Seizures After Intracranial Surgery in Pediatric Patients

ANANNIT VISUDTHIBHAN, M.D.*,
SURANG CHIEMCHANYA, M.D.*,
PONGSAKDI VISUDHIPHAN, M.D.*,
CHINTANA SRIRATTANAJAREE, M.D.*

Abstract

We retrospectively reviewed the occurrence of seizure after performing intracranial operations in children aged less than 15 years. During a 5-year period, there were 18 patients out of a total of 155 who developed one or more seizures within 1 year after operation. The majority of patients (55.6%) had the onset of seizures within 24 hours. Seventy-two per cent of the patients had partial seizures. Two patients who developed immediate postoperative seizures had sodium derangement. Eight of 10 patients who had early onset seizures had had an operation for supratentorial lesions. Among the 6 patients who developed seizures after infratentorial tumor removal, the cause of seizure was not known in 4 patients. We emphasize that prompt investigations to exclude any structural lesions and other possible causes of seizure, especially electrolyte disturbance along with appropriate antiepileptic drug administration, are important in patients who develop seizures after the operation. The recommendation for routine administration of antiepileptic drug prior to the operation has yet to be concluded.

Key word : Seizure, Intracranial Surgery, Children

Intracranial surgery can cause seizures either during the immediate postoperative period or later years[1-3]. Seizures occurring during the immediate postoperative period are more common than in the later stage and are harmful[4,5]. When they occurr in the immediate postoperative period, assessment of consciousness is difficult and brain edema enhanced by secondary increased intracranial pressure would occur. The seizures themselves might not only threaten the patients' lives but also might indicate serious existing intracranial pathologic lesions[1,6,7].

The prevalence of seizures after intracranial surgery varies in many previous reports[1-8]. However, there has been no study conducted in Thailand for pediatric patients in particular.

The purpose of this report is to document the prevalence of the postoperative seizures within 1 year after intracranial surgery in pediatric patients at Ramathibodi Hospital.

* Department of Pediatrics, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand.

PATIENT AND METHOD

The medical records of pediatric patients admitted to the Department of Pediatrics, Ramathibodi Hospital, between January 1988 and December 1992 who had one or more seizures occurring within one year after intracranial operation were retrospectively reviewed. Age, sex, underlying pathology and locations of lesions were collected. Seizures were categorized as simple partial, complex partial, and generalized seizures. Onset of seizures after the operation, initial and long-term treatments were included in the analysis of data. Laboratory findings which included complete blood count, electrolytes, calcium, and magnesium levels as well as computerized tomography scan (CT scan) of the brain were recorded. Patients who had either history of seizure prior to surgery or cranial surgery due to head injury were excluded from this study.

RESULTS

Of the 155 patients aged under 15 years who underwent intracranial operations, there were 96 boys and 59 girls. Their age ranged from 1 month to 14 years. The causes for intracranial operations are shown in Table 1. Surgical removal or biopsy of intracranial tumors was performed in 89 patients and the locations of tumors are shown in Table 2. Ventriculoperitoneal shunt (V-P shunt) insertion was performed in 55 hydrocephalic patients. The causes of hydrocephalus were aqueductal stenosis (n = 19), aqueductal stenosis with neural tube defect (n = 12), porencephalic cyst (n = 7), post-meningitis (n = 7), hydrocephalus in association with agenesis of corpus callosum (n = 1) and unknown-cause communicating hydrocephalus (n = 9). Among these 55 patients, only 1 patient with post-meningitis communicating hydrocephalus had seizure. Surgical treatments for brain abscesses, arterio-venous malformation (AVM), and removal of hematoma due to spontaneous intracranial bleeding of unknown cause were performed in 7, 3, and 1 patients respectively. There were 9 patients who had more than one operation. All of these patients had had V-P shunt placement to relieve the intracranial pressure prior to the surgical removals of brain tumors.

Eighteen out of 155 patients (11.6%) developed seizures after the intracranial surgery. The case summary of all 18 patients is shown in Table 3. Seizures occurred in 17.9 per cent (16/89) after surgical removal or biopsy of the brain tumors. The incidence of seizure was higher in supratentorial (31%) than infratentorial (10.5%) operations. Postoperative seizures after V-P shunting for the treatment of hydrocephalus was only 1.8 per cent (1/55). One patient, out of a total of 3 who had surgical removal of AVM, had seizure occurring postoperation.

Seizures occurred within the first 24 hours after the operation in 55.6 per cent (10/18) of the patients. Three patients (16.6%) had seizures between the second and seventh postoperation day. The rests of the seizures were within the second week, between 2 to 6 months and by 9 months which were 5.5 per cent, 16.6 per cent and 5.5 per cent of the patients respectively (Table 3).

