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Clinical study

Giant cavernous malformations: A single center experience and literature review

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ABSTRACT

Intracranial giant cavernous malformations (GCMs) are rarely reported because of their extremely low incidence. Knowledge of GCM is poor. The goals of this study were to analyze the epidemiological characteristics, clinical manifestations, radiological findings, microsurgical treatment, and neurological outcomes of GCMs. From January of 2003 to December 2016, nine GCM patients who underwent neurosurgical treatment at Beijing Tiantan Hospital were chosen for analysis and their records were reviewed. We also performed an exhaustive literature search and identified all previously reported GCMs. The study population consisted of three males and six females (mean age, 25.1 years). The mean diameter of the malformations was 6.7 cm (range, 6.0–8.4 cm). The most common clinical manifestations were the symptoms caused by mass effect. Radiologically, all GCMs showed mixed T1 and T2 signals; five of them exhibited minimal enhancement after contrast administration. Gross total resection was achieved in all patients without surgical mortality. Postoperatively, three patients developed new surgical complications, including left limbs weakness and left side paralysis. The mean follow-up period after diagnosis was 69.3 months (range, 16–149 months); five patients (55.6%) had achieved full recovery and the remaining four cases (44.4%) were improved to some extent. GCM is a rare subgroup of vascular malformations; it is more prone to occur in children and adolescents. Microsurgical resection should be the treatment of choice for GCMs, and despite their giant size, excellent surgical outcomes after total removal could be achieved.

1. Introduction

Cerebral cavernous malformations (CMs) are benign vascular malformations and are characterized by thin-walled dilated vascular channels without intervening brain parenchyma. The sizes of CMs are highly variable, ranging from a few millimeters to several centimeters. However, unlike giant aneurysms, which have a definite threshold (diameter >25 mm), there exists no consensus on when to call a CM "giant". In 2004, Lawton et al., although arbitrary, defined giant cavernous malformation (GCM) as a CM with a diameter more than 6 cm [1]. According to this criterion, GCMs are very rare. Consequently, many aspects of GCMs remain somewhat undefined.

Herein, we performed a retrospective study of patients with intraparenchymal GCM in a fourteen-year period (2003–2016) to provide insight into these lesions. As far as we know, this is the largest case series of GCM from a single neurosurgical center and also is the first report to describe GCMs as separate entities.

2. Materials and methods

2.1. Patient population

Ethics approval for this study was given by the Research Ethics Board of Beijing Tiantan Hospital, Capital Medical University, and informed consent was obtained from the participants. Between 2003 and 2016, 1395 patients harboring CMs involving the central nervous system (CNS) were surgically treated in Beijing Tiantan hospital. After excluding extra-axial CMs, cases lacking histopathological confirmation, CMs with diameter less than 6 cm, we

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included a total of nine intraparenchymal GCM patients. We retrospectively reviewed medical records and surgical reports of these patients, and extracted the demographic and clinical data. The preoperative and postoperative computer tomography (CT) and magnetic resonance imaging (MRI) data were examined on picture archiving and communication system (PACS) in our hospital.

2.2. Surgical treatment and follow-up

The surgical approach for resection of a GCM depended on the size and the detailed localization of the lesion. The extent of resection was recorded according to the surgical record and postoperative MR images. Pathological examinations of the CM samples were performed by two independent neuropathologists. The Landriel Ibañez classification was used to grade the postoperative complications [2]. Follow-up data were obtained from face-to-face outpatient visits or telephone interviews. The seizure outcomes were determined using the modified Engel classification scale [3]. The modified Rankin Scale (mRS) was assessed twice: mRS score at discharge and mRS score at the latest follow-up were used to represent short-term and long-term outcome, respectively.

2.3. Literature review

We reviewed the literature of GCM confined to the English language by performing a PubMed/MEDLINE search. The search included the following keywords: "cavernous malformation," "cavernous hemangioma," "cavernoma," "cavernous angioma," combined with "giant," and "huge," for all possible combinations. All relevant articles of GCM were carefully reviewed; a total of 35 GCM patients were identified [1,4–28,31].

3. Results

3.1. Demographic data and clinical manifestations

The clinical data of the patients are summarized in Tables 1 and 2. The incidence of GCM among the entire series of CNS CMs was 0.65% (9 of 1395 cases). The study population consisted of 3 males and 6 females, the sex ratio was male 1: female 2. There are four pediatric cases. Mean age at admission was 25.1 years (range, 2–50 years). The interval from disease onset to hospital admission ranged from 2 weeks to 20 years (mean 43.2 months). The common clinical manifestations were the symptoms caused by mass effect (7, 77.8%). Seizure was reported by two cases. At the time of admission, the mean mRS score was 2.3 ± 0.9 (range, 1–4).

Table 2
Characteristics of the GCM patients.

Variable	Value (%)
Age (years)	
Range	2–50
Mean ± SD	25.1 ± 16.3
Gender	
Male	3 (33.3)
Female	6 (66.7)
Interval (months)[a]	
Range	0.5–240
Mean ± SD	43.2 ± 78.7
Side	
Left	2 (22.2)
Right	6 (66.7)
Bilateral	1 (11.1)
Max lesion diameter (cm)	
Range	6.0–8.4
Mean ± SD	6.7 ± 0.7
Single or multiple lesion	
Single	5 (55.6)
Multiple	4 (44.4)
Primary or recurrent lesion	
Primary	9 (100)
Recurrent	0 (0)
Follow-up (months)	
Range	16–149
Mean ± SD	69.3 ± 40.8

SD, standard deviation.
[a] Duration from disease onset to hospital admission.

3.2. Neuroradiological features of GCM

All GCMs in our series were located in the supratentorial compartment of the brain. Maximal lesion diameter of the GCMs

Table 1
Summary of patients presenting with GCM.

Case No.	Age (yrs), Sex	Clinical Presentation	Interval (months)[a]	Location	CT	MRI			MLD (cm)	Extent of Lesion Removal	Outcome
						T1	T2	+C			
1	36, F	Dizziness, nausea, numbness of right limbs	24	Left frontal and basal ganglia region	Hyperdense; punctate calcifications	Mixed	Mixed	Minimal	6.0	GTR	Improved
2	22, M	Headache, nausea, vomiting	0.5	Right temporal	NA	Mixed	Mixed	–	6.1	GTR	Improved
3	50, F	Headache	20	Right temporal	NA	Mixed	Mixed	Minimal	6.6	GTR	Improved
4	17, F	Seizure	10	Right temporal	NA	Mixed	Mixed	Minimal	7.0	GTR	Improved
5	26, M	Headache, slurred speech	2	Right lateral ventricle	NA	Mixed	Mixed	–	6.3	GTR	Improved
6	50, F	Headache, nausea, vomiting	1	Bifrontal	NA	Mixed	Mixed	Minimal	6.0	GTR	Improved
7	7, F	Left arm sharking	0.67	Right paraventricular	Hyperdense; multicystic; patchy calcifications	Mixed	Mixed	–	8.4	GTR	Improved
8	2, F	Right upper limb paralysis	0.5	Left frontal	Hyperdense; lobulated; patchy calcifications	Mixed	Mixed	–	6.6	GTR	Improved
9	16, M	Seizure	0.5	Right paraventricular	Hyperdense; heterogenous; calcifications	Mixed	Mixed	Minimal	7.0	GTR	Improved

F, female; GTR, gross total removal; M, male; MLD, maximal lesion diameter.
[a] Duration from disease onset to hospital admission.

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