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Original Article

A Study of Fusion Assessment among the Patients of Cervical Spine

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Abstract
Objective: *To assess the clinico-radiological outcome of the fusion in anterior cervical decompression and fusion surgeries.*
Methods: *This was a prospective cross-sectional study. Patients operated through anterior approach for cervical spine disease were included in the study. Patients were operated through anterior approach by employing Smith Robinson's technique or Cloward technique (on the basis of surgeon's preference). Inter body grafts used were iliac crest autograft, artificial G graft from Surgiwear Company. Subjective clinical evaluation was assessed by axial pain and Odom's criteria. Nurick grade was used to evaluate improvement in neurological myelopathic status.*
Results: *A total of 62 patients were included in the study. Majority of them were males (80.6%). Majority of them were males (80.6%). Most common age group was 31-40 years. Of the three main group of disease features, degenerative was most common (64.5%). C5/6 disc space was the commonest operated level (64.5%). Iliac crest bone graft was used primarily (46/62=74%) for fusion purpose. Partial anterior graft migration (19.4%) was the most common post-op complication. The subjective assessment of improvement was excellent in 16.1% patients and good was in 45.2%.*
Conclusion: *Best clinico-radiological improvement was found in degenerative group followed by inflammatory and traumatic.*
Keywords: *Cervical spine, Fusion, Anterior decompression.*

Introduction

Decompression and fusion of cervical vertebrae is a combined procedure that has a high success rate in relieving radicular symptoms as well as in stabilizing or improving cervical myelopathy(1). Despite this high success rate, the potential short- and long-term sequelae from the fusion as well as the impact of the fusion on adjacent segment pathology (ASP) are of concern(2).

It is thought that by eliminating motion through segment fusion, the load is shifted to the adjacent segments, thereby producing hypermobility and

possible earlier disk degeneration[3,4]. Several human cadaveric and clinical studies have been performed in which changes in cervical spinal load and motion on the levels adjacent to the spinal fusion have been studied[5].

Anterior cervical fusion is widely used to treat lesions causing instability of the cervical spine, as well as certain complex C2 pedicle fractures. Convincing evidence indicates good short-term outcomes. In the long term, degenerative disc disease frequently develops on either side of the fused segment. The potential role for interbody fusion in this outcome deserves evaluation[6].

Adjacent-segment disease is defined as radiographic deterioration of a mobile spinal segment adjacent to a fused segment. This definition does not require the development of new symptoms. Adjacent-segment disease is usually asymptomatic and rarely requires revision surgery[7]. In patients who underwent anterior cervical fusion to treat post-traumatic lesions, Goffin et al[8] reported degenerative disc changes adjacent to the fused segment in 60% of patients and adjacent-segment disease in 92% of patients 5years after the injury. Risk factors for adjacent-segment disease consist of C5-C6 and C6-C7 lesions, single-level fusion, and pre-existing disc disease.

Most of the studies have focused on patients who required surgery to treat degenerative lesions or who had post-traumatic instability but were older than 50 years of age.

The objective this study was to assess the clinico-radiological outcome of the fusion in anterior cervical decompression and fusion surgeries.

Material and Methods

This was a prospective cross-sectional study. Patients operated through anterior approach for cervical spine disease were included in the study. Patients were operated through anterior approach by employing Smith Robinson's technique or Cloward technique (on the basis of surgeon's preference). Inter body grafts used were iliac crest autograft, artificial G graft from Surgiwear Company. The epidemiological data was collected.

Subjective clinical evaluation was assessed by axial pain and Odom's criteria. Nurick grade was used to evaluate improvement in neurological myelopathic status.

Immediate post-operative X-rays of cervical spine were evaluated for graft and plate position, vertebral space distraction and presence of any immediate complications. Serial dynamic X-rays in lateral view of cervical spine were taken in flexion, neutral & extension, keeping same distance in between source and patients.

The data is presented in frequencies and percentages.

Results

A total of 62 patients were included in the study. Majority of them were males (80.6%). Most common age group was 31-40 years followed by 51-60 (22.6%), 41-50 (19.4%), 60-70 (12.9%), 21-30 (9.7%) and 10-20 (6.5%) years (Table-1).

Of the three main groups of disease features, degenerative was most common (64.5%). Cervical trauma was found in 25.8% patients and tubercular spine in 9.7% patients. Myeloradiculopathy was seen in majority of patients. However, radiculopathy was found only in 3.2% patients (Table-2).

C5/6 disc space was the commonest operated level (64.5%). C4/5 was the second most common operated disc space (45.2%). C4/5 disc space was higher in multi-level (85.7%) followed by C5/6 (70%). C3/4 (42.9%) disc space was higher in single level (Table-3).

Iliac crest bone graft was used primarily (46/62=74%) for fusion purpose after adequate decompression, artificial G bone graft in 10 and in 6 patients, no graft was placed (Table not shown).

Partial anterior graft migration (19.4%) was the most common post-op complication. Kyphosis (9.7%) was the second most common complication. The percentage of other complications was less than 5% (Table-4).

Post-operative radiographs revealed intervertebral distraction of 3-8 mm (average=3.4 mm) in single level disc operated patients, 5-12 mm (average=5.3 mm) in 2 levels and 7-8 mm (average=7.5 mm) in three levels (Table not shown).

Good chance of fusion in single level disc was found to be associated with distraction of more than 3 mm (7/9, 77.8%) than <3 mm (3/5, 60%) (Table-5).

The subjective assessment of improvement was excellent in 16.1% patients and good was in 45.2%. Fair improvement was in 29% patients and poor was in 9.7%. Of the excellent improvement, all patients were degenerative. However, of the good improvement, 78.6% were in degenerative, 7.1% trauma and 11.1% were inflammatory (Table-6).