Fifteen patients (72%) had partial seizures and 5 patients (28%) had either primary or secondary generalized seizures. Among 12 patients who had seizures after the supratentorial surgery, 7 had partial seizures and the rest had generalized seizures. Two patients who had surgical removal of suprasellar tumors (astrocytoma and germinoma in

Table 1. Prevalence of postoperative seizures according to causes for operation.

	No. of patients	No. with seizures (%)
Brain tumors	89	16 (17.9)
Brain abscess	7	0 (0)
AVM	3	1 (33)
Intracerebral hematoma	1	0 (0)
Hydrocephalus	55	1 (1.8)
Total	155	18

Table 2. Prevalence of postoperative seizures according to locations of brain tumors.

Locations	No. of patients	No. with seizures (%)
Supratentorium	32	10 (31)
Suprasellar	11	5 (45)
Hemispheres	7	2 (29)
Thalamus	4	2 (50)
Pineal	5	0 (0)
Intraventricular (choroid plexus papilloma)	5	1 (20)
Infratentorium	57	6 (10.5)
Total	89	16

Table 3. Cases summary of post craniotomy seizures.

Case No.	Sex	Age (yr)	Location of lesion	Type of tumor or lesion	Operation	Pre-op shunt	Intra-op shunt	Postoperative seizures			Associated findings
								Time to onset	Type	Episode	
1	M	2	Posterior fossa	Ependymoma	Removal of tumor	-	-	5 mins	P	3	Post cardiac arrest
2	M	3	Posterior fossa	Astrocytoma	Removal of tumor	-	-	11 days	P	4	Post cardiac arrest
3	F	3	Posterior fossa	Medulloblastoma	Removal of tumor	+	-	9 months	P	1	Post cardiac arrest
4	F	1	Posterior fossa	Astrocytoma	Removal of tumor	-	+	6 months	P	1	Post cardiac arrest
5	M	3	Posterior fossa	Medulloblastoma	Removal of tumor	-	-	2 days	P	1	Subdural hemorrhage
6	M	12	Posterior fossa	Medulloblastoma	Removal of tumor	-	-	2 hours	P	1	*
7	M	6	Thalamus	Astrocytoma	Biopsy	-	+	3 days	P	1	*
8	M	9/12	Third ventricle	Ependymoma	Removal of tumor	-	-	1 hour	G	1	IVH with cerebral edema
9	M	10	Suprasellar	Hamartoma	Removal of tumor	-	-	8 hours	G	2	*
10	F	6	Suprasellar	Astrocytoma	Removal of tumor	+	-	3 hours	P	2	Hyponatremia (Na 120 mmol/L)
11	F	6	Suprasellar	Dermoid cyst	Removal of tumor	-	-	10 hours	P	2	*
12	F	12	Suprasellar	Germinoma	Removal of tumor	-	-	4 hours	G	1	Hypernatremia (Na 152 mmol/L)
13	M	3	Suprasellar	Craniopharyngioma	Removal of tumor	+	-	4 hours	P	4	IVH with cerebral edema
14	M	4/12	Lateral ventricle	Choroid plexus papilloma	Removal of tumor	-	-	1 hour	P	1	IVH with cerebral edema
15	M	14	Fronto-parietal	Astrocytoma	Removal of tumor	-	-	7 days	G	1	IVH with cerebral edema
16	F	8	Fronto-temporal	Malignant Astrocytoma	Removal of tumor	-	-	5 months	P	2	IVH with cerebral edema
17	F	2/12		Hydrocephalus	V-P shunt	+	-	4 months	G	3	Porencephaly
18	M	10	Hemisphere	AVM (ruptured)	Removal of AVM	-	-	1 hour	P	2	*

* CT scan of the brain revealed minimal intracerebral hematoma and edema at surgical site, IVH = intraventricular hemorrhage, AVM = arteriovenous malformation
G = Generalized seizures P = Partial seizures

each patient) developed generalized seizures immediately after the operation. In 1 patient the seizure was associated with hyponatremia (Na^+ 120 mmol/L) and in the other, hypernatremia (Na^+ 152 mmol/L).

Ten patients (55%) developed seizures within 24 hours after operation. Eight had a supratentorial operation while the other 2 had an infratentorial operation. Among these patients, seizure occurred in 1 patient who had cardiac arrest caused by the profound blood loss during removal of posterior fossa tumor. Three patients who had surgical removal of choroid plexus papilloma of the lateral ventricle, craniopharyngioma and ependymoma had seizure caused by intraventricular bleeding with severe cerebral edema after the operation. Two patients had electrolyte disturbance. Intracranial hematomas with cerebral edema at the surgical sites were demonstrated by CT scan in the other 4 patients.

