

# Post-operative complications in patients undergoing anterior cervical discectomy and fusion: A retrospective review

Rahul Yadav, Siddharth Chavali, Arvind Chaturvedi, Girija P. Rath

## Abstract

**Background:** Anterior cervical discectomy and fusion (ACDF) is a surgical procedure used to manage various cervical spine disorders including spondylosis, prolapsed intervertebral disc, trauma and degenerative disc disease. However, this procedure may be associated with significant post-operative complications. In this study, we aimed to analyse the prevalence of post-operative complications following ACDF. **Methods:** Perioperative data of 128 patients who underwent ACDF surgery at our institute over a 3-year period was analysed. Patients who underwent previous neck surgeries were excluded. **Results:** Single level ACDF without cervical plating was observed to be the most commonly performed surgical procedure (53%). Dysphagia was the most common (16.4%) post-operative complaint, followed by neurological deterioration (7.9%). One patient suffered pharyngeal perforation and presented postoperatively with subcutaneous emphysema and haemoptysis. **Conclusions:** Post-operative dysphagia and worsening of pre-existing myelopathy were the most common complications following ACDF, and multilevel surgery was identified as the most significant risk factor. The early detection and prompt management may help reduce mortality and morbidity in such patients.

**Key words:** Anterior cervical discectomy and fusion, cervical spine, complications, radiculopathy

## INTRODUCTION

Cervical radiculopathy is a pathological process involving the cervical nerve roots. It is the result of compression and inflammation of the nerve root (s) at or near the cervical neural foramen. The common causes for radiculopathy are cervical disc herniation<sup>[1]</sup> and cervical spondylosis. Radiculopathy seen in the younger population often are related to disc herniation resulting in direct pressure

Department of Neuroanaesthesiology and Critical Care,  
All India Institute of Medical Sciences, New Delhi, India

### Address for correspondence:

Dr. Girija Prasad Rath, Department of Neuroanaesthesiology and Critical Care, Neurosciences Centre, All India Institute of Medical Sciences, New Delhi - 110 029, India.  
E-mail: girijarath@yahoo.co.in

on an existing nerve, whereas those in older patients often occur due to foraminal narrowing owing to the formation of osteophytes (spondylosis). Besides disc associated spondylotic degeneration, ossification of the posterior longitudinal ligament can also occur with cervical spondylosis. It may result in severe anterior cord compression and subsequent clinical presentation like cervical spondylotic myelopathy (CSM).<sup>[2]</sup> Medical management of cervical spondylotic syndromes typically includes pharmacological and rehabilitation components. Non-steroidal anti-inflammatory drugs, muscle relaxants, analgesics, anti-depressants, anticonvulsants and cervical epidural steroid injection are frequently used for non-operative management<sup>[3-7]</sup> apart from physical therapy exercises, soft and hard collars, cervical

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

**How to cite this article:** Yadav R, Chavali S, Chaturvedi A, Rath GP. Post-operative complications in patients undergoing anterior cervical discectomy and fusion: A retrospective review. J Neuroanaesthesiol Crit Care 2017;4:170-4.

Access this article online	
Quick Response Code: 	Website: www.jnaccjournal.org
	DOI: 10.4103/jnacc.jnacc_18_17

traction, manipulation, other forms of manual therapy, thermal therapy, and acupuncture.

