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Original Article

Predictors of inpatient complications and outcomes following surgical resection of hypothalamic hamartomas

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Abstract

Background: Our aim was to identify the preoperative factors associated with a greater risk of poor inpatient outcomes in those undergoing resection of hypothalamic hamartomas.

Methods: We performed a multi-institutional retrospective cohort analysis via the Nationwide Inpatient Sample (1998 – 2007). Patients of any age who underwent resection of hypothalamic hamartomas were identified by ICD-9 coding. The primary outcomes included inpatient complications, length of stay (LOS), and total charges. Multivariate regression models were constructed to analyze the outcomes.

Results: Two hundred and eighty-two patients were identified with a mean age of 27.7 years, with most being male (53.2%), Caucasian (78.9%), privately insured (69.3%), and treated electively (74.7%) at academic centers (91.7%). A majority (82.2%) had Elixhauser comorbidity scores of < 1, indicating few comorbidities. No inpatient deaths were reported. Mean LOS was 7.39 days and the mean total hospital charges were $53,935. Overall, 19.5% developed an inpatient complication, primarily stroke (16.7%). Female gender, ethnic / racial minorities, higher comorbidity scores, private insurance, and non-academic hospitals were associated with greater LOS and total charges. Private insurance (Odds Ratio, OR: 1.59, $P = 0.045$) and academic hospitals (OR: 1.43, $P = 0.008$) were associated with significantly higher odds of any complication. Minority race / ethnicity was associated with a minimal increase in the odds of postoperative stroke (OR: 1.02, $P < 0.001$) relative to Caucasians.

Conclusions: Through an analysis of a 10-year multi-institutional database, we have described the surgical outcomes of patients undergoing resection of hypothalamic hamartomas. Results demonstrate significant inpatient morbidity, particularly postoperative stroke. Patient- and institution-level factors should be considered in determining the perioperative risk for such patients.

Key Words: Clinical outcomes, complications, hypothalamic hamartoma, nationwide inpatient sample

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INTRODUCTION

Hypothalamic hamartomas are rare, non-malignant, congenital tumors found in the ventral hypothalamus near the region of the tuber cinereum and third ventricle.[2,13] These lesions resemble the gray matter and are composed of non-neoplastic, cytologically normal neural tissue distributed abnormally throughout the hypothalamus.[7]

The most common initial presentation of hypothalamic hamartomas is gelastic seizures, characterized by bursts of laughter in the absence of any emotion.[3,23] These seizures typically present in infancy or early childhood and can develop into widespread seizure disorders or epileptic encephalopathy, with subsequent cognitive and behavioral defects.[5,9,23] Up to 95% of the seizures caused by hypothalamic hamartomas are unresolved by medical treatment and thus require either surgical resection or radiotherapy.[13,18] Although there have been no large-scale trials comparing the efficacy of medical, radiosurgical, or surgical therapies for these lesions, the factors to consider when approaching a therapeutic intervention include: the often refractory nature of medical management, the prolonged time for the effective resolution of symptoms using radiosurgery, and the operative complications and possible need for repeat surgery seen in those undergoing surgical resections.[10,12]

There have been no large, multi-institutional studies investigating the complications and outcomes associated with surgical resection of hypothalamic hamartomas. Thus far, most series investigating outcomes have remained relatively small, single-institution series. The aim of this study is to report the complications and outcomes of patients undergoing surgical resection of hypothalamic hamartomas via a multi-institutional retrospective cohort analysis of the Nationwide Inpatient Sample (1998 – 2007).

MATERIALS AND METHODS

Patients and methods

Data source

This study utilized the Nationwide Inpatient Sample (NIS) database for cases discharged between 1998 and 2007. Data was obtained from the Healthcare Cost and Utilization Project of the Agency for Healthcare Research and Quality.[1] The NIS is a hospital discharge database consisting of an approximately twenty percent representative sample of all inpatient admissions to nonfederal hospitals in the United States, including 1045 hospitals located in 38 states. The NIS contains discharge data on 100% of all discharges from these hospitals, selected for inclusion into the database, using a stratified random sampling technique. Data elements within the NIS were input by hospital-wide coders unaffiliated to any particular physician. This publicly available, de-identified dataset was exempt for review by the Cedars-Sinai Medical Center Institutional Review Board.

