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PROGNOSTIC OUTCOME IN SUBAXIAL CERVICAL SPINE INJURIES MANAGEMENT BY ANTERIOR CERVICAL DYNAMIC PLATE WITH CAGE/GRAFT FIXATION AND POSTERIOR CERVICAL LATERAL MASS SCREW-ROD FIXATION METHODS

Surgery

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ABSTRACT

Introduction: The anterior cervical decompression and fusion (ACDF)procedures, especially in cases requiring decompression of two or more levels. Routine use for the treatment of cervical spondylosis has caused plate design to change significantly in recent years.

Aim: To estimate the incidence of sub axial cervical trauma patients admitted in the Neurosurgery wards of the institute. To study the therapeutic outcome after management of the subaxial cervical trauma cases by Anterior cervical decompression (discectomy/corpectomy) with graft or cage and dynamic plate fixation, posterior lateral mass screw-rod fixation, bidirectional single stage combined approach techniques. To compare anterior dynamic plate graft fixation with the posterior lateral mass screw rod fixation in cases that could be managed by any single approach.

Material and methods: This non randomized prospective observational study was conducted in the Department of Neurosurgery, Mahatma Gandhi Medical College & Hospital, Jaipurfrom April 2018 to December 2019. All diagnosed cases of subaxial cervical spine attending and being admitted to our institute during the study period and treated by anterior cervical decompression with dynamic plate fixation, posterior lateral mass screw rod fixation or combined technique were included in the study.

Result: According to AO Spine Classification Type, 10(20.8%) patients had A2, 15(31.3%) patients had A3, 8(16.7%) patients had A4, 1(2.1%) patient had B2, 13(27.1%) patients had C and 1(2.1%) patient had C,F4. It was found that in Non Severe group, 6(31.6%) patients had A3type in AO Spine Classification Type and in severe group 9(31.0%) patients had A3type in AO Spine Classification Type. In Non Severe group, 4(21.1%) patients had C type in AO Spine Classification Type and in Severe group 9(31.0%) patients had C type in AO Spine Classification Type. The association between AO Spine Classification Type vs ASIA Impairment Scale Group was not statically significant (p=0.6887).

Conclusion: In ASIA IMPAIRMENT SCALE GROUP, 5 SLICS1 was higher [6(31.6%)] in Non Severe group and 8 SLICS1 was higher [9(31.0%)] in Severe group which was not statically significant (p=0.4820).The mean EQ5D post op at 6month of Non Severe (ASIA IMPAIRMENT SCALE) patients was higher than the Severe group of patients which wasstatically significant (p=0.0442).

KEYWORDS

Cervical Spine, Subaxial cervical trauma, posterior lateral mass screw rod fixation.

INTRODUCTION

The subaxial spine C3 to C7 segments, an highly mobile area of the spine and prone to instability and neurological deficits after trauma. A goal of treatment is to decompress the spine when necessary and provide stability in order to promote early mobilization and start the recovery process.

The anterior cervical decompression and fusion (ACDF)procedures, especially in cases requiring decompression of two or more levels. Routine use for the treatment of cervical spondylosis has caused plate design to change significantly in recent years. The first anterior cervical plates were unlocked and required bicortical purchase. Anterior cervical plates with constrained designs and locking plate-screw head connections then came into favor. The latest plates are semi-constrained dynamic plates that allow some movement in rotation and translation[1].

The posterior cervical fusion techniques have also underwent significant advancements. The first attempt to perform a posterior cervical fusion was achieved by placing autograft on the posterior elements and applying a rigid external orthosis such as a Minerva jacket. Over the ensuing years, these techniques have evolved to include variations of hooks, wires, and screw-plate–screw-rod constructs. The need for rigid external orthosis has subsequently decreased.

Recent advances in complex spinal surgery have helped foster the increased number of cervical spine procedures that are using a bidirectional approach i.e circumferential fusion by combined anterior and posterior techniques. This is done for decompression of the neural elements, biomechanical stresses, and to influence fusion.

Graft- and plate-related complications are not uncommon problems associated with anterior cervical fusion surgery. Although the reasons for such complications are protean, one potential set of etiologies centers on plate design. Dynamic cervical plates, which allow for better load sharing while providing overall resistance to motion, address perceived biomechanical deficiencies of rigid cervical plates. But nonunion seen in few cases, may be the consequence of the increased motion and toggling at the graft–bone the fusion ability of the patient[2].

For anterior cervical decompression and fusion, reinforcement by plate fixation was performed to decrease early reconstruction failure and to increase the fusion rate. However, a relatively high complication rate such as graft dislodgement has been reported in patients undergoing multilevel corpectomy and reconstruction. Risk factors associated with early reconstruction failure have not been explicitly described.

