

The Incidence of C5 Palsy after Multilevel Cervical Decompression Procedures: A Review of 750 Consecutive Cases.

Ahmad Nassr, MD¹; Jason C. Eck, DO, MS²; Ravi K. Ponnappan, MD³; Rami R. Zanou, BS⁴; William F. Donaldson III, MD⁴; James D. Kang, MD⁴

Department of Orthopedic Surgery

1. Mayo Clinic, Rochester, MN; 2. University of Massachusetts, Worcester, MA; 3. Thomas Jefferson University, Philadelphia, PA; 4. University of Pittsburgh, Pittsburgh, PA

Introduction

Palsy of the C5 nerve is a well-known potential complication of cervical spine surgery with reported rates ranging from 0-30%.¹⁻³ Symptoms can include paresis of the deltoid and/or biceps brachii muscle, with sensory deficits and/or intractable pain in the shoulders. It typically occurs unilaterally but can rarely present bilaterally.

The exact etiology remains uncertain, but it has been attributed to iatrogenic nerve injury during surgery⁴, tethering of the nerve from shifting of the spinal cord⁵, spinal cord ischemia⁶, and reperfusion injury of the spinal cord.⁷ It is not currently known whether anterior, posterior or combined procedures are associated with increased rates of C5 nerve palsy.

The purpose of this study was to review the incidence of postoperative C5 nerve palsy in a large consecutive series of multilevel cervical spine decompression procedures to determine if any patient factors or surgical approach affected the incidence.

METHODS

A retrospective analysis of 750 consecutive multilevel cervical spine decompression surgeries performed by a single spine surgeon (JDK) was conducted. We included patients undergoing multilevel anterior cervical corpectomy, anterior corpectomy followed by posterior fusion, posterior laminectomy and fusion, and laminoplasty procedures for the treatment of cervical spinal stenosis. Patients were excluded if there was lack of adequate follow-up data, spinal cord injury preventing preoperative or postoperative motor testing, or if the decompressive surgery did not include the C5 level.

Incidence of C5 palsy was determined and compared to determine if statistically significant differences existed among the various procedures, patient age, revision surgery, preoperative weakness, diabetes, smoking, the number of decompressed levels or gender. Statistical analysis was performed using Chi-Squared, Fisher's Exact, and two sample T-test analysis with significance defined as a p-value of less than 0.05.

RESULTS

Of the 750 patients, 120 were eliminated based on the exclusion criteria. The 630 remaining patients included in the analysis consisted of 292 females and 338 males. The mean age was 58 years (range, 19-87). Anterior corpectomy alone was performed in 255 patients, anterior decompression with posterior fusion in 154 patients, laminectomy and fusion in 116 patients, and laminoplasty in 105 patients.

Data are summarized in Table 1. The overall incidence of C5 nerve palsy for the entire group was 42 of 630 (6.7%). The incidence of C5 nerve palsy was highest for the laminectomy and fusion group with 11 of 116 (9.5%), followed by the anterior corpectomy with posterior fusion group with 13 of 154 (8.4%), the anterior corpectomy alone group with 13 of 255 (5.1%), and finally the laminoplasty group with 5 of 105 (4.8%), although these differences did not reach statistical significance (p=0.28).

The time of initial onset of the C5 palsy symptoms ranged from immediately postoperatively to 2 months postoperatively. The majority completely recovered, but 19.0% has some residual pain or deficit at final follow-up. There was no statistical difference in the number of patients with residual deficits based on the type of surgery. The time until maximal recovery ranged from 1 week to 2 years, with a mean time of 21 weeks. The majority (71.4%) recovered within 6 months. The mean age of patient developing postoperative C5 nerve palsy was 57.6, while the mean age of those not developing C5 palsy was 58.6 (p=0.588).

Of the female patients, 13 (4.5%) of 292 developed C5 nerve palsy, while 29 (8.6%) of 338 males developed C5 nerve palsy. This difference was statistically significant (p=0.05, Table 2). Bilateral palsies occurred in 3 of 42 patients (7%). A multi-segment paresis involving more than the C5 root was seen in 2 of 42 patients (5%).