Surgery remains the treatment of choice for patients with CSM. It is generally recommended for patients who have both clinical and radiographic evidence consistent with myelopathy, as the disorder is typically progressive without surgery.<sup>[8]</sup> Anterior cervical discectomy and interbody fusion is an effective procedure used to treat a variety of cervical spine disorders including spondylosis, prolapsed intervertebral disc, trauma and degenerative disc disease.<sup>[9]</sup> Airway complications are common after anterior cervical spine surgery and may range from acute airway obstruction to chronic vocal cord dysfunction.<sup>[10]</sup> Variables associated with post-operative airway complications include a procedure involving more than three vertebral bodies or involvement of C2, C3, or C4; blood loss of >300 ml and operative time >5 h. Vocal cord paralysis resulting from recurrent laryngeal nerve (RLN) palsy is the most common otolaryngologic complication after anterior cervical spine surgery resulting in hoarseness of voice. The nerve dysfunction is transient and most cases resolve at 3 months.<sup>[11,12]</sup> Various other ACDF-related complications have been previously reported which includes: Horner's syndrome, thoracic duct injury, pneumothorax, vertebral artery laceration, carotid artery or jugular vein injury, aneurysm formation, epidural haematoma, wound haematoma, wound infection, epidural abscess, dural laceration, leakage of cerebrospinal fluid (CSF), meningitis, spinal cord contusion, transient or permanent myelopathy, nerve root lesion, additional radicular symptoms, bone graft or instrumentation extrusion, dysphagia and post-operative mechanical instability of the cervical spine.<sup>[13]</sup> We carried out this study to determine the incidence and prevalence of various post-operative complications following anterior cervical discectomy and fusion (ACDF).

## METHODS

After obtaining permission from the Institutional Ethics Committee, this retrospective study was carried out based on post-operative data over a period of 3-year. A total of 128 patients undergoing 1- to 3-level *de novo* ACDF for cervical radiculopathy and/or myelopathy secondary to degenerative disc disease and/or cervical spondylosis, were included; patients with previous neck surgeries were excluded. Pre-operative evaluation included cervical spine X-ray and magnetic resonance imaging (MRI) in all patients. Routine blood workup, including complete blood count and prothrombin time, were obtained. The patients were operated for ACDF using the standard microsurgical technique (anterior Smith-Robinson surgical approach). The patients were operated in supine position with slight head rotation

toward the left. A longitudinal incision is given along the anterior border of the sternocleidomastoid muscle and blunt dissection is used to expose the ventral aspects of the vertebral bodies. Intraoperative fluoroscopy is used to confirm the level. Annulus is incised at the level to be treated, and interspace is widened by applying vertebral spreader and operative microscope is brought into use. The degenerative disc material is removed at each interspace using disc curettes and endplates of the adjacent vertebral bodies are drilled down to the cancellous bone along with the projecting osteophytes. The dissection is performed laterally and a thorough bony decompression was accomplished. It was ensured that both neural foramen and underlying nerve roots were decompressed. Fusion of the disc was performed with any of the three techniques such as tricortical iliac crest autograft, polyetheretherketone (PEEK) cage or artificial disc placement.

Data were collected from the case records, anaesthesia charts and discharge summaries of the patients. Follow-up included detailed clinical examinations during the patients' hospital stay. Statistical analysis was performed using Stata 9.0 (StataCorp, TX, USA). Student's *t*-test was applied to continuous variables and Chi-square test was used to compare nominal variables. When the expected count was <5 in any cell, the Fisher's exact test was used. A *P* < 0.05 was considered as statistically significant.

## RESULTS

Medical records of 128 patients underwent ACDF during the study were analysed; of these 128 patients, 103 (80%) were men and 25 (20%) were women [Figure 1]. Their ages ranged between 22 and 78 years (mean  $\pm$  standard deviation: 47.6  $\pm$  12.1) at the time of operation [Figure 1]. The most common presenting symptom was a weakness of extremities and paraesthesia [Table 1].