Inclusion and exclusion criteria

The data was queried to identify patients with a primary diagnosis of intracranial hamartoma (ICD-9 diagnosis codes 757.32 and 759.6), who underwent craniotomy (ICD-9 procedural codes 01.2, 01.24, 01.51, and 01.59) for tumor biopsy or resection.

Patient characteristics and outcome variables

Patient baseline characteristics included age, sex, race / ethnicity, primary payer, academic hospital status, elective procedure status, and Elixhauser comorbidity score [Table 1]. Patient age was categorized as follows: less than 18, 18 – 44, 45 – 64, and greater than 65 years of age. Race / ethnicity was categorized as Caucasian, African-American, Hispanic, Asian / Pacific Islander, or Other. Primary payers included Medicare, Medicaid, private insurance, or self-pay. We incorporated medical comorbidities according to the Elixhauser Index, in which a score based on the sum of comorbidities was assigned for each of the patients in this study.[12] Relevant comorbidities in the Elixhauser index included congestive heart failure, hypertension, diabetes, renal failure, liver disease, lymphoma, metastatic cancer, coagulopathy,

Table 1: Demographics of 282 hypothalamic hamartoma cases in the United States from 1998 to 2007

Patient Demographics		N	%
Age, in years			
Mean (SE)	27.7 (2.7)		
Median	23.2		
Male		150	53.2
Race			
Caucasian		167	78.9
African-American		15	7.0
Hispanic		14	6.4
Asian / Pacific Islander		<10	-
Other		12	5.5
Primary Payer			
Medicare		15	5.3
Medicaid		55	19.4
Private Insurance		196	69.3
Self-pay		17	6
Academic Hospital Admission		259	91.7
Elective Procedure		178	74.7
Elixhauser Index Score			
0		100	35.6
1		132	46.6
2		40	14.1
3		<10	1.7
4		<10	1.9

obesity, alcohol abuse, drug abuse, and depression, among others. Sex, academic hospital status, and elective procedure status were binary variables.

The primary outcomes evaluated included the average length of stay (LOS), in-hospital mortality, and inpatient costs adjusted for 2010 inflation. Additionally, we identified potential complications in the following categories: stroke (ICD-9 diagnosis codes: 253.5, 998.11, and 997.02), postoperative fluid / electrolyte abnormalities (ICD-9 diagnosis codes: 276.0, 276.1, 276.2, 276.3, 276.4, 276.5, 276.6, 276.7, 276.8, and 276.9), cerebrospinal fluid (CSF), rhinorrhea (ICD-9 diagnosis code: 349.81), iatrogenic panhypopituitarism (ICD-9 diagnosis code: 253.7), and central diabetes insipidus (ICD-9 diagnosis code: 253.5). Use of such ICD-9 diagnosis codes to capture inpatient complications have been well-documented in the literature.[14,15,17]

Statistical analysis

The univariate analysis included a descriptive account of the patient population and outcomes, including the mean, with standard error values to describe continuous variables and proportions to describe categorical variables. Non-parametric multivariate logistic and linear regression models were constructed to analyze binary and continuous outcomes, respectively. In the multivariate analysis, age was analyzed as a categorical variable (with categories as noted above). Race was analyzed as a binary variable (Caucasion versus non-Caucasian), as was the primary payer (private versus non-private insurance). All analyses were conducted using the SAS version 9.1 for Windows (SAS Institute Inc, Cary, NC).

