Surgical Complications Following Malignant Brain Tumor Surgery: An Analysis of 2002 – 2011 Data

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Introduction

Malignant brain tumors are the most common primary brain tumor, and newer evidence has supported more aggressive resections as a mode to improve survival. The purpose of this study is to estimate the incidence of surgical complications and associated in-hospital morbidity and mortality following surgery for malignant brain tumors.

Methods

The Nationwide Inpatient Sample (NIS) database was queried from 2002 – 2011. All adult patients who underwent elective brain surgery for a malignant brain tumor were included. Surgical complications included wrong side surgery, retention of a foreign object, iatrogenic stroke, meningitis, hemorrhage/hematoma complicating a procedure, and neurological complications. Two cohorts (surgical complication and no surgical complication) were analyzed to compare in-hospital mortality, length of stay, hospital costs, and complication development.

Results

A total of 16,530 admissions were analyzed, with 601 (36.2 events per 1,000 cases) surgical complications occurring in 567 patients. The most common complication was iatrogenic stroke, with an incidence of 16.3 per 1,000 cases. Over the examined 10-year period, the overall incidence of surgical complications did not change (P = 0.061) except for iatrogenic strokes, which increased in incidence from to 19.8 events per 1,000 between 2002 and 2011 (P = 0.023). Patients who developed a surgical complication had significantly longer lengths of stay, total hospital costs, and higher rates of other complications. Patients who experienced an iatrogenic stroke had a significantly increased risk of mortality (OR 9.6; 95% 6.3 – 14.8) and so were patients with a hemorrhage/hematoma (OR 3.3; 95% CI 1.6 – 6.6).

Table 1: Demographics of patients undergoing elective cranial neurosurgery for malignant brain tumors between 2002 and 2011

Variable	No Surgical Complication	Surgical Complication	*P* - value
No. cases	15,963	567	
Age	53.9 ± 16.3	54.7 ± 17.3	0.126
Sex (male, %)	57.5	59.8	0.286
Elixhauser comorbidity score (median, IQR)	1 (0 – 8)	2 (0 – 6)	**<0.001**
Urban Hospital (%)	97.6	96.7	0.234
Teaching Hospital (%)	84.2	82.6	0.394
Complications (%)	5.4	19.2	**<0.001**
Pneumonia (%)	0.6	3.5	**<0.001**
Myocardial infarction (%)	0.1	1.9*	0.059
Acute kidney injury (%)	0.5	1.9*	**<0.001**
Respiratory complication (%)	1.1	9.0	**<0.001**
Pancreatitis (%)	0.1*	1.9*	0.075
UTI (%)	2.4	9.9	**<0.001**
DVT (%)	1.0	5.1	**<0.001**
PE (%)	0.2	1.9*	**0.034**
Surgical site complication (%)	0.3	3.9	**<0.001**
Length of stay (mean)	4.4 ± 4.7	11.8 ± 11.8	**<0.001**
Mortality (%)	0.7	9.0	**<0.001**
Total charges ($)	53,638 ± 41,801	111,518 ± 105,304	**<0.001**

IRQ: interquartile range, UTI: urinary tract infection, DVT: deep vein thrombosis, PE: pulmonary embolism
Boldface denotes statistically significant results
* NIS does not allow the publication of values that are less than or equal to 10 observations, so the number 11 was used to calculate percentages

Table 2: Multivariable analysis showing odds ratios of in-hospital mortality stratified by surgical complication

Sentinel event	OR	95% Confidence Interval	*P* – value
Object retention	0.00	0.0 – 0.0	-
Wrong-side surgery	0.00	0.0 – 0.0	-
Iatrogenic stroke	9.6	6.3 – 14.8	**< 0.001**
Meningitis	0.6	0.1 – 5.4	0.688
Hemorrhage or hematoma	3.3	1.6 – 6.6	**<0.001**
Other neurological complication	0.00	0.0 – 0.0	-
Any surgical complication	4.4	2.9 – 6.6	**<0.001**

OR: odds ratio
All analyses were adjusted for patient age, sex and comorbidities
Boldface denotes statistically significant results

Conclusions

In this study, patients undergoing surgery for a malignant brain tumor who suffered from a surgical complication had significantly longer lengths of stay, higher hospital charges, and more complications. Having a surgical complication was an independent risk factor for in-hospital mortality. Nonetheless, it is unclear whether all surgical complications were clinically relevant.

Learning Objectives

1. Know the incidence of surgical complications following malignant brain tumor surgery resection

2. Know the trends in surgical complications following malignant brain tumor surgery over a 10-year period

References

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