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Analysis of Outcome in Cases of Cervical Corpectomy with Fusion by Autograft and Expandable Corpectomy Cage

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ABSTRACT
Objectives: The aim of the our study is to compare the clinical outcomes between cervical reconstruction with expandable cylindrical cage (EEC) and iliac crest autograft in patients with cervical compressive myelopathy who underwent one or two-level anterior cervical corpectomy.
Materials and methods: It is a retrospective descriptive study. 36 patients underwent cervical reconstruction with either iliac crest autograft and plating (6 patients) or ECC with or without plating (30 patients). We compared clinical parameters (Nurick Myelopathy Grade), peri-operative parameters and radiological parameters.
Results: No significant differences between the two groups were found in demographics, neurological presentation, clinical improvement and length of hospitalization. The fusion rate was 100% in both groups. There is no significant difference among the improvement of Nurick score among different fusion techniques. Patients of the autograft group experienced more postoperative complications, although the difference between the two treatment groups was not statistically significant.
Conclusion: Corpectomy is a standard procedure in cases of spinal cord compression by vertebral body. These are safe procedure with minimal morbidity and good results. Fusion with titanium cages avoids donor site morbidity with comparable fusion rates.
Keywords: Corpectomy, Compressive myelopathy, Expandable cylindrical cages, Iliac crest autograft.

I. INTRODUCTION

Corpectomy or Vertebrectomy is removal of most or all of vertebral body. Cervical corpectomy and fusion is an effective surgical technique for the treatment of cervical compressive myelopathy and myeloradiculopathy which may be due to degenerative spondylosis, spinal tuberculosis, ossified posterior longitudinal ligament or trauma [8,10]. Based on the need corpectomy may be single or multi-level.

Traditionally corpectomy defect have been reconstructed with autologous bone grafts such as iliac crest and fibula to restore structural integrity and to maintain the cervical lordosis however, more recently vertebral prosthesis like expandable cylindrical cages (ECCs) with or without plates/screws are being used. Due to the advantages of autologous bone graft for reconstruction of defect after corpectomyviz.,reported higher fusion rates, lesser graft complications and as it is the only graft with the properties of osteogenesis, osteoinduction and osteoconduction several authors still consider autologous bone graft as the gold standard for anterior cervical reconstruction after corpectomy [4,14]. However, due to some disadvantages like donor site morbidity, graft collapse and ability of in situ controlled distraction to allow preservation of a pre-existing lordosis or efficient correction of a kyphotic spine have diverted few surgeons towards reconstruction with vertebral prosthesis like expandable cylindrical cages(ECCs) with or without plates/screws as preferred method of fusion.

The aim of our study is to compare the clinical outcomes between cervical reconstruction with EEC and iliac crest autograft in patients with cervical compressive myelopathy who underwent one- or two-level anterior cervical corpectomy.

II. MATERIALS AND METHODS

Patient selection

This study included retrospective review of records of 36 patients operated at Department of Neurosurgery in B.Y.L. Nair Charitable Hospital, Mumbai between October 2015 to September 2020. Surgical procedure was explained in detail and informed consent was taken from patients. All these patients included in this study underwent

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single or two-level anterior cervical corpectomy with fusion.

Inclusion criteria

Patients with symptoms and signs of moderate to severe cervical myelopathy and those patients with symptoms and signs of mild myelopathy with progressive neurological deterioration were indicated for cervical corpectomy. These patients were included in the study irrespective of underlying aetiology. Patients with excessive instability and those with pathology at cervico-thoracic junction underwent fusion with expandable cylindrical cage with screws.

