Medulloblastoma Operative and Postoperative Complications in Baghdad

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ABSTRACT

Background: Medulloblastoma is one of the most common posterior fossa tumors in childhood, most frequently found in the region of the 4th ventricle, adherent to the inferior medullary velum in the midline. The surgery related complications as well as outcome of medulloblastoma still remain a major challenge.

Objective: To clarify and detect the main perioperative complications of medulloblastoma, and to know the factors that lead to them. Then to determine the methods that can minimize the complications as much as possible.

Methods: This is a case series study conducted at the Neurosurgical Hospitals in Baghdad, between January to December 2014, on 39 patients with histopathologically proven as medulloblastoma. Clinical data was collected including symptoms and signs, in addition to assessment of radiological picture. Data regarding management of the patient including the dealing with hydrocephalus, and the definitive surgery of suboccipital craniectomy starting from anesthesia, positioning, surgical techniques, ending with postoperative care and follow up within 72 hours was recorded. After that analyzing of the correlations of these data to the intraoperative, immediate and early postoperative complications was done.

Results: The most common affected age group was between 5-7 years. Male to female ratio was (2.7-1). Hydrocephalus presented in 94% of patients, and 87% of the tumors were vermian. Ventriculoperitoneal (VP) shunts before definitive surgery was done for 94.8% of the patients. Sitting position was used in 77% of patients and prone in 23%. All patients were operated on by suboccipital craniectomy, gross total resection of the tumor was done in 56%, subtotal resection was done in 36%, while 8% partial resection was done. Bradycardia and arrhythmia was the most common intraoperative complication, followed by cerebellar herniation. The most common postoperative complications were cerebellar dysfunction (20%), cranial nerve injury (16%), and mutism (10%).

Conclusion: Gross total removal of tumor should be the gold standard of neurosurgeon. Midline, classical type, vascular and brain stem violating medulloblastomas are associated with more perioperative complications. Brain stem violation was the main factor that affects the outcome.

Keywords: Medulloblastoma, Posterior fossa, Surgical perioperative complication.

Iraqi Medical Journal Vol. 63, No. 2, July 2017; p.198-204.

Medulloblastoma is a malignant tumor common in the pediatric population but relatively rare in adults, representing only 1% of adult CNS tumors. These tumors are homogeneously enhancing on contrast CT scan, whereas T2-weighted MRI shows hyperintensity[1]. They most commonly occur in the midline, vermian region. Ideal treatment involves a combination of surgery (with maximum resection possible) and adjuvant radiation therapy with possible chemotherapy[2,3]. Recurrence occurs in 30% of the time and may require chemotherapy. Medulloblastoma often causes obstructive hydrocephalus; however, management of this is problematic[4]. Ventriculoperitoneal (VP) shunts can be used, but they can serve as a vector for metastasis. Therefore, the use of a VP shunt to control hydrocephalus should be deferred unless medical management fails[1].

Methods

This is a case series study conducted at the Neurosurgical Hospital in Baghdad between January to December 2014. It was conducted on 39 patients with

histopathologically proven as medulloblastoma.

The patients had different ages, ranging from 3 to 34 years of both sexes and different geographical regions of Iraq.

Clinical data were collected; chief complaint and its duration, other symptoms, and signs. Signs and symptoms were analyzed before and after shunt operation then following tumor resection.

All patients were admitted and investigated, skull x-ray done for patients looking for signs of increase intracranial pressure (ICP) and thinning of the occipital bone. Native CT scan was done for all patients and 14 patients of them with contrast.

The same items mentioned before were reported for MRI which was done for 20 of the patients.

The initial surgery was mostly VP shunt or direct posterior fossa craniectomy with external drainage. Posterior fossa surgery was done under general anesthesia in all patients, usually in sitting position (30 patients, 77%) and in prone position (9 patients, 23%) with Sugita head holder.

Tumor resection was usually done by suction and cautery only in 30 patients, or to less extent with the Cavitron ultrasonic aspirator (CUSA) in 9 patients.

Postoperative CT scan was done for all patients for follow up purposes and because of deterioration in the level of consciousness or other postoperative complications. Patients followed up for 72 hours postoperatively, and surgical mortality was defined as death within the postoperative period (72 hrs).

Results

In this study it was found that the median age of the patients at diagnosis is 13 years, and 83.3% (25 patients) are diagnose by age below 15 years. Male to female ratio was 2.7:1.

