# Outcomes and Risk Factors in Oncologic Temporal Bone Surgery: A Head and Neck-Specific NSQIP

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## Abstract

**Introduction:** Advanced temporal bone and parotid gland malignancies are rare and difficult to manage, often requiring otologic approaches. However, complications of oncologic temporal bone surgery have not been systematically categorized. We aim to detail the postoperative outcomes of lateral temporal bone resection (LTBR) and mastoidectomy for otologic oncology patients, and secondarily, to identify preoperative risk factors.

**Methods:** Retrospective review (2012-2019) of patients with temporal bone or parotid gland malignancies treated with LTBR or mastoidectomy at our institution. Demographic, clinical, and 30-day postoperative data was extracted from a head and neck-specific (HNS) NSQIP database.

**Results:** A total of 174 patients underwent LTBR (N=121) or mastoidectomy (N=53). Of them, 53% had advanced (T3/T4) malignancy. Reconstructive procedures were performed in 98%, with 94% being free flaps.

Half of all patients experienced at least one post-operative occurrence (N = 59/121, LTBR; N=27/54, mastoidectomy), the most common being anemia requiring blood transfusion (N=47/174). Mastoidectomy had a higher risk of facial nerve injury compared to LTBR (21% v. 2%, p<0.01), consistent with its use in advanced parotid malignancy. LTBR patients had a longer length of stay (LOS) (8 v. 6 days, p<0.01). Only 8 patients developed surgical site infections, and the 30-day mortality was 0.

Multivariate analysis showed that increased age (OR 1.5, 95% CI: 1.1-2.0, *p=0.01*), large tumors (T3/T4) (OR 2.8, 95% CI: 1.0-7.7, *p<0.05*), and operative time over 13 hours (OR: 2.4, 95% CI: 1.2-5.0, *p=0.02*) significantly increased the odds of developing an HNS-NSQIP occurrence. The LOS was most correlated with operative times (Rho=0.25, *p<0.01*), but age, frailty score (mFI-5), and tumor stage were also statistically significant (*p<0.05*).

**Conclusion:** LTBR and mastoidectomy, alongside their reconstruction, are associated with relatively high rates for anemia requiring blood transfusion, new-onset facial paralysis, and extended LOS. When performing risk assessment and mitigation, frailty, age, and tumor stage should be considered.

## Introduction

- Oncologic intervention to the temporal bone is indicated for an aggressive and rare subset of head and neck cancers.
- These cancers may arise as primary temporal bone/otologic malignancies or from the nearby parotid glands and periauricular skin.
- Despite advances in neoadjuvant immunotherapy, surgical resection remains the standard of care for large tumors. Lateral temporal bone resection (LTBR) and mastoidectomy with facial nerve decompression, both otologic techniques, are the most often indicated procedures.
- Due to the rarity of these malignancies, there is little evidence regarding the immediate post-operative outcomes of temporal bone surgery in oncology patients.
- As many patients present with advanced stage disease (~50% of our cohort), identification of risk factors is key for risk mitigation and proper patient selection.
- The objectives of this study are to 1) systematically detail the immediate (30 day) post-operative course for oncologic temporal bone surgery and 2) identify risk factors associated with worse outcomes in the post-operative period.

## Methods

- Single-institution, retrospective review of patients undergoing LTBR or mastoidectomy for a pathology-confirmed malignancy.
- Patients identified through a prospectively-maintained otology/neurotology database
- Pre-, Peri-, and Post-operative outcomes obtained through a systematically-collected, comprehensive Head and Neck-Specific National Surgical Quality Improvement Program (HNS-NSQIP) database.

## Results

### Demographics and Premorbidities

- One-hundred and seventy-four patients underwent oncologic temporal bone surgery with reconstruction, consisting of LTBR (n=121) and mastoidectomy (n=53).
- The only significant difference in patient demographics were race/ethnicity (Table 1).
- Squamous cell carcinoma was the predominate histologic subtype (n=81, 47%), with primary subsite as periauricular/auricular skin in LTBR patients and parotid gland for mastoidectomy.
- Over half (n=92, 53%) of procedures were performed for advanced-stage disease (T3, T4), with 26% of tumors classified as recurrent.
- Associated procedures included neck dissection (n=152, 87%), parotidectomy (n=162, 93%), and microvascular free flap reconstruction (n=160, 92%).

