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ISOLATED TRAUMATIC INTRA-VENTRICULAR HEMORRHAGE AND OUTCOME: AN ANALYSIS

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ABSTRACT **BACKGROUND** Isolated traumatic intraventricular hemorrhage (IVH) is very rare and these are often associated with other parenchymal injuries. The overall outcome of patients with traumatic isolated intra-ventricular hemorrhage is poor. We analyze the possible mechanism for isolated traumatic intraventricular hemorrhage at our institute over a period of two years and their outcome. **METHOD** 202 patients were admitted in the tertiary center of Armed Forces Center from August 2017 to July 2019 with closed head injury, of those only 15 (7.4%) patients with isolated intraventricular hemorrhage (GCS less than 8) are studied. The patients with isolated IVH with no other haemorrhage, no comorbidity, no history of alcohol intake and any previous psychiatric illness were included in this study. These patients were assessed with Glasgow Outcome Score (GOS) scale to measure the outcome at the time of discharge. **RESULTS** Out of 15 patients, four (26.6%) patients showed hyperdense lesion in frontal horn, five (33.3%) had hyperdense lesion in occipital horn and six (40%) had hyperdense lesion at foramen of Monroe / third ventricle, among them one had hyperdense in both III ventricle and IV ventricle. All the patients showed isolated intraventricular hemorrhages without any vascular on CT Scan and CT Angiogram. Two had Good Recovery (13%), five had Moderate disability (33%), three had Severe disability (20 %) and five had died (33.3%). **CONCLUSION** The acceleration-deceleration impact along the long axis of the skull may cause shearing injury to perforating vessels of the ependymal layer of the ventricle. The outcome is directly related to initial GCS and it was equivocal on GOS scale.

KEYWORDS : : Isolated traumatic Intraventricular hemorrhage, Outcome, GOS

INTRODUCTION:

Intra-ventricular haemorrhage (IVH) is a rare occurrence in patients with traumatic brain injury. The incidence in various series ranges from 0.4-4%[1]. With the advent of CT scan the diagnosis of post traumatic intraventricular haemorrhage has made it easier. However, it is difficult to find the actual location of the bleed, the pathogenesis and mechanisms involved in the bleed. Due to the rarity of this entity, most single institute studies are retrospective and contain fewer patients. These patients generally present with other forms of intracranial haemorrhage with intra-ventricular haemorrhage extension[2]. The severity of injury is directly proportion to the depth of injury, so presence of IVH indicates that a severe force has been applied to the head [3] IVH is most often caused by tearing of the subependymal veins in the fornix, septum pellucidum or choroid plexus found in autopsy studies [4].

These patients rarely develop hydrocephalus. The prognosis is poor and it is not known whether it is due to the presence of blood in the ventricle per se due to induced hydrocephalus or increased intracranial pressure in these patients.

External Ventricular Drainage (EVD) is an available option in such patients to lower ICP [5] This is a prospective study in post -traumatic IVH with an aim, to determine the probable mechanism of involved and their outcome at the time of discharge.

PATIENTS AND METHODS

This is a prospective study from August 2017-July 2019, 202 cases of head injuries were admitted to the tertiary center of Armed Forces Hospital. Thirty cases had contusion, twelve cases in the frontal lobe, fifteen cases in the temporal lobe and three cases in the parietal lobe. Twenty cases of basal ganglia haemorrhage, twelve in the caudate nucleus and eight in the thalamus, all spreading into the ventricles. In fifty cases the original site of haemorrhage could not be determined. In this group twenty cases had peri-brain stem haemorrhage and different brain stem injury signs. Fifteen cases of isolated Intraventricular haemorrhage without any intracranial lesions. Accompanying major intracranial haemorrhage was found in one hundred cases, thirteen cases had epidural hematoma, forty three cases had subdural hematoma, and seven had a combination of ASDH, EDH and contusion haemorrhages, all requiring primary surgical evacuation, and thirty seven cases had different degrees of minor abnormalities (i.e. minor epidural haemorrhage, minor subdural haemorrhage, sub-arachnoid haemorrhage, minor cortical contusions or subdural effusions which did not need surgical intervention).

