

Venous Thromboembolism Following Meningioma Surgery: A Nationwide Population-Based Retrospective Analysis



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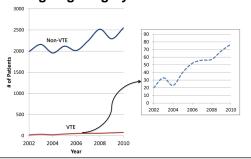
Introduction

Venous thromboembolic events (VTE), which include deep vein thrombosis (DVT) and pulmonary embolisms (PE), represent the most common complication observed in patients undergoing meningioma surgery. Development of postoperative VTE has shown to be fatal in over one third of subjects. The underlying pathophysiological mechanism for this tumor-specific finding remains unclear. There is a paucity of data regarding the clinical complications and comorbidities associated with this cohort. The purpose of this study was to determine the risk factors for VTE in a large cohort of patients with intracranial meningiomas undergoing surgery.

Methods

This retrospective analysis utilized discharge data from the National Inpatient Sample (NIS) from 2002-2010. Patient demographics, comorbidities, length of stay, hospital charges, and postoperative complications were compared between patients with and without VTE. Crosstabulation, Pearson's chi-square tests, Fischer's exact test, and independent 2-tailed t tests were used where appropriate. Binary logistic regression was performed with various postoperative complications as the dependent variable.

Figure 1. Temporal Relationship of Patients with Intracranial Meningioma Undergoing Surgery between 2002-2010



Results

Of 20,259 patients, 426 (2.1%) experienced a VTE, with a three-fold increase in VTE during this time period. Compared to the non-VTE cohort, patients that experienced a VTE were older (62.7 \pm 13.7 vs. 57.2 \pm 14.7; p < 0.001), more commonly male (38.0% vs 30.1%; p = 0.001), had longer hospitalizations (18.8 vs 6.6 days; p < 0.001), and incurred significantly greater hospital charges (\$195,837 vs \$74,434; p < 0.001).

Figure 2. Distribution of Thromboembolic Diseases of the Venous Thromboembolic Cohort



DVT= Deep Vein Thrombosis PE = Pulmonary Embolism

Table 1. Characteristics of Meningioma Patients, cohorts VTE vs. Non-VTE

	VTE	Non-VTE	P-Value
	N = 426, %	N = 19,833, %	
Mean Age, years	62.7±13.7	57.2±14.7	<0.001*
Age Cohorts, %			<0.001**
≤40	7.0	12.5	0.001*
41-60	32.2	44.8	<0.001*
61-80	52.8	37.5	<0.001*
>80	8.0	4.9	0.003*
Unknown	-	0.3	-
Sex, %			0.001**
Male	38.0	30.1	-
Female	61.7	69.1	-
Unknown	0.2	0.8	-
Race, %			0.253#
White	52.6	55.5	0.210
Black	11.0	8.5	0.048*
Hispanic	6.6	6.9	0.836
Asian	2.1	2.8	0.393
Other	3.3	2.6	0.396
Unknown	24.4	23.7	-
Type of Admission, %			<0.001*
Elective	54.7	73.5	-
Non-Elective	45.3	26.4	-
Unknown	-	0.1	-
Mean Length of Stay, days	18.8	6.6	<0.001*
Mean Hospital Charge, dollars	195,837	74,434	<0.001*
# depicts analysis between groups	of a given variable	(age, sex, race)	
* depicts statistical significance			

The VTE cohort also had higher comorbidity rates, including congestive heart failure (5.6% vs 2.2%, p < 0.001), hypertension (50.2% vs 45.1%, p < 0.045), diabetes mellitus (20.4% vs 15.7%, p < 0.010), peripheral vascular disorders (2.8% vs 1.2%, p < 0.003), and preexisting coagulopathies (11.7% vs 2.0%; p < 0.001). There was no significance difference found in obesity rates between VTE and non-VTE cohorts (7.3 vs. 6.9; p=0.788).

Table 2. Percentages of Postoperative Complications in VTE vs. Non-VTE Patients

Comorbidity	VTE N = 426, %	Non-VTE N = 19,833, %	P-Value
Alcohol Abuse	0.7	1.2	0.496
Congestive Heart Failure	5.6	2.2	<0.001*
Pulmonary Disease	10.3	10.4	0.910
Coagulopathy	11.7	2.0	<0.001*
Hypertension	50.2	45.1	0.045*
Hypothyroidism	8.5	10.0	0.279
Liver Disease	0.5	0.5	1.000
Peripheral Vascular Disorders	2.8	1.2	0.003*
Chronic Renal Failure	2.6	1.5	0.065
Obesity	7.3	6.9	0.788
Weight Loss	6.8	1.2	<0.001*
CAD/Chronic Heart Disease	8.9	7.6	0.321
DM	20.4	15.7	0.010*
Preexisting Paralysis	2.1	0.4	<0.001*
Unknown	0.5	1.0	-

VTE patients experienced significantly higher rates of acute postoperative complications including shock, hemorrhage, wound dehiscence, infection, intracerebral hemorrhage, hemiparesis/hemiplegia, stroke, and death during admission. Odds of the aformentioned postsurgical complications remained significantly higher both before and after adjusting for age and gender (all p <.01). Mortality during hospital admission was over four-fold higher in VTE compared to non-VTE group.

Table 3. Logistic Analysis: Relationship of VTE Status to Postsurgical Complications

Conclusion

Occurrence of VTE in patients undergoing meningioma resection portends greater hospital charges, longer lengths of admission, increased postoperative complications and mortality. The finding of increased bleeding diatheses and higher rates of intracerebral hemmorhage associated with VTE seems counterintuitive and adds to the complexity of the underlying pathophysiology in question. The results of this study warrants further investigation and neurosurgeons should be aware of this complication risk when treating meningioma patients.

References

1. Cage TA, Lamborn KR, Ware ML, Frankfurt A, Chakalian L, Berger MS, et al: Adjuvant enoxaparin therapy may decrease the incidence of postoperative thrombotic events though does not increase the incidence of postoperative intracranial hemorrhage in patients with meningiomas. Journal of neuro-oncology 93:151-156, 2009 2. Eisenring CV, Neidert MC, Bové D, Held L, Sarnthein J, Krayenbühl N: Reduction of thromboembolic events in meningioma surgery: a cohort study of 724 consecutive patients. PloS one 8, 2013 3. Gerber DE, Segal JB, Salhotra A, Olivi A, Grossman SA, Streiff MB: Venous thromboembolism occurs infrequently in meningioma patients receiving combined modality prophylaxis. Cancer 109:300-305, 2007 4. Hoefnagel D, Kwee LE, van Putten EH, Kros JM, Dirven CM, Dammers R: The incidence of postoperative thromboembolic complications following surgical resection of intracranial meningioma. A retrospective study of a large single center patient cohort. Clinical neurology and

6.Sughrue ME, Rutkowski MJ, Shangari G, Chang QH, Parsa AT, Berger MS, et al: Risk factors for the development of serious medical complications after resection of meningiomas. Journal of Neurosurgery 114:697-704, 2011

5.Levi AD, Wallace MC, Bernstein M, Walters BC: Venous thromboembolism after brain tumor surgery; a retrospective

neurosurgery 123:150-154, 2014

review. Neurosurgery 28:859-863, 1991