AIMS AND OBJECTIVES

1. To estimate the incidence of subaxial cervical trauma patients admitting in the Neurosurgery wards of the institute.
2. To study the therapeutic outcome after management of the subaxial cervical trauma cases by Anterior cervical decompression (discectomy/corpectomy) with graft or cage and dynamic plate fixation, posterior lateral mass screw-rod fixation, bidirectional single stage combined approach techniques.
3. To compare anterior dynamic plate graft fixation with the posterior lateral mass screw rod fixation in cases that could be managed by any single approach.

MATERIAL AND METHODS

Ethical clearance to carry out the study was obtained from the ethical committee of the institute. The study protocol was explained to the patient/guardian and a written informed consent was obtained from each subject to be enrolled in the study.

Study Setting: Department of Neurosurgery,
Study Period : April 2018 TO December 2019

Type Of Study: Hospital based study.
Study Design: Non Randomized Prospective Observational Study.
Study Sample: All diagnosed cases of subaxial cervical spine attending and being admitted to our institute during the study period and treated by anterior cervical decompression with dynamic plate fixation, posterior lateral mass screw rod fixation or combined technique were included in the study.

INCLUSION CRITERIA:
All the patients admitted to our hospital for the treatment of subaxial cervical injuries and undergoing anterior cervical decompression with dynamic plate fixation, posterior lateral mass screw rod fixation or combined approach.

EXCLUSION CRITERIA:
1. Individuals not willing to participate in the study.
2. Patients presenting with cervical injuries but after proper radiological evaluation needed no operative intervention
3. Patients with poor neurological status in whom definitive investigation to establish injuries could not be done.

Study tools:
(A) Clinical: History taking and clinical examination with help of pre-designed and pre-tested proforma.

(B) Investigation:
[1] Routine hematological and biochemical tests
[2] Radiological
a) NCCT head
b) MRI CERVICAL SPINE WITH WHOLE SPINE SCREENING
c) EMG & NCV OF all 4 limbs
d) Relevant investigations to rule out any associated pathology e.g- for ankylosing spondylitis,

Study Techniques:
This is an observational study among the members of the study population. Results were explained in the form of percentage and by extrapolating and comparing it with standard literature. Patients were examined clinically, radio logically and operated by anterior cervical decompression with graft/cage with dynamic plate fixation, posterior lateral mass screw rod fixation or combined approach. The outcome shall be assessed with SLICS score, ASIA score, ASIA recovery grade, radiology for evaluation of fusion and adjacent segment abnormality if any.

Data Analysis:
Data thus generated was analyzed with the help of Microsoft excel 2007 and SPSS version 22nd software. Appropriate tables were generated. Mean (SD), median (range). Student's unpaired't' test, Chi-square test and other appropriate statistics as applicable was incorporated in the study for statisticalinferences

DISCUSSION
We found that 12(25.0%) patients were in ≤30 years old, 18(37.5%) patients were in 31-40 years old, 13(27.1%) patients were in 41-50 years old and 5(10.4%) patients were in 51-60 years old.The mean Age (yrs) (mean± s.d.) of patients was 37.0833 ± 8.8410. 10(20.8%) patients were female and 38(79.2%) patients were male.

The mean Time of lapse from trauma at presentation (mean± s.d.) of patients was 26.1042 ± 20.7674. We found that 11(22.9%) patients had FFH and 37(77.1%) patients had RTA.

Okawa A et al [3] (2011) found that reconstruction failures included anterior slipping at the bottom of the graft in 2 cases, fracture of the C7 vertebral body in 2 cases, and pullout of a screw in 2 cases. Four patients were found to have nonunion of the graft at the final follow-up, but none had experienced early reconstruction failure. On radiologic measurement, the fusion area lordotic angle after surgery in the patients with reconstruction failures was significantly larger than that of the patients with no complications.

It was found that 1(2.1%) patient had C3#, 2(4.2%) patients had C4#, 1(2.1%) patient had C4-C5#, 2(4.2%) patients had C4listhesis, 16(33.3%) patients had C5#, 2(4.2%) patients had C5-C6#, 7(14.6%) patients had C5listhesis, 11(22.9%) patients had C6#, 4(8.3%) patients had C6listhesis, 1(2.1%) patient had C7# and 1(2.1%) patient had C7listhesis.

In operation procedure, 1(2.1%) patient had 360° fixation C7 corpectomyanterior plate&C6-C7lateral massD1-D2tpsrf, 1(2.1%) patient had C3corpectomy with g-bone plate fixation, 3(6.3%) patients had C4-5-6lateral mass fixation, 3(6.3%) patients had C4corpectomy with cage plate fixation, 1(2.1%) patient had C4corpectomy with g-bone plate fixation, 22(45.8%) patients had C5corpectomy with cage plate fixation, 1(2.1%) patient had C5corpectomy with gbone plate fixation, 15(31.3%) patients had C6corpectomy with cage plate fixation and 1(2.1%) patient had C7corpectomy with cage plate fixation.

