The Association of External Transfer Status with Adverse Outcomes in Otolaryngology

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No sponsorships or competing interests have been disclosed for this article.

Abstract

Objective. To compare rates of morbidity and mortality in patients treated by otolaryngologists who undergo interhospital transfers vs those who do not and to quantify conditions requiring interhospital transfers in this population.

Study Design. Cohort study.

Setting. American College of Surgeons National Surgical Quality Improvement Program.

Subjects and Methods. We identified patients requiring surgery by otolaryngologists in the National Surgical Quality Improvement Program database from 2006 to 2013. We compared patients who were transferred from an outside institution to those admitted from home. Multivariate regression was used to adjust for patient characteristics, comorbidities, and case mix. The primary outcome was overall morbidity and mortality within 30 days of surgery.

Results. We identified 60,498 patients; 488 (0.8%) were transferred from another institution. Operations that were more common in the transferred group were incision and drainage (24.0% vs 1.2%), facial trauma repair (9.0% vs 3.1%), and oropharyngeal hemorrhage control (3.9% vs 0.4%). External transfer patients had significantly longer hospital stays (44.1% vs 4.4% 7 days, $P < .05$). On unadjusted analysis, transferred patients had a significantly higher rate of morbidity and mortality (odds ratio [OR], 11.3; 95% confidence interval [CI], 9.4-13.5). On multivariate analysis, transferred patients had a significantly greater rate of morbidity and mortality (OR, 3.1; 95% CI, 2.4-4.0).

Conclusion. Transfer from another institution is associated with worse outcomes independent of case mix, demographics, and preoperative comorbidities in acute otolaryngology conditions requiring surgery. Practitioners should be aware of this when caring for transfer patients, and transfer status should be considered when measuring hospital quality.

Keywords

external transfer, quality, outcomes, otolaryngology, head and neck surgery, National Surgical Quality Improvement Program

Received August 29, 2017; revised December 7, 2017; accepted December 22, 2017.

Interhospital transfers are a common practice, accounting for 4.6% of all inpatient hospital encounters.¹ Transferred patients are generally thought to be complex cases that an institution is ill-equipped to manage, although other reasons for transfer have been hypothesized, including demographic factors, insurance status, and hospital costs.²,³ Prior studies in this area have focused primarily on intensive care settings and have found an association between transfer status and longer hospital stays, as well as increased mortality.⁴⁻¹⁰ Limited studies in surgical patients have shown similar trends.¹¹⁻¹⁵ No prior studies examining interhospital transfer for conditions treated by otolaryngologists have been performed.

External transfers are particularly consequential in today’s climate of quality metrics and benchmarking. Hospitals could theoretically send their sickest patients to another hospital to limit their health care and economic burden and thus improve their quality metrics. This practice hurts hospitals that accept transfers. Most existing systems that measure quality and evaluate institutions against their peers do not take into account transfer status. One study estimated that a benchmarking system adjusting only for case mix and disease severity, as well as failing to account for transfer status, would penalize a hospital by 39 excess deaths per 1000 admissions compared to hospitals not accepting transfers.⁴

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We sought to examine the effect of interhospital transfers in otolaryngology. Our primary objective was to determine whether transfer status was associated with worse outcomes compared with direct admission in this patient population. Our hypothesis is that transfer status would be associated with greater morbidity and mortality. Secondarily, we wanted to quantify conditions requiring interhospital transfer. This information is essential in establishing risk profiles for patients, both for clinical practitioners and quality improvement systems.

Materials and Methods
This study received an exemption from the Northwestern University Institutional Review Board.

Data Source
We conducted a retrospectively designed cohort study of otolaryngology patients using prospectively collected data from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) from 2006 to 2013. This is a multi-institutional surgical registry that collects detailed information about patient demographics, preoperative risk factors, intraoperative variables, and postoperative outcomes. Postoperative outcomes are prespecified and prospectively collected for 30 days after surgery. Information is obtained via review of inpatient and outpatient medical records, as well as direct patient contact if necessary. The detailed methodology of this database has been previously described.16 All information is de-identified in compliance with the Health Information Portability and Accountability Act. The database has information on more than 3 million patients who underwent surgery during the 8-year study period at over >400 participating sites, including community and academic hospitals.

Patient Selection and Preoperative Variables
We selected all cases from this clinical registry in which the surgical specialty of the primary attending surgeon was designated as “otolaryngology” from 2006 to 2013. Transfer status was the primary independent variable in this study. Patients considered as transfers were moved from another acute care hospital or an outside emergency department. Nontransfers were admitted directly from home or the institutional emergency department. Patients admitted from chronic care facilities such as nursing homes were excluded from the cohort.