Surgical procedure

All operations were performed by single neurosurgeon, at same institute. Patient were given preoperative cephalosporin antibiotic intravenously. All 36 patients were operated under general anaesthesia in supine position. C-arm was used to mark the incision at appropriate level and intra-operatively microscope was used. With aseptic precautions cleaning, painting and draping was done. Linear incision was taken along anterior border of Sternocleidomastoid. Desired vertebral body was approached between trachea oesophagus medially and carotid sheath laterally. Longuscolli split and Cloward retractor applied. Level confirmed by C Arm / Intra-op X-ray. Two/Three level discectomy performed followed by corpectomy. Meticulous preparation of graft / implant bed was done. Cage was impacted with morselized bone chips which was harvested from corpectomy itself in degenerative cases whereas in infective cases it was harvested from iliac crest. Fusion with expandable cage either alone or with Casper plate/ screws or autograft with plate was done. After which haemostasis was achieved, layered closure was done. All patients were given firm cervical collar post-operatively for 6 weeks.

Radiological evaluation

All patients underwent pre-operative cervical spine MR imaging, computed tomography (CT) and plain radiographs. Lateral cervical spine radiographs obtained preoperatively and postoperatively were used to measure the cervical lordosis. A cervical X-ray was obtained before discharge and repeated 3 and 6 months after the operation then annually thereafter. Dynamic flexion and extension views were generally performed 12 months after the operation.

Outcome measures

Successful fusion was defined by lack of segmental movement in flexion–extension radiographic views in the absence of any dark halo around the cage or iliac bone graft [9]. A clinical follow-up examination after each radiological examination and clinical findings were evaluated at presentation and follow-up using the Nurick Grade.

Statistical analysis

Student's test and ANOVA test were used to determine statistical significance between the two groups. A p value of <0.05 was considered as significant.

ILLUSTRATED CASES

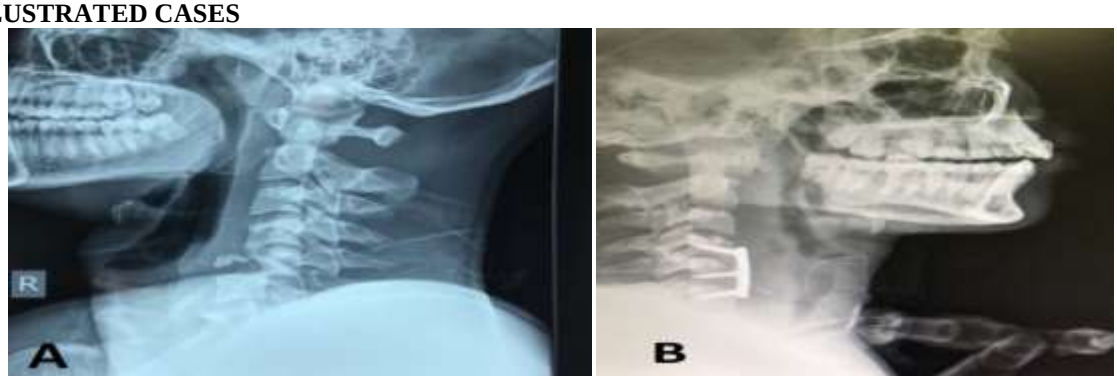

FIGURE 1: Pre-operative (A) and Post-operative (B) radiogragh comparison of a 50 years old patient with cervical myelopathy who underwent C5-corpectomy with iliac crest autograft. Post-operative radiograph shows complete fusion.

