



## Original Article

# Anterior cervical spine surgical complications: Safety comparison between teacher and student

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## ABSTRACT

**Background:** Anterior cervical surgery has a widespread use. Despite its popularity, this surgery can lead to serious and life-threatening complications, and warrants the attention of skilled attending spinal surgeons with many years of experience.

**Methods:** We retrospectively evaluated postoperative complications occurring in 110 patients who underwent anterior cervical surgery (anterior cervical discectomy without fusion, anterior cervical discectomy and fusion, and anterior cervical disc arthroplasty) between 2013 and 2020. These operations were performed by an either an attending surgeon with 30 years' experience versus a novice neurosurgeon (NN) with <5 years of training with the former surgeon. Complications were variously identified utilizing admission/discharge notes, surgical reports, follow-up visits, and phone calls. Complications for the two groups were compared for total and specific complication rates (using the Pearson's Chi-square and Fisher's test).

**Results:** The total cumulative complication rate was 15.4% and was not significantly different between the two cohorts. The most frequent postoperative complication was dysphagia. Notably, there were no significant differences in total number of postoperative instances of dysphagia, dysphonia, unintended durotomy, hypoesthesia, and hypoesthesia; the only difference was the longer operative times for NNs.

**Conclusion:** Surgeons' years of experience proved not to be a critical factor in determining complication rates following anterior cervical surgery.

**Keywords:** Anterior approach, Cervical spine, Complication rate, Learning curve, Retrospective study

## INTRODUCTION

Using the anterior approach to the cervical spine, many spinal surgeons perform anterior cervical discectomy and fusion (ACDF), anterior cervical discectomy (ACD) without fusion, anterior cervical corpectomy and fusion, anterior cervical discectomy and arthroplasty (ACDA), or hybrid surgeries.<sup>[2,7,8]</sup>

One study documented an average 137,000 ACDF performed/year in the U.S. between 2006 and 2013.<sup>[9]</sup>

Despite its widespread use, the anterior approach is not devoid of potential serious complications.

Here, we evaluated whether the postoperative complication rates following anterior cervical surgery varied based on the surgeons' years of practice: senior neurosurgeons (SNs) (SN, with more than 30 years of experience) versus novice neurosurgeons (NNs) (NN, with <5 years of training with the former surgeons).

## MATERIALS AND METHODS

This was a retrospective study on complications rates obtained from medical records (follow-up time of 1 year) of patients undergoing (through a right-sided anterior cervical spine approach) ACD (1 patient), ACDF (105 patients), and ACDA (4 patients).

The procedures were performed from 2013 to 2020 (with 0-Arm Guidance at our institution, IRCCS "Istituto Ortopedico Galeazzi") by either a SN versus a NN. Data were obtained from admission/discharge notes, clinical diaries, operative summaries, follow-up visits, and phone calls.

Data of interest included patients' age and symptoms, radiological diagnosis, type of surgery (ACDF, ACD, and ACDA), operative time, and peri/postoperative complications.

Based on a combination of clinical and radiological features, patients were divided into six groups [Table 1].

### Clinical parameters

Patients in the SN' and NN' groups, respectively, averaged 57 (standard deviation [SD] = 13.36) and 54 (SD = 14.69) years of age and exhibited comparable degrees of radiculopathy and/or myelopathy. Mean operative times for the two cohorts were evaluated and compared utilizing Mann-Whitney U-test; surgical procedure durations ranged from 41 to 161 min (mean = 83.28, SD = 26.5) and from 60 to 158 min (mean = 97.30, SD = 20.6) for the SN and NN, respectively [Table 2]. To test whether the two cohorts were different concerning group composition, Pearson's Chi-square test was adopted: after performing calculations, no statistically significant difference was found between the two, but NN cohort registered a significantly greater mean operative time when confronted with SN [Figure 1].

**Table 1:** Diagnostic classification based on radiological (presence or absence of disc herniation/spondylosis/vertebral instability) and clinical features (cervicobrachialgia, signs of myelopathy).

Group	Diagnosis
Group 1	Cervical disc herniation with pure cervicobrachialgia
Group 2	Cervical disc herniation with myelopathy
Group 3	Cervical spondylosis with cervicobrachialgia
Group 4	Cervical spondylotic myelopathy
Group 5	Cervical instability without myelopathy
Group 6	Cervical instability with myelopathy

### Surgical complications divided into eight groups

*Complications were analyzed in patients who underwent ACD, ACDF, and ACDA.*

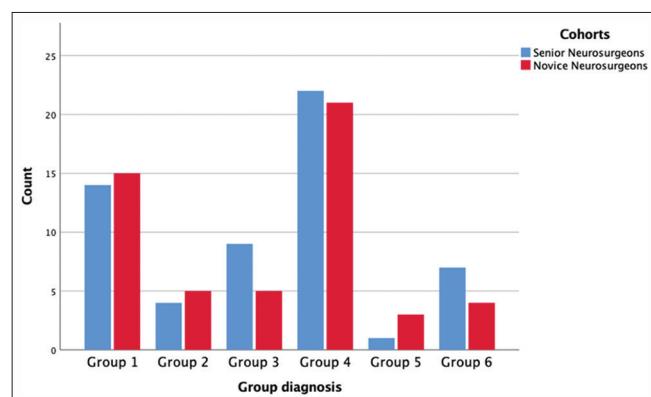
Surgical complications were divided into eight groups as they are in the literature: (1) dysphagia, (2) dysphonia, (3) unintended durotomy, (4) hyposthenia, (5) hypoesthesia, (6) hematoma, (7) Horner's syndrome, and (8) C5 lesions. The frequencies of these complications were then compared for Cohort I SNs (57 patients) versus Cohort II, NNs, (53 patients) using Pearson's Chi-square test and Fisher's test. Computations were made using SPSS (IBM Corp. Release, IBM SPSS Statistics for macOS, Version 26.0).

