

## Post Traumatic Hydrocephalus: A Review of 68 Cases

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### ABSTRACT

**Objective:** To evaluate different factors affecting post traumatic hydrocephalus.

**Material and Methods:** This retrospective study was conducted in the department of Neurosurgery, Postgraduate Medical Institute, Lady Reading Hospital Peshawar from July 2009 to June 2011. Record of all head injury patients was reviewed. Out of 5438 admitted patients with head injury, those who developed post traumatic hydrocephalus were included in the study.

**Results:** A total of 68 patients with post traumatic hydrocephalus were diagnosed over the last two years. Out of these 47 (69%) were male and 21 (31%) female. Mostly they were of young age group between 08 years to 41 years. Mean age of presentation being 20 years. A large group 56 (82%) out of 68 patients were in state of moderate to severe head injury, diagnosed within matter of hours or days, as acute post traumatic hydrocephalus. Those who developed after two weeks, fall in group chronic post traumatic hydrocephalus. Out of these, 55 (81%) patients underwent some sort of CSF diversion procedure like external ventricular drain (EVD) or Ventriculo Peritoneal (VP) Shunt. Subarachnoid hemorrhage, intraventricular hemorrhage, intracranial hematoma, posterior fossa bleed, meningitis and craniotomy were recognized associative factors for development of PTH. There was improvement in about 59% after surgery. And the long term prognosis, expressed in GOS, was good in 44% of the cases.

**Conclusion:** Post traumatic hydrocephalus is a dangerous complication and needs critical consideration and early diagnosis in severe head injury cases.

**Key Words:** Head injury, Post traumatic hydrocephalus, External ventricular drain, VP shunt.

### INTRODUCTION

Post traumatic hydrocephalus is a well known manageable complication after head injury. Its incidence varies greatly in different studies. It is more common in cases with severe head injury with GCS 3 to 8 on presentation, as compared to mild and moderate head injury. The incidence of PTH is significantly lower in cases of mild head injuries and ranges from 0.75% to 10.7%.<sup>1,23</sup> This larger variation in incidence may be due to associated risk factors like subarachnoid hemorrhage, intraventricular hemorrhage and craniotomy procedure for such cases. However the incidence in patients with hydrocephalus, a previous head injury has been implicated as a cause in 2 to 50%.<sup>4,6,10</sup> On the other hand head injury patients have the incidence of

hydrocephalus from 1% to 90%.<sup>5,7,8,9, 12,13,15,16</sup>

The dilatation of ventricles after head injury is common due to post traumatic cerebral atrophy (hydrocephalus en vacuo) which is well differentiated from PTH.<sup>27</sup> Post traumatic hydrocephalus is an active and progressive process of CSF accumulation following cranial injury.<sup>14</sup> Ventricular enlargement is a consequence of space left by degeneration of white matter, which was clear around lateral ventricles in most of chronic hydrocephalus with more than two weeks after head injury. However it is usually associated with other abnormalities in acute cases diagnosed on CT scan findings such as acute subdural hematoma, intraventricular hemorrhage, subarachnoid hemorrhage, supratentorial clot with unilateral ventricular dilata-

tion, posterior fossa space occupying lesion, intracerebral contusion and pneumocephalus. Delayed intraventricular hematoma and hydrocephalus have known association following evacuation of post traumatic acute subdural hematoma.<sup>2,17,18,19</sup> Hypoxic – ischemic insult is main contributory factor in chronic cases with post traumatic hydrocephalus,<sup>11,26</sup> these may have minimal or no changes in earlier post traumatic CT scans. They may have few or no symptoms or rarely present with symptoms that necessitate urgent intervention. On the other hand acute cases are observed in shorter post traumatic periods by the help of serial CT scans on clinical grounds.

## MATERIAL AND METHODS

### Patients

All admitted 5438 patients with head injury at Neurosurgical Unit, Neurosurgical ICU, or Neurotrauma Unit PGMI/Govt. of Lady Reading Hospital Peshawar from July 2009 to June 2011 were retrospectively studied. Data analyzed regarding the incidence, age, sex, mode of injury, clinical findings, CT Scan finding, onset of Post traumatic hydrocephalus, neurosurgical intervention and outcome. Records, OT registers, previous admission charts and available CT scans were scrutinized to take help for relevant information. We encountered 68 patients of PTH, representing 1.25% of the total 5438 head injury cases.