There were 8 patients whose onset of seizure was beyond 24 hours after operation. Six and 2 patients had partial seizures and generalized seizures, respectively.

DISCUSSION

Most published studies concerning seizures after intracranial operation have included patients of all ages. The prevalences varied from one specific study to the others with differences in locations of lesions, types of surgery and the duration of follow-up evaluation[1-3,5,8]. Convulsive seizure at the immediate postoperative period has been well recognized especially after the operation involving supratentorial region. Seizures occurring after posterior fossa surgery were rather uncommon. The prevalence of immediate or early postoperative seizures after infratentorial operation was much lower than that of the supratentorial surgery[1,2].

In the study conducted by Matthew et al, 22 of 118 patients (18.6%), who underwent intracranial surgery had seizures within the first postoperative week[4]. Fukamachi et al found 44 patients out of 493 (8.9%) had seizures within 48 hours after carniotomy; and in patients who had surgical removal of brain tumors, 37 of 275 patients (13.5%) had seizures[1].

The overall prevalence of seizures within 1 year after intracranial surgery was 11.6 per cent (18/155) in our pediatric patients. The two major underlying conditions which required surgical intervention in these patients were brain tumors and hydrocephalus. The prevalence of seizures after surgical treatment of brain tumors and V-P shunt placements were 15.7 per cent (16/89) and 1.8 per cent (1/55), respectively, which were similar to those of the previous reports in all age groups[1,4,8,9]. Postoperative seizures after surgical treatment of supratentorial tumors were 31 per cent which was higher than those of the infratentorial tumors (10.5%). Seventy per cent (7/10) of patients who had supratentorial tumor removal developed seizures within 24 hours. Surgical treatment of the tumors at sellar and thalamic regions had high incidence of postoperative seizures (5/11 and 2/4 respectively).

Seizures during the immediate or early postoperative period after posterior fossa surgery approaching through a suboccipital craniotomy were uncommon. Lee et al reported the incidence of 1.8 per cent among 726 patients who underwent posterior fossa operation. The incidence was highest in medulloblastoma (7.2%) followed by the incidence in surgical treatment for astrocytomas (2.3%)[2].

The overall prevalence of seizures after removal of infratentorial tumor in this series was higher than previous reports. The factor which might contribute to this high prevalence in this study was the delay in diagnosis of the underlying pathology. Many of the seizure patients had very large tumors with massive obstructive hydrocephalus. Associated congenital developmental defects, which might be the epileptogenic focus such as cortical dysplasia, were not excluded in any of these patients owing to the lack of brain imaging such as magnetic resonance imaging. At least 2 patients had partial seizures which occurred at the sixth and the ninth months after operations, respectively. Both patients had foci of seizures corresponding to the side of V-P shunts.

Copeland et al found 24 per cent of postoperative seizures in patients who had V-P shunting for hydrocephalus. The prevalence of seizures appeared to correlate with neither the pathological conditions causing hydrocephalus nor the age of the patients. The occurrence of a complicating infection significantly increased the prevalence of postoperative seizures[8]. In this series, seizures occurred in 1.8 per cent (1/55) of patients with V-P shunting operation for the treatment of hydrocephalus which was similar to most recent reports.

Regarding the etiology of convulsions in the postoperative period, Matthew et al described 2

important factors that would predispose to early seizures. One of which was the occurrence of seizures prior to surgery and the other was the location of the lesions, particularly of the sensorimotor strip[4].

In this study, the presence of focal cerebral lesions such as hematoma was the important factor related to immediate postoperative seizures. The investigations which included analysis of serum electrolytes revealed disturbances of sodium level in 2 patients who had seizures after surgical removal of tumors at sella region. CT scan of the brain performed in the patients who had immediate postoperative seizures demonstrated intracerebral hemorrhage with cerebral edema in 4 patients and intraventricular bleeding in 3 patients. These findings showed that the major cause of the immediate postoperative seizures was either localized lesion or the disturbance of the serum electrolytes especially sodium. A focal lesion would either directly irritate the cerebral cortex or indirectly decrease the threshold for convulsions. Alteration of the blood supply to the cerebral cortex might be another explanation of occurrence of seizures in these patients[1].