According to AO Spine Classification Type, 10(20.8%) patients had A2, 15(31.3%) patients had A3, 8(16.7%) patients had A4, 1(2.1%) patient had B2, 13(27.1%) patients had C and 1(2.1%) patient had C,F4 .
It was found that in Non Severe group, 6(31.6%) patients had A3type in AO Spine Classification Type and in severe group 9(31.0%) patients had A3type in AO Spine Classification Type. In Non Severe group, 4(21.1%) patients had C type in AO Spine Classification Type and in Severe group 9(31.0%) patients had C type in AO Spine Classification Type. The association between AO Spine Classification Type vs ASIA Impairment Scale Group was not statically significant (p=0.6887).

Pitzen TR et al [4] (2009) found that one hundred thirty-two patients were included and assigned by randomization to one of the groups in which they received a routine anterior cervical discectomy and autograft fusion with either a dynamic plate (ABC, study group) or a rigid plate (CSLP, control groupdynamic cervical plate designs provide less implant complications (no patient) compared with rigid plate designs (4 patients). Speed of fusion was faster in the presence of a dynamic plate.

We found that in ASIA IMPAIRMENT SCALE GROUP, 5 SLICS1 was higher [6(31.6%)] in Non Severe group and 8 SLICS1 was higher [9(31.0%)] in Severe group. The association between SLICS1 vs ASIA Impairment Scale Group was not statically significant (p=0.4820).

Our study showed that in ASIA IMPAIRMENT SCALE GROUP, 3rd grade (BSFusion Grade post opat 3month) was higher [14(73.7%)] in Non Severe group and 3rd grade (BSFusion Grade post opat 3month) was higher[25(86.2%)]in Severe group. The association between BSFusion Grade post op at3month vs ASIA Impairment Scale Group was not statically significant (p=0.3682).

Park JO et al [5] in 2013 showed that after 6 months of the surgery, they showed little difference compared with the preoperative heights. However, clinically, patients showed improvements in radiating pain during the follow-up period. Anterior cervical dynamic rotational plating was an effective treatment modality for cervical radiculopathy without the deterioration of the foraminal and intervertebral discal height.

It was found that in ASIA IMPAIRMENT SCALE GROUP, 4th grade (BSFusion Grade post opat 6month) was higher [17(89.5%)] in Non Severe group and 4th grade (BSFusion Grade post opat 6month) was higher [28(96.6%)]in Severe group. The association between BSFusion Grade post op at6month vs ASIA Impairment Scale Group was not statically significant (p=0.4321).

We found that in 4 SLICS1, the mean EQ5D post op 3atmonth (mean± s.d.) of patients was 61.2500 ± 20.9662.In 5SLICS1, the mean EQ5D post op 3 atmonth (mean± s.d.) of patients was 57.7273 ± 10.0905.In 6SLICS1, the mean EQ5D post op 3at month (mean± s.d.) of patients was 50.3846 ± 13.9137.In 7SLICS1, the mean EQ5D post op 3at month (mean± s.d.) of patients was 60.8333 ± 7.3598.In 8SLICS1, the mean EQ5D post op 3at month (mean± s.d.) of patients was 47.3077 ± 13.6344.In 9SLICS1, the mean EQ5D post op 3 atmonth (mean± s.d.) of patients was 35.0000 ± 0.0000.The association between EQ5D post op at3month vs SLICS1was not statically significant (p=0.0958).

We also found that in 4 SLICS1, the mean EQ5D post op at6month (mean± s.d.) of patients was 76.2500 ± 19.3111.In 5 SLICS1, the mean EQ5D post op at6month (mean± s.d.) of patients was 70.4545 ± 9.0704. In 6 SLICS1, the mean EQ5D post op at6month (mean± s.d.) of patients was 63.0769 ± 13.3133. In 7 SLICS1, the mean EQ5D post op at6month (mean± s.d.) of patients was 66.6667 ± 6.8313. In 8 SLICS1, the mean EQ5D post opat 6month (mean± s.d.) of patients was 61.1538 ± 12.6085. In 9 SLICS1, the mean EQ5D post opat

6month (mean± s.d.) of patients was 30.0000 ± 0.0000. The difference between EQ5D post op at6month vs SLICS1 was statically significant (p=0.0172).

