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Clinical commentary

# Descriptive analysis of unplanned readmission and reoperation rates after intradural spinal tumor resection

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ABSTRACT

*Introduction:* Spinal cord tumors (SCT) are relatively uncommon and usually require surgical treatment. Readmission within 30 days after discharge is an important indicator of health care quality. The aim of this study was to investigate the rates and causes of unplanned readmissions and reoperations after SCT surgery.

*Methods:* A retrospective analysis of patients' charts at a single center from May 2007 to September 2015 was completed. Inclusion criteria: history of laminectomy with excision of neoplasm in the spinal cord. Exclusion criteria: (1) surgery outside the timeframe; (2) less than 19 years old; (3) non-neoplastic intramural pathologies; (4) previous resection at the same location; (5) metastatic lesions.

*Results:* We found 131 patients that met criteria. Six patients (4.5%) were readmitted within 30 days and two within 90 days (1.5%). Four underwent reoperation: one for a cerebrospinal fluid leak, two for pseudomenigoceles, and one for repeat laminectomy. Resection of intramedullary tumors resulted in twice the risk of having one or more complications compared to extramedullary tumors (RR 2.0; 95% CI: 1.0–4.2; $p = 0.057$), and nearly four times the risk of having a neurological complication (RR 3.8; 95% CI 1.5–9.5; $p = 0.005$).

*Conclusion:* This study analyzes readmission, reoperation and complication rates for the surgical care of SCT highlighting how SCT surgery is still involved with morbidity in experienced and specialized centers. This information is useful both for health care enhancement projects and for evidence-based patient counseling.



## 1. Introduction

Spinal cord tumors (SCT) are relatively uncommon central nervous system lesions with approximately 850–1,700 new diagnoses annually in the United States [1]. On the basis of myelography, SCTs are classified as extramedullary extradural, intradural extramedullary and intradural intramedullary [1]. The most common intradural spinal tumors are meningiomas (33%), nerve sheath tumors (27%), and ependymomas (21%) [2]. Most extradural tumors originate from the bone, usually from metastatic disease, and behave very differently from intradural tumors [3]. Therefore, we chose to analyze only intradural SCTs because they are relatively similar clinically.

Owing to their most frequent etiologies, primary benign intradural SCTs typically require surgical treatment [4], which, more often than not, is related to morbidity and mortality [2,5]. The postoperative complications described can be categorized as neurological deficits, pulmonary and cardiovascular complications, and wound-related complications [6].

Postoperative complications, resulting directly from surgery or from the hospitalization process, can lead to hospital readmission and reoperation. For spinal surgery in particular, it is acknowledged that reoperation is related to worse outcomes, mainly due to wound infection and implant failures [4,7–10].

Readmission within 30 days of hospital discharge can indicate a low quality health care provider [11]. Readmissions can happen

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because of insufficient therapy, allowing the disease to relapse, or because of in-hospital complications that generate clinical consequences, worsening the prognosis [12].

Health care is becoming increasingly expensive and policymakers seek all possible measures to optimize the health system, avoiding waste and investing in improvements. That being said, the 30-days discharge rate is an important indicator, since it can entail increased costs and is used to quantify the quality of care [13]. Comparison of 2005 with 1976–78 Medicare data demonstrates a rise from 22% to 31% in the readmission rate from a specific population, using the same analytical method [12].

However, there is a lack of quality evidence concerning frequency, risk factors and specific causes for readmission in the treatment for SCTs. The aim of this study was therefore to investigate the rates of and reasons for unplanned short-term (less than 30 days) and long-term (more than 30 days) readmissions and reoperations after SCT surgical care, analyzing the patients and surgical characteristics.

## 2. Materials and methods

### 2.1. Study design

This was a retrospective study of patients treated at one tertiary care institution between May 2007 and September 2015. The Swedish Medical Center Institutional Review Board (IRB) approved the study and a waiver of informed consent was granted.

