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Analysis of the Predictors and Outcomes in Patients of Traumatic Basal Ganglia Bleed with Review of Literature

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Abstract: ***Background: Traumatic basal ganglia hematoma is a rare condition defined as presence of hemorrhagic lesion located in the basal ganglion (caudate nucleus, putamen and globuspallidus) and its neighbouring structures like thalamus and internal capsule[2]. Objective: The purpose of this study is to assess the outcome and predictors in patients with traumatic basal ganglia bleed. Material & methods: The clinical course of 31 head injury patients in whom CT had shown basal ganglia bleed admitted between august 2017 to april 2019 to our hospital, were prospectively analyzed. Results: The patient in this study ranged from 6 years to 80 years in age. Most of the cases (77.42%) were of road traffic accident. Mean GCS at the arrival at the hospital was 8.87 .Volume of hematoma ranged from 1cc to 60cc. 80.65% of patients in this study had associated head injury. 70.94% of the patients had hemiparesis.6 patients had pupil asymmetry at the time of admission. 21 cases (67.74%) had good prognosis (GCOS score of 4 or 5) while 10 patients had bad prognosis (GCOS score of less than or equal to 3). Nine patients expired. In two cases surgical evacuation of hematoma was done. Rest were managed conservatively There were five cases of bilateral TBGH and all cases had associated brain injuries. Three patients out of these five expired. Conclusion: TBGH mainly occurs in young adult males with history of road traffic accident. Most of these cases have associated brain injuries. Prognosis of TBGH correlates with GCS at presentation and pupil asymmetry. Also we observed that presence of associated head injuries and larger volume of hematomas have poorer outcome. Outcome of isolated TBGH is excellent.***

Keywords: traumatic, basal ganglia bleed, outcome, predictors

1. Introduction

Traumatic brain injury (TBI) can be called as a silent epidemic which remains a major cause of disability and mortality worldwide leading to high healthcare expenses1. During TBI many primary lesions of the cranial vault and its contents may occur. One of these injuries are brain contusion. Traumatic basal ganglia hematoma is a rare condition defined as presence of hemorrhagic lesion located in the basal ganglion (caudate nucleus, putamen and globuspallidus) and its neighbouring structures like thalamus and internal capsule[2]. Its mechanism is thought to be due to the shearing strain over the lenticulostriate or anterior choroidal blood vessels caused by rapid acceleration and deceleration forces at the time of injury leading to bleeding[3, 4, 5]. It is relatively uncommon.The incidence reported is around 3% after a closed head injury. Autopsy series on the contrary indicate a much higher incidence of around 10 to 12%[3, 6, 7]. Differences in the incidence of TBGHs in clinical and autopsy series is suggestive that TBGHs may be an important cause of death after severe closed head injury and these lesions are associated with a worse prognosis than other types of posttraumatic intracranial hematomas[7, 8]. It usually occurs in young patients and is associated with high morbidity as well as mortality.

Traumatic basal ganglia hemorrhage is at times difficult to differentiate from spontaneous hemorrhage. The recognition of TBHG is of important in medico legal cases where bleeding may be at times attributed to non traumatic cause[9]. Traumatic hemorrhages are usually small and located in lenticular nucleus zone and external capsule on one or both sides. However, in comparison to this spontaneous hemorrhages are solitary and are located in thalamus and internal capsule[10]. Presence of definite history of trauma along with presence of hemorrhagic site corresponding to the direction of impact favors traumatic hemorrhage[11].

Traumatic basal ganglia bleed occur either as isolated lesion or it can be associated with intracranial injury such as diffuse axonal injury, cerebral contusion, and subdural or extradural hematoma[12]. When it occurs as isolated lesion, it usually has good outcome[6]. However, the patients having associated brain injuries have poorer outcome. Contusions of the basal ganglia may cause extrapyramidal signs secondary to changes in the substantianigra[13- 20] motor paralysis due to involvement of the pyramidal tracts in the internal capsule[15, 18, 21] visual deficits as well as language and sensory impairments due to injury to the lateral geniculate bodies and the thalamus, respectively, and prolonged unconsciousness due to involvement of the reticular activating system[6, 7].