RESULTS

Univariate analysis

A total of 282 patients were identified with a slight male predominance (53.2%). The mean (median) age was 27.7 (23.2) years, with most patients of Caucasian race (78.9%), followed by African-Americans (7.0%). A majority of patients had private insurance (69.3%) and were treated electively (74.7%) at academic hospitals (91.7%). A majority of patients (82.2%) had Elixhauser scores of 1 or less, indicating that these patients had relatively few comorbidities [Table 1].

Missing data was observed for patient-level as well as hospital-level characteristics. For instance, 0.04% of the treated patients had missing age, 29.8% had missing race / ethnicity, and 0.2% had missing primary payer information. Missing hospital-level data included 0.5% of the patients having missing discharge status information. Similar patterns of missing data for these particular covariates have been noted throughout the literature related to data collection from the Nationwide Inpatient Sample.[20,21]

No inpatient deaths were reported. Mean (standard error, SE) length of stay was 7.39 (0.86) days. Patients had mean (SE) total hospital charges of $53,935 ($7,024). Overall, 19.5% of patients developed an inpatient, postoperative complication. Postoperative complications included stroke (16.7%), fluid / electrolyte abnormalities (8.9%), and central diabetes insipidus (7.1%). There were no reported postoperative cerebrospinal fluid leaks, or episodes of postoperative iatrogenic panhypopituitarysm [Table 2].

Factors associated with increased length of stay

In multiple linear regression models adjusted for the Elixhauser comorbidity score, variables such as, patient age category, sex, race / ethnicity, primary payer, and academic hospital status, were associated with significantly longer total LOS: each one point increase in comorbidity score (7.22 days), female sex (3.49 days), private insurance status (2.24 days), and non-academic hospital status (4.18 days). Caucasians had a significantly less total LOS (3.93 less days) relative to their non-Caucasian counterparts. All *P*-values were < 0.001 [Table 3]. Patient age was not associated with any significant change in total LOS.

Factors associated with increased total charges

In the multiple linear regression models adjusted for the Elixhauser comorbidity score, variables such as: sex, race/ethnicity, primary payer, and academic hospital status, were associated with significantly higher total charges: each one point increase in comorbidity score ($57,915), female sex ($34,879), private insurance status ($54,007),

Table 2: Cases and outcomes of 282 hypothalamic hamartoma cases in the United States from 1998 to 2007

Number of Cases by years, N (%)	
1998 – 1999	74
2000 – 2001	72
2002 – 2003	55
2004 – 2005	53
2006 – 2007	28
Total number of cases, N	282
Outcomes	
Mean length of stay, in days (SE)	7.39 (0.86)
In-hospital mortality, %	0
Mean total charges, in US dollars* (SE)	$53, 935 ($7,024)
Patients with complications, %	19.5
Stroke	16.7
Fluid / electroltye abnormalities	8.9
Central Diabetes Insipidus	7.1
Thromboembolic Complications	1.1
CSF leak	0.0
Iatrogenic panhypopituitarysm	0.0

* Dollars adjusted to 2010 inflation

Table 3: Factors associated with statistically significant increased / risk / odds of major outcomes in multivariate analyses

Outcome / Risk Factor	RR / OR	*P*-value
Increased Length of Stay		
Each one point increase in Charlson score	7.22 days	< 0.001
Minority race / ethnicity	3.93 days	< 0.001
Female sex	3.49 days	< 0.001
Private insurance	2.24 days	< 0.001
Non-academic hospital status	4.18 days	< 0.001
Increased Total Charges		
Each one point increase in Charlson score	$57,915	< 0.001
Minority race / ethnicity	$82,703	< 0.001
Younger patient age	$8,695	< 0.001
Female sex	$34,879	< 0.001
Private insurance	$54,007	< 0.001
Non-academic hospital status	$16,000	< 0.001
Increased Overall Complications		
Private insurance	1.59	0.045
Academic hospital status	1.43	0.008

RR: Relative risk, OR: odds ratio

and non-academic hospital status ($16,000). Caucasians (-$82,703) and older patients (-$8,695) had significantly less total charges, relative to non-Caucasian and younger patients, respectively. All *P*-values were < 0.001 [Table 3].