### 2.2. Study population

We included adult patients who underwent resection of an intradural intramedullary or extramedullary tumor. The patient population was taken from the institution's medical records by selecting those with a history of "laminectomy excision lesion or neoplasm spine." Patients were excluded if they (1) had similar surgery outside the above timeframe, (2) were under 19 years of age at the time of the operation, (3) had non-neoplastic intradural pathologies (e.g., atrioventricular fistulae, synovial cysts, arachnoid cysts, epidural tumors, or osseous neoplasms), (4) had a previous resection of an intradural tumor in the same location, and (5) metastatic lesions.

### 2.3. Data collected

The following information was collected: general demographics (sex, BMI, age), medical history (diabetes mellitus, osteoporosis, history of cancer), social history (nicotine use, history of smoking), steroid usage, diagnostic imaging used, surgeon who operated on the patient, procedure, level of pathology, number of levels treated, spinal location, estimated blood loss, complications, tumor characteristics, hospital stay length, readmission (timeframe, reason, reoperation), and length of follow-up. The primary study endpoints were the establishment of immediate in-hospital complication rate, most common complications, unplanned readmission at <30 and > 30 days, and reoperation rate for resection of intradural spinal tumors.

### 2.4. Analysis

We present descriptive statistics using proportions for categorical variables, means and ranges for continuous variables. The cumulative risk of complications with their 95% confidence intervals was estimated by dividing the number of patients with the complication by the total number of patients at risk. We estimated the risk ratio (RR) and 95% confidence interval of having one or more complications comparing tumor location (extramedullary versus intramedullary), and tested the hypothesis that the RR was equal to 1.0 using the Fisher's exact test. A $p$-value of 0.05 was considered statistically significant.

## 3. Results

### 3.1. Population demographics

From among 205 patients receiving surgery for intradural tumors during the study period, 72 were excluded: nine owing to the presence of metastases and 63 to non-neoplastic pathology. This left 133 patients meeting the inclusion criteria, two of whom died before follow-up for non-surgery-related reasons. Therefore, the records of 131 patients contributed to this study (Fig. 1).

### 3.2. Baseline and surgical characteristics

The average age of the study population ($n$ = 131) was 53.1 years (±16.6) and the average BMI was 27.9 (±7.7). Males represented 47.3%. Within the study cohort, 6.9% were active smokers; however, 31.3% of the patients had a history of smoking. Twenty-two patients (16.8%) had a history of cancer of whom 15 (11.5%) underwent chemotherapy and seven (5.3%) had radiation. Fifteen patients (11.5%) were on chronic steroid use. The spinal levels of pathology within the study cohort were 22.9% cervical, 42.8% thoracic and 34.4% lumbar. Details of the characteristics of the study population are presented in Table 1.

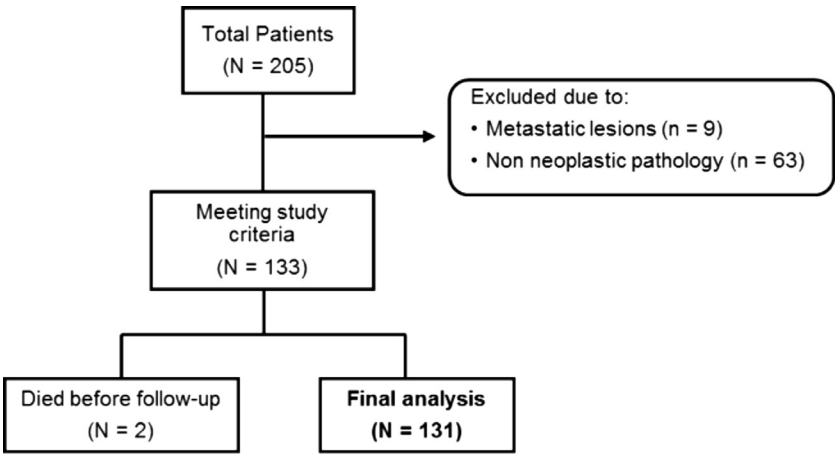


**Fig. 1.** Flow chart for final patient selection in this study.