The number of corpectomy levels was found to be statistically significant with 12/13 palsies in this group occurring in patients having undergone 3-level cervical corpectomies (p=0.002).

Table 1: Demographics and Results

Procedure	# of Pts	Incidence	Age	MOF	Gender	Residual Deficit	Time to Maximal Improvement
Laminoplasty	105	13 (12.4%)	60.9 (39-86)	79/26	Posterior	0 (0%)	21 Weeks (9-40)
Corpectomy	255	13 (5.1%)	58.2 (39-84)	133/124	Posterior	2 (15.4%)	18 Weeks (9-40)
Anterior/Posterior Fusion	154	13 (8.4%)	57.9 (39-86)	88/66	Posterior	3 (23.1%)	28 Weeks (9-104)
Laminectomy and Fusion	116	11 (9.5%)	61.3 (47-87)	68/47	Posterior	3 (27.3%)	18 Weeks (9-36)
Combined	630	42 (6.7%)	57.7 (19-87)	338/292	Posterior	8 (19%)	36 Weeks (9-104)

- 3/42 Bilateral palsies (7%)
- 2/42 Multi-segment Paresis (5%)

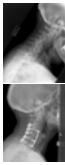
Table 2: Risk Factors

	Gender	Smoking	Revision Surgery	Diabetes	Preop Weakness
C5 Palsy Rate	Male 8.0% Female 4.5%	Yes 8.2% Yes 4.6%	Yes 7.5% Yes 4.9%	Yes 7.3% Yes 4.6%	Yes 8.0% Yes 5.6%
P Value	P=0.05	P=0.21	P=0.43	P=1.00	P=0.32

Anterior/Posterior Group

- 13/155 (8.4%) pts with C5 Palsy
- 8/13 after 3 or 4 level corpectomies
- Resolution in 1 month to 2 years
- 3 Pts with residual weakness at final f/u

Risk Factor	Prevalence
Male Gender	P=0.56 (Patient's Exact)
Smoking	P=0.14 (Patient's Exact)
Previous Cervical Surgery	P=0.22 (Patient's Exact)
# of Upper Extremity Surgery	P=0.12 (Patient's Exact)
Diabetes	P=0.69 (Patient's Exact)
Preoperative Weakness	P=1.00 (Patient's Exact)
# of Corpectomy Levels	P=0.47 (Bilateral Homologous Chi-Square)
Age	P=0.44 (2 Sample T-test)



Corpectomy Group

- 13/255 (5.1%) Pts with C5 Palsy
- 12/13 after 3 level corpectomies
- Resolution in 2 weeks to 10 months
- 2 Pts with residual weakness at final f/u

Risk Factor	Prevalence
Male Gender	P=0.57 (Patient's Exact)
Smoking	P=0.52 (Patient's Exact)
Previous Cervical Surgery	P=0.52 (Patient's Exact)
# of Upper Extremity Surgery	P=0.52 (Patient's Exact)
Diabetes	P=0.69 (Patient's Exact)
Preoperative Weakness	P=0.52 (Patient's Exact)
# of Corpectomy Levels	P=0.02 (Bilateral Homologous Chi-Square)
Age	P=0.11 (2 Sample T-test)
Age	P=0.11 (2 Sample T-test)
Age	P=0.11 (2 Sample T-test)



Laminectomy/Fusion Group

- 11/116 (9.5%) of Pts with C5 Palsy
- Resolution in 1 month - 9 months PO
- 3 Pts with residual weakness at final f/u

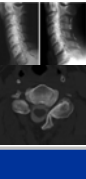
Risk Factor	Prevalence
Male Gender	P=0.29 (Patient's Exact)
Smoking	P=0.59 (Patient's Exact)
Previous Cervical Surgery	P=0.19 (Patient's Exact)
# of Upper Extremity Surgery	P=0.59 (Patient's Exact)
Diabetes	P=0.59 (Patient's Exact)
Preoperative Weakness	P=0.59 (Patient's Exact)
# of Laminectomy Levels	P=0.44 (Bilateral Homologous Chi-Square)
Age	P=0.14 (2 Sample T-test)



Laminoplasty Group

- 5/105 (4.8%) Pts with C5 Palsy
- Resolution in 1 week to 15 months
- No pts with residual weakness at final f/u