Factors associated with increased complications

In the multiple linear regression models adjusted for Elixhauser comorbidity score, variables such as the patient age category, sex, race / ethnicity, primary payer, and academic hospital status, greater odds of any inpatient complication were significantly higher among private insurance payers (OR: 1.59, $P = 0.045$) and those treated in academic hospitals (OR: 1.43, $P = 0.008$). Among specific complications, postoperative stroke was more likely to occur in minority race / ethnicity patients (OR: 1.02, $P < 0.001$) relative to Caucasians [Table 3]. No statistically significant correlations were demonstrated between preoperative factors and other complications, such as cerebrospinal fluid leak or iatrogenic panhypopituitarysm, in this series.

DISCUSSION

Hypothalamic hamartomas are rare, congenital malformations, associated with gelastic seizures, central precocious puberty, and developmental delay. Most lesions are medically refractory and require either surgical resection or radiosurgery. No large, multi-center studies have, to date, assessed complications and outcomes from surgical resection. Our study of the NIS data over a span of 10 years has demonstrated no inpatient mortalities, but has shown an approximately 20% overall inpatient complication rate, including, primarily, postoperative stroke. This analysis also reports useful new data regarding the average LOS and total hospital charges for this patient population.

The demographics of our patient population were similar in many respects to the previous single-center series. For instance, in our series approximately 53% of all patients treated were male. This male predominance in surgically treated hamartoma patients is noted throughout the literature, with the proportion of male patients ranging from 59.5 to 70% in varying series.[23,29] The mean patient age within our study (27.7 years) was significantly higher than in past series. Other series have reported the mean patient age ranging from 8.7 years to 18.3 years of age.[2,22,23,29] This may reflect the slightly older population that tends to be captured in the NIS database, as opposed to secondary data sources such as the Kids Inpatient Sample, which focuses more directly on inpatient pediatric diseases. More typically, younger patients perhaps being operated upon for the first time may have significantly different outcomes than the relatively older patients studied in this analysis. Future investigation and analyses focusing upon outcomes within the more common pediatric subset of patients with hypothalamic hamartomas may prove to elucidate additional clinically relevant predictors of postoperative inpatient outcomes. Furthermore, the mean LOS seems to be slightly higher in our dataset (7.39 days) relative to previously published reports, where the mean LOS has generally been reported to be approximately four days.[22,23] It is unclear why the LOS was so much longer in our dataset. Given that our patient population was also significantly older than in other series, our population may reflect patients undergoing repeat attempts at surgical resection with a secondary prolonged hospital stay, although this hypothesis could not be testing due to limitations within our dataset.

The most common inpatient complication within our analysis was postoperative stroke, affecting approximately 16.7% of patients. This rate of postoperative stroke fell within the range of the previously reported rates, which ranged from 14 to 33%.[3,10,16,22-24] Additionally, numerous past publications in the stroke literature validated our methodology of using ICD-9 diagnostic codes in an administrative database to capture the incidence of stroke as an inpatient complication. Our multivariate analysis demonstrated a modestly significant relationship between minority race / ethnicity and stroke (OR: 1.02, $P < 0.001$). This relationship between race / ethnicity and postoperative stroke, among hypothalamic hamartoma patients, has not been reported previously. This finding could be related to the greater prevalence of stroke risk factors in minority populations, although

a full elucidation of this hypothesis was not possible due to limitations of the dataset.[8,27,28] Additionally, some relationships noted in our multivariate analysis, such as the relationship between insurance status and postoperative inpatient complications like stroke, have not been well-defined in the literature thus far, although we hope these findings provide an impetus for future mechanistic investigation. Future investigations of these associations through rigorous prospective trials would be helpful to further understand this clinical association.