2. Material & Methods

This prospective observational study was conducted on 31 consecutive patients of TBGH in Department of Neurosurgery, VMMC &Safdarjung hospital, New Delhi from August 2017 to April 2019 after approval obtained from the ethical committee of the institute.

To ascertain the diagnosis of TBGH and to rule out spontaneous hemorrhage, patients having no history of hypertension, diabetes, coagulation disorders and having definite history of trauma were included.

Patient admitted in neurosurgical emergency with the history of trauma were subjected to CT Scan after initial resuscitation. They were managed on International Trauma Life Support Protocol. Consent was taken and the proforma of study was filled with complete biodata, mode of injury, time of injury, first aid and time between injury and hospital arrival. After a detailed history and examination, the necessary investigations were sent. Evaluation of GCS (Glasgow coma scale) at admission to categorize the patients in to mild, moderate and severe head injury was done.Volume of hematoma was calculated using the formula: V = length X width X height X 0.532. The patients were subdivided in to two groups, one in which the basal ganglia hematoma occur as isolated lesion and the other in which hematoma was associated with other intracranial injury. Patients were managed conservatively with standard treatment protocol. Two cases were operated. Follow up and clinical outcome of patients were assessed at 1 month, 3 months and 6 months.

The outcome of the patients was analyzed on the basis of GCOS. For the purpose of this study patients were divided into two groups on the basis of their outcome,

1) Good prognosis: The patients having GCOS of 4 or 5 were considered having good prognosis
2) Bad prognosis: the patients having GCOS of 1, 2 or 3 were considered having bad prognosis

3. Results

The patient in this study ranged from 6 years to 80 years in age. Maximum number of cases (54.83%) were in the range of 21-40 years. 80.65% of the patients were males. Most of the cases (77.42%) were of road traffic accident. In this study mean time to reach first hospital was 3hours 27 minutes and to reach neurosurgical center was 15 hours 51 minutes. Mean GCS at the arrival at the hospital was 8.87 and 58.06% of the patients had severe head injury, 16.13% had moderate injury and 25.81% patients were of mild head injury. Volume of hematoma ranged from 1cc to 60cc. The mean volume of hematoma was 10.8 cc. Maximum number of patients 80.65% had volume more than 2cc. Maximum number of patients (80.65%) in this study had associated head injury. 70.94% of the patients had hemiparesis.6 patients had pupil asymmetry at the time of admission. 29.03% of patients had skull fractures. In two cases surgical evacuation of hematoma was done. Conservative management was done in rest 29. Midline shift was observed in 35.48% of the cases. 21 cases (67.74%) had good prognosis (GCOS score of 4 or 5) while 10 patients had bad prognosis (GCOS score of less than or equal to 3). Nine patients expired. No correlation with outcome and mortality could be made with the age, gender, side of the lesion, mode of injury and presence of midline shift or hemiperesis. Significant correlation could not be made between size of the hematoma and outcome. However it was observed that mean volume of the hematoma in patients having bad prognosis was higher (14.9 cc) than the patients having good prognosis (8.86 cc). It was also observed that 72.73% of the patients having volume less than 10 cc had good prognosis whereas among patients having hematoma more than 20cc, only 50% had good outcome. It was observed in this study that mean volume of hematoma was larger (16.22 cc) in the patients of TBGH who expired than in those who survived (8.59 cc), but the difference was not statistically significant. It was also observed in this study that 50% of the patients having volume of hematoma more than 20cc expired whereas among those having a volume of less than 10 cc, only 22.73% expired. GCS at arrival significantly correlated with the outcome and mortality of the patients. Presence of associated head injuries was not significantly correlated with the outcome and mortality of the patients. However 100% of the patients who had bad outcome or expired had associated head injuries. All the six cases of isolated TBGH had good prognosis. Presence of pupil asymmetry significantly correlated with worse outcome and mortality of the patients. In two cases surgical evacuation of hematoma was done and both had good prognosis. There were five cases of bilateral TBGH and all cases had associated brain injuries. Three patients out of these five expired.