## RESULTS

The cumulative complication rate was 15.4% (17/110) that was similar for both cohorts, 9 in SN (15.7%) versus 8 in NN cohort (15.09%) [Table 3 and Figure 2]. The most frequent complication was dysphagia, occurring equally in both groups: 4/57 versus 4/53, respectively. Postsurgical dysphonia was present in 2.7% of all patients, and there was no statistically significant difference between the two groups (Fisher's exact test  $P = 0.53$ ). Intraoperative unintended durotomy occurred in 3 out of 110 patients (2.7%) without any statistically significant difference between the two cohorts (Fisher's exact test  $P = 0.53$ ). Hyposthenia was encountered in 2 out of 110 patients, 1 in each group. Hypoesthesia was present in only in 1 patient (0.9% of all) in the NN cohort.

## DISCUSSION

Epstein reported morbidity rates of ACD and ACDF spanning from 13.2% to 19.3%.<sup>[4]</sup> The most common complications included dysphagia, symptomatic recurrent laryngeal nerve palsy, Horner's syndrome, cerebrospinal fluid leak, postoperative hematoma, instrument mechanical failure, esophageal



**Figure 1:** Distribution of patients between the two cohorts based on group's diagnosis. Groups are specified on Table 1.

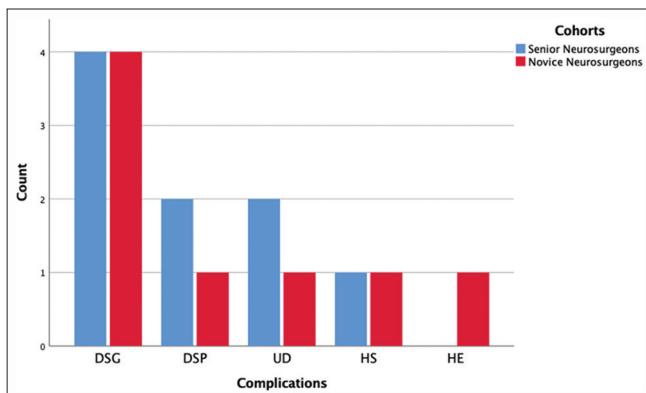
**Table 2:** Total surgical duration and most frequent diagnosis of the two cohorts and direct comparison.

	<b>Senior neurosurgeons</b>	<b>Novice neurosurgeons</b>	<b>P*</b>
Total operative time±Standard deviation (min)	83.28±26.5	97.30±20.6	<0.0001
Group composition (%)	Group 1=24.6 Group 2=7.0 Group 3=15.8 Group 4=38.6 Group 5=1.8 Group 6=13.3	Group 1=28.3 Group 2=9.4 Group 3=9.4 Group 4=39.6 Group 5=5.7 Group 6=7.5	0.912

**Table 3:** Complication frequencies (with relative percentages) of ACD, ACDF, and ACDA surgical procedures.

	<b>Senior neurosurgeons (%)</b>	<b>Novice neurosurgeons(%)</b>	<b>Total (%)</b>
Dysphagia	4 (7)	4 (7.5)	8 (7.3)
Dysphonia	2 (3.5)	1 (1.9)	3 (2.7)
Unintended durotomy	2 (3.5)	1 (1.9)	3 (2.7)
Hyposthenia	1 (1.7)	1 (1.9)	2 (1.8)
Hypoesthesia	0 (0)	1 (1.9)	1 (0.9)
Postsurgical hematoma	0 (0)	0 (0)	0 (0)
Horner's syndrome	0 (0)	0 (0)	0 (0)
C5 lesion	0 (0)	0 (0)	0 (0)
Total	9 (100)	8 (100)	17 (100)

ACD: Anterior cervical disectomy, ACDF: Anterior cervical disectomy and fusion, ACDA: Anterior cervical disectomy arthroplasty.

**Figure 2:** Complications' frequency in the two cohorts. DSG: Dysphagia, DSP: Dysphonia, UD: Unintended durotomy, HS: Hyposthenia, HE: Hypoesthesia.

perforation, worsening of preexisting myelopathy, and nerve root injury.<sup>[1,4,5,10]</sup> Specifically, Horner's syndromes were more likely to occur with surgery at the C5–C6 level due to the progressive lateral divergence of the longus colli muscles C3–C6 (rate 0.06–1.1%).<sup>[3,4]</sup> Notably, Huang *et al.* documented no significant differences with ACDF versus anterior cervical corpectomy in terms of hospital stay, neck and arm pain, fusion rates, and complications.<sup>[6]</sup> In their series, Tasiou *et al.* reported an incidence of 1.7% of dural leakage that could largely be avoided utilizing an operating microscope and a 1.7% of postoperative hematomas.<sup>[10]</sup>

## CONCLUSION

In Epstein's review, ACD and ACDF complication rates ranged from 13.2 to 19.3%.<sup>[4]</sup> In this study, we found that spinal surgeons' years of experience proved not to be a critical factor in determining complication rates for these procedures.

## Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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