In addition, an interesting trend consisting of a decreasing number of hypothalamic hamartoma resections per year has been noted throughout the 10 years of analyzed data. The number of attempted resections has decreased by nearly two-thirds (from 74 procedures over the years 1998 – 1999 to only 28 procedures over the years 2006 – 2007). Even as the exact reasoning for this rapid decline during the same time period is unclear, a number of articles reporting the relative safety and efficacy of radiosurgery for the treatment of hypothalamic hamartomas have been published, possibly swaying the referral patterns away from surgical resection and toward radiosurgery.[25,26] Unfortunately, the NIS is not able to capture outpatient radiosurgery procedures, and thus exploration of this hypothesis was not able to be fulfilled at this time. Moreover, studies are investigating the potential rise of the radiosurgical treatment of hypothalamic hamartomas nationwide.

Interestingly, academic hospitals were associated with greater odds of inpatient complications, although they had significantly reduced total costs and length of stay. The exact mechanism underlying this relationship could not be fully elucidated from this dataset, but past studies in other surgical fields, exploring the relationship between hospital volume or teaching status and outcomes, may shed some additional light upon these findings.[4,6,11,19] For instance, in the general surgery literature, Khuri *et al*., demonstrated that patients undergoing simple colectomies and cholecystecomies at teaching hospitals had significantly higher complication rates than their counterparts treated at non-teaching hospitals.[19] Postulated mechanism for higher complications in this subset of patients treated in academic settings included a greater turnover of patient care between staff and residents, as well as the often greater complexity of the health system at teaching institutions, leading to a higher recognition of complication at such institutions.[4,6] Conversely, numerous reports in the general surgery literature focusing on pancreatic, hepatic, and esophageal cancer resections have demonstrated lower costs and shorter length of stay at academic centers, postulated to be, at least in part, due to the greater ancillary support at such centers expediting patient discharge and reducing the overall costs.[11]

There are a number of limitations to this study. First, given the limitations of the dataset, we were unable to determine whether this relatively older patient population reflected patients undergoing repeat surgical resections. Additionally, due to limitations in coding, we were unable to fully elucidate the impact of varying surgical approaches, such as the transscallosal, orbitozygomatic, pterional, and transfrontal ventricular endoscopic approaches, upon patient complications and outcomes. Also, the use of and modifications to particular surgical techniques may have changed considerably over the past decade, making it difficult to draw definitive conclusions on the safety of particular surgical techniques. Furthermore, we have not been able to capture important pre- and intraoperative variables, such as the achievement of a gross total resection or full disconnection of the hamartoma, in addition to not being able to catalog important anatomical features of the tumor, such as tumor size and location, relative to important adjacent anatomical structures, such as the internal carotid artery, optic apparatus, oculomotor nerve, fornices, and mammillary bodies. Furthermore, our use of the NIS database was limited to only non-federal hospitals, precluding the analysis of patients treated at federal centers, such as the Veteran's Affairs Hospitals. Given the relative rarity of surgical treatment for hypothalamic hamartomas, it may possibly be assumed that the outcomes would be improved at the hands of experienced surgeons or at high-volume centers. Unfortunately, the number of patients identified within the dataset were too small to fully assess these important research questions in the present analysis. Finally, this study was limited in its ability to follow patients after hospitalization to determine long-term seizure outcomes, as the NIS was limited to only inpatient outcome variables.

Nevertheless, we feel that this multi-institutional 10-year cohort analysis provides unique insights into a particular population of patients undergoing a surgical resection of hypothalamic hamartomas. We have found surgical resection to have relatively low inpatient mortality and have confirmed the occurrence of postoperative stroke as a significant complication risk through this nationwide series. Additionally, we have identified preoperative factors that increase patient risk for poor outcomes, which may help to risk-stratify patients for surgical resection or radiosurgery in the years ahead.