Potential predictors of operative outcomes included transfer status, procedure performed, patient demographics, and preoperative comorbidities. Procedure performed was defined by NSQIP as “the most complex of all the procedures performed by the primary operating team during the trip to the operating room.” In addition to the primary procedure, we also coded tracheostomy if this was performed as a secondary procedure as NSQIP only includes tracheostomy as a secondary variable and does not include primary tracheostomy cases. The total relative value units (RVUs) from all surgical procedures performed were also used to adjust for the complexity of surgical case, as many underwent multiple different procedures during their index surgery.

The patient demographics controlled for were age, race, and sex. Comorbidities included American Society of Anesthesiologists (ASA) classification, weight loss, smoking, diabetes, dyspnea, functional health status, ventilator dependence, chronic obstructive pulmonary disease (COPD), ascites, congestive heart failure (CHF), hypertension, acute renal failure, dialysis, disseminated cancer, open wound/wound infection, steroid use, bleeding disorder, intraoperative transfusion, sepsis, and emergency case status. Functional health status was classified as dependent, meaning the patient required any assistance to perform activities of daily living, or independent.

Outcomes
The primary measured outcome was overall morbidity and mortality. This was considered positive if any one of the following 16 complications was met: death, length of stay >7 days, return to the operating room (OR), surgical site infection (superficial, deep, or organ space), wound dehiscence, pneumonia, reintubation, prolonged mechanical ventilation, deep vein thrombosis (DVT) or pulmonary embolism (PE), renal failure (acute or progressive), urinary tract infection (UTI), stroke, cardiac arrest or myocardial infarction, bleeding event, graft/prosthesis failure, or sepsis/septic shock. All complications were measured within 30 days of surgery. Individual differences in these outcomes were also evaluated.

It may be noted that there is a potential overlap between certain preoperative comorbidities and outcome measures (ie, preoperative sepsis and postoperative sepsis). These variables are coded uniquely in NSQIP and there is no overlap. Furthermore, the confounding effect of, for example, preoperative sepsis on postoperative sepsis is controlled for in the statistical models used to perform calculations.

Statistical Analysis
All statistics were computed with SPSS 24 (SPSS, Inc, an IBM Company, Chicago, Illinois). Demographics and preoperative comorbidities and postoperative complications were compared between transferred and nontransferred patients. Continuous variables (age, body mass index) were compared using analysis of variance, and all categorical variables were compared using analysis of variance, and all categorical variables were compared using $\chi^2$ analysis or Fisher exact test if the expected count was less than 5. On unadjusted analysis, we calculated odds ratios (ORs) and 95% confidence intervals (CIs) for each outcome.

Multivariable logistic regression models were then constructed to adjust for differences in demographics, case mix, and preoperative comorbidities. Preoperative variables that were analyzed in these models included age, sex, race, ASA classification, weight loss, smoking, diabetes, dyspnea, functional health status, ventilator, COPD, ascites, CHF, hypertension, acute renal failure, dialysis, disseminated cancer, open wound/wound infection, steroid use, bleeding disorder, transfusion, sepsis, emergency status, surgical
category, and overall RVU total. Transfer status was then evaluated as the independent variable in the final model. Model performance was assessed by the $\chi^2$ values from the omnibus tests of model coefficients.\textsuperscript{17}

In addition to the primary analysis comparing outcomes between transferred and nontransferred patients, we also performed 2 subgroup analyses. For the first, we broke down the cohort by procedure type and analyzed the effect of transfer on overall morbidity and mortality for each procedure. We excluded procedures with fewer than 10 cases in the transfer cohort. For the second, we focused on the transfer cohort and compared transfers admitted from an emergency department vs transfers admitted from an acute care facility.

**Results**

We identified 60,498 total otolaryngology patients, of whom 488 (0.8%) were external transfers. Table 1 summarizes the demographics and preoperative diagnoses of transfer vs nontransfer patients. Transferred patients were more medically complex by all measures.

Transfer and nontransfer group surgical procedures are summarized in Figure 1. Incision and drainage was the most common procedure that transferred patients received (24.0% vs 1.2% in nontransfer patients). Other notable procedures that were more common in the transfer cohort included facial trauma repair (9% vs 3.1%) and oropharyngeal hemorrhage control (3.9% vs 0.4%). Among nontransferred patients, thyroid surgery was the most common case (24.0% vs 7.2%), followed by tonsillectomy and adenoidectomy (21.4% vs 5.3%). RVU total was significantly higher on average for transfer cases, at 20.7 vs 17.4 units ($P < .01$).

