



Complications and outcomes of surgery for spinal meningioma: A Nationwide Inpatient Sample analysis from 2003 to 2010



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ABSTRACT

Objective: The aim of the present study was to analyze the practice patterns, complications and outcome following surgery for spinal meningioma in the United States.

Patients and methods: We performed a retrospective cohort study using the Nationwide Inpatient Sample database from 2003 to 2010. In-patient mortality and discharge disposition were the outcome predictors. **Results:** A total of 13,792 admissions for surgically managed spinal meningioma were identified. The number of admissions increased from 12.6% in 2003 to 14.7% in 2010. 1.2% patients were ≤ 18 years and 28.4% ≥ 70 years. 8.3% patients had high co-morbidity score. The total in-hospital complication rate was 6.4%. 42% of the admissions were discharged to facilities other than home or self-care. Patients in the pediatric and adult age groups had a significantly higher rate of adverse outcome. There was no difference in complication rates and adverse discharge disposition between the hospitals with varying case volumes.

Conclusions: Caucasian patients with private insurance without co-morbidity had significantly lower complication rate and good outcome. Occurrence of spinal meningioma in the pediatric and adult age groups does not carry worse prognosis.

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1. Introduction

Spinal meningiomas constitute 25–46% of all primary spinal tumors and about 12% of all meningiomas [1–4]. These lesions are thought to arise from arachnoidal cap cells, are usually located ventral or ventrolateral to the spinal cord and most commonly in the thoracic region. They lead to chronic spinal cord compression and myelopathy. Surgery is the treatment of choice and curative in most cases. A number of factors have been reported to be associated with patient outcome, notably, age of the patient, neurological status at presentation, extent of resection, histological tumor grade and associated co-morbid conditions [4–6].

Most information regarding patient characteristics, morbidity and outcome after spinal meningioma surgery is available from single institution series [3,6–9]. The aim of the present study is to describe the inpatient morbidity rate, complication rate and nature of complications after surgery for spinal meningioma on a national level. Effects of patient and hospital characteristics on patient outcomes and complications are analyzed.

2. Materials and methods

2.1. Data source

The data was obtained from the Nationwide Inpatient Sample (NIS) database from 2001 to 2010. The NIS is a hospital discharge database that represents about 20% of all inpatient admissions to non-federal hospitals in the United States. The database is provided by Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality (AHRQ, Rockville, MD) [10]. The NIS is the largest all-payer inpatient care database in the United States, containing data on more than seven million hospital stays from approximately 1000 hospitals. The number of states in the NIS has grown from 8 in 1988 to 45 in 2010. It represents 20% stratified sample of nonfederal community hospitals and about 85% of all hospital discharges in the United States.

2.2. Inclusion criteria

The database was queried for all admissions for laminectomy for spinal meningioma in patients of all age groups, using the ICD-9 (International Classification of Diseases, Ninth Revision, Clinical Modification) diagnosis and treatment codes. All admissions having a diagnosis code of 225.4 (benign neoplasm of spinal meninges) and underwent spine surgery – primary procedure codes 03.4 (Excision

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or destruction of lesion of spinal cord or spinal meninges) from 2003 to 2010 were included. The primary adverse endpoints were in-hospital death or discharge to facilities other than home.

2.3. Patient and hospital characteristics

Age of the patient, gender, race, primary payer (Medicare, Medicaid, private insurance, self pay, no charge, or other), type of admission (emergency, urgent, or elective), and admission source (emergency department, transfer from another hospital, transfer from long-term care, or routine), weekend/non-weekend admission and principal procedure performed on first hospital day were included in the analysis. Annual hospital volumes were derived using the unique hospital identifier for each hospital and the hospitals were categorized into quartiles according to the volume of cases.

The modified Charlson Index was calculated for each patient to account for the effect that the co-morbid medical conditions might have on surgical outcome and the score was used in analysis [11].

2.4. Outcome variables

The primary outcomes were in-hospital mortality, discharge disposition and complications. Patients who were discharged to facilities other than home or self-care were grouped together as having adverse discharge disposition. Complications were obtained using the following ICD-9 codes: neurologic complications (997.00–997.09); pulmonary complications (518.81–518.85, 997.3); thromboembolic complications including deep venous thrombosis (DVT) and pulmonary embolism (415, 387, 415.11–415.19, 4510–4519, and 4530–4539); cardiac complications (997.1 and 410); urinary and renal complications (584 and 997.5); hemorrhage or hematoma complicating a procedure (998.1–998.13).