The patients with isolated IVH with no other haemorrhage, no comorbidity, no history of alcohol intake and any previous psychiatric illness were included in this study. The primary CT scan was done within the first six hours of admission and repeated after 24 hours or in case of deterioration. These fifteen patients were further evaluated with MRI/CT angiogram to access the other possibilities of vascular malformation. There were no history of bleeding disorders and all the coagulation parameters were within normal limit. All the patients were admitted to the intensive care unit and if needed, ventilator support was done. Mannitol (1 gm/kg as bolus over 30 minutes and 0.25-0.5 gm/kg q6h) and furosemide (10-20 mg IV q6h) was started judiciously. None of the patients had intracranial pressure monitoring or had undergone barbiturate therapy.

For each case, age, sex and CT abnormalities, mechanism of trauma, probable site of trauma, any surgical intervention, Glasgow Coma Scale (GCS) on admission were recorded, treatment modalities and final outcome according to Glasgow Outcome Scale (GOS) were recorded (Table 1) and analysed .

RESULTS

In the present study,isolated intraventricular haemorrhage was seen in in 15 cases (7.4%) of the total head injury from August 2017 to July 2019.It was commonly observed in age from 4-55 years with a mean age of 28 years. Demographic pattern was eight male and seven females. The mode of injury was acceleration-deceleration injury in form of road traffic accidents in ten cases (66.6%) and fall from height in the other five (33.3%). On admission, Glasgow Coma Scale score varied from 3–8 and all required ventilator support. The clinical presentation was history of fall followed by loss of consciousness with multiple episodes of vomiting and one of them had seizure.

All the patients underwent non-contrast CT of the brain and CT Angiogram to rule out any vascular pathology and tumor pathology. Four (26.6%) patients showed hyperdense lesion in frontal horn, five (33.3%) had hyperdense lesion in occipital horn and six (40%) had hyperdense lesion at foramen of Monroe / third ventricle, among them one had hyperdense in both III ventricle and IV ventricle (Fig 1). All the patients showed isolated intraventricular haemorrhages without any vascular on CT Scan and CT Angiogram. On MRI brain one patient (6.6%) showed blooming on GRE sequence at occipital horn and periventricular region (Fig 2). Rest of the patients showed similar features as the CT scan. Four (26.6%) of patients, mainly with hyperdense lesion at foramen of Monroe/III ventricle required surgical intervention in form of external ventricular drainage.

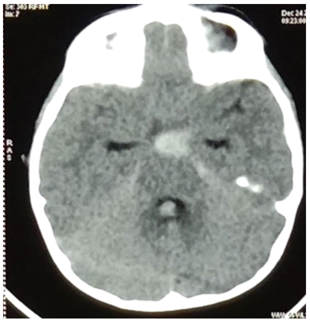

Fig 1 IVH in III Ventricle & IV Ventricle

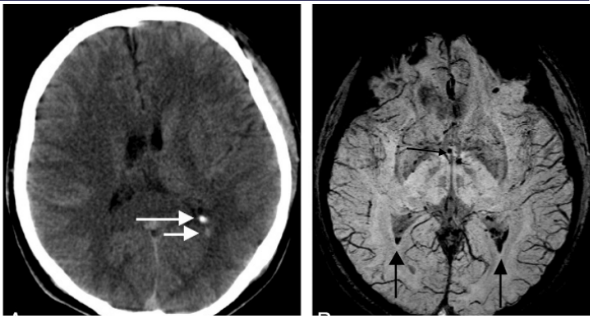

Fig 2 CT Scan showing IVH in occipital horn & MRI showing occipital IVH with periventricular blooming

From the fifteen cases of IVH, five cases expired (33.3%), three developed severe disability (20%), five has moderate disability (33.3%) and two had good recovery (13.3%).