Funduscopic examination was done for all patients with medulloblastoma and the examination was normal in 24% of patients and shows papilledema in 76% of patients significant factors indicate delay diagnosis like papilledema with p value 0.007 and disturbed level of consciousness, (Table 1). Hydrocephalus was presents on CT scan in 37 patients (94%), (Table 2). Shunt operation was conducted before tumor resections in 28 patients from them 17 had emergency shunt within 24 hours and in 11 patients elective shunt after 24 hours. All shunt procedures were ventriculo-peritoneal and site of the ventricular catheter was either frontal or posterior parietal, (Table 3). Total removal was achieved in 22 cases (56%) those were tumors that did not invade the brainstem and were well demarcated. Three patients had only partial removal, (Figure 1). According to histopathology report, medulloblastoma was classic in 18 patients (46%) and desmoplastic in 15 patients (39%), (Table 4). These include bradycardia and arrhythmia in 8 patients (28%). This usually occurs when there is manipulation of brainstem. The most post operative complication was cerebellar dysfunction in 6 patients (20%), (Table 5). In this study, two patients died, (Table 6), due to brainstem edema and postoperative persistent unresponsiveness.

Table 1: Frequency of signs of the patients enrolled in the study.

Signs	No. of patients	% of patients
Papilledema	23	76
Ataxia	18	60
Incoordination	5	17
Dysmetria	5	17
Intension tremor	4	13
Disturbed level of consciousness	4	13
Cranial nerves palsy (VI, IX, X)	3	10
Nystagmus	2	7
Dysartheria	1	3

Table 2: Incidence of hydrocephalus of the patients enrolled in the study.

	No. of patients	% of patients
Hydrocephalus	37	94.8
Normal ventricles	2	5.2

Table 3: CSF diversion procedure.

CSF diversion procedure		Number of patients
Shunt	Emergency	17
	Elective	11
Non shunt (surgery + External drain)		2

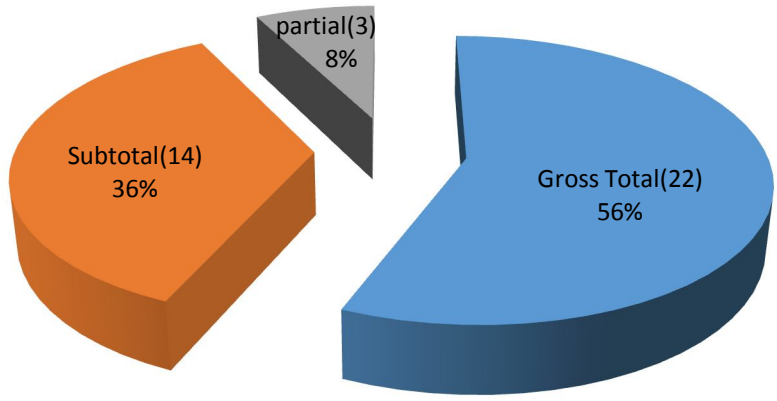

Figure 1: Extent of tumor resection.

Table 4: Frequency of histopathological types of tumors of the patients enrolled in the study.

Histological type	No. of patients	% of patients
Classical type	18	46
Desmoplastic type	15	39
Large cell type	4	10
Anaplastic	2	5

Table 5: Intraoperative and postoperative surgical complications seen in patients enrolled in the study.

Intraoperative complications			**Patients no. (%)**
Hemodynamic instability (bradycardia, arrhythmia)			**8 (26.7)**
Massive swelling and cerebellar herniation			**2 (6.7)**
Severe bleeding			**1 (3.3)**
Skull perforation with fracture			**1 (3.3)**
Postoperative complications			**Patients no. (%)**
Immediate (< 6 hr)	**Persistent unresponsiveness**		**3 (10)**
	Hematoma	**Intracerebellar**	**2 (6.7)**
		Extradural	**1 (3.3)**
Early (< 72 hr)	**Cerebellar dysfunction**		**6 (20)**
	Cranial nerves injury		**5 (16.6)**
	Cerebellar mutism		**4 (13.3)**
	Tension pneumocephalus		**2 (6.7)**
	Pseudobulbar palsy		**1 (3.3)**
	Long tract signs (hemiparesis)		**1 (3.3)**
	CSF leak		**1 (3.3)**

Table 6: Surgical mortality among the patients enrolled in the study.

Number of patients	**Age (years.)**	**Cause of death**	**Time of death**
1	4	Brain stem edema and postoperative persistent unresponsiveness	24hrs postop.
1	11	Brain stem edema and postoperative persistent unresponsiveness	72hrs postop.
Total: 2 (5%)			

——————————Discussion

The present study demonstrated that the most common age group affected was between 5 and 11 years, While DP Muzumdar et al, suggested that the most common age group affected was between 3 and 12 years[5].