Risk Factor	Prevalence
Male Gender	P=0.17 (Patient's Exact)
Smoking	P=0.25 (Patient's Exact)
Previous Cervical Surgery	P=0.25 (Patient's Exact)
# of Upper Extremity Surgery	P=0.25 (Patient's Exact)
Diabetes	P=0.19 (Patient's Exact)
Preoperative Weakness	P=0.25 (Patient's Exact)
# of Laminoplasty Levels	P=0.25 (Bilateral Homologous Chi-Square)
Age	P=0.25 (2 Sample T-test)
Age	P=0.25 (2 Sample T-test)
Age	P=0.25 (2 Sample T-test)



DISCUSSION

Palsy of the C5 nerve root following cervical spine decompressive procedures is a well known but poorly understood potential complication. Previously reported rates range from 0-30%.¹⁻³ Previous investigators have attempted to determine whether or not certain procedures are associated with a higher risk of C5 nerve palsy; however results have been contradictory.

The purpose of the current study was to review the incidence of C5 nerve palsy following multilevel cervical decompressive procedures. The study group consisted of 630 patients, providing the largest groups of patients evaluated for C5 nerve palsy. The overall rate of C5 palsy was 6.7% which is consistent with previously reported values.¹⁻³ Based on our results, there was no significant difference in the risk of developing postoperative C5 nerve palsy based on the type of surgery.

It is generally accepted that the majority of patients develop this complication within the first two weeks and typically resolve within six months. The current study has revealed that 19.0% of patients with C5 nerve palsy had some residual deficit at the final follow-up appointment. When comparing results of C5 palsy it is important to precisely define what is included as C5 nerve palsy. In the current study C5 nerve palsy was defined as a loss of motor strength in either the deltoid or biceps brachii, sensory deficit in the C5 distribution or increased pain in the C5 distribution as compared to the preoperative status. If any of these was still present at the final follow-up it was considered a residual deficit. There was a wide range of time until maximal improvement ranging from 1-104 weeks with a mean of 20.9 weeks. Fortunately, the majority of patients (71.4%) reached maximal improvement within six months.

Significant risk factor for the development of postoperative C5 nerve palsy included male gender and number of corpectomy levels. Male patients (8.6%) were significantly more likely to develop C5 nerve palsy compared to female patients (4.5%). Also increasing number of corpectomy levels was associated with a significant increase in palsy rates (p=0.002).

CONCLUSION

In conclusion, we have determined the incidence of C5 nerve palsy following cervical spine decompressive procedures is 6.7% with an increased risk in male patients. There was a trend towards an increased risk in patients undergoing laminectomy and fusion; however, this was not statistically significant. Patients should be counseled that 19% have residual deficits. Over 70% of these patients recover within six months, but there can be additional recovery up to two years.

REFERENCES

- Inada A, Tsubouchi S, Iwahashi T, et al. Prevention for radiculopathy after cervical laminoplasty. *J Jpn Spine Res Soc* 2002;13:355.
- Sakaura H, Hosono N, Mukai Y, Ishii T, Yoshiokawa H. C5 palsy after decompression surgery for cervical Myelopathy: review of the literature. *Spine* 2003;28:2447-2451.
- Sasai K, Saitoh T, Akagi S, et al. Prevention and pathogenesis of C5 palsy after laminoplasty. *J Jpn Spine Res Soc* 2002;13:230.
- Satomi K, Nishu Y, Kohno T, et al. Long-term follow-up studies of opening-door expansive laminoplasty for cervical stenotic myelopathy. *Spine* 1994;19:507-510.
- Tsuzuki N, Abe R, Saiki K, et al. Extradural tethering effect as one mechanism of radiculopathy complicating posterior decompression of the cervical spinal cord. *Spine* 1995;20:209-214.
- Rovira M, Torrent O, Ruscaleda J. Some aspects of the spinal cord circulation in cervical myelopathy. *Neuroradiology* 1975;9:209-214.
- Chiba K, Toyama Y, Matsumoto M, et al. Segmental motor paralysis after expansive open-door laminoplasty. *Spine* 2002;27:2108-2115.