
Examining National Outcomes after Thyroidectomy with Nerve Monitoring



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- BACKGROUND:** Previous intraoperative nerve monitoring (IONM) studies have demonstrated modest-to-no benefit and did not include a nationwide sample of hospitals representative of broad thyroidectomy practices. This national study was designed to compare vocal cord paralysis (VCP) rates between thyroidectomy with IONM and without monitoring (conventional).
- STUDY DESIGN:** We performed a retrospective analysis of 243,527 thyroidectomies during 2008 to 2011 using the Nationwide Inpatient Sample.
- RESULTS:** Use of IONM increased yearly throughout the study period (2.6% [2008], 5.6% [2009], 6.1% [2010], 6.9% [2011]) and during this time, VCP rates in the IONM group initially increased year-over-year (0.9% [2008], 2.4% [2009], 2.5% [2010], 1.4% [2011]). In unadjusted analyses, IONM was associated with significantly higher VCP rates (conventional 1.4% vs IONM 1.9%, $p < 0.001$). After propensity score matching, IONM remained associated with higher VCP rates in partial thyroidectomy and lower VCP rates for total thyroidectomy with neck dissection. Hospital-level analysis revealed that VCP rates were not explained by differential laryngoscopy rates, decreasing the likelihood of ascertainment bias. Additionally, for hospitals in which IONM was applied to more than 50% of thyroidectomies, lower VCP rates were observed (1.1%) compared with hospitals that applied IONM to less than 50% (1.6%, $p = 0.016$). Higher hospital volume correlated with lower VCP rates in both groups (<75, 75 to 299, >300 thyroidectomies/year: IONM, 2.1%, 1.7%, 1.7%; conventional, 1.5%, 1.3%, 1.0%, respectively).
- CONCLUSIONS:** According to this study, IONM has not been broadly adopted into practice. Overall, IONM was associated with a higher rate of VCP even after correction for numerous confounders. In particular, low institutional use of IONM and use in partial thyroidectomies are associated with higher rates of VCP. Further studies are warranted to support the broader application of IONM in patients where benefit can be reliably achieved. (*J Am Coll Surg* 2014;219:765–770. © 2014 by the American College of Surgeons)
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Thyroidectomy is largely a straightforward, safe, and effective operation for benign and malignant thyroid disease. As such, thyroidectomy is performed by surgeons with varying levels of expertise. In the past 2 decades, several

technologic advances have altered the approach to thyroid surgery, including the introduction of intraoperative nerve monitoring (IONM) to prevent recurrent laryngeal nerve injury,¹ a shift to ambulatory surgery,² and more recently, robotic approaches for cosmetic reasons.³

Evidence to support IONM of the recurrent laryngeal nerve during thyroidectomy remains controversial and describes only modest⁴⁻⁶ or no benefit.^{7,8} Yet the adoption of IONM was reportedly as high as 29% among surveyed otolaryngologists in 2007⁹ and 37% among surveyed endocrine surgeons in 2006.¹⁰ The prevailing notion today is that IONM is a safe adjunct to thyroidectomy. However, evidence remains limited, and nearly all studies involve a single medical center with high-volume surgeons. Given the wide range of surgeons performing thyroidectomy, national databases can provide

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Abbreviations and Acronyms

IONM = intraoperative nerve monitoring
 NIS = Nationwide Inpatient Sample
 VCP = vocal cord paralysis

further insight into the effect of broad IONM adoption on VCP rates.

Because complications after thyroidectomy are low, national databases with high volume and case diversity present an opportunity for robust subgroup analysis. Databases such as the Nationwide Inpatient Sample (NIS) can yield broad generalizable results in a field with substantial variability among surgeons. In this light, the objective of this study was to measure the nationwide outcomes of thyroidectomy with and without IONM.

METHODS

The NIS is a national database funded by the United States Agency for Healthcare Research and Quality (AHRQ). It is the largest all-payer inpatient health care database in the United States and collects data from a 20% stratified sample of hospitals around the country. Weight coefficients for each hospital are provided to yield national estimates of inpatient stays. Data from admission to discharge are included for each patient in this database, including charge and cost data. Cases that were performed in an outpatient or ambulatory setting are not included in the NIS. Financial data were inflation-adjusted to reflect 2013 equivalents.¹¹

Nationwide Inpatient Sample data were obtained according to the Agency for Healthcare Research and Quality guidelines. The years 2008 to 2011 were selected because of the introduction of the International Classification of Diseases-9th Revision, Clinical Modification (ICD-9-CM) code for intraoperative nerve monitoring (00.94) in 2007. It should be noted that ICD-9-CM does not distinguish between intermittent and continuous IONM.

A listing of ICD-9-CM codes used for this study can be found in Table 1. Patients were identified by ICD-9-CM procedure codes for thyroidectomy. Presence of a neck dissection code was designated for each patient. The primary endpoint of this study was a diagnosis of same admission VCP. Although diagnoses of partial and complete VCP were included in our outcomes, the distinction between transient and permanent VCP is not captured within the ICD-9-CM coding scheme. It should be noted, however, that the codes used are distinct from dysphonia (784.42), which was not included in our analysis. Hospital-level analysis was performed for thyroidectomy case volume and laryngoscopy use. Surgeon-level

analysis could not be performed because the Agency for Healthcare Research and Quality removed surgeon-level data from 2009 onward.

Propensity-score analysis was performed first by identifying preoperative variables that significantly differed by a p value of less than 0.001 between conventional and IONM groups. These variables were entered into a binary logistic regression, and the logit was stored as the propensity score. Nearest neighbor 1-to-1 matching then was performed for each thyroidectomy type. Propensity score quartile analysis was also performed using the same propensity score as above. Statistical analysis was performed with SPSS version 21. Institutional IRB approval was obtained for this study.

RESULTS

Between 2008 and 2011, there were 243,527 thyroidectomies accrued in the NIS database. Patient demographics

Table 1. Study Definitions and Associated ICD-9-CM Descriptions and Codes

| Primary procedure and outcomes | Description and code |
|---------------------------------|---|
| Partial thyroidectomy | Unilateral thyroid lobectomy (06.2) |
| | Excision of lesion of thyroid (06.31) |
| | Other partial thyroidectomy (06.39) |
| Complete thyroidectomy | Complete thyroidectomy (06.4) |
| Adjunctive procedures | |
| Intraoperative nerve monitoring | Intraoperative neurophysiologic monitoring (00.94) |
| Neck dissection | Regional lymph node excision (40.3) |
| | Radical neck dissection NOS (40.40) |
| | Radical neck dissection, unilateral (40.41) |
| | Radical neck dissection, bilateral (40.42) |
| Laryngoscopy | Laryngoscopy or other tracheoscopy (31.42) |
| Outcomes | |
| Vocal cord paralysis | Vocal cord paralysis NOS (478.30) |
| | Vocal cord paralysis, unilateral, partial (478.31) |
| | Vocal cord paralysis, unilateral, complete (478.32) |
| | Vocal cord paralysis, bilateral, partial (478.33) |
| | Vocal cord paralysis, bilateral, complete (478.34) |

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