

Pre operative need  
for  
ventriculoperitoneal  
shunts in children  
health and social ...



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## **Abstract**

**Objective:** The present study was based on the hypothesis that reducing ICP in patients with posterior fossa tumors presented with hydrocephalus is a predictor of a successful tumor resection surgery and enhanced patient outcomes. **Methods:** Between December 2010 and December 2012, 23 pediatric patients with posterior tumor fossa with symptomatic hydrocephalus admitted in the pediatric neurosurgery department at the First Affiliated Hospital of Xinjiang Medical University, were studied retrospectively. Fourteen patients received VP shunting prior to elective tumor resection surgery. The remaining 9 patients underwent elective tumor resection surgery directly. **Results:** ICP in majority of the preoperative group resolved and improved their general clinical conditions. However, few in the un-shunted group had uncontrolled postoperative ICP requiring postoperative VP-shunting. **Conclusion:** Preoperative shunting reduces ICP significantly of the tense posterior fossa and provide more appropriate approach for tumor resection and decrease the rate of postoperative complication . However, further studies are warranted to elucidate the postoperative effects of preoperative VP shunting. **Key words:** posterior tumor fossa, hydrocephalus, intracranial pressure, ventriculoperitoneal shunt

## **2. Introduction**

Tumors occurring in the central nervous system (CNS) are solid neoplasms frequently observed in infancy. These tumors frequently occur in the posterior cranial fossa [1, 2]. Posterior fossa is a small space in the

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intracranial cavity cradled on all sides by bone and restricted from the above by the tentorium cerebella [2]. In childhood ( $\leq 15$  yrs) more than 50% of tumors of the central nervous system (CNS) originate from the posterior cranial fossa, as compared to  $< 5\%$  cases in adulthood. Most pediatric patients with such tumors are often presented with symptoms of hydrocephalus, characterized by accumulation of excess cerebrospinal fluid (CSF) in the ventricular system brain and therefore, increasing intracranial pressure (ICP). If uncontrolled, ICP can lead to permanent brain damage, life threatening sequelae, and mortalities. The main goals of treating such pediatric patients are to enhance remission of both ICP and brain tumors. Ventriculoperitoneal (VP) shunting (for preoperative CSF diversion) or endoscopic third ventriculostomy (ETV) coupled with tumor resection surgery are the standard treatments of these patient group [1, 2]. However, in childhood, such tumorous lesions are frequently proximal to the fourth ventricle therefore, pointing to the high cases of obstructive hydrocephalus, in this patient group [3]. Hydrocephalus is medical condition characterized by accumulation of excess cerebrospinal fluid (CSF) in the ventricular system and cisterns of the brain. The most serious clinical implication of hydrocephalus is increased intracranial pressure (ICP) that can damage the brain [3, 4]. The primary goals of treating pediatric patients with posterior fossa tumor coupled with hydrocephalus are to enhance remission of both ICP and brain tumors [5]. Although surgical excision of the tumorous brain lesions is the definitive procedure, the quality of life of these patients is often degraded by the continuously surging ICP, before tumor resection surgery is carried out [4-6]. In the view of moderating ICP, the use of ventriculoperitoneal (VP) shunts for postoperative CSF diversion has <https://assignbuster.com/pre-operative-need-for-ventriculoperitoneal-shunts-in-children-health-and-social-care-essay/>

remained the gold standard practice in the management of non-obstructive hydrocephalus in children with posterior fossa tumors [5-7]. With improvements in the preoperative diagnosis of hydrocephalus and shunting procedures, neurosurgeons suggested shunting before tumor extraction [8]. Although some pediatric patients with posterior fossa tumors may undergo tumor resection surgery without ETV or postoperative CSF diversion through VP shunting, it is becoming increasingly difficult to ignore the clinical benefits demonstrated by these preoperative procedures [10, 11]. Given that, some patients may require postoperative CSF diversion, it is important to investigate if postoperative VP or ETV procedures moderates postoperative ICP and associated complications [10]. The present study was based on the hypothesis that reducing ICP in patients with posterior fossa tumors coupled with hydrocephalus is a predictor of a successful tumor recession surgery. In this regard, reducing ICP preoperatively is likely to enhance pre- and postoperative outcomes and minimize potential complications. Therefore, the objectives of this paper are to determine whether there is a need for preoperative VP shunting in pediatric patients with posterior fossa tumors with hydrocephalus, scheduled to undergo tumor recession surgery.

