Single-level Anterior Corpectomy with Fusion versus 2-level Anterior Cervical Decompression with Fusion: A Prospective Controlled Study with 2-year Follow-up Using Cages for Fusion

Dear Editor,

Anterior cervical discectomy and fusion (ACDF) and anterior cervical corpectomy and fusion (ACCF) are performed for decompression of the spine when the primary compressive pathology lies anterior to the spinal cord – prolapsed intervertebral discs (PID), ossified posterior longitudinal ligament (OPLL), spondylodiscitis and retropulsion of fractured bony fragments. More specifically, ACDF is preferred for discal and retrodiscal pathology, whereas ACCF is indicated for retrovertebral pathology. When 2 consecutive levels of fusion are required, some authors have proposed the feasibility of ACCF to achieve 2 fusion surfaces rather than 4 fusion surfaces. Current literature shows similar clinical outcomes between the 2 methods.[1,2] It is noted, however, that the fusion methods were heterogenous in some studies when they were studying only 2 consecutive levels of fusion. Other studies compared ACCF versus ACDF with varied levels of fusion within each arm. We hypothesise that by using cages for both ACCF and ACDF in this matched-paired study, we would be able to better compare the intermediate term results and complications of 1-level ACCF versus 2-level ACDF.

Materials and Methods

This is a prospective case controlled study of 28 patients, 14 in each arm, with a minimum follow-up of 2 years. Ethical approval was sought from the institutional ethics committee. We reviewed prospectively collected data of all patients who underwent 2-level ACDF and 1-level ACCF by the senior author from 2007 to 2009. Twenty-eight consecutive patients with various pathologies amenable to anterior decompression were included. These patients were match-paired based on age, gender and levels of fusion.

The parameters recorded and analysed included patient demographics, presence of preoperative myelopathy, intraoperative details (duration of operation, level of operation, types and sizes of implant and bone grafts, somatosensory evoked potentials (SSEP) and motor evoked potentials (MEP) signal changes, complications), postoperative details (drop in haemoglobin, length of hospitalisation, and time to return to work), postoperative radiological findings (fusion, correction of kyphosis), functional scores ((visual analogue scale (VAS), neck disability index (NDI), EuroQOL-5 dimensions (EQ-5D health score and EQ-5D index)), and surgery-related complications.

Functional scores were obtained during standard follow-up visits at 6 months, 1 year, and 2 years. Fusion rates based on the Bridwell grading system and degree of lordosis for the fused segments were recorded based on the interpretation of anteroposterior and lateral projections of the cervical spine obtained at the 2-year follow-up visit by 2 independent spine surgeons. The lordosis of the fused vertebral segments were measured using lines on Radweb software placed on the superior endplate and the inferior endplate of the fused vertebral segments. All patients were followed up for a minimum duration of 24 months.

Results

There were 28 patients reviewed, with 14 patients in each arm (ACCF versus ACDF). The mean age for ACCF was 58.5 years and 56.5 years for ACDF. The range of follow-up was between 24 months to 40 months, with a mean of 26.8 months. There was no lost to follow-up at the 24-month period for all patients. The male to female ratio was 6:1 (12:2) for both groups.

In the ACCF group, 3 patients had C4 corpectomy and fusion, 8 had C5 corpectomy and fusion, and 3 had C6 corpectomy and fusion. Similarly, the ACDF group had 3 patients with C3/4 and C4/5 fusion, 8 with C4/5 and C5/6 fusion, and 3 with C5/6 and C6/7 fusion. Comparable number of patients displayed myelopathic features preoperatively (11 in the ACCF group and 12 in the ACDF group). The functional scores preoperatively were similar in both groups.

All patients had PID requiring anterior decompression. The ACCF group had 6 patients with ossified posterior longitudinal ligament, 3 patients with hard and calcified sequestrated discs, 3 patients with burst fractures with bony retropulsion, 1 patient with kyphotic deformity, and 1 patient with retrolisthesis requiring corpectomy.

Implants used in the ACCF group included 11 Harms cages (Depuy Spine, Raynham, MA) and 3 Pyramesh cages (Medtronic Sofamor Danek, Memphis, TN); 9 SlimLoc plates (Depuy Spine, Raynham, MA), 3 Atlantis plates (Medtronic Sofamor Danek, Memphis, TN), 1 CSLP

Table 1. Results

	ACCF	ACDF	*P* Value
Type of implants	11 Harms	9 Bengal	NA
	9 Slimloc	7 Slimloc	
	3 Atlantis	3 Atlantis	
	1 CSLP	2 CSLP	
	1 Eagle	1 Eagle	
	3 Pyramesh	2 Cervios	
		1 Orion	
		3 Solis	
Type of grafts	11 local	1 local with chronos	
	3 iliac	12 iliac	
		1 DBX®	
Duration of surgery (mins)			
(median) (SD)	148.5 (35.97)	165 (30.49)	
(mean)	158.58	155.93	1.000
Cage height (mm) (SD)	13 (0.86)	5.75 (0.85)	NA
Intraoperative events			
Excess bleeding	3	1	0.298
Intraoperative SSEP improvement	2	4	0.324
Intraoperative MEP improvement	2	3	0.500
Haemoglobin drop (SD)	0.95 (1.43)	0.85 (0.84)	0.490
Length of hospitalisation (days) (SD)	4 (9.88)	3.5 (9.97)	0.591
Return to work (days) (SD)	67 (42.51)	66 (48.46)	0.808
Fusion rates (at 2 years) (SD)	1 (0.363)	3 (0.579)	<0.001
Restoration of lordosis (deg) (SD)	0 (3.68)	-0.025 (8.54)	0.025
Postoperative surgical complications			
Cage subsidence	4	0	
Screw migration/cutout	3	0	
Screw in disc space	1	0	0.004
Implant breakage	0	0	
Adjacent level fractures	0	0	
Residual numbness	1	1	

