Prognostic Factors of Patients Undergoing Surgical Decompression Following Traumatic Brain Injuries

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Introduction

Over the past several decades, the rate of traumatic brain injury (TBI)-related hospitalizations and emergency room visits in the United States has steadily increased, yet mortality in these cases has decreased by 7%. This improvement in outcome is largely due to the strides made in prehospital care, neurocritical care management, and the resurgence of surgical techniques, such as decompressive craniectomies. Numerous studies have examined indications for surgical removal of traumatic space-occuping lesions as such as intracranial hematomas, but few agree on prognostic factors of outcome in these same patients. With the increased incidence of TBI, it is imperative to identify clinical factors predictive of patients who benefit from early mobilization of resources and operative treatment.

Aim of Study

Identify prognostic factors for immediate outcome following surgical intervention.

Patient population: TBI patients with intracranial hemorrhages between 2008-2010 who received craniectomy or craniotomy at a level I trauma center.

Outcome: Based on discharge location

- Favorable – Patients discharged home/rehab
- Unfavorable – Skilled nursing facility (SNF), step-down facility, hospice, death

Methods

Our initial search using Current Procedural Terminology (CPT) codes encompassing craniotomy and craniectomy yielded a total of 285 patients. We then exluced all non-trauma patients, procedures other than craniotomy or craniectomy (i.e. burr hole washout), repeat operations, pediatric patients (age <18 y.o.). This resulted in 181 patients who underwent either a craniotomy or craniectomy for evacuation of a traumatic intracranial hematoma during 2008-2010 at LAC+USC Medical Center (Table 1). We then examined patient charts and evaluated 13 parameters for prognositc value (Table 2 & 3).

Statistical Analysis: A Wilcoxon Rank Sum test was performed for continuous variables and Chi-Squared test was used for categorical variables.

Table 1: Demographic and Clinical Data Summary

Characteristics	n (%)
Total no. of patients	181
Mean age	43.15 ± 21.22
Sex	
Male	148 (81.8)
Female	33 (18.2)
Race	
White	22 (12.2)
Black	9 (5.0)
Hispanic	117 (64.6)
Asian	20 (11.0)
Other/Unknown	13 (7.2)
Admission GCS	
Mean	9.29 ± 4.65
3-8	79 (44.6)
9-12	27 (15.3)
13-15	71 (40.1)
Midline shift on Head CT	134 (75.7)

Characteristics	n (%)
Type of Intracranial Hemorrhage	
Epidural	46 (25.4)
Subdural	134 (74.0)
Subarachnoid	97 (53.6)
Intraparenchymal	105 (58.0)
Intraventricular	20 (11.0)
>1 type of hemorrhage	127 (70.2)
Operation Method	
Craniotomy	
Unilateral	103 (56.9)
Bilateral	3 (1.7)
Craniectomy	
Unilateral	62 (34.3)
Bilateral	0 (0.0)
Discharge Status	
Home/Rehab	46 (25.4)
Skilled Nursing Facility	50 (27.7)
Step-Down Facility	44 (24.3)
Hospice	2 (0.01)
Deceased	39 (22.0)

Table 2: Analysis of Prognostic Factors - Continuous Variables

	Favorable			Unfavorable			
Variable	Mean ± SD	Median	IQR	Mean ± SD	Median	IQR	p value
Age (year)	29.56 ± 18.28	26	19 - 39	47.65 ± 20.23	49	30 - 63.5	<0.01
GCS Admission	12.96 ± 3.32	15	11 - 15	8.04 ± 4.38	7	4 - 13	<0.01
GCS Discharge	14.52 ± 1.23	15	15 - 15	11.61 ± 3.03	11.5	9 - 14	<0.01
Operation Length (hr)	1.4 ± 8.68	1.83	1.15 - 2.22	1 ± 5.88	2.24	1.65 - 2.98	<0.01
Length of Stay	8.29 ± 14.42	4	3 - 7	15.74 ± 15.04	13	5 - 21.5	<0.01
INR	1.08 ± 0.07	1.08	1.03 - 1.13	1.25 ± 0.43	1.14	1.06 - 1.26	<0.01
PTT	28.34 ± 2.43	28	26.4 - 30.3	30.75 ± 5.57	29.9	27.1 - 33.05	0.01
Degree of Midline Shift (mm)	2.7 ± 4.75	0	0 - 3	7.45 ± 6.57	6	0.55 - 10	<0.01

Table 3: Analysis of Prognostic Factors - Categorical Variables

Variable	Favorable, *n* (%)	Unfavorable, *n* (%)	p value
Race			0.52
White	6 (27.27)	16 (72.73)	
Black	0 (0)	9 (100)	
Hispanic	31 (26.50)	86 (73.5)	
Asian	5 (25.00)	15 (75)	
Other/unknown	3 (25.00)	9 (75)	
Hyponatremia			0.17
Pre-operative period	2 (25)	6 (75)	
Post-operative period	9 (15)	51 (85)	
Both pre-op and post-op	1 (20)	4 (80)	
None	33 (30.56)	75 (69.44)	
Hypernatremia			<0.01
Pre-operative period	1 (50)	1 (50)	
Post-operative period	3 (3.85)	75 (96.15)	
Both pre-op and post-op	0 (0)	9 (100)	
None	41 (44.57)	51 (55.43)	
Fever	5 (7.94)	58 (92.06)	<0.01
None	39 (37.5)	65 (62.5)	

Results

The following factors were all found to be significantly associated with a favorable outcome of going home or to a rehabilitation facility:

- Younger age
- Greater initial GCS score
- Shorter operative time & hospital stay
- Decreased preoperative INR & PTT
- Less preoperative midline shift
- Hypernatremia
- Fever

Race and hyponatremia during the hospital stay were not found to be associated with outcome.

Discussion

This work supports some of the current prognostic models in the literature as well as identifies additional clinical variables with predictive value of outcomes in the pre- and post-surgical setting.

Limitations

There are a number of limitations with our work:

1) Our experience is at a single institution over a relatively short study period

2) As with any retrospective study, we are susceptible to selection and information bias

3) We only examined predictors of short-term outcome

Acknowledgements

Thank you to J. Peter Gruen, M.D., Steven Cen, Ph.D., and Tim Wen, M.S. for help with this project.

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