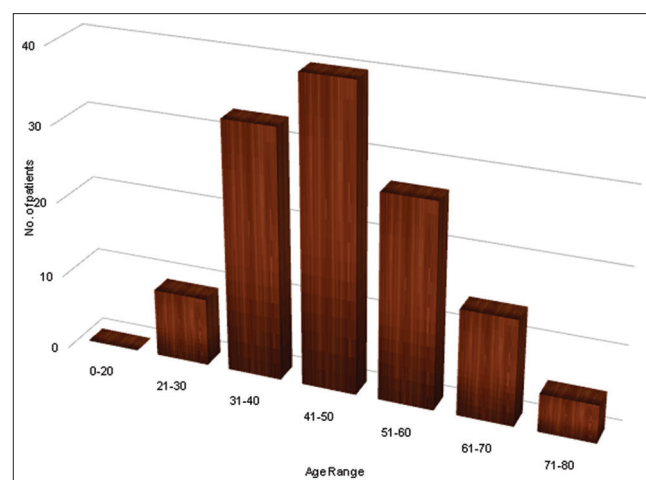


Figure 1: Histogram showing age distribution of patients

Tracheal intubation was performed with the aid of fiberoptic laryngoscope in all cases. Airway was secured, in the majority of the patients, with fiberoptic laryngoscope aided endotracheal intubation under general anaesthesia (77%). Awake fiberoptic aided intubation (after administering topical anaesthesia to the airway, superior laryngeal nerve and trans-tracheal blocks) was done in the remaining patients (23%).

Most of the patients underwent 1-level ACDF (61%). Four patients underwent 3-level ACDF had their cervical spine stabilised with anterior cervical plating [Table 2]. Fusion in majority of the patients was performed with tricortical iliac crest autograft (78%).

Postoperatively, 21 patients (16.4%) reported mild to moderate dysphagia [Table 3]; one of them also had an anterior graft dislocation. The majority of these patients (18 of 21) had no problems with eating or drinking, and they considered their swallowing difficulty as minor. Their complaints subsided 2–7 days after surgery. The remaining patients (3 of 21) reported moderate difficulty in swallowing. Their dysphagia gradually improved over a 2–4 weeks period, and finally disappeared with no further consequences. There was a significant increase in the incidence of dysphagia in patients undergoing 3-level ACDF as compared to

those undergoing 1- or 2-level procedures ( $P = 0.04$ ). However, no significant difference in the occurrence of post-operative dysphagia was observed in patients who underwent plating versus those who were without it.

Neurological deterioration was diagnosed in ten patients (7.9%). There was no significant difference in the incidence of worsening of pre-existing myelopathy between patients operated for 1, 2 or 3-level ACDF ( $P = 0.56$ ). Posterior displacement of bone graft, as revealed by MRI, was the cause of development of rapidly worsening quadriparesis in three patients; they were administered intravenous methylprednisolone sodium succinate. They underwent early re-exploration with the removal of the displaced graft and placement of fresh bone graft. Their neurological condition gradually improved over the next 10 weeks, and they returned to pre-operative functional levels 18 weeks after the procedure. Five patients experienced transient paraparesis in the immediate post-operative period which improved spontaneously over the next 4–6 weeks. Cervical spine MRI obtained in these patients immediately after the procedure revealed signal changes in the spinal cord at the level of the surgical intervention. Two patients developed worsening of weakness in both upper extremities, in whom MRI did not reveal any compression of neural structures. Both these patients recovered completely within 8 weeks.

Five patients (3.9%) developed unilateral RLN palsy. The clinical diagnosis was confirmed by using indirect laryngoscopy. These patients were managed conservatively with spontaneous resolution of symptom (s) over 8–10 weeks period. Neither the level of ACDF surgery nor the application of anterior plate for cervical spine stabilisation was associated with any significant difference in the incidence of RLN palsy ( $P = 0.91$ ). Four patients (3.1%) developed CSF leak due to a dural perforation. They were managed successfully with re-suturing of the wound and insertion of lumbar drain. Anterior graft dislocation was diagnosed in two patients (1.5%). One patient complained of post-operative dysphagia. The other patient was asymptomatic; dislocation was diagnosed using a routine post-operative X-ray taken 6 h after surgery. Both patients underwent re-exploration and fusion with iliac crest bone graft.

