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Study of clinical outcome following cervical spine surgery: prognostic indicators

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ABSTRACT

Background: Cervical spine surgeries done through anterior approach and posterior approach. Anterior approach is preferred in degenerative conditions and cervical spine injury. Posterior approach preferred in pathological conditions like intra dural extra tumor. Our study is to analyse the functional outcome and recovery of patients who undergone cervical spine surgeries by anterior cervical discectomy and fusion (ACDF) by bone graft with or without instrumentation, anterior cervical decompression by corpectomy and fusion and posterior cervical decompression by laminectomy.

Methods: This cross-sectional study contains patients admitted in Surgery Department, Gandhi Medical College and Hamidia Hospital, Bhopal between July 2017 to April 2019 with degenerative disease/trauma/pathological (tumor) having neurological deficit or not, to know the clinical outcome after cervical spine surgeries anterior approach and posterior approach after approval from ethical committee.

Results: In 70 cases of study 09 patients had mild preoperative neurology score (15-17) in which 3 patients had no improvement after 6 months and 06 patients improved (normal function). 39 patients had moderate preoperative neurology score (12-14) in which 28 patients improved with moderate to mild score and 03 patients remain same (no improvement). 03 patients improved after 1 year with mild score. 22 patients had severe preoperative neurology score (0-11) in which 05 cases improved with severe to moderate score and 05 cases improved with severe to mild score. These 05 cases improved with mild score after 1 year.

Conclusions: Anterior approach is better than posterior approach in our study which is comparable with existing studies in terms of hospital stay, neurological recovery and final outcome.

Keywords: ACDF, Anterior approach, Cervical spine

INTRODUCTION

Cervical spine surgeries done through anterior approach and posterior approach. Anterior approach is preferred in degenerative conditions and cervical spine injury. Posterior approach preferred in pathological conditions like intradural extramedullary tumor. Operative management is indicated for most of the patients with clinically evident degenerative disease and it is recommended for patients who have either substantial or progressive impairment of neurological function without

sustained remission.^{1,2} Surgery for degenerative disease involving one or two motion segments may be successfully performed with a low incidence of complications, and consensus favors anterior cervical decompression with fusion and instrumentation for this kind of patients while surgical treatment for multilevel cervical myelopathy (MCM) of three or more levels is associated with less predictable outcomes and a higher frequency of complications.^{3,4,6} Surgical management is the treatment of choice in cases of progressive or severe neurological.⁷ Anterior decompressive approaches

typically involve anterior cervical discectomy and fusion (ACDF) or anterior cervical corpectomy and fusion (ACCF), whereas posterior approaches comprise laminoplasty or laminectomy with or without arthrodesis. In general, an anterior approach is preferred in cases of ventral compression occupying few levels while attempting to restore cervical lordosis.⁴ Every year many cases of degenerative disease, traumatic cervical spine injuries/tumor are getting admitted and operated in Department of Surgery, Gandhi Medical College, Hamidia Hospital, Bhopal. Our study is to analyze the functional outcome and recovery of patients who undergone cervical spine surgeries by anterior cervical decompression and fusion by bone graft with or without instrumentation, anterior cervical decompression by corpectomy and fusion and posterior cervical decompression by laminectomy.

METHODS

This cross-sectional study included All patients with degenerative disease/trauma/pathological (tumor) having neurological deficit or not were admitted in surgery department, Gandhi Medical College and Hamidia Hospital, Bhopal, were included in this study conducted between July 2017 to April 2019 to know the clinical outcome after cervical spine surgeries anterior approach and posterior approach.

Inclusion criteria

Patients admitted in Gandhi Medical College and Hamidia Hospital, Bhopal, undergoing cervical spine surgeries.

Exclusion criteria

Age group <13 years. Conservatively managed cases. Patients of cervical spine injury admitted in emergency as well as in routine. Patients of degenerative disease/tumor admitted in routine time. All blood investigations including complete blood picture, renal function tests, serum electrolytes, X-ray cervical spine anteroposterior view and lateral view, MRI cervical spine with screening of whole spine, physician fitness and pre-anaesthetics checkup is done and then plan the procedure.