### **3. Methods**

This study enrolled 23 pediatric patients with posterior fossa tumor with symptomatic hydrocephalus admitted in the pediatric neurosurgery department at the First Affiliated Hospital of Xinjiang Medical University, Urumqi, China. The study was carried out retrospectively between December 2010 and December of 2012. Therefore, patients with asymptomatic hydrocephalus and those already shunted at the beginning of the study,

were excluded from the study. Preliminary medical records pertinent to this study were obtained from the hospital. All the 23 patients were started on daily doses of anti-inflammatory agents (corticosteroids), and underwent computerized tomography (CT) scans, upon admission to the hospital. Upon successful CT scans confirming tumor location and intracranial pressure ICP, the patients either received preoperative shunting procedures prior to their tumor resection surgeries (posterior fossa surgery) or directly underwent elective tumor resection surgeries. Therefore, the patients were divided into two groups; the preoperative (n= 14) and non-preoperative (n= 9) groups. Patients in the preoperative group received VP shunt to reduce ICP and relieve from symptoms caused by elevated ICP. On the other hand, the non-preoperative group underwent tumor resection surgeries with neither ETV nor VP shunts. The VP shunt group comprised of some exclusive patients with emergency cases of hydrocephalus with severe ICP. These patients underwent magnetic resonance imaging (MRI) on their brain and whole spine prior to undergoing preoperative VP shunt procedure. The VP shunt group comprised of 14 patients who received VP shunts prior to their elective tumor resection surgeries. To evaluate ICP progress, the VP shunt group received follow-up CT scans immediately after VP shunting procedure while waiting for an elective tumor resection surgery. On the other hand, the non-preoperative group comprised of nine patients who received CT-scans to trace their tumor location and directly underwent elective tumour recession surgery, without insertion or establishment of any form of shunts. This group also received follow-up CT scans to monitor their ICP. All the 23 patients received followed-up CT scans after tumor resection surgery to monitor their recovery progress and the recurrence patterns of ICP. The follow-up CT scans <https://assignbuster.com/pre-operative-need-for-ventriculoperitoneal-shunts-in-children-health-and-social-care-essay/>

were scheduled after 3 days, 7 days, 16 days and after 2 months.

Descriptive analysis and comparison was performed in both groups and were made by using SPSS for windows using version 10. The following patient outcomes were noted: duration of tumour recession surgery, incidences of surgical complications, sign and symptoms of ICP, improvement of hydrocephalus and cases of postoperative VP shunting.

#### **4. Results**

Twenty-Three pediatric patients with posterior fossa tumor had symptomatic hydrocephalus with notable intracranial pressure (ICP). There were significantly high number male patients (n= 19) as compared to their female counterparts (n= 4). The ages of the enrolled pediatric patients ranged from 3 months to 12 years, with a mean age of 6. 7 years. There were 8 (34. 78%) cases of cerebellar astrocytoma, 5 (21. 73%) cases of medulloblastoma, 3(13. 04%) cases of brainstem glioma, 3 (13. 04%) cases of ependymoma, 2(8. 69%) of cerebellopontine angle tumors, 1 (4. 34%) cases of cerebella dermoid cysts, and 1 (4. 34%) case of cerebella cavernous hemangioma (see table 1). Table 1: Distribution of the types of posterior fossa tumors in the enrolled patients and demographic data

**Tumor****n (%)****Males(n)****Females(n)****Mean Age (yrs)**

Cerebella astrocytoma 8(34. 78)616. 1Medulloblastoma 5(21. 73)506.

4Brainstem glioma 3(13. 04)305. 3Ependymoma 3(13. 04)217.

6cerebellopontine angle tumors 2(8. 69)207. 3cerebella dermoid cysts 1(4.

34)028. 2cerebella cavernous hemangioma 1 (4. 34)106. 4

**Total****23(100%)****19****4****6. 7**

A total of 14 patients (60. 86%) underwent a preoperative procedure prior to their elective brain tumor resection surgery. In the preoperative group, 14 patients received VP shunts. The duration of insertion of the VP shunts ranged from 12 to 27 minutes with insertion duration of 17. 5 minutes. Follow-up CT scans immediately after VP procedure show that the signs and symptoms of the surging ICP reduced significantly in all 14 patients in the preoperative shunting group, respectively. Further follow-up CT scans, of patients in the VP group, respectively, showed no complications within 36 hours of insertion. No any complications were observed in the patient awaiting elective tumor resection surgery. All of 23 patients successfully

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underwent their elective surgery between the day 2 and day 7 of their admission in the hospital.

## **Preoperative Findings**

### **Preoperative group**

#### **Non-preoperative**

#### **VP(%)**

#### **Non-preoperative (%)**

#### **Number of Patients**

14(100)9(100)

#### **CSF-leak**

01(11. 11)

#### **Blocked VP shunt**

0N/A

## **Postoperative VP-shunting**

02(22. 22)

## **Postoperative seizures**

00No Significant preoperative complications were noted at all in preoperative shunted group. On the other hand, in non-shunted group, one patient (11. 11%) had csf-leakage complication and 2 patients (22. 22%) were evidenced by the surging ICP that necessitated post-operative shunting.



