

Drivers of Unfavorable Outcomes Following Resection of Benign Intradural Spine Tumors and the Effect of Hospital Volume on Outcomes: An Analysis of 18,297 Patients Across 774 US Hospitals Using the National Inpatient Sample 2002-2011

> Piyush Kalakoti MD; Symeon Missios MD; Anil Nanda MD, FACS Neurosurgery, Louisiana State University Health Sciences Center, Shreveport



Introduction

Benchmarking outcomes and riskprediction are key to improving quality of care and informed decision making in neurosurgery. With limited data available on post-operative outcomes following resection of benign intradural spine tumors, we identified predictors and developed a risk-factor based model for outcomes using the National Inpatient Sample (NIS). Additionally, the impact of hospital case-volume on outcomes was investigated.

Methods

Cohort Definition: A populationbased cohort analyses on patients undergoing surgery for benign intradural spine tumor (ICD-9-CM diagnosis code 225.3 or 225.4) resection (ICD-9-CM procedure code 03.0, 03.4, 03.09, 81.0 or 81.00-81.08) in the US between 2002-2011 was performed.

Outcomes/Endpoints: Post-

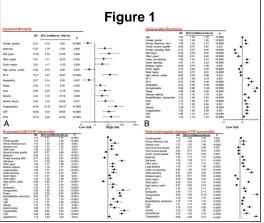
operative inpatient mortality, unfavorable discharge, prolonged LOS (>75th percentile), high hospital charges (>75th percentile), neurologic and cardiac complication.

Hospital case-volumes:

Hospitals were labelled as a low volume (LVC=<14) or a high volume center (HVC >14) based on median value of surgeries performed during the study period.

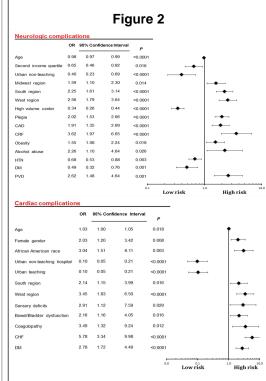
Statistical Analyses: A

multivariable logistic regression model was fit with generalized estimating equation for correcting clustering of similar outcomes within hospitals using sandwich variance-covariance matrix estimator for each of the outcomes, while controlling for patient demographics, comorbidities and hospital characteristics. A risk-factor based model for outcome prediction was developed on a bootstraped cohort. ROC curves were used to assess the accuracy of models.



Results

18,297 patients underwent resection for intradural spine tumors in the US across 774 hospitals. Regression analyses identified drivers of postoperative outcomes. Patients with extremity plegia, NF-2, CAD, obesity, coagulopathy or CHF had a higher likelihood of inpatient mortality (Figure 1A), unfavorable discharge (Figure 1B), prolonged LOS (Figure 1C), high-charges (Figure 1D).



Neurologic (top panel) and cardiac (lower panel) complications

			F	Igu	ire	3					
 CoopJop#Ry 40			galogathy + PH2 + 1	1005 925 825 425 425 425 335 335 335 335 335 335 335 335 335 3	C 110%	- Congriqueth	45	50	60	N	10
 Sprine	Sprins + Doternity Physic	- seine -	Estremity Page +	42 385 385 385 385 385 385 385 385 385 385	0 1055 205 205 205 205 205 205 205 205 205	a — Properative	iyirx — hoop	senative Sprins +	Couplingative	hesperati	ve Sprime = Cou

Line graphs depicting age dependent probability of (A)death, (B)unfavorable discharge, (C)prolonged LOS, and (D)High -charges. Statistically significant (3 highest ORs) predictors in regression, as well as their combination, against the patients' age were plotted.

Predictive model application

(Figure 3): Patients with NF-2 having PVD and coagulopathy had 4 times higher risk of death. Similar trends were observed for unfavorable discharge in NF-2 patients having preoperative syringomelia and plegia. History of CHF and syrinx in patients with coagulopathy increased the risk of prolonged LOS by 6 times.

Confidence Interv	al P 0.045 ├──	
16 0.98	0.045	_ _
		•
.76 0.98	0.018	•
.62 0.77	<0.0001	•
.60 0.74	<0.0001	•
.26 0.44	<0.0001	→
.45 0.94	0.024	
.73 1.37	0.997	
.41 0.86	0.006	→
.46 0.92	0.016	-
.33 1.03	0.064	· • ·
.51 1.61	0.738	· •
.80 3.29	0.184	→
	60 0.74 26 0.44 45 0.94 73 1.37 41 0.86 46 0.92 33 1.03 51 1.61	100 0.74 <0.001

Conclusion

Using the NIS, we identified drivers of critical post-operative inpatient outcomes in patients undergoing intradural spine tumor resection. Patients undergoing surgery at an HVC fared better than those at LVCs. A risk factor based predictive model of all the outcomes was devised that could potentially assist with risk stratification, directing pre-surgical evaluation, aid in decision making and referral for complex cases.