All cases were preoperatively assessed clinically by modified JOA scale (Japanese Orthopedic Association Scale) pre-operative and post-operative neurology score and radiologically by X-ray cervical spine AP, lateral, MRI cervical spine. Appropriate informed written consent was obtained from the patient and their relatives after explain the purpose of the surgery and the neurological recovery.

Statistical analysis done by paired T test and unpaired T test. Paired T test - a paired T test is a type of location test that is used when comparing two sets of measurements to assess whether their population means

differ. A paired difference test uses additional information about the sample that is not present in an ordinary unpaired testing situation, either to increase the statistical power or to reduce the effects of confounders.

RESULTS

The cross-sectional study is done in Gandhi Medical College and Hamidia Hospital, Bhopal, Madhya Pradesh in which 70 cases is taken which had undergone for cervical spine surgeries in degenerative disease, cervical spine injury, intra-dural extra-medullary tumor/intradural intramedullary tumour. Statistical analysis of these cases was done using paired T test and unpaired T test to know the outcome, safety, long term result of anterior approach and posterior approach.

Table 1: Distribution of age.

Age in years	Frequency	Percent
13-20	05	08
21-30	20	28
31-40	18	25
41-50	07	10
51-60	05	08
61-70	15	21
Total	70	100

Table 2: Sex incidence.

Sex	Frequency	Percent
Male	44	62
Female	26	38
Total	70	100

Table 3: Distribution of mode of etiology.

Mode of etiology	Frequency	Percent
Degenerative disease	28	40
Trauma	21	30
Pathological	21	30
Total	70	100

Table 4: Distribution of type of lesions.

Level of lesion	Frequency	Percent
C-1/c-2	1	2
C-2/c-3	2	3
C-3/c-4	6	8
C-4/c-5	20	28
C-5/c-6	30	42
C-6/c-7	7	10
#c-3 body	2	3
#c-5 body	1	2
#c-6 body	1	2
Total	70	100

Table 5: Neurological outcomes according to etiology.

Etiology	Motor loss	Sensory loss	Bladder involvement	Death
Degenerative	Quadriplegia- 15	09	06	06
	Paraparesis- 13			
Trauma	Quadriplegia- 06	18	15	10
	Quadripareisis- 10			
Tumor	Paraparesis- 05	07	04	04
	Quadripareisis- 13			
	Paraparesis- 07			

The most common age group was 21-30 years 28%, the maximum age 70 years, the mean age in our study 40 years, and the study is done in Hamidia Hospital in which 70 cases taken. Out of 70 cases there are 44 (62%) males and 26 (38%) females.

There were 44 males 62% and 26 females 38%. Incidence of males is more because they are more involved in field work and outside work.

The most common mode of etiology is degenerative disease 40% followed by cervical spine injury 30% (RTA/accidental fall/slip while carrying weight). Pathological (intra-dural extramedullary tumour/intra-dural intramedullary tumour).

The most common level was c-5/c-6 (40%) then c-4/c-5 (28%). In degenerative etiology quadripareisis occurs in 15 persons and paraparesis in 13, which includes 06 death among them. In trauma 06 patients had quadriplegia, 13 had quadripareisis and 05 had paraparesis including 10 deaths. Tumor causes quadripareisis in 13 patients and paraparesis in 07 including 04 death.

Table 6: Distribution of type of surgery.

Type of surgery	Frequency	Percent
Anterior cervical discectomy with fusion by G graft/autologous graft (degenerative conditions)	28	40
Anterior cervical discectomy with fusion by G graft with plating (traumatic cervical spine injury)	17	21
Anterior corpectomy with fusion by bone graft (traumatic cervical spine injury)	4	6
Posterior cervical laminectomy (pathological conditions)	21	30
Total	70	100

Out of 70 surgeries 28 were anterior cervical discectomy with fusion by G graft/autologous graft (degenerative conditions). 17 were anterior cervical discectomy with fusion by G graft with plating (traumatic cervical spine injury). Anterior corpectomy with fusion by bone graft were 4 and 21 were posterior cervical laminectomy.

Neurological status before and after cervical spine surgery ACC to modified JOA scale. Mild score 15-17, moderate score 12-14 and severe score 0-11.

Table 7: Follow up neurological status before and after 6 months and 1 year.

