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Hypoglossal Nerve Palsy After Cervical Spine Surgery

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Abstract

Study Design: Multi-institutional retrospective study.

Objective: The goal of the current study is to quantify the incidence of 2 extremely rare complications of cervical spine surgery; hypoglossal and glossopharyngeal nerve palsies.

Methods: A total of 8887 patients who underwent cervical spine surgery from 2005 to 2011 were included in the study from 21 institutions.

Results: No glossopharyngeal nerve injuries were reported. One hypoglossal nerve injury was reported after a C3-7 laminectomy (0.01%). This deficit resolved with conservative management. The rate by institution ranged from 0% to 1.28%. Although not directly injured by the surgical procedure, the transient nerve injury might have been related to patient positioning as has been described previously in the literature.

Conclusions: Hypoglossal nerve injury during cervical spine surgery is an extremely rare complication. Institutional rates may vary. Care should be taken during posterior cervical surgery to avoid hyperflexion of the neck and endotracheal tube malposition.

Keywords

cervical spine, complications, hypoglossal palsy, glossopharyngeal palsy, retrospective

Introduction

Quantifying rare complications is critical for comprehensive risk profiling of particular treatment modalities and counseling patients.[1] Persistent deficits of the hypoglossal (CN XII) and glossopharyngeal (CN IX) nerves can be significant. By providing motor innervation to the tongue, the hypoglossal nerve is critical for speech and swallowing. Deficits of the nerve are manifested by dysphagia, dysarthria, and ipsilateral tongue deviation. The glossopharyngeal nerve provides motor, sensory, and parasympathetic innervation to the tongue, pharynx, and hypopharynx. Palsy is characterized by decreased taste and sensation in the posterior third of the tongue and an impaired gag reflex. Postoperative hypoglossal nerve palsy has very rarely been reported after anterior cervical discectomy and fusion procedures as well as corpectomy.[2-4] Hypoglossal nerve palsy has also been reported as a rare complication after posterior cervical spine surgery.[5-7] To the authors' knowledge, there have been no reports of new glossopharyngeal nerve deficits after cervical spine surgery. The goal of the current multi-institutional study was to analyze a very large number of patients in an attempt to quantify incidence rates of these rare complications.

Methods

We have conducted a retrospective multicenter case-series study involving 21 high-volume surgical centers from the AOSpine North America Clinical Research Network, selected for their excellence in spine care and clinical research infrastructure and experience. Medical records for 17 625 patients who received cervical spine surgery (levels from C2 to C7)

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Table 1. Comparison of the Clinical Characteristics of the Current Case and Previously Reported Cases of Hypoglossal Nerve Palsy After Cervical Spine Surgery.

Reference	Incidence	Operation	Permanent (Yes/No)	Notes
Park et al (2007)[3]	1/15	C2/3, 3/4, 4/5 ACDF	Yes	All upper cervical anterior operations
Park et al (2011)[10]	NA	C3/4 ACDF	Yes	
Yasuda et al (2015)[2]	NA	C3/4 ACDF	No	
Saunders et al (1991)[4]	1/40	NR	Yes	All corpectomy
Sengupta et al (1999)[9]	NA	C2-5 corpectomy	Yes	
Grob et al (1991)[12]	1/161	C1/2 transarticular	No	All transarticular screws
Hong et al (2006)[7]	NA	C1-2 Harms	No	
Kang et al (2013)[5]	NA	C3-6 laminectomy	Yes	
Park et al (2013)[6]	NA	1. C4/5 foraminotomy	No	
		2. C3-5 laminoplasty	No	

Abbreviations: ACDF, anterior cervical discectomy and fusion; NA, not applicable; NR, not reported.

between January 1, 2005 and December 31, 2011, inclusive, were reviewed to identify occurrence of 21 predefined treatment complications. The complications included reintubation requiring evacuation, esophageal perforation, epidural hematoma, C5 palsy, recurrent laryngeal nerve palsy, superior laryngeal nerve palsy, hypoglossal or glossopharyngeal nerve palsy, dural tear, brachial plexopathy, blindness, graft extrusion, misplaced screws requiring reoperation, anterior cervical infection, carotid artery injury or cerebrovascular accident, vertebral artery injuries, Horner's syndrome, thoracic duct injury, tetraplegia, intraoperative death, revision of arthroplasty, and pseudomeningocele. Trained research staff at each site abstracted the data from medical records, surgical charts, radiology imaging, narratives and other source documents for the patients who experienced one or more of the complications from the list. Data was transcribed into study-specific paper Case Report Forms (CRF). Copies of CRF forms were transferred to the AOSpine North America Clinical Research Network Methodological Core for processing, cleaning, and data entry.

Descriptive statistics were provided for baseline patient characteristics. Paired *t* test was used to analyze changes in clinical outcomes at follow-up compared with preoperative status.