ACCF: Anterior cervical corpectomy and fusion; ACDF: Anterior cervical discectomy and fusion; CSLP: Cervical spine locking plate; MEP: Motor evoked potentials; NA: Not applicable; SSEP: Somatosensory evoked potentials; SD: Standard deviation

plate (Synthes Spine, West Chester, PA), and 1 Eagle plate (Depuy Spine, Raynham, MA). In the ACDF group, there were 9 Bengal cages (Depuy Spine, Raynham, MA), 3 Solis Cages (Stryker Spine, Kalamazoo, MI), and 2 Cervios cages (Synthes Spine, West Chester, PA); 7 SlimLoc plates (Depuy Spine, Raynham, MA), 3 Atlantis plates (Medtronic Sofamor Danek, Memphis, TN), 2 CSLP plates (Synthes Spine, West Chester, PA), 1 Eagle plate (Depuy Spine, Raynham, MA), and 1 Orion plate (Medtronic Sofamor Danek, Memphis, TN). With regards to the bone grafts, the ACCF group had 11 patients with local grafts and 3 with anterior iliac crest grafts. The ACDF group had 12 patients with anterior iliac crest grafts, 1 with local graft and Chronos (Synthes Spine, West Chester, PA), and 1 with demineralised bone matrix DBX (Synthes Spine, West Chester, PA).

The comparison of factors between ACCF and ACDF are shown in Table 1. At 2-year follow-up, there is no significant difference in operative times, bleeding rate, SSEP/MEP improvement, length of hospitalisation, return to work, and postoperative functional scores (based on VAS, NDI, EQ-5D health score and index) (P >0.05). ACDF is superior in fusion rate (P <0.001) and restoration of lordosis (P = 0.025). ACCF has more instrumentation and graft-related complications (P = 0.004).

One patient had residual C8 dermatomal numbness in

the ACDF group. In the ACCF group, 4 patients had cage subsidence, 3 had screw loosening resulting in migration and cutout, 1 had screw inserted into the disc space, and 1 had persistent neck pain not better with surgery requiring another magnetic resonance imaging (MRI) 1 year after surgery. The MRI did not show any worsening of spondylotic changes. Of those patients who had screw loosening, 1 patient (7%) had backing out of the anterior plate occurring 34 days after operation and requiring revision surgery. He underwent revision of anterior cervical plating with the instrumentation extending till C7 vertebra distally.

Discussion

There are numerous studies that compared ACDF and ACCF in treating multilevel cervical spondylotic myelopathy, with conflicting evidence.[1-5] Our study was able to standardise the use of cages for both ACCF and ACDF to compare the 2-year results and complications between this 2 surgical methods. Limitations of our study include a lack of randomisation of patients, lack of trauma cases and a short-term follow-up. Implant differences include different cages being used and different bone grafting techniques. Fusion was also not confirmed via computed tomography (CT) scans in our study. Based on our study, ACDF should be the procedure of choice for anterior decompression of 2-level cervical disease in view of better fusion rate, better restoration of lordosis, and less instrumentation and graft-related complications.

Acknowledgement

The authors would like to acknowledge the following individuals: Ms Heng Wee May and Ms Low Jia Ying Elaine for their help in the collection of data.

REFERENCES

1. Guo Q, Bi X, Ni B, Lu X, Chen J, Yang J, et al. Outcomes of three anterior decompression and fusion techniques in the treatment of three-level cervical spondylosis. Eur Spine J 2011;20:1539-44.
2. Uribe JS, Sangala JR, Duckworth EA, Vale FL. Comparison between anterior cervical discectomy fusion and cervical corpectomy fusion using titanium cages for reconstruction: analysis of outcome and long-term follow-up. Eur Spine J 2009;18:654-62.
3. Oh MC, Zhang HY, Park JY, Kim KS. Two-level anterior cervical discectomy versus one-level corpectomy in cervical spondylotic myelopathy. Spine (Phila Pa 1976) 2009;34:692-6.
4. Jiang SD, Jiang LS, Dai LY. Anterior cervical discectomy and fusion versus anterior cervical corpectomy and fusion for multilevel cervical spondylosis: a systematic review. Arch Orthop Trauma Surg 2012;132:155-61.
5. Lian XF, Xu JG, Zeng BF, Zhou W, Kong WQ, Hou TS. Noncontiguous anterior decompression and fusion for multilevel cervical spondylotic myelopathy: a prospective randomized control clinical study. Eur Spine J 2010;19:713-9.

Hwee Weng Hey, [1]*MMED (Orth), FRCSEd (Orth), MCI (Sing)*, Keng Lin Wong, [1] *MRCS (Ed)*, Ai Sha Long, [1]*MRCS (Ed)*, Hwan Tak Hee, [2]*FRCS (Ed, Glas), FAMS (Ortho)*

[1]Department of Orthopaedic Surgery, University Orthopaedic, Hand and Reconstructive Microsurgery Cluster, National University Health System, Singapore
[2]Pinnacle Spine and Scoliosis Centre, Singapore

Address for Correspondence: Dr Hey Hwee Weng Dennis, Department of Orthopaedic Surgery, National University Hospital Singapore, 1E Kent Ridge Road, Singapore 119228.
Email: dennis_hey@nuhs.edu.sg