It was found that in 4 SLICS1, the mean EQ5D post op at6month (mean± s.d.) of patients was 76.2500 ± 19.3111. In 5 SLICS1, the mean EQ5D post opat 6month (mean± s.d.) of patients was 70.4545 ± 9.0704. In 6 SLICS1, the mean EQ5D post op at6month (mean± s.d.) of patients was 63.0769 ± 13.3133. In 7 SLICS1, the mean EQ5D post opat 6month (mean± s.d.) of patients was 66.6667 ± 6.8313. In 8 SLICS1, the mean EQ5D post op at6month (mean± s.d.) of patients was 61.1538 ± 12.6085. In 9 SLICS1, the mean EQ5D post op at6month (mean± s.d.) of patients was 30.0000 ± 0.0000. The difference between EQ5D post op at6month vs SLICS1 was statically significant (p=0.0172).

Our study showed that in 1st grade, the mean EQ5D post op at 6month (mean± s.d.) of patients was 30.0000 ± 0.0000. In 2nd grade, the mean EQ5D post op at 6month (mean± s.d.) of patients was 52.5000 ± 10.6066. In 4th grade, the mean EQ5D post op at 6month (mean± s.d.) of patients was 66.4444 ± 12.4144. The difference between EQ5D post op at 6month vs BSFusion Grade post op at 6month was statically significant (p=0.0084).

It was found that in Non Severe, the mean EQ5D post op at 3month (mean± s.d.) of patients was 57.1053 ± 11.4644. In Severe, the mean EQ5D post op at 3month (mean± s.d.) of patients was 50.5172 ± 14.6595. The difference between EQ5D post op at 3month vs ASIA IMPAIRMENT SCALE was not statically significant (p=0.1051).

We found that in Non Severe, the mean EQ5D post op at 6month (mean± s.d.) of patients was 69.2105 ± 14.1680. In Severe, the mean EQ5D post op at 6month (mean± s.d.) of patients was 61.4138 ± 12.5086. The difference between EQ5D post op at 3month vs ASIA IMPAIRMENT SCALE was statically significant (p=0.0442).

Table: Distribution of mean EQ5D post opat 3month and 6month:SLICS1

		Number	Mean	SD	Minimum	Maximum	Median	p-value
EQ5D post op at 3month	4	4	61.2500	20.9662	30.0000	75.0000	70.0000	0.0958
	5	11	57.7273	10.0905	30.0000	65.0000	60.0000	
	6	13	50.3846	13.9137	25.0000	75.0000	50.0000	
	7	6	60.8333	7.3598	50.0000	70.0000	62.5000	
	8	13	47.3077	13.6344	20.0000	60.0000	50.0000	
	9	1	35.0000	.0000	35.0000	35.0000	35.0000	
EQ5D post op at 6month	4	4	76.2500	19.3111	50.0000	95.0000	80.0000	0.0172
	5	11	70.4545	9.0704	55.0000	90.0000	70.0000	
	6	13	63.0769	13.3133	45.0000	90.0000	65.0000	
	7	6	66.6667	6.8313	60.0000	80.0000	65.0000	
	8	13	61.1538	12.6085	40.0000	90.0000	65.0000	
	9	1	30.0000	.0000	30.0000	30.0000	30.0000	

Table: Distribution of mean EQ5D post op at 3month: BSFusion Grade post op at 3month and at 6month: BSFusion Grade post op at 6month

		Number	Mean	SD	Minimum	Maximum	Median	p-value
EQ5D post op 3month	1	1	45.0000	.0000	45.0000	45.0000	45.0000	0.2033
	2	4	43.7500	7.5000	35.0000	50.0000	45.0000	
	3	39	53.2051	14.1648	20.0000	75.0000	60.0000	
	4	4	63.7500	8.5391	55.0000	75.0000	62.5000	
EQ5D post op at 6month	1	1	30.0000	0.0000	30.0000	30.0000	30.0000	0.0084
	2	2	52.5000	10.6066	45.0000	60.0000	52.5000	
	4	45	66.4444	12.4144	40.0000	95.0000	65.0000	

Table: Distribution of mean EQ5D post opat 3month and 6month: ASIA IMPAIRMENT SCALE

		Number	Mean	SD	Minimum	Maximum	Median	p-value
EQ5D post op 3month	Non Severe	19	57.1053	11.4644	35.0000	75.0000	60.0000	0.1051
	Severe	29	50.5172	14.6595	20.0000	70.0000	55.0000	
EQ5D post op 6month	Non Severe	19	69.2105	14.1680	30.0000	95.0000	70.0000	0.0442
	Severe	29	61.4138	12.5086	40.0000	90.0000	65.0000	

CONCLUSION

The association between AO Spine Classification Type and ASIA Impairment Scale Group was not statically significant (p=0.6887). In ASIA IMPAIRMENT SCALE GROUP, 5 SLICS1 was higher [6(31.6%)] in Non Severe group and 8 SLICS1 was higher [9(31.0%)] in Severe group which was not statically significant (p=0.4820).The mean EQ5D post op at 6month of Non Severe (ASIA IMPAIRMENT SCALE) patients was higher than the severe group of patients which was statically significant (p=0.0442).

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