REFERENCES

1. Available from: http:// www.hcup-us.ahrq.gov/nisoverview.jsp. HCUP Databases. Healthcare Cost and Utilization Project (HCUP). Agency for Healthcare Research and Quality, Rockville, MD. [Last accessed on 2011 Jun]..
2. Abla AA, Rekate HL, Wilson DA, Wait SD, Uschold TD, Prenger E, *et al*. Orbitozygomatic resection for hypothalamic hamartoma and epilepsy: Patient selection and outcome. Childs Nerv Syst 2011;27:265-77.
3. Andrew M, Parr JR, Stacey R, Rosenfeld JV, Hart Y, Pretorius P, *et al*. Transcallosal resection of hypothalamic hamartoma for gelastic epilepsy. Childs Nerv Syst 2008;24:275-9.

4. Ayanian JZ, Weissman JS. Teaching hospitals and quality of care: A review of the literature. Milbank Q 2002;80:569-93.
5. Berkovic SF, Arzimanoglou A, Kuzniecky R, Harvey AS, Palmini A, Andermann F. Hypothalamic hamartoma and seizures: A treatable epileptic encephalopathy. Epilepsia 2003;44:969-73.
6. Billingsley KG, Morris AM, Dominitz JA, Matthews B, Dobie S, Barlow W, *et al*. Surgeon and hospital characteristics as predictors of major adverse outcomes following colon cancer surgery: Understanding the volume-outcome relationship. Arch Surg 2007;142:23-31; discussion 32.
7. Brandberg G, Raininko R, Eeg-Olofsson O. Hypothalamic hamartoma with gelastic seizures in Swedish children and adolescents. Eur J Paediatr Neurol 2004;8:35-44.
8. Chong JY, Sacco RL. Epidemiology of stroke in young adults: Race / ethnic differences. J Thromb Thrombolysis 2005;20:77-83.
9. Daly DD, Mulder DW. Gelastic epilepsy. Neurology 1957;7:189-92.
10. Delalande O, Fohlen M. Disconnecting surgical treatment of hypothalamic hamartoma in children and adults with refractory epilepsy and proposal of a new classification. Neurol Med Chir (Tokyo) 2003;43:61-8.
11. Dimick JB, Cowan JA Jr, Colletti LM, Upchurch GR Jr. Hospital teaching status and outcomes of complex surgical procedures in the United States. Arch Surg 2004;139:137-41.
12. Elixhauser A, Steiner C, Harris DR, Coffey RM. Comorbidity measures for use with administrative data. Med Care 1998;36:8-27.
13. Frazier JL, Goodwin CR, Ahn ES, Jallo GI. A review on the management of epilepsy associated with hypothalamic hamartomas. Childs Nerv Syst 2009;25:423-32.
14. Giles KA, Hamdan AD, Pomposelli FB, Wyers MC, Schermerhorn ML. Stroke and death after carotid endarterectomy and carotid artery stenting with and without high risk criteria. J Vasc Surg 2010;52:1497-504.
15. Gopaldas RR, Chu D, Dao TK, Huh J, LeMaire SA, Lin P, *et al*. Staged versus synchronous carotid endarterectomy and coronary artery bypass grafting: Analysis of 10-year nationwide outcomes. Ann Thorac Surg 2011;91:1323-9.
16. Harvey AS, Freeman JL, Berkovic SF, Rosenfeld JV. Transcallosal resection of hypothalamic hamartomas in patients with intractable epilepsy. Epileptic Disord 2003;5:257-65.
17. Hasan O, Orav EJ, Hicks LS. Insurance status and hospital care for myocardial infarction, stroke, and pneumonia. J Hosp Med 2010;5:452-9.
18. Kerrigan JF, Ng YT, Chung S, Rekate HL. The hypothalamic hamartoma: A model of subcortical epileptogenesis and encephalopathy. Semin Pediatr Neurol 2005;12:119-31.
19. Khuri SF, Najjar SF, Daley J, Krasnicka B, Hossain M, Henderson WG, *et al*. Comparison of surgical outcomes between teaching and nonteaching hospitals in the Department of Veterans Affairs. Ann Surg 2001;234:370-82; discussion 382-3.
20. Mukherjee D, Chang DC, Quinones-Hinojosa A: New methods to assess trends in neuro-oncological care. J Neurooncol 2010;97:155-6.
21. Mukherjee D, Kosztowski T, Zaidi HA, Jallo G, Carson BS, Chang DC, *et al*. Disparities in access to pediatric neurooncological surgery in the United States. Pediatrics 2009;124:e688-96.
22. Ng YT, Rekate HL. Endoscopic resection of hypothalamic hamartoma for refractory epilepsy: Preliminary report. Semin Pediatr Neurol 2007;14:99-105.
23. Ng YT, Rekate HL, Prenger EC, Wang NC, Chung SS, Feiz-Erfan I, *et al*. Endoscopic resection of hypothalamic hamartomas for refractory symptomatic epilepsy. Neurology 2008;70:1543-8.
24. Palmini A, Chandler C, Andermann F, Costa Da Costa J, Paglioli-Neto E, Polkey C, *et al*. Resection of the lesion in patients with hypothalamic hamartomas and catastrophic epilepsy. Neurology 2002;58:1338-47.
25. Romanelli P, Muacevic A, Striano S. Radiosurgery for hypothalamic hamartomas. Neurosurg Focus 2008;24:E9.
26. Schulze-Bonhage A, Trippel M, Wagner K, Bast T, Deimling FV, Ebner A, *et al*. Outcome and predictors of interstitial radiosurgery in the treatment of gelastic epilepsy. Neurology 2008;71:277-82.
27. Stansbury JP, Jia H, Williams LS, Vogel WB, Duncan PW. Ethnic disparities in stroke: Epidemiology, acute care, and postacute outcomes. Stroke 2005;36:374-86.
28. Trimble B, Morgenstern LB. Stroke in minorities. Neurol Clin 2008;26:1177-90.
29. Yao HX, Luo SQ, Ma ZY, Zhang YQ, Jia G. Complications after transcallosal transseptal interforniceal resection of hypothalamic hamartoma: Analysis of 37 cases. Zhonghua Yi Xue Za Zhi 2009;89:898-900.