The mean age at presentation in the present study was 13 years, while E Helseth, T lundar et al, found in their study that the mean age at presentation was 8.10 years[6].

Males were more affected than female in this study (28 males, and 11 females), with male to female ratio was: (2.7:1). It was (1.6:1) in the study of C Akyus et al[7], the study of DP Muzumdar et al[5], and Agerlin N, Gjerris F, Brincker H et al which show male to female ratio (2:1)[8].

The most common presenting symptoms of patients in the current study were vomiting 77% and headache 73%. This was agreed by the study of RD Alston et al, the vomiting was the commonest (88%)[9]. While in the study of DP Muzumdar et al[5], which were 75.3% and 63.2% for headache and vomiting, and the study of A Urberuaga et al, which were 78% and 70%[10].

In this study, 76% of the patients presented with papilledema, while in the study of D Muzumdar et al[5], 63% presented with papilledema, which is significant different value (p value=0.0071), which is also can be explained by delayed diagnosis.

Midline Vermian site was the dominant over the hemispheric (87%,13% respectively) in this study, which also was in D Muzumdar et al (91%, 8%)[5], and A Urberuaga et al (64%, 36%)[10].

In 26% of the patients the radiology demonstrated brain stem invasion, and most of these patients presented with cranial nerve deficit. This was lower than that of D

Muzumdar et al in which, 42% of the patients had brain stem involvement[5].

Most of the patients of medulloblastomas in this study presented with obstructive hydrocephalus at admission (94.8%) as a result of obstruction of 4th ventricle by the tumour. This was agreed by the studies of D Muzumdar et al (92.5%)[5], and A Urberuaga et al (95%)[10]. In the present study, most of the obstructive hydrocephalus cases were severe, and emergency VP shunts were done for them (59%), which can be explained by delayed diagnosis and presentation.

Most of neurosurgeon in our hospital indicated precraniectomy shunting for these patients, concluding that it will improve the clinical features of raised ICP, provide lax brain during tumour resection and facilitate smooth postoperative course, as reported by Griwan et al[11] and Goel[12]. Furthermore, Lee et al concluded that patient with extensive tumour that present in late stage of disease, especially in developing countries, are most likely to benefit from precraniotomy shunting[13].

Two complicated cases occurred after VP shunting, one case developed malfunctioning of the shunt before the definitive surgery and was operated on for shunt revision, the other case developed serious complication which was upward transtentorial herniation, this patient developed deterioration of consciousness 3 hours after the surgery of VP shunt and CT scan done for him, and after that urgent suboccipital craniactomy and debulking of the tumour done for him.

All patients in this study underwent suboccipital craniectomy, sitting position was used in 30 patients (77%), while prone position was used in 9 patients (23%). In this study, sitting position was not used for age group below 5 years. In patients operated on by sitting position, the major problem which was encountered was the pneumocephalus which affect high percentage of patients. Also, fracture of skull resulting from fixation of the head by pins was recorded in one case.

In 22 patients (56%) gross total resection was done, and in 14 patients (36%) subtotal resection of the tumour was done, while in 3 patients (8%) partial resection of the tumour was done. This percentage was approximately equal to that of C Akyus et al (56.7% total, 38.3% subtotal, and 4% partial)[7].

The most important parameter that affect the extent of tumour removal was brain stem violation, indicated by the intraoperative development of bradycardia and/or arrhythmia during the surgeon's attempt to remove the tumour from the fourth ventricle floor, and the high vascularity of the tumour[10,15,16].

Postoperative check CT scan was performed for all the patients, evaluating extent of tumour removal and searching for postoperative complications.

Postoperative CT scan, as Morreal et al concluded, was more reliable than surgeon's estimate of the extent of tumour removal during surgery[14]. Among 17 patients presumed by surgeon to be totally removal, only 2 patients showed residual tumour on postoperative check CT scan.

So generally, CT scan confirmed surgeon's estimation of tumour removal in 88% of cases. Karoly et al reported 79% confirmation between surgeon's judgment of tumour removal and CT scan finding[17].

The histopathological results of the tumours in this study was mostly of classical type in 18 patients (46%), desmoplastic in 15 patients (38%), large cell in 4 patients (10%) and anaplastic in 2 patients (5%).

The tumour of desmoplastic histopathology occurs in the patients older than 16 years and all of them were hemispheric. This predominance of classical type also shown in the study of D Muzumdar et al (92.2%)[5].

Intraoperative bradycardia was developed in 25% of patients in this study, which resulted from brain stem manipulation during the surgeon's attempt to remove the tumor from the 4th ventricle floor[11,18]. So, this complication affect significantly on the degree of tumor resection as demonstrated in the results of this study (mostly surgery ends with subtotal resection, P value=0.03).

