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RESEARCH ARTICLE

COAGULOPATHY AS A PREDICTOR OF OUTCOME IN INDIAN PATIENTS WITH ISOLATED HEAD TRAUMA

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ABSTRACT

Background: Hemostatic abnormalities have been frequently reported in patients with traumatic brain injury. These changes are reported to predict outcome. This study aimed at evaluating the association between coagulopathy detected within the first 12h and outcome in Indian patients with isolated head trauma.

Methods: One hundred patients admitted within 12h of head injury were enrolled in the study. Based on the GCS, head injury was classified as mild (GCS13-15), moderate (GCS 9-12) and severe (GCS 3-8). Complete blood count including platelet count, Prothrombin time (PT) and Activated partial thromboplasin time (APTT) were done in all patients. Based on the value of PT (11sec) and APTT (28sec) of laboratory controls, coagulopathy was defined as prolonged PT (>14sec) and/or APTT (>34sec). Patients were followed up till the time of discharge/death.

Results: The prevalence of coagulopathy was 39%.Associated thrombocytopenia was observed in 30/ 39 (76.9%) patients while 18 patients had isolated thrombocytopenia. The mortality was 26%.Platelet count was significantly ($p<0.001$) lower and PT and APTT significantly ($p<0.001$) higher in non survivors as compared to survivors. The mortality was significantly ($p<0.001$) higher in patients with thrombocytopenia and coagulopathy as compared to patients in whom these parameters were normal.

Conclusion: Hemostatic parameters in patients with isolated head trauma at admission may be used to identify patients with a poor outcome.

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INTRODUCTION

Traumatic brain injury (TBI) is a leading cause of post traumatic morbidity and mortality (Dutton and Mc Cunn, 2003). Considering the high economic burden of TBI, evaluation of factors which can predict prognosis will aid in better management of these patients. Glasgow coma score (GCS) (Jennett *et al*., 1977) at admission is used to assess severity of injury and predict prognosis in these patients. Coagulopathy has been frequently observed in patients with TBI and it's presence is reported to be an independent predictor of mortality (Saggar *et al*., 2009). Most patients with coagulopathy are asymptomatic but it leads to secondary brain damage by causing hemorrhage as also infarction due to thrombosis, both of which further contribute to morbidity (Olson *et al*., 1989). Coagulation abnormalities are evident soon after trauma (Scherer and Spangenberg, 1998). Their detection will allow identification of patients likely to have an adverse outcome.

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This can thus help in early initiation of therapy leading to improved prognosis (Subramaniam *et al*., 2013). According to a 2005 survey, 80% of doctors believed that an accurate assessment of prognosis was important when they made decisions about the use of specific methods of treatment such as hyperventilation, barbiturates, or mannitol, and whether or not to withdraw treatment (Perel *et al*., 2007). This study aimed to correlate the presence of coagulopathy in patients admitted within 12hours of isolated head trauma with outcome.

MATERIALS AND METHODS

One hundred patients admitted within 12h of head injury were enrolled in the study. A written informed consent was obtained from all patients for their inclusion in the study. A detailed history was taken and thorough clinical examination including assessment of GCS (Jennett *et al*., 1977) was done in each patient. Head injury was classified as mild (GCS13-15), moderate (GCS 9-12) and severe (GCS 3-8). The following investigations were done in all patients: complete blood counts including platelet count (Automated analyser LH 500), PT (PT Dade Behring Thromborel S) and APTT (APTT Dade Behring

Based on the value of PT (11sec) and APTT (28sec) of laboratory controls, coagulopathy was defined as prolonged PT (>14sec) and/or APTT (>34sec) (Carrick *et al*., 2005). SPSS (20.2) was used for calculating Range, Mean, Standard deviation and Median values for all the quantitative and qualitative parameters. For comparison between survivors and non survivors for all the qualitative parameters, Chi-Square test/ Fisher's Exact Test was employed while for all the quantitative parameters, Unpaired T-test was used. The study received clearance from the Institutional Ethics Committee for human research. The procedures followed were in accordance with the ethical standards on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. The patients were followed up till the time of discharge/death.

RESULTS

The age of the patients ranged from 7-82y with a Mean ±SD of 33.7 ±13.6y; majority (60%) of patients being in the age range of 21-40years. The study included 78(78%) males and 22(22%) females. Road traffic accident was the most (74%) frequent cause of TBI, the others being fall from a height (13%) and physical assault (13%). As assessed by GCS, mild, moderate and severe injury were seen in 45%, 28% and 27% respectively. The results of platelet count, PT, INR and APTT and the abnormal result observed in each parameter are shown in Table 1.