On unadjusted analysis, 15 of 16 individual complications were significantly more frequent among transferred patients. Accordingly, overall morbidity and mortality was significantly higher among this group (OR, 11.3; 95% CI, 9.4-13.5). On multivariate analysis, 8 of these 16 complications remained significantly higher among transferred patients, including length of stay >7 days (OR, 4.5; 95% CI, 3.4-5.9), DVT or PE (OR, 2.6; 95% CI, 1.3-5.3), and sepsis or septic shock (OR, 1.8; 95% CI, 1.1-2.9). Median

**Table 1. Demographics and Preoperative Comorbidities.\textsuperscript{a}**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Nontransfer (n = 60,010)</th>
<th>Transfer (n = 488)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, mean, y</td>
<td>48.8</td>
<td>49.9</td>
<td>.16</td>
</tr>
<tr>
<td>% Male</td>
<td>25,374 (42.3)</td>
<td>294 (60.2)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>BMI, mean, kg/m$^2$</td>
<td>28.4</td>
<td>26.1</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Race (white)</td>
<td>42,243 (70.4)</td>
<td>317 (65.0)</td>
<td>.01</td>
</tr>
<tr>
<td>Preoperative comorbidities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>4800 (8.0)</td>
<td>41 (8.4)</td>
<td>.40</td>
</tr>
<tr>
<td>Smoker</td>
<td>11,946 (19.9)</td>
<td>169 (34.6)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>3241 (5.4)</td>
<td>80 (16.4)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Dependent functional status$^b$</td>
<td>750 (1.2)</td>
<td>93 (19.1)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Ventilator</td>
<td>109 (0.2)</td>
<td>63 (12.9)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>COPD</td>
<td>1723 (2.9)</td>
<td>48 (9.8)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Ascents</td>
<td>14 (0.0)</td>
<td>6 (1.2)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>148 (0.2)</td>
<td>23 (4.7)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Hypertension</td>
<td>19,307 (32.2)</td>
<td>169 (34.6)</td>
<td>.13</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>46 (0.1)</td>
<td>4 (0.8)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Dialysis</td>
<td>255 (0.4)</td>
<td>14 (2.9)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Metastasis</td>
<td>1026 (1.7)</td>
<td>27 (5.5)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Steroid use</td>
<td>1213 (2.0)</td>
<td>35 (7.2)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Weight loss</td>
<td>759 (1.3)</td>
<td>23 (4.7)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Bleeding disorder</td>
<td>887 (1.5)</td>
<td>49 (10.0)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Transfusion</td>
<td>51 (0.1)</td>
<td>21 (4.3)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Sepsis</td>
<td>818 (1.4)</td>
<td>135 (27.7)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Emergency</td>
<td>1038 (1.7)</td>
<td>123 (25.2)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>ASA classification $\geq 3$</td>
<td>19,015 (31.7)</td>
<td>309 (63.3)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Open wound</td>
<td>1025 (1.7)</td>
<td>85 (17.4)</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index; COPD, chronic obstructive pulmonary disease.

$^a$Values are presented as number (%) unless otherwise indicated.

$^b$Dependent functional status indicates that a patient needs help with all activities of daily living.

![Figure 1](image-url)
length of stay for transferred patients was 6 days vs 1 day for nontransfer patients. Controlling for all other factors, external transfer was associated with a significantly higher rate of overall morbidity and mortality (OR, 3.1; 95% CI, 2.4-4.0). Transferred patients had a significantly increased risk of 30-day mortality on univariate analysis (OR, 17.2; 95% CI, 10.1-29.2) but no significant difference on multivariate analysis (OR, 1.1; 95% CI, 0.5-2.5). The results of these analyses as well as raw complication rates can be found in Table 2.

A subgroup analysis by procedure type was also performed. We excluded 8 of 21 procedures as they had fewer than 10 patients in the transfer cohort, leaving 13 procedures. On unadjusted analysis, interhospital transfer was associated with increased morbidity and mortality for 9 of 13 procedures. On multivariate analysis, 4 of 13 procedures showed a significant correlation between transfer status and morbidity and mortality: other oral cavity/oropharynx (OR, 3.9; 95% CI, 1.9-8.3), laryngectomy (OR, 11.1; 95% CI, 1.4-91.3), thyroidectomy (OR, 3.4; 95% CI, 1.2-9.5), and otologic surgery (OR, 13.5; 95% CI, 3.2-57.8). These findings are summarized in Table 3.

A subgroup analysis within the transfer cohort comparing those admitted from an outside hospital’s emergency department to those admitted from an outside hospital’s acute inpatient ward revealed no significant difference in morbidity and mortality (OR, 0.78; 95% CI, 0.54-1.13).