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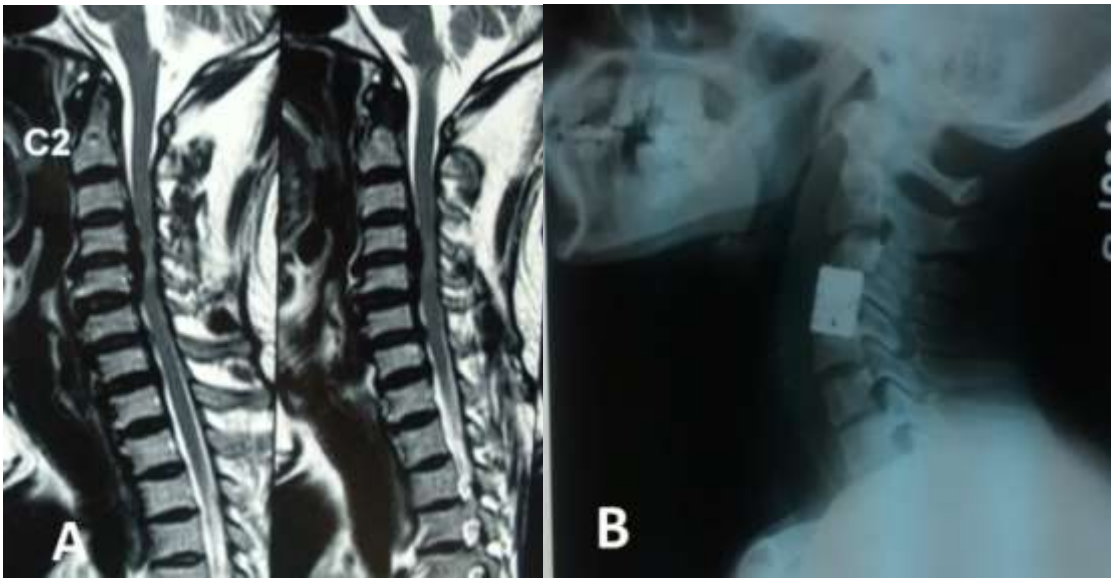

FIGURE 2: Pre-operative MRI (A) and Post-operative (B) radiogragh images of a 62 years old patient with cervical myelopathy who underwent C4-corpectomy with standalone cage fusion.

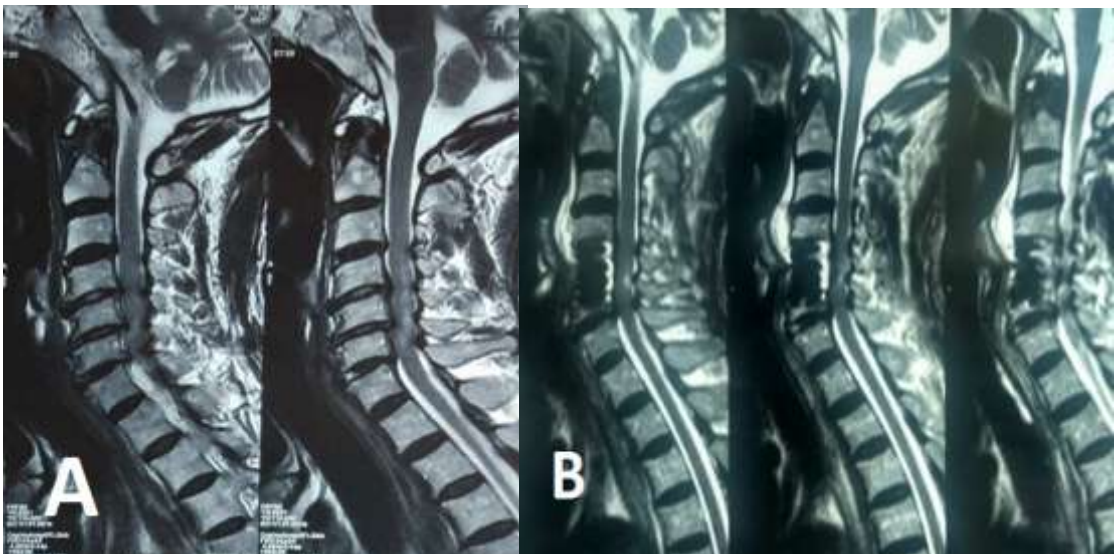

FIGURE 3: Pre-operative MRI (A) and Post-operative (B) MRI images of another 55 years old patient with compressive cervical myelopathy who underwent C5-6 corpectomy with standalone cage fusion.

