The Effect of Hospital Case-Volume on Pediatric Patients with Resected Posterior Fossa Tumors

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Introduction

Pediatric neurosurgery has the highest morbidity and mortality rates of any pediatric surgical specialty (NSQIP data, Bruny et al., 2013).

Higher volume hospitals correlate with improved markers of quality of care in various surgical specialties: CABG (Gutacker et al., 2017); lung transplant (Mooney et al., 2016); pediatric MoyaMoya revascularization (Titsworth et al., 2016); adult brain tumor resection (Nuno et al., 2015), *etc*.

Hypothesis: Hospitals with higher case-volumes of pediatric brain tumor resections will show improved outcomes in children.

Methods

We queried the Pediatric Health Information System (PHIS) for children ages 0-17 years undergoing brain tumor resection (supra- and infratentorial) between 2011 and 2015. Length of hospital stay (LOS), routine discharge and cost were analyzed for associations with hospital volume adjusted for patient demographic and clinical characteristics.

Definitions: Low volume: < 50 cases/year (n=28); Medium volume: 50 – 100 cases/year (n=12); High volume: > 100 cases/year (n=9)

LOS: time from admission to routine discharge (censored if patient discharged to any other type of care facility or expired); Routine discharge: discharge to patient's home; Complex procedure: infratentorial tumor resection.

Results

A mean of 3,276 children per year underwent surgery in 49 U.S. hospitals. Chi-squared tests showed race, ethnicity, transfers, discharge disposition, payment type and region to be associated with hospital volume (tables 1 and 2).

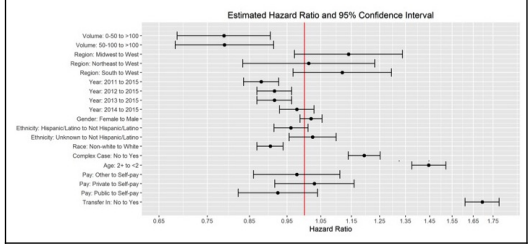
Table 1. Patient Characteristics

Characteristics	Total (%)	Hospital volume (average per year)			
		< 50	50-100	> 100	
Gender					ns
Female	7560 (46.2)	1802 (47.1)	2237 (45.6)	3521 (46.1)	
Male	8818 (53.8)	2026 (52.9)	2669 (54.4)	4123 (53.9)	
Unknown	2 (0.01)	0 (0.00)	2 (0.04)	0 (0.00)	
Race					p<0.0001
Caucasian	5345 (32.6)	1361 (35.6)	1435 (29.2)	2549 (33.3)	
Other	11035 (67.4)	2467 (64.4)	3473 (70.8)	5095 (66.7)	
Ethnicity					p<0.0001
Hispanic/Latino	2708 (16.5)	822 (21.5)	640 (13.0)	1246 (16.3)	
Non-hispanic	12158 (74.2)	2714 (70.9)	3755 (76.5)	5689 (74.4)	
Unknown	1514 (9.24)	292 (7.63)	513 (10.5)	709 (9.28)	
Age					ns
> 2 yo	14168 (86.5)	3287 (85.9)	4291 (87.4)	6590 (86.2)	
≤ 2 yo	2212 (13.5)	541 (14.1)	617 (12.6)	1054 (13.8)	
Complex procedure					ns
No	16289 (99.4)	3810 (99.5)	4871 (99.2)	7608 (99.5)	
yes	91 (0.56)	18 (0.47)	37 (0.75)	36 (0.47)	