### Peri- and Post-Operative Outcomes

- This cohort underwent long operative times, with nearly 38% of procedures being longer than 13 hours.
- Almost half of this cohort experienced at least one HNS-NSQIP occurrence in the thirty days postoperatively (n=59, 49%).
- The most common HNS-NSQIP occurrence was anemia requiring blood transfusion (n=47, 27%).
- No mortality was observed in this study.

**Table 1.** Table of baseline Demographics and Clinical Data:

| | Surgery | | | |
|---|---|---|---|---|
| | **Lateral Temporal Bone Resection (N=121)** | **Mastoidectomy (N=53)** | **Total Oncologic Temporal Bone Surgery (N=174)** | **P-value** |
| **Clinical Characteristics:** | | | | |
| **Age** | | | | 0.9370[1] |
| Mean (SD) | 67.0 (13.46) | 67.2 (12.08) | 67.1 (13.02) | |
| **Male Gender**, n (%) | 94 (77.7%) | 30 (56.6%) | 124 (71.3%) | 0.0070[2] |
| **Race/Ethnicity**, n (%) | | | | <.0001[2] |
| White | 110 (93.2%) | 35 (66.0%) | 145 (84.8%) | |
| Black | 1 (0.8%) | 7 (13.2%) | 8 (4.7%) | |
| Other | 7 (5.9%) | 9 (17.0%) | 16 (9.3%) | |
| **BMI** | | | | 0.9335[1] |
| Mean (SD) | 27.6 (6.03) | 27.5 (5.85) | 27.6 (5.95) | |
| **ASA Score**, n (%) | | | | 0.8086[1] |
| ASA 2 | 10 (8.3%) | 5 (9.4%) | 15 (8.7%) | |
| ASA 3 | 105 (87.5%) | 45 (84.9%) | 150 (86.7%) | |
| ASA 4 | 5 (4.2%) | 3 (5.7%) | 8 (4.6%) | |
| **mFI-5 Score**, n (%) | | | | 0.4001[2] |
| 0 | 47 (38.8%) | 21 (39.6%) | 68 (39.1%) | |
| 1 | 48 (39.7%) | 25 (47.2%) | 73 (42.0%) | |
| 2+ | 26 (21.5%) | 7 (13.2%) | 33 (19.0%) | |

**Table 2.** Postoperative HNS-NSQIP Occurrences

| | Surgery | | | |
|---|---|---|---|---|
| | **Lateral Temporal Bone Resection (N=121)** | **Mastoidectomy (N=53)** | **Total Oncologic Temporal Bone Surgery (N=174)** | **P-value** |
| **Postoperative Experience:** | | | | |
| **Length of Stay** | | | | |
| Mean (SD) | 7.6 (5.41) | 5.5 (1.83) | 7.0 (4.72) | 0.0005[1] |
| Median | 6 | 5 | 6 | |
| **HNS-NSQIP Occurrences:** n (%) | | | | |
| Any NSQIP Occurrence | 59 (48.8%) | 27 (50.9%) | 86 (49.4%) | 0.7909[2] |
| **Cardiac:** | | | | |
| Myocardial Infarction | 1 (0.8%) | 0 (0.0%) | 1 (0.6%) | 1.0000[1] |
| Supraventricular Tachyarrhythmia | 1 (0.8%) | 0 (0.0%) | 1 (0.6%) | 1.0000[1] |
| **Pulmonary:** | | | | |
| Pneumonia | 6 (5.0%) | 1 (1.9%) | 7 (4.0%) | 0.6769[1] |
| Pulmonary Embolus | 3 (2.5%) | 0 (0.0%) | 3 (1.7%) | 0.5541[1] |
| **Neurological:** | | | | |
| Altered Mental Status | 8 (6.6%) | 5 (9.4%) | 13 (7.5%) | 0.5146[2] |
| Coma | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 1.0000[1] |
| Cerebrovascular Accident | 1 (0.8%) | 0 (0.0%) | 1 (0.6%) | 1.0000[1] |
| Facial Nerve Injury | 2 (1.7%) | 3 (5.7%) | 5 (2.9%) | 0.1661[1] |
| **Surgery-Related Occurrence:** | | | | |
| Anemia requiring blood transfusion | 39 (32.2%) | 8 (15.1%) | 47 (27.0%) | 0.0191[2] |
| **Surgical Site Infections*** | | | | |
| Recipient Site | 4 (3.3%) | 2 (3.8%) | 6 (3.4%) | 1.0000[1] |
| Donor Site | 1 (0.8%) | 0 (0.0%) | 1 (0.6%) | 1.0000[1] |
| **Flap Loss** | | | | |
| Partial | 1 (0.8%) | 0 (0.0%) | 1 (0.6%) | 1.0000[1] |
| Total | 1 (0.8%) | 0 (0.0%) | 1 (0.6%) | 1.0000[1] |
| **Other HNS-NSQIP Occurrences**** | 10 (8.3%) | 6 (11.3%) | 16 (9.2%) | 0.5721[1] |
| **Related Readmission within 30 Days** | 4 (3.3%) | 2 (3.8%) | 6 (3.4%) | 1.0000[1] |
| **30-Day Mortality** | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 1.0000[1] |