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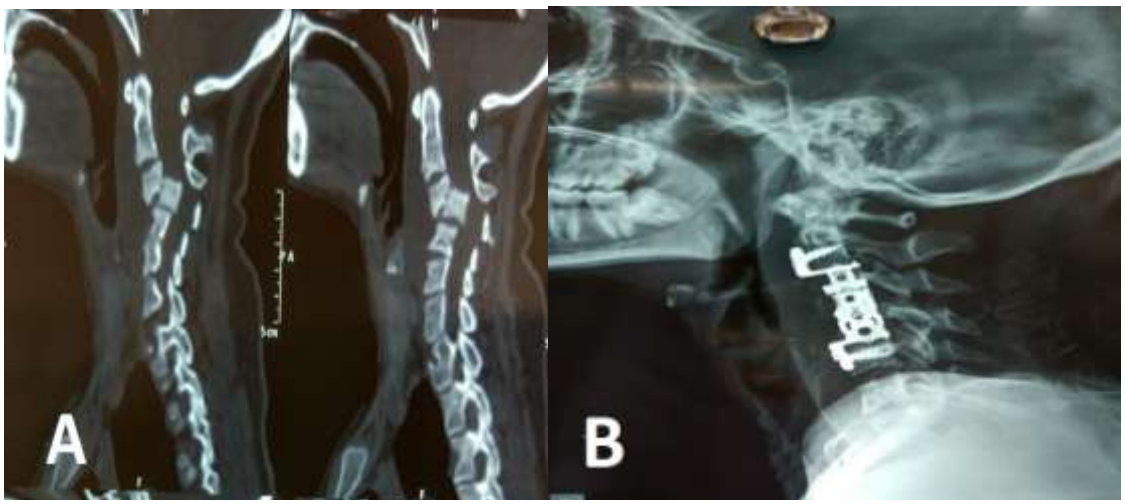

FIGURE 4: Pre-operative CT (A) and Post-operative (B) Radiograph images of a 34 years old patient with spinal tuberculosis who underwent C4-C5 corpectomy followed by cage with screw fixation.

III. RESULTS

Our study had in total 36 patients, who were divided in two groups which were similar in parameters of demographics and clinical parameters.Mean age of the patients in our study group was (Figure5). Out of 36, 24 patients were male and 12 patients were female (Figure 6).