### Radiology

Initial CT scan of all those suspected PTH patients admitted to neurosurgical unit in emergency was compared to the serial CT scans taken on clinical suspicion. Those with positive clinical suspicion and increasingly dilating ventricular system on CT scan were included. And an Evans' index  $\geq 0.30$  was taken into consideration if previous scan was comparatively in normal limits. Those with dilated temporal horns ( $\geq 2$  mm) of lateral ventricles, dilated 3<sup>rd</sup> ventricle ( $\geq 5$  mm), periventricular hypodensity (translucency) and diminution of fissures, sulci and cisterns all favored points in PTH were also taken into consideration for diagnosis. All cases with dilated ventricular system with 60 years age or more, severe comorbidities or previous VP shunted patients were excluded. Other associated CT findings were also noted. And unilateral ventriculomegaly noted in some of large hematomas.

The patients with low GCS, external ventricular drains were put in, and those patients with GCS 10 and

above, ventriculoperitoneal shunt were inserted.

Data analysis was performed through SPSS version 10.0. Frequencies and percentages were computed to present categorical variables like age, sex, CT findings, per op findings, and improvement.

## RESULTS

A total of 68 patients were diagnosed as PTH of total 5438 admission head injury cases. Out of these 47 (69%) were male and 21 (31%) female. Mostly they were of young age group between 08 years to 41 years. Mean age of presentation was 20 years. A large group of (82%) patients presented in state of severe head injury, and were diagnosed within matter of days, as acute post traumatic hydrocephalus. Remaining (18%) patients, who developed PTH after two weeks, fall in group chronic post traumatic hydrocephalus. Acute PTH cases are associated with of intracranial pathologies like intraventricular, intracerebral hematoma or subarachnoid hemorrhage.

Out of these, 55 (81%) patients underwent some sort of CSF diversion procedure like external ventricular drain (EVD) or Ventriculo Peritoneal (VP) Shunt. Subarachnoid hemorrhage, intraventricular hemorrhage, intracranial hematoma, posterior fossa lesion, meningitis and craniotomy were recognized associative factors for development of PTH. There was improvement in about 59% after surgery. And the long term prognosis, expressed in GOS, was good in 44% of the cases. There were 4 mortalities recorded in first group.

## DISCUSSION

Ventricular enlargement is a common sequel of severe

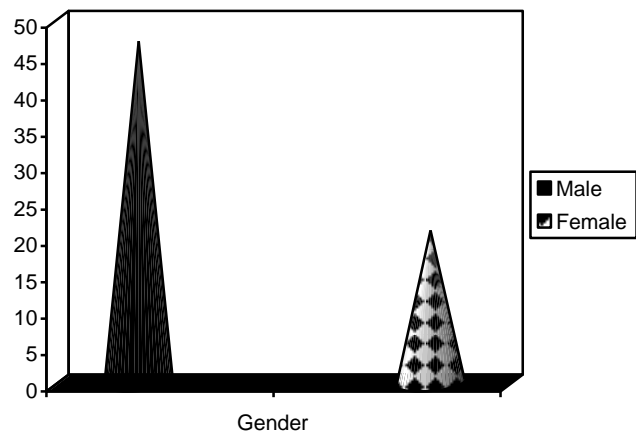


Fig. 1:

**Table 1:** Total head injury admissions between July 2009 and June 2011.

Total Admissions (GCS)	No. of Cases	Incidence of PTH
Mild head injury (13 – 15)	2565	02 (3% of all PTH)
Moderate head injury (9 – 12)	1636	10 (15%)
Severe head injury (3 – 8)	1237	56 (82%)

**Table 2:** CT scan findings.

CT scan findings	Incidence
Intraventricular hemorrhage	33 (48.5%)
Subarachnoid hemorrhage	12 (17.6%)
Cerebral contusions	06 (8.8%)
Intracranial hematomas (EDH, SDH)	12 (17.6%)
Depressed skull fracture	02 (02.9%)
Firearm Injury (Metallic Foreign Bodies)	03 (04.4%)

closed head injury.<sup>21,22,24</sup> The accurate incidence of post traumatic hydrocephalus is not known. In some large head injury series, the incidence of post traumatic hydrocephalus was reported to range from 1.5% to 4%.<sup>9,24</sup> Other series shows the incidence being from 0.7 – 86%.<sup>17-19</sup> But the incidence of symptomatic hydrocephalus has been reported to be from 0.7% to 29%.<sup>17,18</sup> Hence, it is important to distinguish between PTH and cerebral atrophy as the latter usually do not respond to neurosurgical procedures.<sup>28,30</sup> Dandy reported the PTH for the first time in 1914.<sup>2</sup>

PTH may present with various clinical syndromes including obtundation, failure to improve and a tetrad of symptoms including psychomotor retardation, memory loss, gait ataxia and incontinence.<sup>29,31</sup> Sometimes, the patient may be too injured to demonstrate clinical signs and symptoms of PTH, or may present with atypical symptoms.<sup>29</sup> According to Groswasser, et al when a patient is in a state of prolonged coma or when there is an arrest in the clinical progress in conscious cranio-cerebral injured patients, communicating hydrocephalus should be suspected.