There is no definite conclusion regarding routine prophylactic administration of anticonvulsive drug for patients undergoing cranial operation. The recommendations varied from center to center [10-14]. There were some studies which did not demonstrate any statistically beneficial effects of phenytoin administration prior to surgery[15,16]. One recent study by De Santis et al demonstrated the beneficial effect of intravenous phenytoin administration in decreasing the prevalence of postoperative seizures[17]. However, the prevalence of seizures in patients who received phenytoin was 7.8 per cent which was not strikingly lower than that in our study. Despite the lack of antiepileptic drugs prophylaxis for postoperative seizures in our patients, the occurrence of seizures within one week after the operation was only 8.3 per cent (13/155). The seizures were readily controlled by administration of basic antiepileptic drugs such as phenytoin or phenobarbitone along with prompt detection and correction of the underlying causes.

At present, the administration of prophylactic antiepileptic drug is not routinely practiced in our institution. However, one must anticipate immediate postoperative convulsion in the patient who is undergoing surgical intervention for supratentorial lesions. It should be emphasized that in every child who has immediate postoperative seizures, rapid and effective control of seizures with appropriate antiepileptic drugs is mandatory. Prompt evaluation of the patient concerning the fluid and electrolyte balances and proper assessment for coexisting intracranial pathology causing seizures should be carried out. Management should be given accordingly as early as possible to reduce complications and morbidities in the patient.

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อาการชักภายหลังการผ่าตัดสมองในผู้ป่วยเด็ก

อนันต์นิตย์ วิสุทธิพันธ์, พ.บ., พงษ์ศักดิ์ วิสุทธิพันธ์, พ.บ.*, สุรางค์ เจียมจรรยา, พ.บ.*, จินตนา ศรีรัตนจารี, พ.บ.**

คณะผู้รายงานได้ทำการศึกษาย้อนหลังของอาการชักที่เกิดขึ้นภายในระยะเวลา 1 ปีภายหลังการผ่าตัดสมองในผู้ป่วยเด็กอายุต่ำกว่า 15 ปีในโรงพยาบาลรามาธิบดี ตั้งแต่เดือนมกราคม 2531 จนถึงเดือนธันวาคม 2535 เป็นเวลา 5 ปี พบว่ามีผู้ป่วยจำนวน 18 ราย ในจำนวนผู้ป่วยที่ได้รับการผ่าตัดสมองทั้งสิ้น 155 ราย หรือร้อยละ 11 เกิดมีอาการชัก โดยที่ผู้ป่วยส่วนใหญ่คือร้อยละ 55.6 จะเกิดมีอาการชักภายในระยะเวลา 24 ชั่วโมงแรกภายหลังการผ่าตัด โดยที่สาเหตุของอาการชักที่เกิดนั้นได้แก่ ความผิดปกติของสมดุลโซเดียม ภาวะเลือดออกในโพรงสมองหรือในเนื้อสมองร่วมกับมีอาการแสดงถึงการเสียหน้าที่ของสมองรวม จำนวน 2, 3 และ 4 รายตามลำดับ ผู้ป่วยจำนวนร้อยละ 72 จะมีอาการชักเฉพาะบางส่วน ผู้ป่วยที่ได้รับการผ่าตัดสมองส่วนเหนือต่อเทนทอเรียม เกิดอาการชักมากกว่าผู้ป่วยที่ได้รับการผ่าตัดสมองส่วนใต้ต่อเทนทอเรียม ในการศึกษานี้ไม่มีผู้ป่วยคนใดได้รับยากันชักก่อนได้รับการผ่าตัด และพบว่าอุบัติการของการเกิดการชักนี้ใกล้เคียงกับการศึกษาในต่างประเทศในผู้ป่วยที่ได้รับยากันชักก่อนการผ่าตัด คณะผู้ศึกษามีความเห็นว่ายังไม่มีความจำเป็นในการให้ยากันชักเพื่อป้องกันอาการชักก่อนการผ่าตัดสมอง และเน้นถึงความจำเป็นเร่งด่วนที่แพทย์จะต้องทำการตรวจค้นในผู้ป่วยทุกคนที่เกิดอาการชักภายหลังการผ่าตัดสมอง เพื่อหาสาเหตุของการชักที่อาจจะเกิดจากความผิดปกติของสมดุลสารน้ำและเกลือแร่ ภาวะเลือดออกในกะโหลกศีรษะหรือความผิดปกติอื่น ๆ ทั้งนี้เพื่อจะให้การรักษาที่เหมาะสมต่อไป

คำสำคัญ : อาการชัก, การผ่าตัดสมอง, สาเหตุ, ผู้ป่วยเด็ก

* ภาควิชากุมารเวชศาสตร์, คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี, มหาวิทยาลัยมหิดล, กรุงเทพ ฯ 10400