In this study, this complication occurred mostly in the vermian midline tumors, and

there is strong correlation with tumors that invaded the brain stem, (P value<0.001).

Three patients (8%) in this study developed massive swelling and cerebellar herniation. The only factor that is significantly related to this complication found in this study was the extent of tumor resection, (P value=0.025). So, it occurred more common on cases end with subtotal or partial resection than total resection.

Intraoperative severe bleeding occurred in one patient during the opening of dura. The source of bleeding was from the occipital sinus which was hardly controlled by clipping[3,19,20].

Skull perforation occurred in 3 years child during skull stabilization by pins. This case was complicated postoperatively by small EDH, and managed conservatively. Tew JMJ, and Scodary DJ found that in age group between 2-4 years the use of pins for fixation should be with caution and better to use padded horseshoe and prone position[21].

Air embolism was not detected in any case in this study, this explained by the low sensitive monitoring devices used for the detection of it. The high sensitive devices (primordial Doppler, and transesophageal echocardiography) not available in our hospital.

Four patients in this study developed persistent unresponsiveness postoperatively. One of them suboccipital craniactomy was done urgently for decompression of the tumor as a result of developing upward herniation post shunting. In this patient and in another one, post-operative CT scan revealed brain stem edema.

In the other patients, post-operative CT scan revealed intraparenchymal cerebellar hematoma with pressure effect on brain stem, that was operated on immediately. Despite the relation was not significant, in 2 of these patients brain stem invasion by the tumor was present (P value=0.5).

Postoperative hematoma occurs in 3 patients (10%), 2 of them was intracerebellar and one of them was extradural. This result approximates to that of D Muzumdar et al, which demonstrated incidence of 7% post-operative hematoma in patients operated on between 1985-2000. But it disagrees that of the same study of patients operated on between 2001-2010(zero)[5]. Advanced neurosurgical techniques and microscopic surgery still highly restricted in our hospitals, which play role in the prevention of such complication.

The most common postoperative complication in this study was cerebellar dysfunction, 8 patients (20%), as ataxia, dysmetria, and nystagmus.

In 4 patients of them was associated with cerebellar mutism. This association was termed by J Siffert et al as postoperative cerebellar mutism syndrome (CMS). He demonstrated the percentage of patients undergoing cerebellar or IV tumors may reach to 25%[23]. In our study this association occurred in 10%.

Post-operative cranial nerve injury percentage within the patients in the study of D Muzumdar et al was 26% in patients group between years of 1985-2000, and 9% in patients group between years of 2001-2010[5]. The present study demonstrated a percentage in between those of D Muzumdar et al study, it was 16%. VI and VII cranial nerve were the most affected[5].

The occurrence of this complication was significantly related to brain stem invasion by the tumor (P value=0.005), and to surgeries end with subtotal tumor resection (P value=0.018).

Cerebellar mutism occurred in 4 patients in this study (10%), which is always associated with vermian located tumors. This result was approximately agreed by that of V Donger HR et al, which demonstrated an incidence of 16%[24]. But it is quite different from that of D Muzumdar et al (2%)[5].

Pneumocephalus was developed in 18 patients, and all of them were operated on by sitting position. Only, in 2 of them there were serious tension pneumocephalus and required tapping.

Pseudobulbar palsy was documented in 1 patients; this patient had brain stem invasion by the tumor. In spite of patients' recovery, it was considered a serious complication because it led to aspiration pneumonia and the patient was managed by tracheostomy.

It was observed in this study that patients presented with disturbed level of consciousness had in addition to hydrocephalus, brain stem invasion by the tumor. And they were more risky for developing perioperative complications such

as hemodynamic instability, postoperative unresponsiveness, and cranial nerve injury.

Mortality within 72 hours post-operatively was reported in two cases (5%), proceeded by postoperative persistent unresponsiveness. Mortality rate was 8% in the study of D Muzumdar et al within patients group between years 1985-2000, and 2% within patients group between years 2001-2010[(5)].

In conclusion; V-P shunt before definitive surgery carried a risk of serious complications and one of them that occurred in our study (upward herniation). Early post-operative mortality mainly resulted from brain stem edema, that resulting from brain stem injury.

We recommend using of intra-operative neuro-physiological monitoring to decrease cranial nerve injury. Endoscopic third ventriculostomy (ETV) may be better than v-p shunt to decrease complication and CSF metastasis. Gross total removal of tumor should be the goal of neurosurgeon.

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IMJ 2017;63(2):198-204.