Pre-operative neurology score	Follow up neurology score after 6 months	Follow up neurology score after 1 year
Mild - 09	Remain same - 03	Remain same - 03
	Improved - 06	Improved - 06
Moderate - 39	Moderate to >mild - 28	Moderate to mild - 31
	Moderate- >moderate - 03	
Severe - 22	Death - 08	Severe to >mild - 10
	Severe to >moderate - 05	
	Severe to >mild - 05	
	Death - 12	

Table 8: Neurological outcome according to type of approach (anterior vs posterior approach).

Anterior approach (n=49)	Posterior approach (n=21)
Severe to >mild - 03 cases	Severe to >mild - 05 cases
Severe to >moderate - 09 cases	Severe to >moderate - 00 cases
Moderate to >mild - 16 cases	Moderate to >mild - 08 cases
No improvement - 05 cases	No improvement - 04 cases
Death - 16 cases	Death - 04 cases

Table 9: Comparison of mean change of score (neurological outcome) in anterior vs posterior approach by using unpaired T test.

S. no.	Procedure	N	Mean change in post op neurology score	SD	SEM	P value
1	Anterior approach	49	2.33	0.920	0.177	0.004
2	Posterior approach	21	1.74	1.421	0.296	0.001

In 70 cases of study 09 patients had mild (decrease weakness in hands or proximal arm, able to walk without aid, no sensory loss, no bladder involvement) pre op neurology score (15-17) in which 3 patients had no improvement after 6 months and 06 patients improved (normal function). 39 patients had moderate (fine motor functions decreased and need handrails on stairs, no sensory loss, no bladder involvement) pre-operative neurology score (12-14) in which 28 patients improved with moderate to mild score and 03 patients remain same (no improvement). 03 patients improved after 1 year with mild score. 22 patients had severe (fine motor functions massively decreased and need walking aid on flat floor, minimal sensory loss, bladder dysfunction present) pre-operative neurology score (0-11) in which 05 cases improved with severe to moderate score and 05 cases improved with severe to mild score. These 05 cases improved with mild score after 1 year.

In series of 70 cases, the cases which has been operated through anterior approach had more improvement in post-operative neurology/functional outcome than posterior approach. The cases operated through anterior approach 16 deaths occurred and the cases operated through posterior approach 04 deaths occurred.

DISCUSSION

The study is done in Gandhi Medical College and Hamidia Hospital, Bhopal in which 70 cases is taken which had undergone for cervical spine surgeries in degenerative disease, cervical spine injury, intra-dural extramedullary tumour/intra-dural intramedullary tumour. Statistical analysis of these cases was done using paired T test and unpaired T test to know the outcome, safety, long term result of anterior approach and posterior approach.

From our study it was found that are more commonly involved in the age group of 21-40 years who are the most important persons socioeconomically. The younger age group is working age group in which traumatic cervical spine injury and pathological (IDEM) are common and degenerative conditions is more common in old age group. In our study mean age group is 21-30 years. In Qena university study mean age group is 21-30 years.⁸ In Masshad University of Medical Sciences study mean age group is 31-40 years.⁹ In University of Health

Sciences study, Ontario mean age group is 21-30 years.¹⁰ In our study out of 70 cases 44 cases 62% are males and 26 females 38%. In Qena University study out of 50 cases males 36 (72%), females 14 (28%). In Masshad University of Medical Sciences study out of 70 cases males 40 (57.1%), females 30 (42.8%). In University of Health Sciences study, Ontario out of 50 cases males 26 (52%), females (48%). Males are more commonly involved than females due to they are more involved in field work and outside work. In our study most common mode is degenerative disease 28 cases 40% are present. Cervical spine injury which is due to RTA, ACC fall and slip while carrying weight 21 cases 30% are present, in which RTA is more common followed by acc fall which is similar to these 3 studies. In Dr. Ali Kamel (Qena University, South Valley) study most common mode of etiology is degenerative disease followed by cervical spine injury.⁸ In Dr. Imam Reza (Masshad University of Medical Sciences) most common mode of etiology is degenerative disease followed by cervical spine injury. In Dr. Salem El Zuway (University of Health Sciences Study, Ontario) Sciences most common mode of etiology is degenerative disease followed by cervical spine injury.

