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Technical Notes

C5 palsy following esophageal diverticulum resection

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ABSTRACT

Background: C5 palsy (C5P) is a recognized potential postoperative complication of cervical spine surgery but has rarely been reported following an open esophageal diverticulectomy.

Methods: A 61-year-old underwent an open esophageal diverticulectomy for symptomatic Zencker's diverticulum.

Results: Postoperatively, she presented with right upper extremity weakness and sensory deficits consistent with a C5P that was later confirmed by electromyography.

Conclusion: The potential for C5P after esophageal diverticulectomy for symptomatic Zencker's diverticulum is rare. Postoperative recognition and appropriate management are critical to recovery.

Keywords: C5 palsy, Cervical spine, Cervical spondylosis, Esophageal diverticulum

INTRODUCTION

C5 palsy (C5P) is a well-documented potential complication following cervical spine surgery, occurring in 0–30% of patients.[4,8,10] While cases of C5P following anterior and posterior cervical spine surgery have been widely described,[2,3,6,7,9] cases following open esophageal diverticulectomy are rare.

CASE PRESENTATION

A 61-year-old female with a history of Crohn's disease presented initially with 1 year of dysphagia and a 40 lb weight loss. A barium esophagram revealed a Zencker's diverticulum just above the thoracic inlet. The patient agreed to proceed with a transoral stapling with possible open diverticulectomy. Under general endotracheal anesthesia (i.e., Macintosh blade under direct laryngoscopy), she underwent flexible upper gastrointestinal endoscopy. A 2.5 cm Zencker's diverticulum was identified above the cricopharyngeus muscle. A resolution clip was placed in the diverticulum apex. Stapling attempts using a rigid endoscope to place the bivalved diverticula blade into both the diverticula and esophagus were unsuccessful. The procedure was aborted and converted to an open repair utilizing a left anterior sternocleidomastoid approach; the diverticula was removed, and the esophagostomy was oversewn in a two-layer fashion. The final endoscopy confirmed the diverticulum was excluded, the esophagus patent and the leak test was negative.

Table 1: Reference summary table.

Author	Year	Article type	Results	Key points
Alonso *et al.*[1]	2018	AS	• In 10 cadavers dissected to expose the cord, roots, and nerves from C4 to T1, the greatest displacement of nervous tissue was generated by shoulder depression. • Displacement occurred primarily at the intradural rootlet level • C5 rootlet underwent the greatest displacement, decreasing gradient down to C7	• Shoulder depression is often used in cervical spine surgery; however, causes significant tension and displacement of the C5 rootlet • In extreme cases, shoulder depression may displace the cord to the ipsilateral side
Bydon *et al.*[2]	2014	RC	• In 1001 C4–5 surgeries, C5P incidence was 5.2% • Incidence in corpectomy was 4.0% versus 1.0% in ACDF • Incidence in posterior foraminotomy 14.5% versus 2.4% in anterior	• Corpectomy, and an increasing number of corpectomy levels, has a higher incidence of C5P versus ACDF • Posterior approaches have a higher incidence of C5P than anterior
Deshpande *et al.*[3]	2022	REV	• In a review of 43 articles, postoperative C5P is most commonly defined as reduced deltoid strength by≥1 MMT grade • Few studies stratify C5P based on severity or recovery	Proposed C5P Classification: *Severity* MMT Grade Mild 4/5 Moderate 3/5 Severe ≤2/5 *Recovery* Complete 5/5 Sufficient 4/5 Useful 3/5
Hirabayashi *et al.*[5]	2019	REV	• Two theories of C5P etiology: 1. Segmental spinal cord theory Anterior horn cells are damaged from pre/perioperative ischemia or reactive oxygen during reperfusion. 2. Nerve root injury theory Anterior rootlet and/or nerve root mechanically damaged by compressive or distractive force	Countermeasures to prevent C5P: • Avoid excessive lateral stretch of multifidus muscles for prolonged periods during surgery • Prevent distraction force to the C5 root by slightly flexing the elbow and abducting the shoulder during positioning (i.e., pillow under the axilla) • Prevent excessive posterior spinal cord shift or hyperlordotic alignment
Tsuzuki *et al.*[9]	1993	RC	• In a review of 188 surgeries, postoperative nerve root palsies occurred in 20 patients (11%) • The C5 nerve is the most likely to sustain postoperative paralysis	• C5P is more likely in cases of posterior expansion/displacement of the thecal sac after decompression and with anteriorly protruding superior articulating processes • Elongation of the extradural portion of the C5 root associated with C5P postoperatively
Wang *et al.*[10]	2017	MA	• In 11,481 patients, C5P occurred more with posterior versus anterior approaches (6.2% vs. 5%) and those with OPLL versus CSM (8.1% vs. 4.8%) • Male patients had a higher incidence than females (5.7% vs. 4%)	• Postoperative C5P incidence is higher with male gender, posterior approach, and OPLL

ACDF: Anterior cervical discectomy and fusion, AS: Anatomical study, C5P: C5 palsy, CSM: Cervical spondylotic myelopathy, MA: Metaanalysis, MMT: Manual muscle testing, OPLL: Ossified posterior longitudinal ligament, RC: Retrospective cohort, REV: Review

Postoperative course

Immediately postoperatively, the patient awoke with significant proximal right upper extremity weakness (manual muscle testing grade ⅕ in deltoid and biceps) and near-complete sensory loss from the right shoulder to the elbow. She was diagnosed clinically with a right C5P. The brachial plexus magnetic resonance was normal [Figure 1]. The magnetic resonance imaging of the cervical spine, however, documented multilevel cervical spondylosis with moderate C4–5 right and severe left C4–5 foraminal stenosis, with foraminal spondylotic encroachment at the C5–6 and C7–T1 levels [Figure 2]. Her symptoms gradually improved within 4 postoperative months, with sensory deficits resolved and right deltoid and biceps strength recovered to the 4/5 level. In addition, the electromyography confirmed normal motor unit recruitment.

