The Incidence and Risk Factors of Postoperative Entrapped Temporal Horn in Trigone Meningiomas

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■ OBJECTIVE: **To determine risk factors for the occurrence of postoperative entrapped temporal horn (ETH), a specific form of isolated hydrocephalus that is a severe complication after resection of lateral ventricular trigone tumors, following trigone meningioma surgery.**

■ METHODS: **A retrospective review was performed of 121 cases of trigone meningiomas surgically treated between November 2011 and March 2015 in Beijing Tiantan Hospital. Patient demographics, imaging features, surgical procedures, and postoperative complications were evaluated by statistical analysis.**

■ RESULTS: **The median follow-up time was 24.1 months. Postoperative ETH developed in 23 patients (19.0%). Primary univariate analysis showed that young age, a longer clinical history, development of postoperative meningitis, and a longer duration of ventricular drainage were significantly associated with an increased risk of postoperative ETH. Subsequent multiple logistic regression analysis indicated that a clinical history of >3 months (odds ratio [OR], 4.8; $P = 0.008$), postoperative neurologic deficits (OR, 4.2; $P = 0.014$), duration of ventricular drainage >3 days (OR, 4.8; $P = 0.012$), and postoperative meningitis (OR, 9.9; $P = 0.001$) were independently associated with a risk of postoperative ETH.**

■ CONCLUSIONS: **Postoperative ETH frequently occurs in patients with trigone meningiomas. The severity of surgical injury of the surrounding brain tissue partly accounts for the risk of postoperative ETH. Clinical management of ventricular drainage and postoperative meningitis are of utmost importance. Ventricular drainage should be performed on an individual basis, and drainage tubes should be removed as early as possible.**

INTRODUCTION

Entrapped temporal horn (ETH) is a specific form of focal hydrocephalus. It is usually caused by an obstruction of the trigone of the lateral ventricle, which isolates the temporal horn from the rest of the ventricular system.[1,2] Continued secretion of cerebrospinal fluid (CSF) by the choroid plexus within the temporal horn leads to progressive dilation of the temporal horn.

The isolated and enlarged temporal horn existing as a mass causes intracranial hypertension and even uncal herniation. Moreover, trapped CSF spaces occasionally can complicate the management of hydrocephalus and present the surgeon with a treatment dilemma.[3] Standard and optimal treatments have not been established yet. Shunt placement or implantation of foreign bodies can cause infection, and failure necessitates future revisions.[1] Dilation or fenestration in the trigone area via a second craniotomy or neuroendoscopic procedure risks damage to the visual pathway, and the opening may not be permanent, as postoperative scarring in the trigone area may lead to reentrapment.[1,2,4]

Postoperative entrapped temporal horn (ETH) in trigone meningiomas has rarely been discussed as a separate entity in the literature, and data focusing on independent risk factors for it are limited. Furthermore, minimizing these factors helps prevent subsequent postoperative ETH and obviates the need for further management, which is severely harmful to patients' health and very expensive. In this study, we aimed to investigate the risk factors for postoperative ETH in a consecutive cohort of 121

Key words
- Isolated hydrocephalus
- Risk factors
- Temporal horn
- Trigone meningioma

Abbreviations and Acronyms
CSF: Cerebrospinal fluid
EI: Edema index
ETH: Entrapped temporal horn
OR: Odds ratio

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Citation: World Neurosurg. (2016) 90:511-517.
http://dx.doi.org/10.1016/j.wneu.2016.03.040

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

patients who had undergone resection of trigone meningiomas in a large neurosurgical center in China.

MATERIALS AND METHODS

Patients

This study was approved by the Research Ethics Board of Beijing Tiantan Hospital. A consecutive series of 121 patients with lateral ventricular trigone meningiomas from 10 different subdivisions of the Neurosurgery Center in Beijing Tiantan Hospital underwent tumor resection from November 2011 through March 2015. The operations were performed by 12 senior neurosurgeons. The histologic diagnosis was based on the 2007 World Health Organization classification criteria.[5] Patient demographics, surgical records, histologic records, follow-up records, and imaging data were reviewed. Postoperative ETH was assessed based on the patients' presentation and neurologic images analyzed retrospectively.