4. Discussion with Review of Literature

There have been variable opinions on the outcome of the patients of TBGH. Few previous studies have demonstrated that most of the cases with isolated basal ganglia hemorrhage have good outcome [6]. In one large series patients with a traumatic basal ganglia haematoma had a poor prognosis[2] but cases with a favourable outcome have been reported[5].

Mean age of the patients in this study was 31.87 years, ranging from 6 years to 80 years in age. Maximum number of cases (35.48%) were in the range of 21-30 years. This finding of TBGH was more commonly observed in younger patients as they were more commonly involved in road traffic accidents. Most of the studies done in past also showed more percentage of cases in the younger patients as they are more involved in road traffic accidents.

80.65% of the patients were male and 19.35% were female patients in this study. Studies in the past have also shown that main victims of TBGH in our society are young males because they are the bread and butter winner for their families[2, 3, 7].

In this study majority of the patients (77.42%) in this study were involved in road traffic accident, suggesting that inertial phenomena were responsible for most TBGH.

As time period to reach hospital from the scene of accident is also an important factor. Study done by Aziz et al[37] the minimum and maximum time to reach hospital was 1 and 12 hour with an average time of 7 hours. It has been observed in this study that the mean time of reaching neurosurgical center is high i.e 15 hours 51 minutes and also to reach first hospital

where resuscitation can be done is 3 hours 27 minutes. Faster resuscitation and reaching to neurosurgical centers may have resulted in more favorable outcome of the patients.

Mean GCS at the arrival at the hospital was 8.87. GCS at arrival was significantly correlated with outcome of the patients (p = 0.0001). All the patients who had bad outcome in this study had GCS less than or equal to 8 in this study. GCS at arrival was significantly correlated with mortality of the patients (p = 0.0001). All the patients who expired in this study had GCS less than or equal to 8 in this study. In the study done by Kumar et al [10]average GCS was 10 and all patients had fair or excellent outcome. In study conducted by Jayakumar PN et al [32] average GCS at admission was 7 and it was associated with poor prognosis. Similarly in the study done by Boto G et al [2] only the cases of severe head injury having GCS less than 8 were included and the outcome of the patients was poor. Also in the study done by Takeuchi et al [35], the mean GCS of the patients at the time of admission was 7.5 and outcome was poor in 60% of the patients and 35% of the patients expired.

In this study, out of 31 patients 9 (29.03%) patients had skull fractures. It has also been observed in the past studies that patients with TBGH have a relatively low incidence of skull fractures, in contrast with those suffering falls, in whom TBGHs rarely develop[7, 34].

In this study no significant correlation was seen between the laterality of the lesion and outcome of the patient (p = 0.296) as well as between laterality of the lesion and mortality of the patients (p = 0.131). However it was observed that 60% of the patients having bilateral lesions expired whereas 23.08% of the patients having unilateral lesions expired. This is in contrast to the findings of the cases of bilateral TBGH reported in the past. Most of the cases of bilateral TBGH reported in the past had a good outcome[42, 43, 45]. Kankaneet al[44] reported two cases of bilateral TBGH and both had good outcome. Kumar et al [10] described one patient with bilateral basal ganglia bleed amongst 10 cases of TBGH with a fair outcome. Willem Guillermo et al[48], Pandey et al [38] and Moriya etal [46] have reported cases of bilateral TBGH having bad prognosis. In this study there were five cases of bilateral TBGH. All cases had associated brain injuries. Three out of five patients of bilateral TBGH expired in this study. Neha Gupta et al[41] reported five cases of bilateral isolated cases of TBGH with all of them showing good prognosis.