Table 2. Hospital-Related Factors

Characteristics	Total (%)	Hospital volume (average per year)			
		< 50	50-100	> 100	
Transfer in					p<0.0001
No	13896 (84.8)	3279 (85.7)	3820 (77.8)	6797 (88.9)	
Yes	2484 (15.2)	549 (14.3)	1088 (22.2)	847 (11.1)	
Discharge home					p<0.0001
No	1993 (12.2)	600 (15.7)	628 (12.8)	765 (10.0)	
Yes	14387 (87.8)	3228 (84.3)	4280 (87.2)	6879 (90.0)	
Payment					p<0.0001
Other	1492 (9.11)	346 (9.04)	377 (7.68)	769 (10.1)	
Private	8108 (49.5)	1572 (41.1)	2664 (54.3)	3872 (50.7)	
Public	6381 (39.0)	1801 (47.0)	1773 (36.1)	2807 (36.7)	
Self-pay	399 (2.44)	109 (2.85)	94 (1.92)	196 (2.56)	
Region					p<0.0001
Midwest	4108 (25.1)	765 (20.0)	1564 (31.9)	1779 (23.3)	
Northeast	2596 (15.8)	271 (7.08)	690 (14.1)	1635 (21.4)	
South	5936 (36.2)	1771 (46.3)	1197 (24.4)	2968 (38.8)	
West	3740 (22.8)	1021 (26.7)	1457 (29.7)	1262 (16.5)	

Figure 1. Length of Hospital Stay



The hazard of routine discharge in high volume hospitals was 27% higher than medium (p=0.0015) and 27% higher than low (p=0.0007), reflecting shorter LOS in high volume centers (figure 1). As a binary endpoint, the odds ratios for routine discharge were 1.45 (p=0.304) and 1.96 (p=0.0482) for high vs. medium, and high vs. low volume hospitals, respectively (figure 2). The geometric mean costs in high volume hospitals were 60% and 40% less than in medium (p=0.0164) and low volume hospitals (p=0.0908), respectively (figure 3). Shorter LOS and increased odds of discharge home was seen for older patients (HR 1.45, p<0.0001; OR 2.02, p<0.0001), non-complex procedures (HR 1.19, p<0.0001; OR 1.25, p=0.0008), and for those that did not transfer in from another facility (HR 1.70, p<0.0001; OR 2.18, p<0.0001). Longer LOS and decreased odds of routine discharge was seen for non-caucasian race (HR 0.90, p<0.0001; OR 0.86, p=0.0119).

Figure 2. Routine Discharge

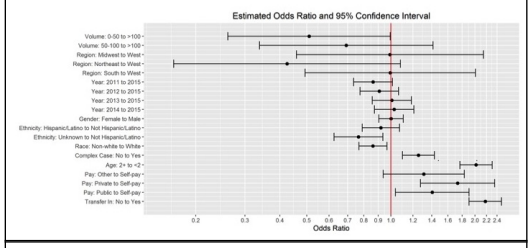
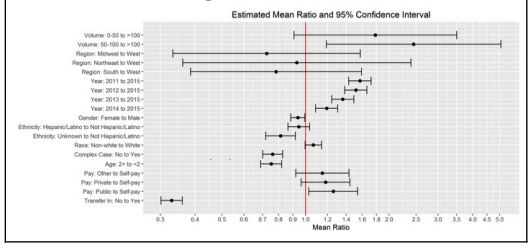


Figure 3. Cost



Conclusions

Higher volume hospitals in PHIS had improved quality of care (shorter LOS, increased discharge home, and reduced cost) for children requiring brain tumor resection. Indicators of complex procedures were associated with poorer outcomes. Thus, referral to higher volume children's hospitals may improve outcomes for children with newly diagnosed tumor needing a complex procedure (posterior fossa and brainstem tumors). Longer LOS and decreased odds of discharge home for non-caucasian patients raise concern for racial disparities in access to specialized pediatric neurosurgical care.

Learning Objectives

1) Understand the utility of large prospectively collected nationwide databases.
2) Discuss the markers of quality of care in pediatric neurosurgery.
3) Modify referral patterns to surgical subspecialties.

References

Gutacker, N. et al. Health Serv Res 2017, 52 (2), 863–878.
Mooney, J. et al. Ann Am Thorac Soc 2016, 13 (7), 1034–1041.
Titsworth, W. L. et al. Stroke 2016, 47 (5), 1303–1311.
Nuno, M.et al. Journal of Neurosurgery 2015, 123 (5), 1247–1255.