## 5. Discussion

Hydrocephalus is an important clinical presentation of pediatric patients with posterior fossa tumors. Papilledema and visual impairment, seizure and impaired consciousness are among the problems caused by hydrocephalus. Although tumor resection surgery is the definitive procedure in this patient group, the surging preoperative ICP pose the risk of permanent brain damage. This strongly reveals the suggestion of the need of preoperative CSF diversion prior to tumor resection surgery [3, 4]. Ventriculoperitoneal (VP) shunting is the standard procedure for postoperative CSF diversion appropriate in cases of non-obstructive hydrocephalus. The current clinical guidelines recommend VP shunting of hydrocephalus patients for 1-2 weeks prior to craniotomy. This allows decompression of ventricles to allow better operative field [11]. About a third of patients with posterior fossa tumors coupled with symptomatic hydrocephalus require continuous CSF diversion necessitating permanent postoperative VP shunting [11]. Despite previous controversies, now most pediatric neurosurgeons have gained significant insights on the clinical benefits using endoscopic third ventriculostomy (ETV) in patients with posterior fossa tumor presented with obstructive hydrocephalus. Importantly, ETV is important in emergency cases of severe hydrocephalus induced by posterior fossa tumors and in postoperative period [12-14]. In Some patients with previously " failed" ETV subsequently requires VPS insertion [15]. It is unclear whether or not the success of of an ETV is more sustainable than a shunt because the relative risk of an ETV is initially higher than that of a shunt but drops below the failure of a shunt after 3 months, and the long term benefit of ETV can be realized in several years [16]. The present study sought to re-establish the need for and the

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clinical benefits of preoperative procedures (VP) in this patient group. In the present study, four patients (28. 57%) received VP shunt in the emergency setting. This strongly supports the high incidence of posterior fossa tumors located proximal to the fourth ventricle, pointing to the etiology of obstructive hydrocephalus [3]. Furthermore, this implies that VPS or ETV which are life-saving procedures in emergency cases of severe hydrocephalus [12, 24, 25]. Both ETV and VPS are different procedures with different tools having almost same effect on patients with hydrocephalus by reducing the elevated ICP. ETV requires endoscopic video equipment and single-use endoscopes are more expensive (\$400 including endoscope and catheter bal-loon) than shunts (\$275 for a shunt). So VPS is still reasonable option for RPA grade metastasis patients with hydrocephalus [17]. Patients who received preoperative VPS or ETV exhibited significant remission of the surging ICP and underwent useful tumor resection surgery, without complications. In this regard, none of preoperative group had postoperative ICP elevation requiring postoperative VPS shunting. This was very significant as compared to 33. 33% in the non-preoperative group. Although administration of steroidal anti-inflammatory agents (corticosteroids) prior to tumor resection surgery enhances remission of posterior fossa swelling, this clinical strategy seems not efficacious in moderating ICP [12, 18, 23]. This strongly supports that precraniotomy procedures (VP or ETV) significantly enhance remission of ICP prior to craniotomy [11]. The surgeon's interpretation of total or near total extraction of the tumor bulk is more closely correlated with postoperative CT diagnostic findings when operating field is decompressed. In this regard, such precraniotomy procedures improve patient's general physiological conditions; therefore minimize

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potential complications during tumor resection surgery and allows smooth postoperative course of treatment. Technical differences were found during tumor resection surgery in both groups. In preoperative shunted group, the craniotomy was found to be done with much ease comparing to patients in un-shunted group with high tension of ICP. While the opening of dura in patients of unshunted group there is always high risk of cerebral cortex damage because of its adhesion to dura caused by elevated ICP which proceeds with different complications during and after surgery. The quality of life of patients with posterior tumor fossa in the postoperative period depends on the dependency of postoperative shunting. Although such patients undergoing tumor resection surgery require precraniotomy shunting, this may influence their postoperative need for CSF diversion through routine or permanent shunting [19, 10]. A similar recent study investigated the difference in postoperative outcomes between similar groups of patients who received the preoperative VP shunting and those who did not. The study demonstrates that although preoperative VP shunting relieves ICP pressure, it necessitates postoperative shunting in some cases [20]. Two recent studies have demonstrated that younger age and severity of hydrocephalus prior to tumor resection are good predictors of postoperative hydrocephalus [21, 22]. However, in the present study, the age of patients who required postoperative shunting was between 8 months and 6 years. Therefore, although results in the present study support the need of preoperative shunting in the view of ICP, further more it should be investigated clinically in order to improve patient outcomes.

## **6. Conclusion**

Hydrocephalus characterized by surging ICP is a very important clinical presentation of patients with posterior fossa tumors. Although tumor resection is the definitive procedure for such patients, the success or failure of managing ICP preoperatively can influence postoperative outcomes. Findings from the present study support the need for preoperative CSF diversion through VP shunting. Preoperative shunting reduces ICP significantly of the tense posterior fossa and provides more appropriate approach for tumor resection. The group of patients with preoperative shunting had significantly less postoperative complications, and a considerable percentage of those without preoperative shunting needed it later in the course of their disease. Further studies are warranted to elucidate if VP and ETV are strong predictors for the need of postoperative shunting.