Enlargement of hematomas was not observed in this study as compared to the observation made by Boto etal[2]. However it was observed that mean volume of the hematoma in patients having bad prognosis was higher (14.9 cc) than the patients having good prognosis (8.86 cc). We also observed that 72.73% of the patients having volume less than 10 cc had good prognosis whereas among patients having hematoma more than 20cc, only 50% had good outcome.The findings are similar to that observed by Munemoto et al [31] who observed that massive type of hematoma has a poor prognosis while spotty hemorrhages have good prognosis. The size of hematoma did not show correlation with prognosis of the patients in the study done by Jayakumar P N et al[32]. Boto G et al [2] also observed that the mortality rate was not significantly different in patients with hematomas of less than 10 ml, compared with those with a volumes of 10 to 25 ml or larger than 25 ml. They also observed that mortality rate was higher in patients with larger hematomas and in whom enlargement of hematomas was seen or there was elevated ICP. Aziz P A et al [37] also observed that prognosis is better with small volume of blood. In their study patients with an average volume of 20 ml had poor prognosis.

We observed that all nine patients who expired in this study had associated brain injuries along with basal ganglia bleed. However the correlation was not statistically significant. It was observed that among 9 patients who had diffuse axonal injury, only 3 had good outcome. Macpherson et al[7] studied 61 patients of TBGH. They found 41 patients had isolated lesions while 20 had another associated hematomas. They also observed bad outcome in patients of TBGH. This is in contrast to the findings of the current study. Katz D L et al [6]observed that TBGH has a favorable outcome if it occurs in isolation. They also observed that in four patients having Diffuse Axonal Injury prolonged muteness occurred. Lee J P et al[34] also observed that the post traumatic intraventricular hemorrhage and brainstem hemorrhage usually coexisted with a poor outcome. In the study done by S Kumar et al [10] it was observed that out of ten patients of TBGH, additional brain parenchyma injuries were present in six patients in the form of focal contusions in four patients, intraventricular bleed in one and Diffuse Axonal Injury in three patients. They observed that cases in which TBGH was associated with Diffuse Axonal injury were associated with relatively poorer GCS at admission but improvement was not different from the patients not having DAI. They also concluded in their study that DAI, per se, is an important factor governing the outcome in any head injury patient including TBGH. Boto G R et al[2] studied 37 severely head injured patients of TBGH and found that associated intracranial lesions were present in 21 patients. In 22 patients Intraventricular hemorrhage was observed (59%), in 16 patients subarachnoid hemorrhage was found(43%), in 10 patients diffuse brain swelling was observed 10 (27%), focal brain contusion were present in six patients(16%), and acute subdural hematoma in five patients (14%). Takeuchi et al[35] observed in their study of 20 patients of TBGH that most cases had associated brain injuries (focal contusions in 9 patients, subdural hematomas in 5, an epidural hematoma in 1, intraventricular hemorrhage in 4, subarachnoid hemorrhage in 10, and diffuse axonal injuries in 5 patients).They stated that TBGH has high frequency of associated intracranial lesions and has a poor outcome. In the study done by Peer Asad Aziz et al [37] it was highlighted that outcome of the patients of TBGH mainly depend on two factors that is Diffuse Axonal Injury and volume of hematoma and in certain cases time to reach hospital. They observed that all four patients who died had associated head injuries (two patients had Diffuse Axonal Injury and two had intraventricular bleed). These findings are consistent with our study. We also observed that most of the cases of TBGH had

other associated brain injuries and all the patients who had poor outcome in our study had associated brain injuries.

A significant correlation was observed between the pupil asymmetry and the outcome of the patients (p = 0.007) and mortality of the patients (p = 0.004). It was observed that 83.33% of the patients having pupil asymmetry expired. Similar findings were observed by Lee J P etal[34] who suggested that abnormal pupil reaction, impaired occulocephalic response, old age (greater than 60) and abnormal motor response to pain stimuli were the hallmarks of poor prognosis in patients of TBGH.

Most of the patients (93.55%) were managed conservatively in this study. In two patients surgical evacuation of the hematomas were done and both cases had good prognosis. These patients had volumes of hematomas 24 cc and 17 cc. Boto G R etal [2] in their study observed four patients out of 37 underwent surgery. In contrast to our study all patients who underwent surgery in their study had bad prognosis. Three patients expired and one was severely disabled. They suggested that surgical evacuation should be considered in patients with TBGH with a volume more than 25cc.Similarly in the study of 20 cases done by Takeuchi S et al [35]six patients underwent surgery and all these patients had poor outcome. Both the patients who underwent surgery in our study survived and had good outcome. We also recommend that surgical evacuation should be considered in patients having large hematoma.

