



# Thirty-day morbidity and mortality following otologic/neurotologic surgery: Analysis of the NSQIP



Zachary G. Schwam, MD, Elias Michaelides, MD, Phoebe Kuo, BA, Michael A. Hajek, BA, Benjamin L. Judson, MD, Christopher Schutt, MD  
Yale School of Medicine, Department of Surgery, Section of Otolaryngology, New Haven, CT

## Abstract

**Objective:** To determine the rate and timing of, as well as risk factors for postoperative morbidity and mortality following otologic and neurotologic surgery.

**Study Design:** Retrospective cohort study.

**Methods:** 1415 patients were identified in the ACS NSQIP 2005-2010. Simple summary statistics, chi-square, and multivariable logistic regression were performed.

**Results:** Lateral skullbase surgery (LSB) was done in 36.5%, and middle ear/mastoid procedures (MEM) were performed in 62.1%. The overall adverse event rate was 11.0%, although it was significantly higher for LSB (25.0%) and lower for MEM (2.8%). The overall mortality rate was 1.5%. Complications occurred postdischarge in 31.1% of cases. The outpatient setting (odds ratio [OR] 0.26, 95% confidence interval [CI] 0.13-0.53) and undergoing MEM procedures (OR 0.27, 95% CI 0.14-0.52) were associated with lower risk of experiencing any complication. Impaired functional status (OR 9.92, 95% CI 3.65-26.94) was associated with postoperative mortality. An open wound preoperatively was associated with multiple causes of postoperative morbidity.

**Conclusions:** Patients undergoing approaches to the skull base and neurotologic tumor resections had the highest adverse event rate. Open wounds were predictive of several postoperative complications, and poor functional status was associated with mortality. Patients with significant comorbidities should be evaluated early on in their postoperative course to prevent readmission as well as major morbidity and mortality.

## Introduction

There is a paucity of data describing postoperative and postdischarge complications (PDCs) following otologic and neurotologic procedures. The National Surgical Quality Improvement Program (NSQIP). It provides prospective, risk-adjusted, thirty-day patient data from over 400 sites throughout the United States and represents the largest quality improvement program in North America.

The aim of this study was to characterize the short-term complications following otologic/neurotologic procedures in adults and to identify factors that place specific patients at risk for these complications.

## Methods

Data were extracted from the ACS NSQIP 2005-2010. The NSQIP contains thirty-day patient data until 30 days postoperatively and is not restricted to in-hospital events.

Procedures were stratified by lateral skullbase/neurotologic tumor resection (LSB) and middle ear/mastoid (MEM) procedures. Postoperative adverse events were characterized as either occurring during admission or post-discharge.

Cases with missing data for variables of interest were excluded. Univariate analysis and multivariable logistic regression models were used. All tests were two-sided, and the final threshold for significance was  $P \leq 0.05$ .

## Results

A total of 1,415 patients were analyzed. Most procedures were in an outpatient setting, and 64.1% had comorbidities. Lateral skullbase (LSB) comprised 36.5%, while Middle Ear/Mastoid (MEM) procedures were performed in 62.1%. Both procedure types were performed in 1.4%. Concurrent procedures were undertaken in 18.4% of patients.

The most common primary otologic/neurotologic procedures performed were tympanoplasty (527), tympanomastoidectomy (285), and retrosigmoid intradural approach to a neurotologic tumor (218). Median LOS was 4.0d for LSB and 0.0d for MEM.

The overall adverse event rate was 11.0%, with the most common being infectious, reoperation, and respiratory. The overall mortality rate was 1.5%.

31.1% of complications occurred in the postdischarge period (PDP). The median time from surgery to all adverse events was 7.0 days.

In multivariate analyses, the outpatient setting was associated with lower rates of infectious complications and overall complication. An open wound was associated with higher risk of surgical-site, infectious, neurologic, and any complications. Poor preoperative functional status and pulmonary comorbidities were risk factors for postoperative mortality. Procedure type was not independently linked to specific adverse events.