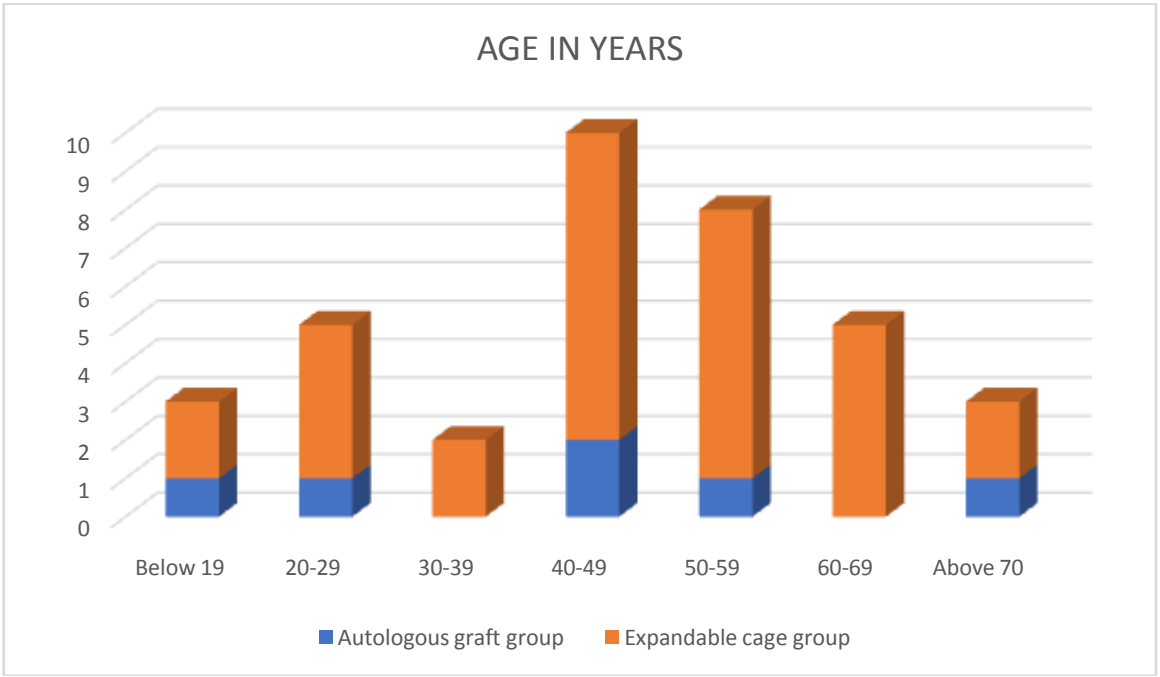

FIGURE 5: Age wise distribution of patients

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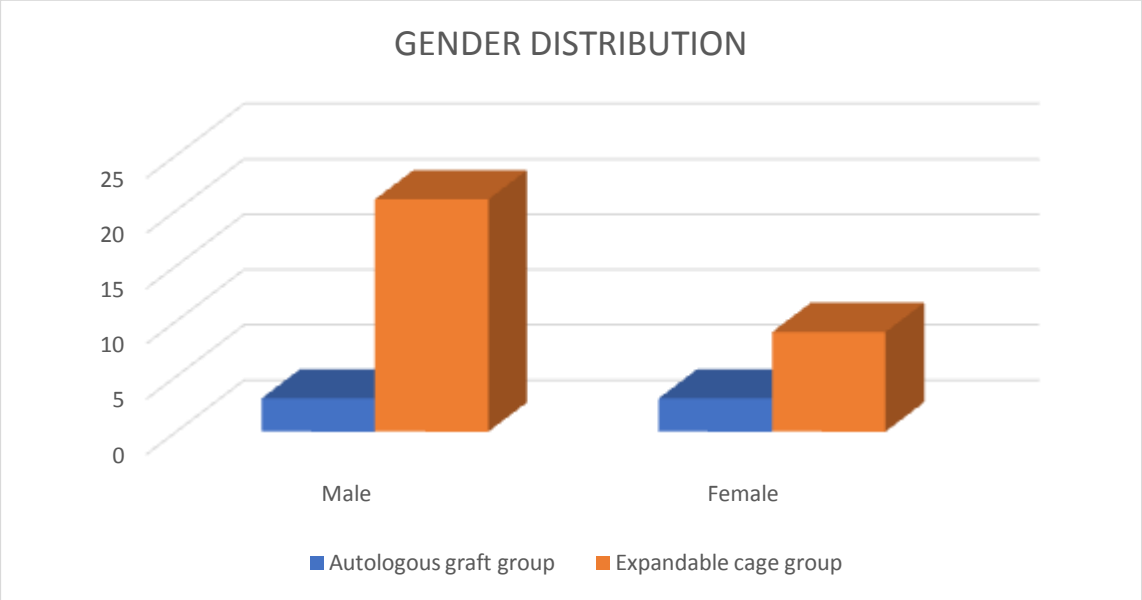

