Clinical Neurology and Neurosurgery 160 (2017) 12–18

Contents lists available at ScienceDirect

Clinical Neurology and Neurosurgery

journal homepage: www.elsevier.com/locate/clineuro

Thirty-day non-seizure outcomes following temporal lobectomy for adult epilepsy

Brandon A. Sherrod, Matthew C. Davis, Kristen O. Riley*

Department of Neurological Surgery, University of Alabama at Birmingham, Birmingham, AL, USA

ARTICLE INFO

Keywords:
Epilepsy
Temporal lobectomy
NSQIP
Morbidity
Mortality
Adverse event
Complication

ABSTRACT

Objective: Multi-institutional rates of acute adverse outcomes other than seizures after temporal lobectomy (TL) are not well understood. Here we analyzed short-term morbidity and mortality following TL using a validated national database.

Patients and methods: The multi-institutional American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database was queried by Current Procedural Terminology (CPT) code for TL procedures performed for adult patients with diagnoses related to epilepsy from 2008 to 2014. Patient demographics, operative variables, hospital variables, preoperative laboratory values, and preexisting comorbidities were analyzed using univariate and multivariate techniques to determine associations with 30-day postoperative morbidity and mortality.

Results: A total of 202 TL procedures were analyzed, 80 (39.6%) with intraoperative electrocorticography (ECOG) and 122 (60.4%) without ECOG. Mean age was 40.4 ± 13.7 years, and 47.5% of patients were male. Overall morbidity and mortality were 11.4% and 2.0%, respectively. The most common adverse outcomes were reoperation (5.4%), stroke with residual deficit (2.5%), failure to wean from ventilator (2.0%), and surgical site infection (2.0%). Adverse event rates were not significantly different between TLs with and without ECOG (13.1% vs. 8.8%, $p = 0.375$). Independent predictors of adverse events included prior stroke (OR 7.60, 95% CI 1.22–47.17, $p = 0.029$) and chronic steroid use (OR 10.90, 95% CI 1.03–115.79, $p = 0.048$). Diabetes mellitus ($p = 0.078$) and older age ($p = 0.145$) approached but did not reach significance in the multivariate model.

Conclusions: We report rates of acute morbidity and mortality following TL procedures using a national database. These findings can be used both to assist with patient selection as well as patient counseling prior to surgery.

1. Introduction

Refractory temporal lobe epilepsy (TLE) is the most common cause of pharmacoresistant seizures [1,2]. Temporal lobectomy (TL) is performed after exhausting most other efforts to control refractory TLE. Given that seizure control is the ultimate goal of TL, numerous studies have investigated seizure outcomes after TL in adults [3–11] and children [12–15]. However, few studies have investigated other (non-seizure) postoperative outcomes after TL, especially using multicenter data. Due to the recognized underutilization of TL for refractory TLE, understanding the full extent of TL complications is paramount in making informed decisions prior to TL surgery [1,2].

A review of the literature on major and minor complications following TL is displayed in Table 1. Hader et al. (2013) reviewed rates of major and minor complications following procedures for invasive seizure monitoring or resective surgery, finding that the rates of minor medical complications, major medical complications, and mortality following TL was 5.4%, 1.6%, and 0.4%, respectively [16]. However, Hader et al. (2013) recognized the limitations of lacking prospectively collected, standardized complication data. Furthermore, follow-up period requirements were not standardized across studies in the review. An analysis of the Nationwide Inpatient Sample (NIS) dataset found that morbidity after anterior TL was 10.8%, with no mortality [17]. However, the NIS is an administrative, not clinical, dataset, and the International Classification of Diseases, Ninth Revision [ICD-9] codes used in the NIS study are not specific to TL [18]. Most other studies on TL outcomes focus on seizure outcomes and are limited to single-center experiences with relatively small case series [8,10,19]. Furthermore, many of the previously cited studies lack data on complications considered to be “minor” such as urinary tract infection, wound disruption, etc. Minor non-seizure complications still have significant potential to negatively affect quality of life, length of hospital stay, and cost of care

* Corresponding author at: Department of Neurosurgery, University of Alabama at Birmingham, 1720 2nd Avenue S., FOT 1008, Birmingham, AL 35294-3410, USA.
E-mail address: koriley@uabmc.edu (K.O. Riley).

http://dx.doi.org/10.1016/j.clineuro.2017.05.027
Received 16 January 2017; Received in revised form 3 May 2017; Accepted 29 May 2017
Available online 08 June 2017
0303-8467/

Table 1
Literature reports of major and minor complications after TL surgery in adults.

Major Complications[b]			Minor Complications[b]		
Complication	Rates, %	Citation	Complication	Rates, %	Citation
Death	0.4	[16]	Memory impairment (mild)	3.2	[16]
	0.0	[17,19]			
	3.0	[10]			
Hemorrhage or hematoma	1.2	[17]	Psychiatric[a]	5.8	[16]
	2.0	[16]			
Infection[c]	0.8	[17]	Dysphagia	2.1	[16]
	1.9	[16]		5.5	[10]
	2.0	[10]			
	2.9	[19]			
Visual field defect	1.1	[17]			
	3.0	[10]			
Hydrocephalus	1.3	[16]			
	0.4	[17]			
DVT or PE	0.0	[17]			
	0.7	[16]			

DVT = deep venous thrombosis; PE = pulmonary embolism.
[a] Psychiatric includes personality changes, etc. otherwise not attributable to cognitive decline or memory changes alone.
[b] Definitions of "major" and minor vary by study. Here, we have classified major and minor complication by relative severity, not acuity or duration. Time to complications, whether acute or chronic, was not distinguished..
[c] Minor wound infections were excluded.

even if long term health is not affected. There is a need for a nationwide, multicenter study on rates of complications following TL surgery.