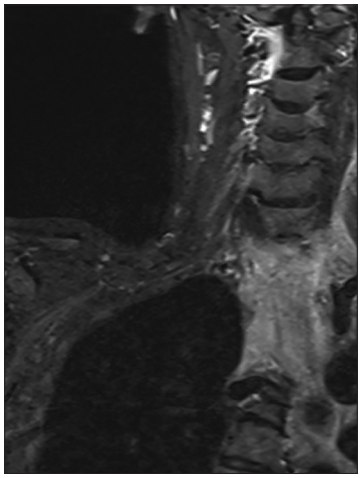

Figure 1: Coronal brachial plexus magnetic resonance imaging short-tau inversion recovery sequence showing grossly normal appearance without associated signal change throughout the brachial plexus.

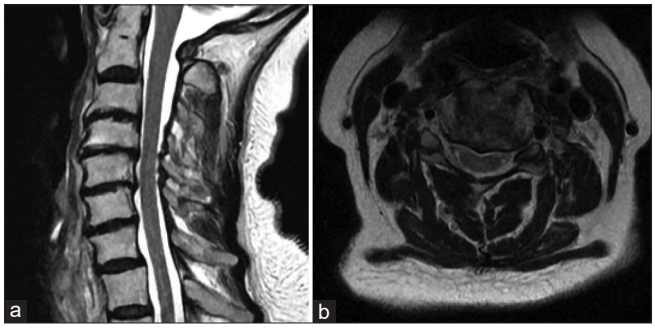

Figure 2: (a) Sagittal T2-weighted magnetic resonance imaging (MRI) of the cervical spine showing multilevel spondylotic changes. (b) Axial T2-weighted MRI of the cervical spine at the C4–5 level showing severe left and moderate right foraminal stenosis.

DISCUSSION

Laryngoscopy and basic airway maneuvers may result in sufficient extension of the cervical spine to result in neurological damage.[1,5] A summary table of pertinent references describing C5 palsy incidence, diagnosis, and injury mechanisms is provided in Table 1. Notably, identifying signs and symptoms of cervical spondylosis preoperatively and avoiding perioperative cervical hyperextension maneuvers should help avoid the new onset of C5 root and/or cord compromise postoperatively.

CONCLUSION

In patients with severe pre-existing cervical spondylosis, care should be taken to avoid excess shoulder retraction and stretch injuries during intubation, laryngoscopy/endoscopy, and, in this case, open esophageal diverticulectomy for symptomatic Zencker's diverticulum.

Ethical approval

The Institutional Review Board approval is not required.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

REFERENCES

1. Alonso F, Voin V, Iwanaga J, Hanscom D, Chapman JR, Oskouian RJ, *et al*. Potential mechanism for some postoperative C5 palsies: An anatomical study. Spine (Phila Pa 1976) 2018;43:161-6.
2. Bydon M, Macki M, Kaloostian P, Sciubba DM, Wolinsky JP, Gokaslan ZL, *et al*. Incidence and prognostic factors of C5 palsy: A clinical study of 1001 cases and review of the literature. Neurosurgery 2014;74:595-605.
3. Deshpande N, Stino AM, Smith BW, Little AA, Yang LJ, Park P, *et al*. Defining postoperative C5 palsy and recovery: A systematic review. J Neurosurg Spine 2022;38:457-64.
4. Gu Y, Cao P, Gao R, Tian Y, Liang L, Wang C, *et al*. Incidence and risk factors of C5 palsy following posterior cervical decompression: A systematic review. PLoS One 2014;9:e101933.
5. Hirabayashi S, Kitagawa T, Yamamoto I, Yamada K, Kawano H. Postoperative C5 palsy: Conjectured causes and effective countermeasures. Spine Surg Relat Res 2018;3:12-6.
6. Nassr A, Eck JC, Ponnappan RK, Zanoun RR, Donaldson WF 3rd, Kang JD. The incidence of C5 palsy after multilevel cervical decompression procedures: A review of 750 consecutive cases. Spine (Phila Pa 1976) 2012;37:174-8.
7. Sakaura H, Hosono N, Mukai Y, Ishii T, Yoshikawa H. C5 palsy after decompression surgery for cervical myelopathy: Review of the literature. Spine (Phila Pa 1976) 2003;28:2447-51.
8. Shou F, Li Z, Wang H, Yan C, Liu Q, Xiao C. Prevalence of C5

nerve root palsy after cervical decompressive surgery: A meta-analysis. Eur Spine J 2015;24:2724-34.
9. Tsuzuki N, Abe R, Saiki K, Okai K. Paralysis of the arm after posterior decompression of the cervical spinal cord. II. Analyses of clinical findings. Eur Spine J 1993;2:197-202.
10. Wang T, Wang H, Liu S, Ding WY. Incidence of C5 nerve root palsy after cervical surgery: A meta-analysis for last decade. Medicine (Baltimore) 2017;96:e8560.

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