Intraoperative ultrasound or neuronavigation was used to guide the surgery. A transsulcal approach was used for removal of 79 tumors (65.3%), and a transcortical approach was used in 42 tumors (34.7%). Placement of a ventricular drainage tube depended on each patient's intraoperative situation and the surgeon's preference. A ventricular drainage tube (Medtronic, Minneapolis, Minnesota, USA) was placed in 106 patients (87.6%); 15 patients (12.4%) did not receive a ventricular drainage tube. The time of drainage tube removal was determined based on the patient's status and the results of computed tomography scan and CSF examination. The drainage tube was removed without complication after 1–21 days. Duration of ventricular drainage was $\leq$3 days in 45 patients (37.2%) and >3 days in 61 patients (50.4%). The Simpson grading system was used to assess the degree of tumor resection.[6] Total resection of 117 tumors (96.7%) was performed; subtotal resection of 4 (3.3%) tumors was performed because of extremely hard texture of the residual tumor and strong adhesion to vessel. Residual tumors were confirmed by postoperative magnetic resonance imaging.

For a diagnosis of postoperative meningitis in our series, either organisms were cultured from CSF, or 1 of the following signs or symptoms was present with no other recognized cause: fever of >38°C, headache, meningeal signs, and at least 1 of the following: 1) increased white blood cell count, decreased glucose level, and elevated protein in CSF; 2) organisms seen on Gram stain of CSF; 3) positive antigen test of CSF; 4) organisms cultured from blood; or 5) diagnostic single-antibody titer (IgM) or 4-fold increase in paired sera (IgG) for pathogen.[7,8]

Definition and Treatment of Postoperative ETH

A postoperative ETH was defined as radiographic evidence of progressive enlargement of the ipsilateral temporal horn after tumor removal as well as intracranial hypertension symptoms (headache, vomiting, papilledema), homonymous hemianopsia, hemiparesis, or memory loss.[9,10]

Statistical Analysis

IBM SPSS statistics for Windows version 19.0 (IBM Corporation, Armonk, New York, USA) was used for all statistical analyses. Patient demographics, imaging features, surgical procedures, and postoperative treatments were analyzed. For each variable, the relative risk was calculated as the risk of events in patients with the characteristic divided by the risk of events in patients without the characteristic. Characteristics identified as potential risk factors according to univariate analysis underwent multivariate logistic regression analyses. To ensure selection of the best combination of explanatory variables, the variables with a P value of < 0.20 were included in the model; they remained in the model only if they were significantly related to the response variable ($P < 0.10$). A P value of < 0.05 (2-sided) was considered statistically significant.

RESULTS

Patient Demographics

Patient demographics and baseline characteristics are summarized in Table 1. Analysis included 121 patients (87 females [71.9%] and 34 males [28.1%]) with an age range of 6–70 years (median, 44 years). Histologic examination revealed 104 World Health Organization grade I meningiomas (86.0%; 55 of fibromatous type [45.5%], 5 of meningothelial type [4.1%], 42 of mixed or transitional type [34.7%] and 5 other [4.1%]), 14 grade II meningiomas (11.6%), and 3 grade III meningiomas (2.4%). The length of clinical history ranged from 9 days to 11 years (median, 3 months). The chief complaints included headache (63 patients; 52.1%), preoperative neurologic deficits (e.g., motor disturbance, hemianopsia, sensory disturbance, aphasia, memory disorders) (36 patients; 29.8%), and seizures (5 patients; 4.1%). There were 15 asymptomatic meningiomas (12.4%) incidentally detected during routine physical examination. The median preoperative Karnofsky performance scale score was 90 (range, 70–100). Patients were evaluated clinically and by serial imaging (computed tomography or magnetic resonance imaging) for a median follow-up period of 24.1 months (range, 3.6–42.2 months).

Imaging Studies

The tumor was located on the left side in 66 patients (54.5%) and on the right side in 55 patients (45.5%). The mean maximum tumor diameter was 4.6 cm (range, 1.5–8.2 cm). The extent of peritumoral brain edema was assessed by calculation of the edema index (EI) based on preoperative magnetic resonance imaging.[11,12] Among 121 patients, EI ranged from 0 to 5.49 (median, 0.61). There was no edema present (EI <0.1) in 30 patients (24.8%). Peritumoral brain edema was present in 91 patients (75.2%): mild edema (EI 0.1–1.0) in 44 patients (36.4%), moderate edema (1EI 1.0–2.0) in 24 patients (19.8%), and severe edema (EI >2.0) in 23 patients (19.0%).

Postoperative Complications

Complications occurred in 57 cases (47.1%). Seizures developed in 10 patients (8.3%). Fresh operative neurologic deficits included hemiparalysis in 9 patients, aphasia in 11 patients, hemianopia in 20 patients, sensory disturbance in 2 patients, and memory disorders in 24 patients. Postoperative meningitis was documented in 24 patients (19.8%), including bacterial meningitis (CSF bacteria culture positive; 1.7% [2 of 121 patients]) and chemical meningitis (CSF bacteria culture negative; 18.1% [22 of 121 patients]). Intraventricular hemorrhage (>10 mL) was detected in 8 (6.6%)