2.5. Statistical analysis

Statistical analysis was performed using the SPSS software (v21, IBM Inc.). We used discharge weights to develop national estimates. Various tests used were Fisher exact test, the Wilcoxon rank-sum test, the Spearman rank correlation, linear and logistic regression. 'P' value <0.05 was considered significant. Missing values were omitted during analysis.

3. Results

3.1. Patient characteristics

A total of 13,792 admissions for surgically managed spinal meningioma were identified from 2003 to 2010 in the United States. The number of admissions increased from 12.6% in 2003 to 14.7% in 2010. Patient and hospital characteristics are presented in Table 1. 2% patients were in the pediatric age group (≤ 18 years). 28.4% admissions were for patients in the elderly age group (≥ 70 years). Four-fifths of the patients were Caucasian and about two-third were women. About half of the patients had private insurance and Medicare was the primary payer in one-third.

28.5% of the patients had co-morbidities and 8.3% were in the high co-morbidity group (modified Charlson Index ≥ 3). The total in-hospital complication rate was 6.4%. The median length of stay for the entire cohort was 4 days and the median total hospital charges were \$39,166. Table 2 lists the percentage of admissions with various co-morbidities and post operative complications

Table 1

Characteristics of 13,792 admissions for patients who underwent resection of spinal meningioma between 2003 and 2010.

Characteristic	N (%)
Age (n = 13,767)	
≤ 18 yrs	344 (2.5)
19–69 yrs	9513 (68.1)
≥ 70 yrs	3909 (28.4)
Gender (n = 13,699)	
Female	9160 (66.9)
Male	4538 (33.1)
Race (n = 10,652)	
Caucasian	8509 (75.9)
African-American	715 (6.7)
Primary payer (n = 13,773)	
Medicare	5223 (37.9)
Private	6962 (50.6)
Co-morbidities (n = 13,792)	
None (0)	12,916 (93.6)
Low (1–2)	804 (5.8)
High (≥ 3)	73 (0.5)
Hospital case volume (n = 13,792)	
Low (Q1)	1047 (7.6)
Medium (Q2)	1251 (9.0)
High (Q3)	3033 (22.0)
Very high (Q4)	8462 (61.4)
Teaching status (n = 13,718)	
Teaching	9673 (70.5)
Non-teaching	4045 (29.5)
Bed strength (n = 13,718)	
Low	899 (6.6)
Medium	2571 (18.7)
High	10,248 (74.7)
Time of surgery (n = 13,792)	
2003–2006	6653 (48.2)
2007–2010	7139 (51.8)

3.2. Complications and outcomes

There were 14 (0.1%) in-hospital deaths during the study period. 42% of the admissions were discharged to facilities other than home or self-care. Table 3 presents the association of various patient and hospital characteristics with complications and adverse discharge disposition. Only Caucasian patients with private

Table 2

List of the associated co-morbidities and postoperative complications of patients undergoing spinal meningioma surgery.

Co-morbidities	N (%)
AIDS	10 (0.1)
Collagen vascular disease	253 (1.8)
Congestive heart failure	346 (2.5)
Diabetes, uncomplicated	1667 (12.2)
Diabetes with chronic complications	243 (1.8)
Hypertension	6356 (43.5)
Liver disease	131 (1.0)
Lymphoma	53 (0.4)
Metastatic cancer	75 (0.5)
Obesity	1201 (8.8)
Solid tumor without metastasis	115 (0.8)
Peptic ulcer disease	0
Chronic pulmonary disease	1495 (10.9)
Peripheral vascular disorder	201 (1.5)
Complications	
Neurologic	251 (1.8)
Pulmonary	123 (0.9)
Thromboembolic including deep venous thrombosis and pulmonary embolism	94 (0.7)
Cardiac	107 (0.8)
Urinary and renal	191 (1.4)
Hemorrhage or hematoma complicating a procedure	184 (1.3)
All complications	877 (6.4%)

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