Table 1. Platelet count, PT, INR and APTT and abnormal results in patients with TBI

Parameter	Range	Mean ±SD	Abnormal result	%
Platelet count ($x10^9$/L)	46-274	152.8± 58.4	<150	48
PT(sec)	10.9-52.6	14.4± 5.5	>14	31
APTT(sec)	28.0-61.0	32.5±5.0	>34	26
INR	1.0-4.8	1.3± 0.5	>1.3	27

Coagulopathy was observed in 39% patients. Thirty of these 39 (76.9%) patients had associated thrombocytopenia while 18 patients had thrombocytopenia without associated coagulopathy. Thrombocytopenia and/or coagulopathy were present in 57% patients. The mortality in this study was 26%. Platelet count was significantly ($p<0.001$) lower and PT, APTT and INR significantly ($p<0.001$) higher in non survivors as compared to survivors (Table2).

Table 2. Platelet count, PT and APTT in survivors and non survivors

Parameter	Survivors	Non survivors	p value
Platelet count($x10^9$/L)	172.2± 50.5	97.3± 41.8	<0.001
PT(sec)	12.5 ±1.5	20.0 ±8.4	<0.001
APTT(sec)	30.9 ± 2.7	37.2± 6.8	<0.001

Table 3. Mortality in patients with and without thrombocytopenia and/or coagulopathy

Parameter	Mortality(%)
Platelet count	
Thrombocytopenia	50.0
Normal	3.8
PT	
Prolonged	74.2
Normal	4.4
APTT	
Prolonged	61.6
Normal	13.6

$p<0.001$ for all parameters

A significantly ($p<0.001$) higher mortality was seen in patients with thrombocytopenia and coagulopathy as compared to patients in whom these parameters were normal (Table 3). The mortality in patients with coagulopathy and/or thrombocytopenia was significantly ($p<0.001$) higher (26/57, 45.6%) as compared to those without coagulopathy and/or thrombocytopenia (0%).

DISCUSSION

Coagulopathy remains a serious complication of TBI. It's prevalence in isolated TBI differs considerably among studies due to different study designs and the criteria used to define coagulopathy (Salehpour *et al.,* 2011). Coagulopathy is associated with an increased risk for delayed bleeding and formation of cerebral microthrombi leading to infarction (Harhangi *et al.,* 2008). If recognized early, these complications can be prevented thus improving the prognosis in these patients (Stein *et al.,* 1992). This study assessed the association of coagulopathy with outcome in patients with isolated head trauma. Coagulopathy and/or thrombocytopenia were observed in 57% patients at admission. These findings are consistent with those reported by other authors (Chhabra *et al.,* 2013; Talving *et al.,* 2009). In a study on 387 patients with isolated TBI, coagulopathy was observed in 34% patients. It was associated with low GCS <8, higher mortality and longer ICU stay (Talving *et al.,* 2009).

The mortality in this study was 26%. Non survivors showed a significantly ($p<0.001$) lower platelet count and higher PT and APTT as compared to survivors. Similar results were observed in a study on 52 patients with severe head trauma. There was a significant negative correlation of PT, APTT and INR with Glasgow outcome score. As seen in the present study Median PT, APTT and INR were significantly higher and median platelet count significantly lower in non survivors as compared to survivors (Salehpour *et al*., 2011) . Olson *et al* also reported a strong correlation between prolonged APTT and poor outcome (Olson *et al*., 1989). Similar results have been reported by other authors (Salehpour *et al*., 2011; Vavilala *et al*., 2001). In a study on 107 patients with isolated TBI, both coagulopathy at admission and during the first 24h after trauma were an independent prognostic factor for unfavourable outcome (Greuters *et al*., 2011). Patients with thrombocytopenia and deranged tests of hemostasis had a significantly ($p<0.001$) higher mortality as compared to patients in whom these parameters were normal. Similarly the mortality in patients with coagulopathy and/or thrombocytopenia was significantly ($p<0.001$) higher than those without coagulopathy and/or thrombocytopenia. Similar results were reported in a study on 7638 patients with head injury. Both PT and APTT were independent predictors of mortality (MacLeod *et al.,* 2003). Carrick *et al* studied 184 patients with blunt trauma, 18% of whom died. Thrombocytopenia and coagulopathy were seen in 67% and 62% patients who died. In survivors thrombocytopenia and coagulopathy were seen in 40% and 28% patients (Carrick *et al*., 2005). Similar results were reported by other authors (Chhabra *et al*., 2013; Greuters *et al*., 2011; Ghaemi *et al*., 2011). Thus in patients with isolated head trauma, platelet count, PT and APTT at admission may be used as predictors of outcome. This warrants their routine determination regardless of severity of injury. As coagulopathy is amenable to treatment, it's early identification and timely management may prevent secondary injury and improve outcome.

Conflict of interest: All the authors have no conflict of interest to disclose.

Informed consent: Informed consent was taken from all individual participants in this study.

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