Commentary

National US data on hypothalamic hamartoma

This is a 10 year retrospective survey of hypothalamic hamartoma (HH) patients who had surgery extracted from a multi-institutional national US database. Trends in epidemiology, health costs, length of stay and complications have been captured. The results are interesting but raise a number of questions which have been addressed in part by the authors.

One of the major drawbacks of this study is that it surveys only a 20% representative sample of non-Federal US Hospitals. How representative is this of all the patients with HH having surgery? The few children in this study is a concern because most of the surgery is done in this age group. The analysis is not able to determine what type of surgery was performed or how severe the complications were. Although the stroke rate was 16.7% in this database, this is not our experience using the transcallosal approach.[30] The transsylvian and subfrontal approaches probably are associated with a greater risk of stroke than the transcallosal approach, particularly with the larger HH.[30] The surgeons' experience is also likely to be a major factor in the stroke rate. Surgical techniques and surgeons' experience have improved over the last ten years, with endoscopic resection or disconnection becoming more commonly used and morbidity of surgery falling. Radiosurgery has increased for the adolescent and adult patients with HH. HH is best treated within Comprehensive Epilepsy Centers by surgeons familiar with all the treatment options and the technical aspects of surgery.[31] This study has not been able to address these important issues. It is also not clear why the patients' race, insurance status, or the type of hospital (private, academic etc) should affect the complication rates and this deserves further investigation.