Table 1. Otologic and Neurotologic procedures performed on the study population

Procedure type	n
<b>Lateral Skullbase approach</b>	
Middle fossa for tumor resection*	101
Middle fossa for encephalocele repair*	12
Posterior fossa for tumor resection*	78
Posterior fossa for encephalocele repair*	16
Petrous apicectomy*	1
<b>Resection of Neurotologic tumors</b>	
Tympanicum*	5
Extradural/petrous apex*	37
IAC lesions*	6
Kawase triangle, intradural*	24
Facial nerve tumor*	1
Retrosigmoid, extradural*	12
Retrosigmoid, intradural*	218
<b>Temporal bone resection*</b>	13
<b>Vestibular surgery</b>	
Endolymphatic sac surgery*	2
Labyrinthectomy	2
Vestibular nerve section*	1
<b>Rehabilitative surgery</b>	
Congenital aural atresia	19
Cochlear implantation	3
Auditory Brainstem Implant*	2
Bone conduction hearing device	1
Stapedectomy	11
<b>Repair of CSF leak</b>	
Middle cranial fossa*	38
Posterior fossa, with free tissue graft*	26
<b>Facial Nerve Surgery</b>	
Decompression lateral to the geniculate ganglion	1
Transtemporal total decompression	2
Intratemporal repair	2
Extracranial repair	1
Nerve graft harvest	2
<b>Middle Ear and Mastoid Procedures</b>	
Tympanoplasty	527
Tympanomastoidectomy	285
Mastoidectomy	63
Middle ear exploration	12
Excision of EAC exostoses	6
Mastoid debridement	3
Myringotomy, placement or removal of PE tube	37
Cerumen removal	1

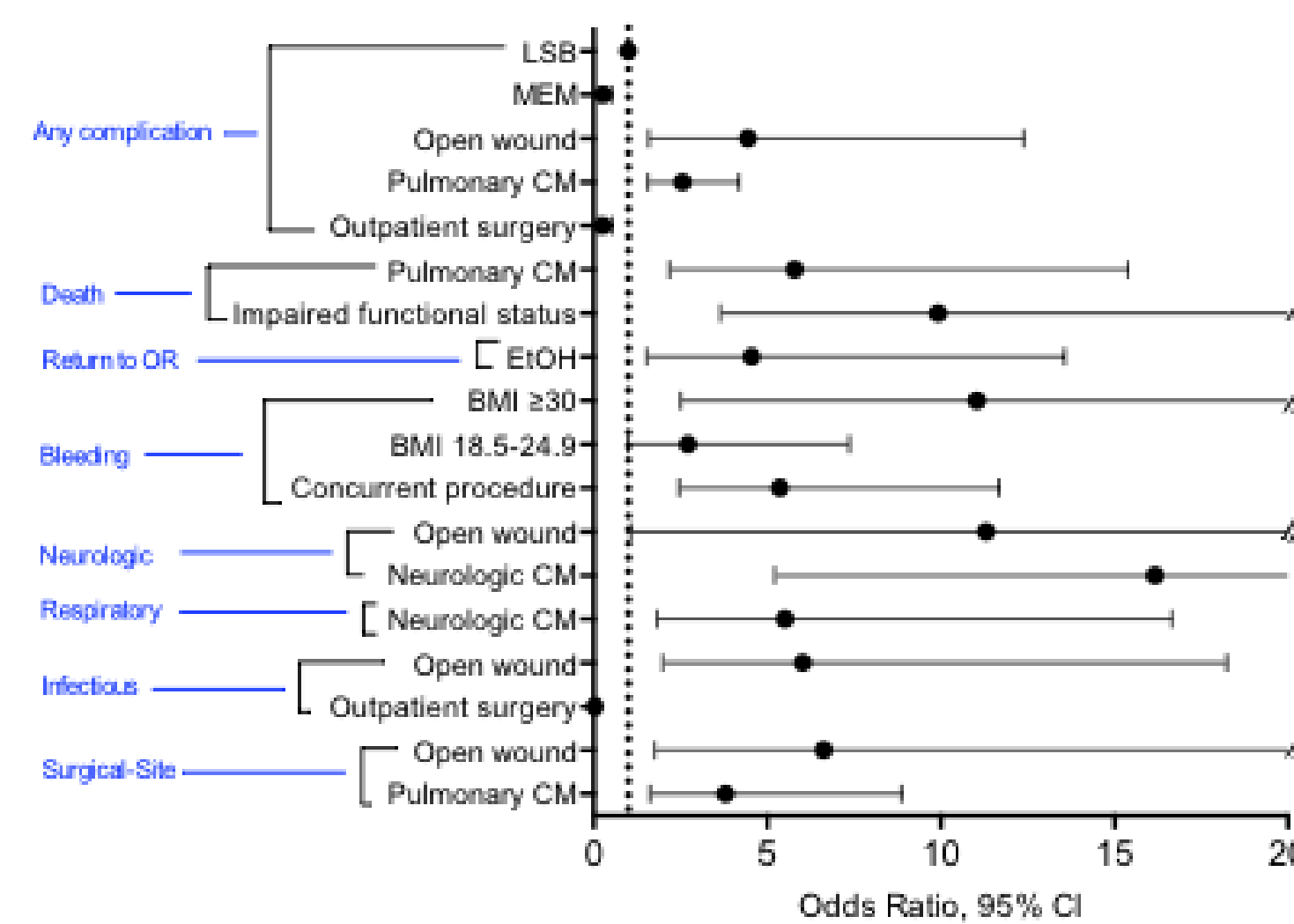
Table 2. Rates of postoperative adverse events stratified by procedure type