In this study 21 patients out of 31(67.74%) had good prognosis. Nine patients expired. In this study more than 50% of cases had good prognosis. Studies in the past has given variable opinions on the outcome of the patients of TBGH. Studies in past showed that TBGH occurs mainly in young patients and is associated with high morbidity and mortality [2, 6, 7, 31, 32]. Macpherson[7] observed in 61 patients of TBGH that Sixty-six percent of the latter patients had unfavorable outcomes. They concluded that presence of TBGH is an evidence of primary brain injury and carries a worse prognosis than other post traumatic intracranial hematoma. Similarly Jayakumar et al [32] reported on 22 patients with TBGH and concluded that the location and size of the hematoma did not correlate with prognosis of the patients. They also concluded that these patients form a specific subgroup of the head injured population with poor prognosis. . Lee JP et al [34] reported on 52 patients suffering from TBGHs, who represented 0.9% of the entire population undergoing CT scanning after closed-head injury. They observed that overall prognosis was unfavorable in 46% of their cases. In their study the hallmarks of poor prognosis were advanced patient age (60 years), the presence of abnormal pupillary changes, impaired oculocephalic and motor responses, and intraventricular and brainstem hemorrhage. Similarly in series of Boto GR et al[2] nearly 60% of the patients died and 84% had an unfavorable outcome. It was also observed by them that 73% of patients in whom there was hematoma volume enlargement died, but the overall outcome in this subgroup was not different from that seen in the global series. The poorer outcomes in their series may be because of inclusion of Severe Head Injury patients and because of exclusion of hemorrhagic lesions less than 2 ml. Takeuchi S et al [35] observed in 20 patients of TBGH that these lesions are associated with high frequency of associated intracranial lesions and has a poor outcome and mortality. Also GCS score and midline shift were identified as prognostic factors by them.

In contrast to the above mentioned studies, few studies in the past have shown a favorable outcome of TBGH. Katz D et al[6] also observed in five patients of TBGH that isolated TBGH is associated with a favorable recovery. Overall recovery of the patients depends upon associated cerebral damage than TBGH itself. S Kumar et al[10] also concluded in study of ten patients that prognosis of TBGH patients appears favorable if they are not associated with coagulation disorders and/or large hematoma. Aziz et al [37] mentioned in their study of 19 patients of TBGH that TBGH has favorable outcome if managed according to proper guidelines. They also concluded that isolated cases of TBGH has a good outcome if they are not associated with DAI and other serious associated injuries. These findings are consistent with our study. We also observed a good prognosis in isolated cases of TBGH.

In this study there were five cases of bilateral TBGH and three of them had bad prognosis. Cases of bilateral TBGH reported in the past showed god prognosis in contrast to our study. It has been observed in our study that all these five cases were associated with other brain injuries and three of them were having bad prognosis while the cases of bilateral TBGH reported with good prognosis in past were mostly isolated lesions. In this study we have observed that TBGH as isolated lesion has good prognosis but in association with other injuries both unilateral and bilateral cases have poor prognosis. The outcome of the patients of TBGH is determined by many factors including GCS at presentation, pupil reaction, volume of hematoma, associated brain injuries and surgical evacuation should be considered in cases of large hematomas.

5. Conclusion

TBGH mainly occurs in young adult males with history of road traffic accident. They are less frequently associated with skull fractures. Most of these cases have associated brain injuries. No correlation could be made with the outcome of the patients and age of the patient, gender, mode of injury, laterality of lesion, presence of midline shift or hemiparesis. Prognosis correlates with GCS at presentation and pupil asymmetry. Presence of associated head injuries and larger volume of hematomas have poorer outcome. Outcome of isolated TBGH is excellent.

6. Limitations of the Study

ICP monitoring was not taken as a part of management in this study. Larger studies are required for better analysis and comparison

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