[1]Fisher Exact p-value; [2]Chi-Square p-value.
*Includes superficial, deep, and organ/space infections
**Includes other flap complications (hematoma, seroma, thrombosis) and other ICD codes not otherwise identified

## Results

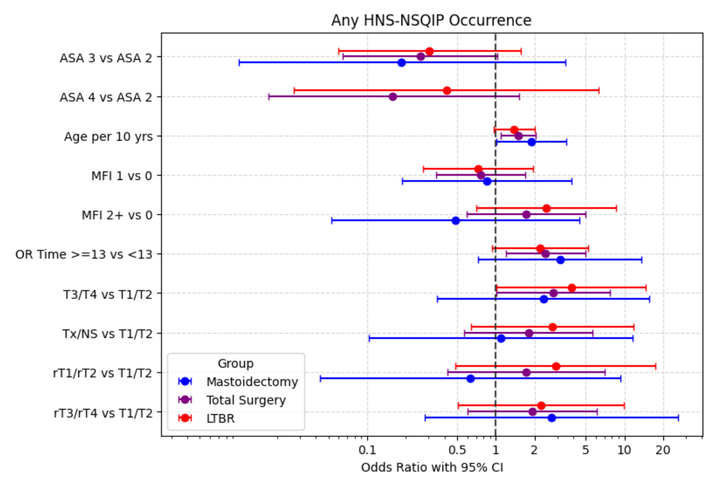
### LTBR vs. Mastoidectomy Outcomes

- 100% of LTBRs required reconstruction (microvascular free tissue and pedicled/rotational flaps), while around 8% of mastoidectomy cases were closed primarily.
- Rates of perioperative anemia were significantly higher in LTBR patients, likely secondary to reconstructive technique (32% vs 15%, p=0.0191).
- LTBR patients had significantly longer average length of stay than mastoidectomy patients (7.6 days versus 5.5 days, p<0.001).
- Iatrogenic facial nerve injury was more common in mastoidectomy, but not significantly, in keeping with its indication for advanced parotid disease.

### Multivariable Analysis of Risk Factors for Developing any HNS-NSQIP Occurrence (*p<0.001*)

- Age (per decade) → OR 1.5 (50% higher odds)
- Large Tumors (T3/T4) → OR 2.8 (180% higher odds)
- Lengthy operative time (>13 hours) → OR 2.4 (140% higher odds)

**Figure 1.** Graphical representation of the odds ratio for preoperative factors associated with developing any HNS-NSQIP occurrence.




## Discussion

- Oncologic temporal bone surgery, consisting of LTBR and mastoidectomy, are associated with relatively high rates of anemia, iatrogenic facial nerve injury, and extended length of stay greater than one week.
- Patient age, tumor stage, and operative time should be considered for risk assessment and mitigation

**References available upon request**

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