Figure-2: Stability of Injury

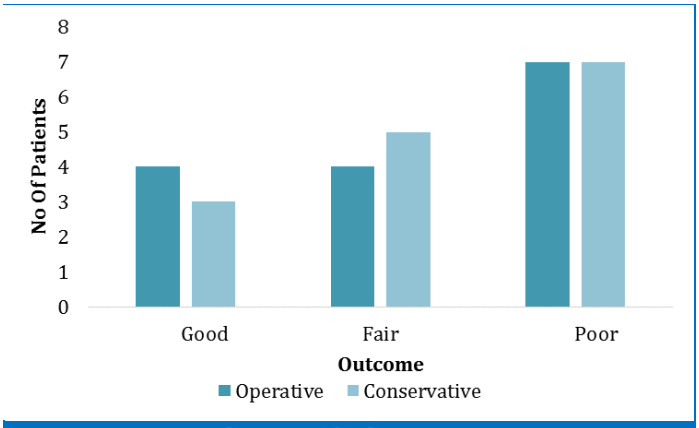

Figure-3: Outcome at the time of discharge

Discussion

Comprehensive information on the neurological and skeletal outcomes of patients with cervical spine can be obtained from this study. Some of whom were chosen for surgical management while some were chosen for conservative management depending on patients and their injury. Patients were divided into two groups, Conservative and operative. Demographically both groups were identical. Age, Sex, Mode of injury are comparable in both groups. These findings correlates with similar studies.[12] In this study more than 80% Patients are male. In similar study it was concluded that elderly male are more prone to develop cervical spine injury due to road traffic accidents.[13] in our study road traffic accident was major culprit followed by fall from height for cervical spine injury. This finding is consistent with similar western

study[14], while in one study this trend was reversed.[13]

In conservative group 2 Patients had whiplash injury and cervical spine injury without radiological abnormality (SCIWORA). In operative group only 1 patient had traumatic disc prolapse. Commonest level of injury was C5-6 injury and C 4-5. Injuries around C5 include (C4-5-6) approximately 56% was slightly higher than other similar study.[12] In operative group out of 15 patient 3 patients had stable cervical spine injury 12 had unstable injury. In conservative group 5 patients had stable cervical spine injury while 10 had unstable cervical spine injury. In operative group out of 15 patient 3 had stable cervical spine injury, 12 had unstable injury. In conservative group 5 had stable cervical spine injury and 10 had unstable cervical spine injury. In a similar study only 1 patient who had been given surgical management developed spinal instability while in conservative group spinal instability was seen in 10 patients at 3 months.[12]

Somi brace was used in 6 patient and four post collar was used in 3 patients. Mean application time after injury and application of hard cervical orthosis is 14 days. After achieving reduction of injury if spine found stable than early application of hard cervical orthosis was advised. Mean duration of application of hard cervical orthosis is 11 Wks.in a similar study external support with a removable orthosis was continued while sitting (or standing) in patients having instable spinal injury.[12]

Average stay is this study was found 50 days in conservative group and 45 days in operative group. Less No. of days for stay in operative group because of early mobilization but this difference is not statistically significant.in a similar study mean duration of stay was 42.9 days in surgical group while 47.9 in non-surgical group.[12]

Early surgery in this study was not directly related to better neurological out come as in other series. This difference may be because of delay in admission resuscitation facility, limited ventilator facility, affordability of patient for MRI/ CAT SCAN and overall load of patient of in general hospital.[4,12] It was also observed that delay in surgery was not related to lesser no. of complication.

Irrespective of line of management 50% patient improve improved neurologically. Remaining remained at same level or worsened. Overall mortality rate was 11 out of 30 (36.66%) mortality was similar in booth operative and non-operative group. (Operative 33.33%, Non operative-40%). Comparing neurological improvement in conservative (46.66%) and operative (53.33%) group was found to be similar. The poor result in this group was irrespective of choice of the line of management this may due to severity of injury itself or poor preoperative and post-operative management facility available in general hospital in our country.