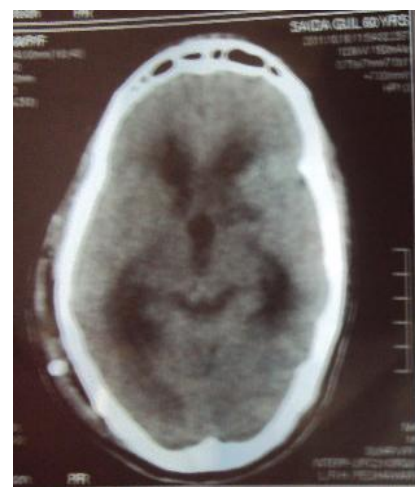
In the severe head injury, PTH takes only few

**Table 3:** Outcome following neurosurgical intervention.

Neurosurgical intervention	GCS Level	No. of cases	Outcome
Ventriculo-peritoneal shunt	13 – 15 = 00 09 – 12 = 06 03 – 08 = 09	15	08 – good improvement 05 – moderate improvement 02 – no improvement
External ventricular drain	13 – 15 = 00 09 – 12 = 06 03 – 08 = 09	34	18 – good improvement 06 – no improvement 10 – died / No improvement
External ventricular drain followed by VP shunt	13 – 15 = 00 09 – 12 = 06 03 – 08 = 09	06	04- good improvement 01 – no improvement 01 – died / No improvement



**PTH with remnant of Intraventricular bleed**



**A Symptomatic case of PTH.**

weeks or less to develop, whereas ventriculomegally related to cortical atrophy evolves slowly over a period of 6 months or more post trauma. However, cortical atrophy did not strictly correlate with PTH, particu-

larly in the most severe cases, suggesting a different mechanism of development. Cortical atrophy seemed to be strongly related to documented anoxia and Diffuse Axonal Injury, whereas PTH develops probably due to CSF blockage around the convexities such as suggested by the high correlation with decompressive craniectomy.<sup>3,19,20</sup> Forglou described obliteration of subarachnoid spaces with fibrous thickening of the leptomeninges particularly in sulci and base of the brain.<sup>3,30</sup> This finding is in agreement with Marmarou et al. Moreover Wood et al. found that patients who have had clinical symptoms of hydrocephalus for less than 6 months have a better prognosis.

Our study indicates that younger age, shorter duration of coma, severe head injury (GCS 3 – 8), and decompressive craniectomy in acute phase could be the risk factors for the development of PTH. Moreover intraventricular hematoma and subarachnoid hemorrhage highly favours the development of PTH in acute phase just in a matter of hours or days. A correlation between PTH and Duration of coma was also reported by Meyers et al.<sup>26</sup>

Patients who benefited from surgery were those, who manifested a deterioration of clinical status. This data seems to suggest that selection of the patients for surgery can be defined principally on clinical basis. Deterioration involved many functions, but consciousness and behavior were the most indicative. Lewin has reported on of the largest series of patients with ventricular dilation following severe head injury. In his series 59 patients with generalized ventricular dilation had an evidence of obstruction in the basal cistern.<sup>33</sup>

SPECT may be helpful in differentiating ventricular enlargement due to cortical atrophy and hydrocephalus. PTH influences the functional and behavioral outcome of severe TBI and represents an important prognostic factor for posttraumatic epilepsy.<sup>23</sup>

## CONCLUSION

According to our study results Posttraumatic hydrocephalus is particularly rare in mild and moderate head injury cases as compared to the higher incidence in cases with severe head injury. Traumatic intraventricular hemorrhage and / or SAH were the commonest risk factors as seen on initial CT scans.

PTH commonly developed in the first two to three weeks when the patients were convalescing on the wards. Clinical and radiological monitoring is of great concern especially in patients with a high risk factor for earlier diagnosis and according management plan.

Surgical outcome is significant once diagnosis is established in time, 44% cases in our study with good outcome.

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