**Table 1: Presenting symptoms**

Symptoms	Number of patients (%)
Weakness of extremities	100 (78)
Paraesthesia	83 (65)
Stiffness/gait abnormality	63 (49)
Neck pain	60 (47)
Radiation of pain	34 (27)
Bladder/bowel involvement	33 (26)

**Table 2: Type of surgery performed**

Number of vertebral levels	With plate (%)	Without plate (%)
1	10 (8)	68 (53)
2	17 (13)	29 (23)
3	4 (3)	0

**Table 3: Post-operative complications**

Number of levels	Dysphagia		Neurological deterioration	RLN palsy	Dural tear	Anti-graft dislocation	Oesophageal perforation	Wound infection
	With plate	Without plate						
1	3	5	5	3	1	1	0	0
2	3	7	5	2	3	1	0	1
3	3	0	0	0	0	0	1	0

RLN=Recurrent laryngeal nerve



One patient (0.78%) developed a wound infection at the operative site. Blood culture was positive for *Escherichia coli* and the patient recovered after administration of systemic antibiotics. Accidental pharyngeal perforation occurred in one patient, and the patient experienced a sudden bout of coughing with haemoptysis in the post-operative period; subsequently, he developed subcutaneous emphysema of the neck. The combination of non-contrast computed tomography scan of cervical spine and oral contrast revealed pharyngeal leak of contrast from the hypopharynx (C3, C4). The patient was managed conservatively, as the surgical emphysema did not regress, re-exploration of the wound and repair of defect in hypopharynx was done 10 days later.

## DISCUSSION

ACDF represents one of the commonly performed spinal procedures. The clinical outcome of this procedure is good or excellent in the majority of the cases,<sup>[14,15]</sup> although on rare occasions, serious complications have been reported.<sup>[13,16]</sup> The safety of this procedure requires early identification and prompt management of potential complications.

The management of airway in a patient with cervical spine abnormalities requires careful consideration. In our study, two patients (1.6%) required tracheal reintubation; one developed laryngeal oedema while the other experienced carbon dioxide narcosis as a consequence of acute airway obstruction, probably after pharyngeal oedema. Our results were similar to those observed in other studies. Manninen *et al.* reported acute post-operative airway obstruction requiring re-intubation in four (1.2%) patients.<sup>[17]</sup> Sagi *et al.* observed six (1.9%) patients required re-intubation due to pharyngeal oedema.<sup>[10]</sup>

Mild transient dysphagia occurs most often due to irritation after tracheal intubation and surgical retraction of neck tissue. Rarely, anterior graft dislocation, oesophageal injury, and post-operative haematoma may cause it; however, the exact pathophysiologic mechanism for the occurrence of dysphagia is unknown.<sup>[18]</sup> Dysphagia was the most common (16.4%) post-operative complaint in this study; patients undergoing a 3-level ACDF had a higher incidence of dysphagia, probably due to wider dissection and more retraction of the soft tissue. The incidence of dysphagia ranges between 2% and 67% among various clinical series.<sup>[18,19]</sup> Earlier, the post-operative dysphagia was considered to be an inevitable condition and not a complication.<sup>[13]</sup> Riley *et al.* identified multilevel surgery and female sex as the risk factors for the development of dysphagia.<sup>[19]</sup> It has been suggested that maintenance of endotracheal tube (ETT) cuff pressure between 15 and 25 mmHg

may reduce intubation-related complications in patients undergoing general anaesthesia.<sup>[20]</sup> During anterior cervical spine surgery, lowering of the ETT cuff pressure after placement of the retractor may reduce the incidence of post-operative dysphagia, sore throat and hoarseness. In our patients, ETT cuff pressure monitoring was performed at regular intervals in all patients with an aneroid manometer to keep pressures between 20 and 30 cm H<sub>2</sub>O.