Table 1. Case summary and outcome

Cases	Age (yrs)	Sex	Cause	GCS	CT	MRI	CT Angio	Surg	Outcom
1	4	M	FFH	8	® FIVH	R FIVH	No vasc	No	GR
2	12	M	RTA	7	® OIVH	R B/L OIVH	No	No	MD
3	24	F	RTA	5	III Vent	III vent	No	EVD	Dead
4	36	M	RTA	8	L FIVH	L IVH	No	No	GR
5	8	F	FFH	6	B/L OIVH	B/L OIVH	No	No	MD
6	42	M	RTA	8	III Vent	III Vent	No	EVD	Dead
7	32	F	FFH	7	RFIVH	R FIVH	No	No	MD
8	46	M	RTA	7	III Vent	III Vent	No	No	Dead
9	7	F	FFH	8	B/L OIVH	B/L OIVH with perivent blooming	No	No	SD
10	28	F	RTA	8	III Vent	III Vent	No	EVD	SD
11	17	M	RTA	3	III Vent and OIVD	III Vent and OIVD	No	EVD	Dead
12	35	F	FFH	7	B/L OIVH	B/L OIVH with corpus callosal blooming	No	No	SD
13	55	M	RTA	3	III vent &IV vent	III Vent and IV Vent	No	EVD	Dead
14	46	F	RTA	8	B/L FIVH	B/L FIVH	No	No	MD
15	25	M	RTA	8	B/L OIVH	B/L OIVD	No	No	MD

Legend : RTA (Road Traffic Accident);FFH (Fall From Height);RFIVH (Right Frontal IVH);OIVH (Occipital IVH);B/L OIVH (Bilateral Occipital IVH);III Vent (III Ventricle);IV Vent (IV Ventricle);Vasc (Vascular);EVD (External Ventricular Drain);MD (Moderate Disability);SD (Severe Disability);GR (Good Recovery)

DISCUSSION:

Trauma is the leading cause of morbidity and mortality in patients younger than 45 years old and it is currently the fourth leading cause of death worldwide [6]. Traumatic Brain Injury (TBI) accounts for a significant proportion of these injuries. Most common cause of TBI in India continues to be motor vehicular accidents[7]. Other common causes include falls and assault[7]. The elderly population is at an increased risk of head injury because of the possibility of falls due to various reasons and other associated co-morbidity[8]. This leads to increased number of post-traumatic intra-cranial haemorrhage following trivial trauma[8].Paediatric population has a different profile of head injury as compared to adults. These patients more commonly present with fall as a cause for TBI[9].Intra-cranial haemorrhage is a common occurrence in patients with head injury. Most common type of haemorrhage is subdural haemorrhage which may be acute or chronic depending on the onset as well as mode of injury [10]. Extra-dural haemorrhage is seen more commonly in the younger population and is mostly associated with fractures of the overlying cranium, usually in the temporal region[10]. Pediatric patients more commonly present with EDH at unusual sites[11].Intra-ventricular haemorrhage is usually associated with other forms of intra-cranial haemorrhage and generally seen in patients with severe TBI[2,5]. Isolated intra-ventricular haemorrhage in a patient with head injury is a rare occurrence[2].

