Risk of Reoperation for Hemorrhage in Patients Post-craniotomy

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Introduction

-There is currently a significant focus on outcome improvement and cost reduction through curtailing excessive and duplicative care [1]. Reoperation is intricately tied to both measures and represents a substantial burden on costs and outcomes.

-A large concern among neurosurgeons is returning to the OR for cranial hemorrhage.

-Rates of reoperation for hemorrhage and associated risk factors vary depending upon indication for craniotomy. Few efforts at analyzing reoperation among large pools of craniotomy cases have been undertaken [8].

-The National Surgical Quality Improvement Program (NSQIP) provides a wide array of data aimed at improving outcomes and as of 2012 detailed records regarding reoperations were added to NSQIP [16,17].

Objectives

-Identify the clinical factors associated with reoperation for hematoma evacuation after craniotomy.

-Create a risk score to stratify patients based on risk for reoperation for hemorrhage.

Methods

-5,520 adult craniotomy cases from 2012 NSQIP data set

-Reoperation for hemorrhage selected based on CPT code

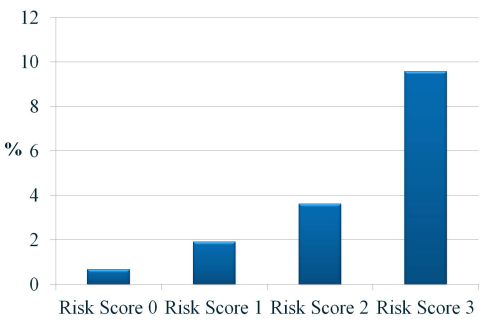
-Univariate Chi-squared analysis and multivariate binary logistic regression model

-Risk score creation and receiver operating characteristics (ROC) curve

Principal operation among cases reoperated on for hemorrhage

Principal Procedure	n (%)
Hematoma evacuation	26 (32.1)
Brain tumor excision	43 (53.1)
Intracranial tumor excision	27
Meningioma excision	14
CPA tumor excision	1
Pituitary tumor excision	1
Anterior circulation aneurysm	3 (3.7)
Posterior circulation aneurysm	1 (1.2)
Other	8 (9.9)
Total	81 (100.0)

Risk of reoperation for hemorrhage based on risk score



Factors associated with reoperation for hemorrhage in univariate analysis

Factor	p Value	OR (95% CI)
PREOP		
Bleeding Disorder	<0.001	4.8 (2.7-8.7)
Hypertension	<0.001	2.4 (1.5-3.7)
Emergency case	<0.001	3.4 (2.2-5.3)
INTRAOP		
Primary CPT for evacuation	<0.001	4.7 (2.9-7.5)
ASA Score 4-5	<0.001	2.6 (1.7-4.3)
POSTOP		
Ventilator dependent >48hrs	<0.001	7.4 (4.6-12.1)
Unplanned reintubation	<0.001	8.9 (4.9-15.9)
Pneumonia	<0.001	6.8 (3.7-12.6)
Bleeding transfusion	<0.001	4.8 (2.9-7.9)
DVT	<0.001	4.9 (2.3-10.4)
VTE	<0.001	4.1 (2.0-8.3)
Postop Infections	0.001	3.9 (1.9-7.9)
Septic shock	0.003	7.6 (2.6-21.8)

*Bolded factors significant in multivariate analysis

Three point hemorrhagic risk score

Risk Score	No. Patients (%)	No. reops for hemorrhage (%)	No. 30d mortality (%)	Mean total LOS
0	3001 (54.4.)	20 (0.7)	50 (1.7)	6.0
1	2093 (37.9)	40 (1.9)	92 (4.3)	7.8
2	332 (6.0)	12 (3.6)	42 (12.7)	11.4
3	94 (1.7)	9 (9.6)	29 (30.8)	9.2
Totals	5520	81	213	7.1

Results

-Reoperation for hemorrhage is associated with increased mortality

-All factors scores ranged from 0 to 6 (median = 0)

-AUC = 0.767 (95% CI 0.711-0.823)

-Preoperative factors scores ranged from 0 to 3 (median = 0)

-AUC = 0.683 (95% CI 0.623–0.744)

-3-point preop risk score is still capable of predicting increased risk of reoperation for hemorrhage

Conclusions

-A limited set of factors are useful in predicting those most likely requiring reoperation for hemorrhage

-Use of merely preoperative factors also strongly predicts reoperation for hemorrhage

References

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16. American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP). User Guide for the 2012 ACS NSQIP Participant Use Data File. www.acsnsqip.org

17. Curran T, Zhang JQ, Lo RC, et al. Risk factors and indications for readmission after lower extremity amputation in the American College of Surgeons National Surgical Quality Improvement