Neurological deterioration secondary to posterior graft dislocation or spinal cord contusion occurred in 7.9% of our patients. In a similar series, Bertalanffy and Eggert reported worsening of pre-existing myelopathy in 3.3% of patients; although 5.4% of their patients developed myelopathy or radiculopathy without fusion.<sup>[13]</sup>

RLN palsy has been variously described as hoarseness, vocal fatigue, post-operative airway obstruction, persistent cough and dysphagia.<sup>[11,12]</sup> The incidence of this complication during ACDF with or without fusion has been reported to range between 0.2% and 16.7%.<sup>[11,13,16,19,21]</sup> In our study, five patients (3.9%) developed unilateral RLN palsy, which is similar to that reported by Fountas *et al.*<sup>[21]</sup> who observed this complication in 3.1% of patients. However, Jung *et al.* found an overall incidence of RLN palsy to be 24% following ACDF. Post-operative vocal cord paralysis may occur due to compression of RLN as a consequence of suboptimal placement of the retractor.

The incidence of dural perforation has been reported to be between 0.2% and 2.8%.<sup>[13,16,21]</sup> In our series, dural tear manifested as CSF leak occurred in 3% of patients. However, none of our patients developed meningitis. Bertalanffy and Eggert observed dural perforation in 1.8% of patients<sup>[13]</sup> who subsequently developed cutaneous CSF fistula and meningitis in 0.2% of cases. Anterior graft dislocation has been reported in approximately 2% of patients in previous studies<sup>[21]</sup> and a similar incidence was observed in our series.

Accidental oesophageal or pharyngeal perforation is a dreaded complication of ACDF surgery;<sup>[16,19]</sup> the exact incidence is not known. One of our patients suffered pharyngeal perforation which manifested post-operatively with haemoptysis and subcutaneous emphysema. Early identification and prompt management of the complication may significantly reduce mortality in such patients. The development of post-operative haematoma at the wound site is a relatively less frequent complication with incidence varying between 1% and 11%.<sup>[13,19,21]</sup> We did not encounter any such complication, in our study. Meticulous haemostasis and avoidance of prolonged soft tissue retraction possibly help reducing its incidence.

This study has certain limitations being retrospective in nature. Intraoperative neurophysiologic monitoring was not performed in these patients. The use of somatosensory and motor evoked potentials in patients with radiculopathy, helps identification of spinal cord injury during the Intraoperative period, thereby allowing for real-time correction, prevention and management of irreversible neurologic injuries.<sup>[22]</sup> Graft-related complications were not evaluated in this study. Furthermore, the distribution of patients among different subgroups such as single versus multiple level procedures, plated versus non-plated, autologous bone graft versus allograft - PEEK cage, and use of artificial disc was uneven.

## CONCLUSIONS

ACDF is the standard procedure for cervical radiculopathy and myelopathy secondary to anterior compression after disc prolapse or osteophytes. Pharyngeal and/or laryngeal oedema are the most common causes of acute airway obstruction requiring re-intubation during post-operative period. Post-operative dysphagia, worsening of pre-existing myelopathy, unilateral RLN palsy and dural perforation were the most common complications associated with ACDF, in this study. Surgery at multiple levels was the major risk factor for the development of post-operative dysphagia. The early detection and prompt management of such complications are of paramount importance and may help reducing morbidity and mortality, significantly.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