Fortunately, the prognosis for patients with HH particularly the children with severe gelastic epilepsy and behavioral disturbance has improved dramatically over the last 20 years due to the expanded treatment options and a greater understanding and experience with this

uncommon condition.[31] These trends are not captured in this study. However, the methodology used in this study is underutilised in neurosurgery research and could provide new perspectives on the neurosurgical treatment of many other diseases of the nervous system and spine. It has the potential to alter health policy and trigger further clinical trials to answer specific questions in neurosurgery. The authors are to be thanked for introducing neurosurgeons to this methodology.

30. Rosenfeld JV, Feiz-Erfan I. Hypothalamic hamartoma treatment issues: Surgical resection with the transcallosal approach. Seminars in Pediatric Neurology 14:88-98, 2007.
31. Rosenfeld JV. The evolution of treatment for hypothalamic hamartoma: A personal odyssey. Neurosurg Focus 30(2):E1-5, 2011.

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Commentary

Surgery for hypothalamic hamartomas

The authors should be commended for analyzing this large database of hypothalamic hamartomas to bring insights on the consequences of surgically approaching this difficult pathology. Remarkably, 95% of seizures caused by hypothalamic hamartomas are uncontrolled by drugs, tempting neurosurgeons to remove them. Therefore, the authors reviewed the inpatient complications of 282 patients operated on in the academic or private sector, with or without insurance and treated in multiple institutions from 1998 to 2007. During this 10-year interval, they were able to identify a trend to less surgery, disclosing that a complication rate of 20% and a stroke incidence of 17% are probably no longer acceptable results for a benign pathology such as hypothalamic hamartomas. Mainly when better medical management of seizures associated to the growing availability of radiosurgery to curb gelastic fits appear to decrease the morbidity of the management of these lesions.[32,33]

This study portraits an older population (27.7 years) than what is believed to be the case for a congenital and an early identified disease, common in the childhood. There was a slight predominance of males (53.2%), in accordance to the literature. The racial distribution of Caucasian (78.9%) is likely because the patients were privately insured (69.3%), a selection bias. Another interesting finding is that the patients had an Elixhauser comorbidity scores of <1, indicating few comorbidities; however, they still had a long stay in the hospital (7.3 days) and an expensive admission ($53 935). As expected for a chronic disease, the surgery was elective in the majority of the patients (74.7%), occurring in tertiary academic centers (91.7%) due to the rarity and complexity of the procedure. This also suggests that the centers were qualified to perform this highly specialized surgery.

The authors were able to identify factors related to long hospital stay such as female gender, ethnic/racial minorities, high comorbidity scores, private insurance, and non-academic hospitals. Minority race/ethnicity was associated with higher incidence of postoperative stroke in relation to Caucasians. Adjusting for Elixhauser comorbidity score, age, sex, race/ethnicity, primary payer, and academic hospital status, each were associated with higher total charges.

Overall, this work is very informative on the consequences of operating on hypothalamic hamartomas. Unfortunately, the outcomes of these patients are not provided, not even a short-term follow-up after discharge. One may speculate that the results are not bright enough to entice the authors to report. Even without this most relevant information, the learning that surgery has a high risk of complications with uncertain benefits for the patients is important to orient clinicians on the management of this pathology. The multi-institutional decrease in the number of surgeries over the years suggests the disfavor that the surgery has gained, despite of imaging improvement for surgical planning and exquisite microsurgical techniques. Moreover, the multi-institutional nature of this report scores the fact that this report reflects what happens in the real world and not the skewed view of a single skilled neurosurgeon working in an outstanding institution.

REFERENCES

32. Régis J, Scavarda D, Tamura M, Villeneuve N, Bartolomei F, Brue T, *et al*.Gamma knife surgery for epilepsy related to hypothalamic hamartomas. SeminPediatrNeurol 2007;14:73-9.
33. Selch MT, Gorgulho A, Mattozo C, Solberg TD, Cabatan-Awang C, DeSalles AA. Linear accelerator stereotactic radiosurgery for the treatment of gelastic seizures due to hypothalamic hamartoma.Minim Invasive Neurosurg 2005;48:310-4.

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