

Neurosurgical Procedures in Traumatic Brain Injury in the United States: 2002-2011

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Learning Objectives

By the conclusion of this session, participants should be able to:

1)To quantify the aspects of the neurosurgical management of traumatic brain injury in the United States.
2)To describe current trends and changes in neurosurgical interventions for traumatic brain injury.
3)To identify patient and injury level factors associated with neurosurgical intervention in patients with traumatic brain injury.

Introduction

Traumatic brain injuries (TBI) are a significant cause of morbidity and mortality sometimes requiring neurosurgical intervention. We sought to describe the epidemiology of TBI-related neurosurgical intervention (NSI) in the United States.

Methods

Using the Nationwide Inpatient Sample (2002-2011), all patients admitted with TBI were isolated and patients undergoing specific neurosurgical interventions (NSI) were identified. The Abbreviated Injury Scale classified (AIS) into mild (AIS<=2), moderate (AIS=3), and severe (AIS>=4). NSI procedures examined included: intracranial pressure (ICP) monitor placement, craniectomy/craniotomy, cranioplasty, ventriculostomy, and ventricular shunt placement.

Results

Among 2,057,726 patients admitted for TBI, NSI occurred in 6.4%, of whom 73.1% were male and 79.8% had insurance coverage.

Patients undergoing NSI were younger than non-NSI patients (mean age 40.4 (SE 0.52) vs. 53.5 (SE 0.46) years, p<0.001).

Most patients undergoing NSI were treated at teaching hospitals (77.1%) and in urban centers (95.7%) (both p<0.001), and had moderate (50.5%) or severe (44.8%) TBI.

POPULATION CHARACTERISTICS

MEAN AGE (+/-SE) in years	40			(58.8)
Gender (Male)	96,374	(73.1)	1,133,181	
Race (white)	111,999	(85.0)	1,686,716	(87.6)
Payer				
Medicare/Medicaid	48,633	(36.9)	939,240	(48.8)
Private	56,539	(42.9)	673,198	(35.0)
Uninsured	26,622	(20.2)	313,493	(16.3)
Hospital bed-size (Large)	99,092	(75.2)	1,354,970	(70.4)
Hospital location (urban)	126,148	(95.7)	1,767,138	(91.8)
Hospital Region				
North-East	29,139	(22.1)	498,064	(25.9)
Mid-West	21,168	(16.1)	325,124	(16.9)
South	57.825	(43.9)	755,166	(39.2)
West	23,662	(18.0)	347,578	(18.1)
Hospital (Teaching)	101.548	(77.1)	1.166.403	(60.6)
Hospital volume (>94 /vear)	119,957	(91.0)	1.421.831	(73.8)
N:	SI PROCEDU	RES	(34.9%)	
ICP-MONITORING	17,902		(13.6%)	
CRANIOTOMY/CRANIECTOMY	42,636		(32.4%)	
CRANIOPLASTY	36,706		(27.9%)	
VENTRICULOSTOMY	31,355		(23.8%)	
EXTRACRANIAL SHUNT	9,639		(7.3%)	
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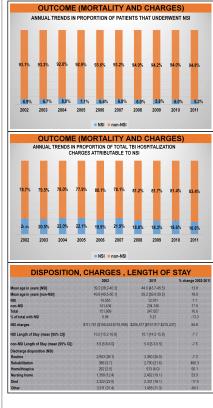
	NJUKT C	HARACTERISTICS
	NSI by	Injury mechanism
Total (All mechanisms)	6.4%	90.6%
MVA Occupant	7.3%	92.7%
Motorcycles	10.4%	83.4%
Bicycles	7.7%	92.3%
Pedestrians	10.8%	18.2%
Other transport	8.4%	91.6%
Falls	3.8%	95.2%
Firearms	23.5%	76.5%
Struck by/cut	9.9%	91.1%
Other mechanism	9.1%	90.9%
Unreported	7.1%	92.9%
		# NGS # No-NGS
		= NSI = No-NSI
	NJURY C	HARACTERISTICS
•		
	NSI by inj	ury type and patterns
ntracranial injury with skull		
fractures	19.0%	81.0%
Other Skull fractures	16.4%	83.6%
	3.0%	
specified intracranial injury	-	97.0%
unspecified ICH	5.8%	94.2%
SAH/SDH/EDH	7.2%	92.8%
rebral laceration/Contusion	7.3%	92.7%
Concussions	0.2%	99.8%
		NSI Poor-NSI
	NJURY C	HARACTERISTICS
	NSI by Injury	Severity and Intentionality
Severe	10.1%	89.9%
Moderate	10.4%	89.6%
Mild	0.8%	99.2%
Unintentional	6.0%-	94.0%
Assault	10.8%	49.2N
	15.0%	85.0%
Self harm		
Self harm Unreported	7.2%	92.8%

Results (Ctd)

Diagnostic and monitoring procedures accounted for 34.9% of all NSI, followed by craniotomy/craniectomy (32.4%), cranioplasty (27.9%), ventriculostomy (23.8%) and ventricular shunt procedures (7.3%).

Firearm injuries most frequently required NSI (23.3%) compared with pedestrianinjuries (10.8%) and motorcycle injuries (10.4%) (p<0.001).

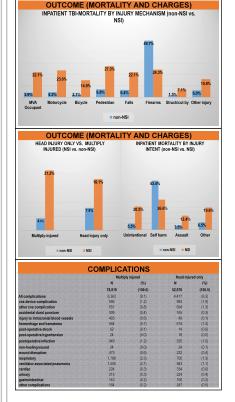
The proportion of TBI cases involving NSI decreased from 6.9% in 2002 to 5.2% in 2011 (p<0.001).



Results (Ctd)

Intracranial Pressure (ICP) monitors were placed in 0.44% of patients in 2007 vs. 1.47% in 2011 while the proportion of patients undergoing craniectomy/craniotomy declined slightly from 2.03% in 2002 to 1.83% in 2011 (both p<0.001).

On average, patients undergoing NSI were hospitalized longer than non-NSI patients [16.4days (95%CI 15.7; 17.0)] vs. [5.8days 95%CI 5.6; 5.9)].



Conclusions

Younger patients and those with more severe TBI were more likely to undergo NSI, with a substantial increase in ICP monitor placements and corresponding decline in craniectomies/craniotomies.

Not surprisingly, patients undergoing NSI required substantially longer inpatient care.

Key

NIS-Nationwide Inpatient Sample; NSI-Neurosurgical Intevention; ICD-9 codes- International Clasification of Diseases (9th Revision); CNS - Central Nervous System; 95% CI- 95% Confidence Interval; IQR-Interquartile Range