FIGURE 6: Gender wise distribution of patients

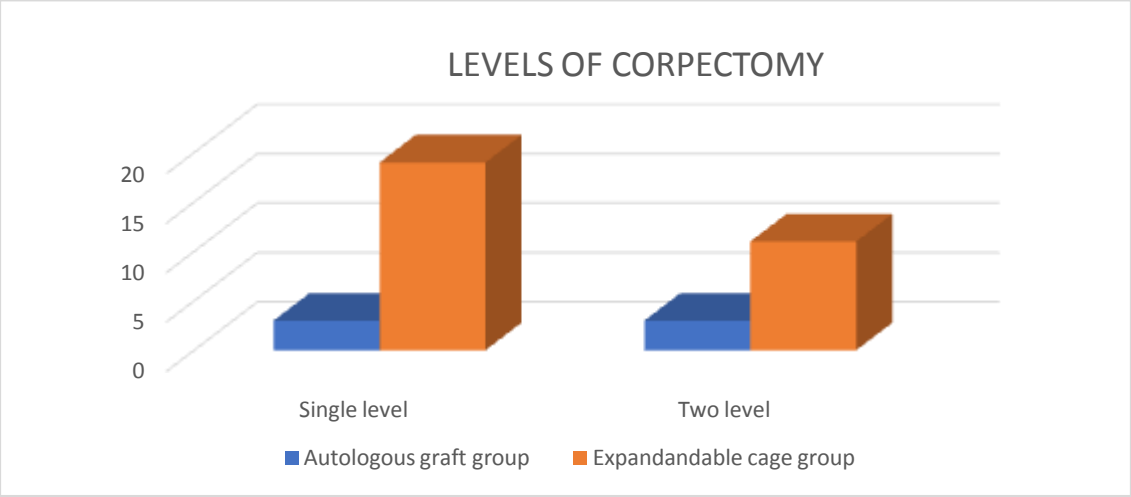

FIGURE 7: Distribution of patients based on single or twolevel corpectomy.

Sr No	Characteristic	Value
1	**Age, in years** Mean ± SD Range	 45.2 ± 16.6 Max 72, Min 13
2	**Gender, n(%)** Male Female	 24 (67%) 12 (33%)
3	**Symptom duration, in months** Mean ± SD Range	 26.46 ± 44.43 Max 240,Min 0.27

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4	**Presenting Symptoms, n(%)** Neck pain Upper limb radiating pain Difficulty in walking Limb Weakness Sensory symptoms Bowel/bladder complaints	 34 (94.44%) 22 (61.11%) 17 (47.22%) 18 (50.00%) 24 (66.67%) 12 (33.33%)
5	**Presenting Signs, n(%)** Motor weakness Abnormal Reflexes Sensory involvements	 22 (61.11%) 32 (88.89%) 15 (41.67%)
6	**Segment Level Involved, n (%)** Single Two	 22 (61.11%) 14 (38.89%)
7	**Postoperative complications, n(%)** Swallowing difficulty Donor site infection Cervical wound infection	 1 (2.78%) 1 (2.78%) 1 (2.78%)
8	**Recurrence Rate, n(%)**	0

Table 1: Patient Characteristic of 36 Patients with cervical compressivise myelopathy seen at our institute between 2015 to 2020.

Group Statistics	FUSION TECHNIQUE	N	Mean	Std. Deviation	Std. Error Mean	t	df	P Value
PRE-OP NURICK GRADE	Cage with/without screw/plate	30	2.53	1.432	0.261	-1.475	34	0.149
	Iliac crest graft with plate and screw fixation	6	3.5	1.643	0.671			
POST-OP NURICK GRADE	Cage with/without screw/plate	30	0.73	1.015	0.185	-1.681	34	0.102
	Iliac crest graft with plate and screw fixation	6	1.5	1.049	0.428			

Table 2: Comparison of pre and post-operative Nurick grade by Paired T Test.

*P Value <0.05= Significant

It is observed from the above table that there exists a significant difference among the pre and post-operative scores in all the three types of fusion technique as proved by Paired T test.

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ANOVA					
Improvement Score	**Sum of Squares**	**df**	**Mean Square**	**F**	**P Value***
Between Groups	0.333	2	0.167	0.091	0.914
Within Groups	60.667	33	1.838		
Total	61	35			

Table 3: ANOVA Test

*P Value >0.05= Significant

There is no significant difference among the improvement of Nurick score among different fusion technique as proved by one way Anova.

IV. DISCUSSION

Corpectomy or Vertebrectomy is removal of most or all of vertebral body. Width of the corpectomy varies, depending on individual patient anatomy and can range from 15 to over 20 mm. A corpectomy width of 16 to 18 mm is typically sufficient for decompression. There are two types of corpectomy namely median central corpectomy and limited oblique corpectomy. Fusion methods described are autograft with plating and expandable cage with or without plating/ screw. The efficacy of such an approach in patients with ventral spinal cord compression induced by pathology that extends beyond the disk space behind the vertebral body are confirmed by several clinical studies[1,7,19].