The purpose of the current study was to investigate non-seizure postoperative complications following TL surgery using a nationwide, multi-institutional clinical database.

2. Material and methods

2.1. Data acquisition

The American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) was initiated in 2005 to identify areas of quality improvement in surgery. The NSQIP database contains millions of procedures across hundreds of hospitals primarily located in the United States and Canada, including academic and non-academic centers [20–25]. The ACS trains clinical data abstractors at each NSQIP site and employs strict data collection and case exclusion criteria, with inter-rater reliability rates at 98% or greater [20–26]. Researchers and clinicians at NSQIP participating hospitals may access the entire dataset, which is stripped of any patient or hospital identifying information.

The ACS NSQIP adult dataset was obtained for years 2008–2014. The number of hospitals participating in each database year are: 211 hospitals (2008), 237 hospitals (2009), 258 hospitals (2010), 315 hospitals (2011), 374 hospitals (2012), 435 hospitals (2013), and 517 hospitals (2014) [20–25]. The accuracy (in comparison to chart review), follow up, ability to improve outcomes for participating hospitals, and inter-rater reliability of this database have been validated by several independent studies and internal ACS audits [26–29]. Procedures performed by a neurosurgeon were filtered from the main dataset by querying the surgical subspecialty variable for "Neurosurgery". Temporal lobectomy procedures were filtered from the neurosurgery-only dataset by Current Procedural Terminology (CPT) codes: 61537 (craniotomy; temporal lobectomy, without intraoperative ECOG) and 61538 (craniotomy; temporal lobectomy, with ECOG). Cases were excluded from the analysis if the NSQIP postoperative diagnosis was not epilepsy-related. Trauma cases (e.g., hematoma evacuation) and patients under the age of 18 are automatically excluded from the NSQIP dataset and were not included for this analysis. The University of Alabama at Birmingham Institutional Review Board (IRB) does not require IRB approval of NSQIP studies because NSQIP data are de-identified and considered a public dataset [30].

2.2. Variables of interest

Patient demographics included age, gender, race, and body mass index (BMI). Patient comorbidities included obesity, diabetes, tobacco use within the previous year, hypertension requiring medication, chronic steroid use, previous stroke with/without deficit, and preoperative sepsis. Preoperative laboratory values included hypernatremia (Na > 145 mEq/L), hyponatremia (Na < 135 mEq/L), thrombocytopenia (< 150k platelets/μL), leukocytosis (> 11k WBC/μL), elevated creatinine (> 1.2 mg/dL), and anemia (hematocrit < 36% for females; < 40% for males). Lab values were only included if at least 85% of cases had recorded values (e.g., AST and ALT laboratory values are available in NSQIP, but less than 85% of patients in our cohort had these lab values recorded). Postoperative diagnoses were determined by ICD-9 codes. Hospital variables included length of stay, time from operation to discharge, time from admission to operation, and prior operation within 30 days. Operative variables included operative time, emergent operation status, American Society of Anesthesiologist (ASA) class, perioperative blood transfusion, and wound classification.

Complications are tracked by NSQIP for up to 30 days postoperatively; follow-up beyond the 30-day window is not recorded. Complications for this study included reoperation, death, bleeding requiring transfusion, subdural hemorrhage, intracerebral hemorrhage, surgical site infection (superficial incisional, deep incisional, or organ/space [includes osteomyelitis, ventriculitis, meningitis, and intracranial abscesses]), pneumonia, failure to wean from ventilator, urinary tract infection (UTI), deep venous thrombosis (DVT), pulmonary embolism (PE), sepsis/septic shock, and stroke with resultant neurological deficit. NSQIP complication coding follows strict criteria for entry and are coded by trained data abstractors with minimal (< 2%) inter-rater disagreement; full definitions for complication coding criteria are provided in the referenced ACS NSQIP User Guides [20–25].

2.3. Statistical analysis

Univariate analyses of the association between overall morbidity and patient demographics, preexisting comorbidities, abnormal lab values, and operative factors were performed using Chi-square test, Fisher's exact test, binary logistic regression, or independent sample Student's *t*-test where appropriate. The alpha value for significance was set at 0.05. Variables that reached significance in the univariate analyses were then entered into a multivariate logistic regression model. An area under the curve (AUC) analysis for a receiver operating characteristic (ROC) curve was performed to determine predictive accuracy of the multivariate model. All statistical analyses were performed using SPSS Version 23.0 (IBM Corp, Armonk, NY, 2015).

3. Results

3.1. Patient demographics, comorbidities, and laboratory values

A total of 202 procedures were performed, 80 (39.6%) with intraoperative ECOG and 122 (60.4%) without intraoperative ECOG. Patient demographics, comorbidities, and laboratory values are shown in Table 2. Age ranged from 18 to 78 years, with 13 patients age 65 or older in this study (6.4% of total). There was essentially an even gender distribution (47.5% male). The most common comorbidities were