Complication related to recumbency (Bed sore) were more in the conservative group (6) as compared to operative group (4). 1 patient developed laryngeal nerve palsy and injury to esophagus in operative group. 1 patient developed post-operative superficial infection. Common cause of death in both group was due to respiratory failure secondary to cord edema extending to medulla.

Early appearance of sign of recovery may be more important in determining the degree of neurological recovery rather than type of treatment given, stabilization chosen for surgery, mechanism of bony injury and anatomical reduction. Fair result are better in conservative group so it is not that every time operative result are better than conservative result but this being only small study and large no. of patient are required for confirmation.

Very good result was obtained in conservative group in 20%, while in operative group is 26.66% patients. But fair result was obtained in conservative group in 33.33% and operative group in 26.66%. Patients. Equal no. of poor result was obtained in both conservative and operative group that is 46.66%.

Conclusion

The ultimate neurological and functional outcome of cervical injury was probably decided at time of injury itself rather than by chosen management. Improvement in neurological function was independent of factor like type of surgery, Mechanism of injury (flexion-extension), spinal deformity and type of management. Surgical stabilization result in batter alignment and stability, early rehabilitation and probably decrease in length of stay but has its own complication and great economic burden to patients.

References

1. Syre P, Petrov D, Malhotra NR. Management of upper cervical spine injuries: a review. J Neurosurg Sci 2013;57:219-40.
2. Hutchison RL, Rayan GM. Astley Cooper: his life and surgical contributions. J Hand Surg Am 2011;36:316-20.
3. Bucci MN, Dauser RC, Maynard FA, Hoff JT. Management of post-traumatic cervical spine instability: operative fusion versus halo vest immobilization. Analysis of 49 cases. J Trauma 1988;28:1001-6.
4. Donovan WH, Kopaniky D, Stolzmann E, Carter RE. The neurological and skeletal outcome in patients with closed cervical spinal cord

injury. J Neurosurg 1987;66:690-4.
5. Aarabi B, Mirvis S, Shanmuganathan K, Vaccaro AR, Holmes CJ, Akhtar-Danesh N, et al. Comparative effectiveness of surgical versus nonoperative management of unilateral, nondisplaced, subaxial cervical spine facet fractures without evidence of spinal cord injury. J Neurosurg Spine 2014;20:270-7.
6. O'Dowd JK. Basic principles of management for cervical spine trauma. European spine journal : official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society. 2010;19 Suppl 1:S18-22.
7. Denis F. Spinal instability as defined by the three-column spine concept in acute spinal trauma. Clin Orthop Relat Res 1984;189:65-76.
8. Turner-Stokes L, Nyein K, Turner-Stokes T, Gatehouse C. The UK FIM+FAM: development and evaluation. Functional Assessment Measure. Clin Rehabil 1999;13:277-87.
9. White AA III PM, Panjabi MM. The clinical biomechanics of spine. 2nd ed. Philadelphia; Lippincott. 1990.
10. Zdeblick TA, Wilson D, Cooke ME, Kunz DN, McCabe R, Ulm MJ, et al. Anterior cervical discectomy and fusion. A comparison of techniques in an animal model. Spine. 1992;17:S418-26.
11. Gertzbein SD. Scoliosis Research Society. Multicenter spine fracture study. Spine. 1992;17:528-40.
12. Donovan WH, Cifu DX, Schotte DE. Neurological and skeletal outcomes in 113 patients with closed injuries to the cervical spinal cord. Paraplegia 1992;30:533-42.
13. Yang S, Ding W, Yang D, Gu T, Zhang F, Zhang D, et al. Epidemiology and Risk Factors of Cervical Spine Injury during Heating Season in the Patients with Cervical Trauma: A Cross-Sectional Study. PloS one. 2013;8:e78358.
14. Ho CH, Wuermser LA, Priebe MM, Chiodo AE, Scelza WM, Kirshblum SC. Spinal cord injury medicine. 1. Epidemiology and classification. Arch Phys Med Rehabil 2007;88:S49-54.

Cite this article as: Patel A, Sutariya B. Comparison of functional and neurological outcome of conservative and operative management in patients with cervical spine injury with complete quadriplegia. Int J Med Sci Public Health 2014;3:625-629.
Source of Support: Nil
Conflict of interest: None declared