Discussion

External transfers are an important topic as they make up 4.6% of all inpatient encounters1 and are associated with higher costs and worse outcomes in multiple medical and surgical disciplines.5,11 This has implications for practitioners caring for transferred patients as well as for quality metrics, which may be penalizing institutions that accept transfers due to the associated worse outcomes. No studies have examined the impact of transfer status on otolaryngology patients or procedures.

We used the NSQIP database to evaluate the effect of transfer status on postoperative complications in otolaryngology. Our study found that transferred patients had significantly higher overall morbidity and mortality (OR, 3.1; 95% CI, 2.4-4.0). Transferred patients had significantly higher rates of length of stay >7 days, return trips to the OR, and numerous postoperative complications (Table 3). These findings are consistent with prior studies showing an independent association between interhospital transfer status and worse outcomes among various surgical and intensive care settings.5,11 The effect size in our patient cohort is larger than in previously examined studies, suggesting a uniquely at-risk nature of otolaryngology patients. For example, studies on transfer in general and colorectal surgery reported adjusted risk ratios for complications of 1.03 and 1.18, respectively.14,18 The risk ratio for morbidity and mortality in our study was 3.1.

Clearly, transferred patients represent a medically complex group, as they have significantly higher rates of nearly all measured comorbidities vs nontransferred patients (Table 1). Still, even after controlling for case mix and these existing diagnoses, interhospital transfer is associated with increased morbidity and mortality. Loss of continuity and the effects of a “handoff” are likely influencing factors. Both are well known to significantly increase risk of complications in surgical patients.19,20 Another consideration is that transfer
patients have higher rates of psychiatric comorbidities, making it more difficult to care for them. While we were unable to evaluate this as NSQIP does not include the relevant variables, it has been shown that “need for psychiatric care” is a very common reason for transfer, lending credence to this hypothesis. It is also possible that transferred patients could worsen during the actual movement between hospitals, as a result of the movement itself or the associated delay; however, this possibility remains unstudied and challenging to examine. Our leading hypothesis is that there are unmeasured patient factors and surgical nuance contributing to the greater complications among transferred patients that we are unable to control for. For example, a patient transferred with massive goiter causing upper airway obstruction is likely to have more complications than a routine thyroideectomy for a small suspicious nodule.

Our study also quantified what conditions otolaryngology patients are transferred for, which has never been studied before. We found that incision and drainage cases made up a quarter of all transfers despite being a rare procedure among nontransferred patients. Contemporary studies examining deep neck abscesses confirm that most of these patients are increasingly treated at teaching hospitals. Facial trauma cases and oropharyngeal hemorrhage control also made up a large proportion of transferred patients compared with nontransferred patients.

The high rates of facial trauma and oropharyngeal hemorrhage control in the transfer cohort are concerning given the often urgent or emergent needs in such cases. However, certain institutions are ill-equipped to handle these challenging cases, so they transfer those cases to more specialized institutions. Further, high-volume hospitals have lower mortality rates for complex conditions than low-volume hospitals, suggesting that such patients should be transferred. For example, in thyroid surgery, surgeons performing a high volume of thyroid surgery have a lower incidence of recurrent laryngeal nerve injury and shorter hospital stays. Given this medical justification for interhospital transfers in otolaryngology and the frequency with which they are occurring, efforts to incorporate transfer status into institutional quality measures are worthwhile. Currently, national improvement measures do not account for this, and studies have shown that this penalizes hospitals accepting transfers.

There are several limitations to consider when interpreting our results. Our database shares the limitations of all studies of large databases, including errors in coding and data entry. These issues are minimized via the rigorous methodology employed in NSQIP. We did not have information on the reason for transfer or on the resources available at the hospital that transferred, such as if the transferring facility had otolaryngology available. NSQIP only includes transferred patients who underwent a surgical procedure, and thus our study does not capture transferred patients with acute otolaryngology conditions who were managed medically; in some clinical situations, this may make up a significant proportion of patients. Still, we feel this study offers significant insights using a robust tool to examine a topic that has not been previously addressed.

Conclusion
Our study shows that transfer status is an independent risk for morbidity and mortality among otolaryngology patients. Practitioners can use our findings to assess risk and guide management of externally transferred patients. Initiatives to judge hospital quality should take this into account when assessing individual institutions that accept transfers.

Author Contributions
Krish Suresh, study concept and design, analysis and interpretation of data, drafting and revising manuscript, final approval; Christopher J. Gouveia, analysis and interpretation of data, critical revision of the manuscript for important intellectual content, final approval; Robert C. Kern, analysis and interpretation of data, critical revision of the manuscript for important intellectual content, final approval; John D. Cramer, study concept and design, analysis and interpretation of data, drafting and revising manuscript, final approval.

Disclosures
Competing interests: None.
Sponsorships: None.
Funding source: None.

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