	LSB (N=516)	MEM (N=879)	Both LSB and MEM (N=20)	P	Overall (N=1415)
Overall	25.0 (129)	2.8 (25)	10.0 (2)	<.001	11.0 (156)
Infectious	8.5 (44)	0.5 (4)	5.0 (1)	<.001	3.5 (49)
Return to operating room	6.6 (34)	0.6 (5)	5.0 (1)	<.001	2.8 (40)
Respiratory	5.6 (29)	0.2 (2)	5.0 (1)	<.001	2.3 (32)
Surgical-site	3.1 (16)	1.5 (13)	5.0 (1)	.085	2.1 (30)
Bleeding	4.7 (24)	0.2 (2)	5.0 (1)	<.001	1.9 (27)
Death	3.7 (19)	0.2 (2)	0.0 (0)	<.001	1.5 (21)
Neurologic	3.3 (17)	0.0 (0)	5.0 (1)	<.001	1.3 (18)
VTE	2.3 (12)	0.0 (0)	0.0 (0)	<.001	0.8 (12)
Graft failure	0.6 (3)	0.1 (1)	5.0 (1)	.001	0.4 (5)
Cardiovascular	1.0 (5)	0.0 (0)	0.0 (0)	.013	0.4 (5)
Renal	0.4 (2)	0.0 (0)	0.0 (0)	.175	0.1 (2)

Table 4. Rates of complications occurring post-discharge and timing to event

	% (n)	Median days to event
Superficial SSI	100.0 (13)	17.0
Deep SSI	100.0 (2)	9.0
Organ-space SSI	90.9 (10)	13.0
Wound dehiscence	60.0 (3)	9.0
Septic shock	60.0 (3)	15.0
Death	57.1 (12)	19.0
Urinary tract infection	42.1 (8)	8.0
Graft failure	20.0 (1)	7.0
Sepsis	30.8 (8)	10.0
Stroke	28.6 (4)	3.5
Pulmonary embolism	25.0 (1)	6.0
Deep venous thrombosis	20.0 (2)	7.5
Pneumonia	19.0 (4)	9.0
Reintubation	17.6 (3)	2.0
Failure to wean	3.8 (1)	3.0
Renal insufficiency	0.0 (0)	2.0
Acute kidney injury	0.0 (0)	14.0
Coma	0.0 (0)	6.0
Peripheral nerve injury	0.0 (0)	1.0
Cardiac arrest	0.0 (0)	8.0
Myocardial infarction	0.0 (0)	1.0
Bleeding requiring transfusion	0.0 (0)	0.0

Figure 1. Adjusted risk factors for various postoperative adverse events



## Discussion/Conclusions

This is the first assessment of postoperative morbidity and mortality following ONS using the NSQIP in an adult population, and the first to analyze the timecourse of specific complications in the postoperative period following ONS. Poor pre-operative functional status was an important predictor of postoperative complications, while the outpatient setting was found to be protective, likely due to patient selection. Unfortunately, the NSQIP does not track otology-specific complications such as hearing outcomes or CSF leak. Patients with the aforementioned comorbidities as well as additional ones identified as risk factors in our models should be counseled preoperatively and evaluated early on in their postoperative course to mitigate major morbidity, mortality, and readmission.

Zachary G. Schwam, MD  
Resident Physician  
Icahn School of Medicine at Mount Sinai  
Email: zachary.schwam@mountsinai.org

Christopher Schutt, MD  
Fellow, Neurotology  
Michigan Ear Institute  
Email: caschutt13@gmail.com