Advantages of autograft with plating are higher fusion rates whereas disadvantages include donor site morbidity, artery or nerve injuries, hematoma, infections and chronic donor site pain. On the other hand expandable cage with or without plate/screw has advantages like immediate stability, lesser chances of graft migration due to serration on the edges and no donor site morbidity, disadvantages includes reduction of segmental height, loss of segmental lordosis and decreased fusion rates.

There is some correlations between cervical alignment and clinical outcomes [1,16], a recurrent finding is the increase in the incidence of chronic neck pain relative to increasing postoperative kyphosis [14,15]. A progressive postoperative kyphotic increase in focal cervical sagittal alignment has been described after uninstrumentedcorpectomy [14]. Rajshekar and colleagues [14] in a series of 93 patients with such compressive myelopathy who underwent one or two-level corpectomy and uninstrumented iliac bone grafting observed an average kyphotic change of the segmental angle of 10 degrees that was associated with a C2–C7 regional kyphosis in 5% of patients. Andaluz and colleagues [1] described an overall progressive kyphotic increase in focal sagittal alignment after one- and two-level instrumented cervical corpectomy for compressive myelopathy in a series of 130 patients.

Cervical cages are small, porous, hollow, and cylindrical implants designed to restore physiologic disk height and allow bone growth through the implant with consequent bony fusion. Loss of height was 2.2 ± 2.3 mm in one level corpectomy with fusion subgroup of our study. Osseous incorporation by formation of bony trabeculae are seen after 6 months indicating bony fusion. Bony fusion rates were similar in both subgroups.

Absence of motion detected between the spinous processes in flexion–extension radiographic views should be used for assessment of cervical subaxial fusion and to exclude pseudoarthrosis [9]. Accordingly, a 100% fusion rate for both autograft and ECC was documented by us. These findings are in agreement with previously reported fusion rate after one- and two-level anterior cervical corpectomy for the treatment of spondylotic myelopathy [1,2,5,6,11,13,20]. Also overt instability after one- and two-level corpectomy with plating is uncommon and can occasionally occur from progressive subsidence due to excessive endplate removal and poor bone quality [12,18]. The combination of anterior and posterior instrumentation and fusion is seldom required after one or two-level corpectomies [20].

Hence, in our study we found that the functional status of most patients in either groups improve from a mean overall pre-op Nurick grade of 2.69 ± 1.49 to a mean post-op Nurick grade of 0.86 ± 1.05 i.e. by greater than a 1-point increase. This results are comparable to the findings of Perrini et.al who in their study concluded that functional status of all their patients changed from a mean overall Nurick grade 2.11 ± 1.09 to a mean Nurick grade of 1.14 ± 1.02 (1.2 ± 1.2 and 1 ± 0.79) in their autograft and expandable cage groups, respectively; $p = 0.464$), representing a 1-point increase ($p < 0.05$)[20].

Complications rates with corpectomy with autograft were slightly higher as compared with corpectomy with ECC, although the difference was not statistically significant. Donor site

complications after harvesting tricortical iliac bone graft occurred in 2 patients of the autograft group. These results are consistent with those of recent literature that report rates of complications after harvesting iliac bone ranging from 4% to 39% [3,17]. Clinical studies demonstrated that a careful surgical technique can minimize but not completely eliminate most of these complications [17]. Only one patient presented persistent swallowing difficulties, which resolved within 2 weeks. Transient swallowing discomfort is extremely common after anterior cervical surgery and was not considered as significant complication [20].

LIMITATIONS OF THE STUDY

The results presented in this study are retrospective. In addition, the small sample size only allows reduced statistical inference.

V. CONCLUSION

Corpectomy is a standard procedure in cases of cervical compressive myelopathy. These are safe procedure with minimal morbidity and good results. Fusion with titanium cages provides fusion rates alike autograft fusion with avoidance of donor site morbidity.

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