Table-1: Demographic profile of patients

Demographic profile	No. (n=62)	%
Gender		
Male	50	80.6
Female	12	19.4
Age in years		
10-20	4	6.5
21-30	6	9.7
31-40	18	29.0
41-50	12	19.4
51-60	14	22.6
60-70	8	12.9

Table-2: Distribution of nature of disease

Nature of disease	No. (n=62)	%
Main group		
Degenerative	40	64.5
Cervical trauma	16	25.8
Tubercular spine	6	9.7
Sub-group		
Myeloradiculopathy	60	96.8
Radiculopathy	2	3.2
Pott's	6	9.7

Table-3: Distribution of operated disc levels

Disc space	Level*				Total (n=62)	
	Single		Multi-level			
	No.	%	No.	%	No.	%
C3/4	6	42.9	8	57.1	14	22.6
C4/5	4	14.3	24	85.7	28	45.2
C5/6	12	30.0	28	70.0	40	64.5
C6/7	6	33.3	12	66.7	18	29.0

*Multiple response

Table-4: Distribution of pos-op complications

Complications	No. (n=62)	%
Partial anterior graft migration	12	19.4
Complete anterior graft migration	2	3.2
Posterior graft migration	0	0.0
Kyphosis	6	9.7
Post-op neurological deterioration	2	3.2
Donor site infection	2	3.2
Mortality	2	3.2

Table-5: Distribution of fusion in variable disc space distraction

Level	Distraction	Fusion		Non-fusion	
		No.	%	No.	%
Single level	<3 mm	6	60.0	4	40.0
	≥3mm	14	77.8	4	22.2
Two levels	<3 mm	8	57.1	6	42.9
	≥3mm	6	60.0	4	40.0
Three levels	<3 mm	2	33.3	4	66.7
	≥3mm	2	50.0	2	50.0

Table-6: Distribution of outcome and disease features (Odom's criteria)

Outcome	Disease features							
	Degenerative		Trauma		Inflammatory		Total	
	No.	%	No.	%	No.	%	No.	%
Excellent	10	100.0	0	0.0	0	0.0	10	16.1
Good	22	78.6	2	7.1	4	14.3	28	45.2
Fair	6	33.3	10	55.6	2	11.1	18	29.0
Poor	2	33.3	4	66.7	0	0.0	6	9.7

Discussion

Decompression and fusion of cervical vertebrae is a combined procedure that has a high success rate in relieving radicular symptoms as well as in stabilizing or improving cervical myelopathy[(1)]. Despite this high success rate, the potential short- and long-term sequelae from the fusion as well as the impact of the fusion on adjacent segment pathology are of concern[(9)]. It is thought that by eliminating motion through segment fusion, the load is shifted to the adjacent segments, thereby producing hypermobility and possible earlier disk degeneration.4,5 Several human cadaveric and clinical studies have been performed in which changes in cervical spinal load and motion on the levels adjacent to the spinal fusion have been studied[(10, 11)].

Radiographic assessment of fusion remains an important aspect of the determination of success of cervical spinal fusion. Although pseudarthrosis does not preclude the possibility of a good or excellent clinical outcome, it has been associated with a higher rate of clinical failure and may be associated with late deformity, neurologic symptoms and pain.

In the present study, majority of them were males (80.6%). Most common age group was 31-40 years followed by 51-60 (22.6%), 41-50 (19.4%), 60-70 (12.9%), 21-30 (9.7%) and 10-20 (6.5%) years. In a study (Reddy et al, 2016), 11 (59%) of the patients included in the study were males, while 6 (41%) were females[(12)]. Haid et al[(13)] reported that their study group was composed of 43 men and 32 women, with a mean age of 44 years ranging 8 to 76 year.

In the present study, 40 patients had degenerative disease, 16 had cervical trauma and 6 had tubercular spine. Almost all the patients presented with myelopathic features. All the patients underwent for surgical decompression, fusion and fixation procedure through anterior approach. Smith Robinson's technique was used in 58 patients and Cloward's technique in 4 patients. 28 patients operated for single disc level, 30 for two level and 4 for three levels.

In the present study, C5/6 disc space was the commonest operated level (64.5%). C4/5 was the second most common operated disc space (45.2%). C4/5 disc space was higher in multi-level (85.7%) followed by C5/6 (70%). C3/4 (42.9%) disc space was higher in single level. In a study, in patients with a single-level procedure, the C5/6 or C6/7 was involved most, and the adjacent C6/7 or C5/6 was at high risk to degenerate[(14)]. An average rate of 4.3% (range: 1.6%–12.1%) has been documented in literature for the incidence of C5 root palsy after anterior decompression and fusion[(15)]. In this study, iliac crest bone graft was used primarily (46/62=74%) for fusion purpose after adequate decompression, artificial G bone

graft in 10 patients and in 6 patients no graft was placed.

The commonest complication was partial anterior graft migration constit Partial anterior graft migration accounting for 19.4%. This finding is in agreement with the study by Martin et al[16]. In this study, 6 patients (9.7%) developed increased kyphosis in post operative radiology.

Odom's criteria was used to assess the subjective improvement in this study and found that more than half (61%) patients experienced excellent or good outcome. Good chance of fusion in single level disc was found to be associated with distraction of more than 3 mm than less than 3 mm group in this study. Brower et al[17] reported excess distraction of >3mm was related to non-union and graft collapse.

Conclusion

Best clinico-radiological improvement was found in degenerative group followed by inflammatory and traumatic.

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