- Hunt WE, Miller CA. Management of cervical radiculopathy. *Clin Neurosurg* 1986;33:485-502.
- Emery SE. Cervical spondylotic myelopathy: Diagnosis and treatment. *J Am Acad Orthop Surg* 2001;9:376-88.
- France RD, Houpt JL, Ellinwood EH. Therapeutic effects of antidepressants in chronic pain. *Gen Hosp Psychiatry* 1984;6:55-63.
- Magni G. The use of antidepressants in the treatment of chronic pain. A review of the current evidence. *Drugs* 1991;42:730-48.
- Ward NG. Tricyclic antidepressants for chronic low-back pain. Mechanisms of action and predictors of response. *Spine (Phila Pa 1976)* 1986;11:661-5.
- Ferrante FM, Wilson SP, Iacobo C, Orav EJ, Rocco AG, Lipson S. Clinical classification as a predictor of therapeutic outcome after cervical epidural steroid injection. *Spine (Phila Pa 1976)* 1993;18:730-6.
- Rowlington JC, Kirschenbaum LP. Epidural analgesic techniques in the management of cervical pain. *Anesth Analg* 1986;65:938-42.
- Sampath P, Bendebba M, Davis JD, Ducker TB. Outcome of patients treated for cervical myelopathy. A prospective, multicenter study with independent clinical review. *Spine (Phila Pa 1976)* 2000;25:670-6.
- Jacobs WC, Anderson PG, Limbeek J, Willems PC, Pavlov P. Single or double-level anterior interbody fusion techniques for cervical degenerative disc disease. *Cochrane Database Syst Rev* 2011;(1):CD004958.
- Sagi HC, Beutler W, Carroll E, Connolly PJ. Airway complications associated with surgery on the anterior cervical spine. *Spine (Phila Pa 1976)* 2002;27:949-53.
- Jung A, Schramm J, Lehnerdt K, Herberhold C. Recurrent laryngeal nerve palsy during anterior cervical spine surgery: A prospective study. *J Neurosurg Spine* 2005;2:123-7.
- Apfelbaum RI, Kriskovich MD, Haller JR. On the incidence, cause, and prevention of recurrent laryngeal nerve palsies during anterior cervical spine surgery. *Spine (Phila Pa 1976)* 2000;25:2906-12.
- Bertalanffy H, Eggert HR. Complications of anterior cervical discectomy without fusion in 450 consecutive patients. *Acta Neurochir (Wien)* 1989;99:41-50.
- Samartzis D, Shen FH, Goldberg EJ, An HS. Is autograft the gold standard in achieving radiographic fusion in one-level anterior cervical discectomy and fusion with rigid anterior plate fixation? *Spine (Phila Pa 1976)* 2005;30:1756-61.
- Shen FH, Samartzis D, Khanna N, Goldberg EJ, An HS. Comparison of clinical and radiographic outcome in instrumented anterior cervical discectomy and fusion with or without direct uncovertebral joint decompression. *Spine J* 2004;4:629-35.
- Fielding JW. Complications of anterior cervical disk removal and fusion. *Clin Orthop Relat Res* 1992;284:10-3.
- Manninen PH, Jose GB, Lukitto K, Venkatraghavan L, El Beheiry H. Management of the airway in patients undergoing cervical spine surgery. *J Neurosurg Anesthesiol* 2007;19:190-4.
- Tortolani PJ, Cunningham BW, Vigna F, Hu N, Zorn CM, McAfee PC. A comparison of retraction pressure during anterior cervical plate surgery and cervical disc replacement: A cadaveric study. *J Spinal Disord Tech* 2006;19:312-7.
- Riley LH 3<sup>rd</sup>, Vaccaro AR, Dettori JR, Hashimoto R. Postoperative dysphagia in anterior cervical spine surgery. *Spine (Phila Pa 1976)* 2010;35 9 Suppl:S76-85.
- Garg R, Rath GP, Bithal PK, Prabhakar H, Marda MK. Effects of retractor application on cuff pressure and vocal cord function in patients undergoing anterior cervical discectomy and fusion. *Indian J Anaesth* 2010;54:292-5.
- Fountas KN, Kapsalaki EZ, Nikolakakos LG, Smisson HF, Johnston KW, Grigorian AA, *et al.* Anterior cervical discectomy and fusion associated complications. *Spine (Phila Pa 1976)* 2007;32:2310-7.
- Li F, Gorji R, Allott G, Modes K, Lunn R, Yang ZJ. The usefulness of intraoperative neurophysiological monitoring in cervical spine surgery: A retrospective analysis of 200 consecutive patients. *J Neurosurg Anesthesiol* 2012;24:185-90.