Severity of head injury can be categorized on the basis of GCS score of a patient on arrival. A thorough evaluation of associated injuries must be done to exclude other life-threatening injuries. TBI is associated with trauma to cervical spine in 4 -12.5% of cases in various series[12].A careful and timely assessment of patients is necessary to avoid unnecessary delays that can lead to permanent disability or loss of life. Grc ˇevic ´ topologically described the various sites of periventricular injury, including the lateral walls of lateral ventricular corners, lateral walls of the posterior horns and tips of the frontal horns, and the third ventricle wall [13]. A medicolegal study by Makino localized the ventricular wall damage by comparing the morphological changes to the ventricle boundary in 50 brain injured and 50 non-brain-injured cases[14]. The ventricular wall damage was defined as haemorrhagic damage to the subependymal tissue. The damage sites were most frequently observed in the posterior horn, anterior horn, and the attachment of the choroid plexus. These findings were similar to our study. Another medicolegal study by Kuroda and co-workers examined 41 autopsy cases and noted subependymal haemorrhage frequently accompanied by axonal injuries at the anterior horns of the bilateral ventricles in the injured brain[15]. In our study we had one case with axonal injury with intraventricular hemarrhage which was demonstrated in MRI image. Maxeiner and Schirmer systematically examined the frequency of intraventricular haemorrhage in 676 formalin-fixed brains and found that ventricular haemorrhages were the predominant results of periventricular lesions[16]. This study showed equal distribution in various regions of the ventricle. This study also revealed the equal distribution in various regions of ventricles whether due to fall or acceleration-deceleration injury.

It is evident from this study that ventricular dilatation may be focal or a generalized which often follows closed head injuries. Although dilatation may occur, the frequency with which it is found increases with the severity of the trauma. Intraventricular haemorrhage causes impairment of cerebral spinal fluid circulation (CSF), causing ventricular size enlargement (hydrocephalus) and increased intracranial pressure and may cause microscopic brain damage which may not be established in the existing imaging modality. The hemolysis in CSF and the spontaneous removal of IVH is very slow, due to deficient fibrinolysis. The current treatment modalities include external ventricular drainage and more aggressive is administration of fibrinolytics such as tissue plasminogen activators. Although both treatments can expedite the clearance of IVH but no conclusion can be drawn from the effect on clinical outcome[17].

Cordobes et al. mentioned the most common mechanism of IVH in head injury was the spread of blood in to the ventricle from nearby contusion haemorrhage[18]. Nine cases in this study had contusional intraparenchymal haemorrhage as the cause of IVH and in the remaining 22 cases other mechanisms were involved. In the contusional group, in contrast with the basal ganglia haemorrhage group, the impact and the intracranial lesion were on the lateral side while in the basal ganglia group the lesion which almost corresponded to the impact side are more posterior (occipital) for thalamic and anterior (frontally) for caudate nucleus haemorrhage. Tsai et al. described intraventricular haemorrhage as an irregular sub-ependymal enhancement before rupture of ependyma to produce IVH[19]. In LeRoux and colleagues' report only 4 of the 43 patients with traumatic IVH needed ventricular drainage for acute hydrocephalus (93%)[20,21].This study showed acute hydrocephalus in six patients with obstruction predominantly at III ventricle which required surgical intervention.

The outcome is poor in intraventricular haemorrhage. Cause of poor outcome is not clearly known; it may be due to the presence of blood in the ventricles, hydrocephalus development or due to increased intracranial pressure[22] Lee et al. in their study found a good outcome for isolated intraventricular haemorrhage[23]. Is et al. reported a good outcome in a paediatric patient with an isolated intraventricular haemorrhage[24].

CONCLUSION

Isolated traumatic intraventricular haemorrhage is an extremely rare variant occurring more commonly in males and the age groups of 30–40 years, in acceleration- deceleration injuries with an equivocal outcome, hence being studied. Acute post-traumatic hydrocephalus is a very rare clinical finding (delayed dilatation of the ventricles after a head injury is commonly due to traumatic cerebral atrophy called hydrocephalus ex-vacuo[25]. and its presence indicates a very poor prognosis regardless of what treatment methodology are taken especially if all four ventricles are filled with blood.

LIMITATION

In this study 15 cases of traumatic IVH in severe closed head injury were studied and analysed for age, sex, cause of trauma, GCS on admission, CT findings, treatment modalities, probable site of impact and final outcome for each case. A poor outcome is obtained from this study because only patients with severe head injury (GCS less than 8) were included (5 died, 5 moderate disability, 3 severe disability and 2 good recovery). If we had included all grades of patients with head injuries from mild to moderate to severe blunt head injuries with IVH a more favourable outcome would have resulted.

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