This study was ethically approved by the institutional ethics committees at all participating sites.

Results

Data was available from 8887 patients from 21 institutions. All patients had surgery for cervical spine pathologies. There were 0 postoperative glossopharyngeal nerve palsies. There was one new postoperative hypoglossal nerve palsy (0.01%). This patient had undergone a C3-7 posterior fusion for cervical myelopathy. The operative time was 165 minutes. The patient was managed conservatively and the deficit resolved. Per site, the incidence of hypoglossal nerve deficit ranged from 0% to 1.28%.

Discussion

Hypoglossal nerve injuries after cervical spine surgery have rarely been reported as complications in the literature. To the authors' knowledge, no studies have evaluated the incidence of glossopharyngeal nerve palsy after cervical spine surgery. To quantify the incidence of these rare complications, the current study evaluated for the first time a large, multi-institutional series of patients undergoing all cervical spine operations. In this series, there was 1 hypoglossal nerve palsy and no glossopharyngeal nerve palsies.

Injury to the hypoglossal nerve has been reported in several case reports and small series (Table 1). The course of the hypoglossal nerve places it at risk during cervical spine surgery. It has most commonly been reported as a sequela after anterior operations, in particular the high cervical levels. It exits the skull base through the hypoglossal canal and proceeds inferiorly in the carotid sheath. Above C1/2 it is connected fibrously to the vagus nerve (CN X). Below C1/2, it breaks away and travels between the internal carotid artery and the internal jugular vein. At C2/3, it courses medially where it may be at risk during anterior approaches as demonstrated in a cadaveric study.[8] Consistent with this, Park et al[3] reported 15 cases of high cervical operations (C2/3) with a high incidence of permanent hypoglossal nerve palsy (6.67%). Saunders et al[4] reported 1 permanent hypoglossal nerve palsy in 40 cases of corpectomy for cervical myelopathy (2.5%) but did not provide details of the exact procedure performed in that one patient. Sengupta et al[9] reported a second case of permanent deficit after C2-5 anterior corpectomy, which may have been related to dividing the nerve inadvertently while attempting to coagulate a suspected crossing vessel. Below C2/3, the hypoglossal takes a more lateral orientation and may not be at direct risk during anterior operations. However, deficits have been reported after C3/4 anterior operation and may be related to compression from excessive retration.[2,6,10]

Hypoglossal nerve palsy has also been less commonly reported after C1/2 transarticular screw placement (Table 1). A cadaveric study demonstrated that the hypoglossal nerve lies immediately anterior to the lateral aspect of the C1 lateral mass (2-3 mm from the middle of the lateral mass) and the C1/2 facet and therefore may be at risk with anterior breaches if the screw is slightly laterally placed.[11] Grob et al[12] reported one hypoglossal nerve deficit after 161 consecutive cases (0.6%) that

was thought to be related to nerve irritation due to a screw that had breached the cortex anteriorly. The deficit resolved after the screw was revised. One report exists of a transient hypoglossal nerve injury after a C1 lateral mass screw placed as part of a posterior Harms construct.[7] Although final radiographs demonstrated good screw placement, the hypothesis was that the nerve may have been injured during drilling or tapping.

Interestingly, hypoglossal nerve injury has also been described after posterior operations involving the lower cervical spine (Table 1). Therefore, the surgery is not directly related to the damaged nerve. Kang et al[5] reported hypoglossal nerve palsy after a noninstrumented C3-6 laminectomy for myelopathy and suggested that the deficit may have been related to compression of the hypoglossal nerve against the mandible from neck flexion or from stretching of the nerve by the endotracheal tube. Likewise, Park et al[6] reported 2 cases of hypoglossal nerve palsies, which were also suggested to be related to excessive neck flexion. In the current series, the one reported hypoglossal nerve palsy was transient and occurred following a C3-7 posterior fusion. Anatomically, the hypoglossal nerve would not be at risk during this procedure. It is therefore possible that neck flexion or endotracheal tube compression may have been the cause. Neck flexion opens the interlaminar spaces as well as translates the posterior elements upward to facilitate screw trajectories in the setting of thoracic kyphosis. Nevertheless, care must be taken to avoid hyperflexion of the neck. The reported incidence in the current study is lower than previously reported. This is likely because of the fact that previous series have focused solely on procedures that place the hypoglossal nerve at specific risk; corpectomy, high anterior cervical operations, and transarticular fixation.

Conclusions

In this large, multi-institutional study of cervical spine operations, 1 hypoglossal nerve palsy was observed (0.01%). This may have been related to endotracheal intubation. At the institutional level, the incidence ranged from 0% to 1.28%. Although theoretically placed at risk during cervical spine surgery, 0 glossopharyngeal injuries were reported. Care with intubation and neck flexion may help avoid this extremely rare complication.

Declaration of Conflicting Interests

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