In our study most common level of lesion is found at C-5/C-6 level 30 cases 42%. Followed by C-4/C-5 20 cases (28%). In Dr. Ali Kamel (Qena University, South Valley) study most common level of lesion is C-5/C-6 followed by C-4/C-5. In Dr. Imam Reza (Masshad University of Medical Sciences, Iran) most common level of lesion is C-5/C-6 followed by C-4/C-5. In Dr. Salem El Zuway (University of Health Sciences study, Ontario) most common level of lesion is C-5/C-6 followed by C-4/C-5. In our study we found that neurological outcome is better in anterior approach than posterior approach although 16 deaths occurs in anterior approach in trauma and degenerative patients because of patients came late to hospital and operated late. In Dr. Ali Kamel (Qena University, South valley) study they found better neurological outcome than posterior approach. In our study we found that average hospital stay in anterior approach is 7 days and in posterior approach is 10 days. In Qena University study they found that average hospital stays in patients operated through anterior approach is 7 days and in posterior approach is 12 days. In Masshad University of Medical Sciences study average hospital stay in patients operated through anterior approach is 8 days and in posterior approach is 10 days.

Table 10: Outcome in similar studies.

Variables	Qena University Hospital, South Valley ⁸	Imam Reza Hospital, Masshad University of Medical Sciences, Iran ⁹	University and Health Sciences, Ontario, Canada ¹⁰	GMC and Hamidia Hospital, Bhopal
Total cases	50	70	50	70
	M-36 (72%) F-14 (28%)	M-40 (57.1%) F-30 (42.8%)	M-26 (52%) F-28 (58%)	M-44 (62.8%) F-26 (37.14%)
Mean age group	21-30	31-40	21-30	21-30
Mode of injury	Degenerative>trauma>tumour	Degenerative>trauma>tumour	Degenerative>trauma>tumour	Degenerative>trauma>tumour
Level of lesion	C-5/c-6 F/b C-4/c-5	C-5-c-6 f/b C-4/c-5	C-5/c-6 F/b c-4/c-5	C-5/c-6 f/b c-4/c-5
Neurological outcome (ant vs post approach)	Ant>post	Ant>post	Ant>post	Ant>post
Avg hospital stay	Ant-7 days Post-12 days	Ant-8 days Post-10 days	Ant-7 days Post-10 days	Ant-7 days Post-10 days
Mortality rate	15 cases (30%)	30 cases (42.8%)	16 cases (32%)	20 cases (28.5%)
Outcome	Ant approach-30 cases	Ant approach-40 cases	Ant approach-34 cases	Ant approach-49 cases
	Improved-15	Improved-20	Improved-20	Improved-28
	No improvement-05	No improvement-05	No improvement-06	No improvement-05
	Death-10	Death-15	Death-08	Death-16
	Post approach-20 cases	Post. Approach-30 cases	Post approach-16 cases	Post approach-21 cases
	Improved-10	Improved-10	Improved-05	Improved-13
	No improvement-05	No improvement-05	No improvement-03	No improvement-04
	Death-05	Death-15	Death -08	Death-04

M- Male, F- Female, Ant- Anterior, Post- Posterior.

In University of Health Sciences study, Ontario, average hospital stay in anterior approach is 7 days and in posterior approach is 10 days. In our study mortality in 20 cases. In Qena University study mortality in 15 cases. In Masshad University of Medical Sciences study mortality in 30 cases. In University of Health Sciences study, Ontario, mortality in 16 cases. The most important factor responsible for prognosis of neurological recovery were neurological status at the time of injury, mode of etiology, level of lesion and age.

This is also confirmed in our study, in which 80% of the patients under the age of 40 years and who were having incomplete lesion have better neurological recovery.

CONCLUSION

As result of anterior approach is better than posterior approach in our study which is comparable with existing studies in terms of hospital stay, neurological recovery and ultimate outcome. Some types of cervical spine surgeries can be done by anterior approach only and some types of cervical spine surgeries can be done by posterior approach only. But there are many cases where surgery can be done by anterior approach and posterior approach both. Anterior decompressive approaches

typically involve ACDF or ACCF, whereas posterior approaches comprise laminoplasty or laminectomy with or without arthrodesis. In general, an anterior approach is preferred in cases of ventral compression occupying few levels while attempting to restore cervical lordosis. In these cases, anterior approach should be preferred. Anterior correction is more appropriate and weight bearing correction.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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