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Research Artice

Traumatic Subarachnoid Hemorrhage Comprising Outcome with Modified Fisher Grade

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ABSTRACT

Traumatic Brain Injury (TBI) is an intimidating challenge faced by neurosurgeons. Among the wide spectrum of brain injuries, Traumatic Subarachnoid Hemorrhage (tSAH) is considering as major causes of morbidity and functional impairment. Traumatic brain injury is a common cause of morbidity and mortality worldwide. Traumatic subarachnoid hemorrhage is one of the common forms of traumatic brain injuries. The reported incidence is around 30%.

Keywords: Traumatic brain injury; Subarachnoid hemorrhage; CT scan; Head injury

INTRODUCTION

Traumatic Brain Injury (TBI) is an intimidating challenge faced by neurosurgeons. Among the wide spectrum of brain injuries, Traumatic Subarachnoid Hemorrhage (tSAH) is considering as major causes of morbidity and functional impairment. Traumatic brain injury is a common cause of morbidity and mortality worldwide [1]. Traumatic subarachnoid hemorrhage is one of the common forms of traumatic brain injuries [2]. The reported incidence is around 30% [3].

In 1859 Wilks first described traumatic subarachnoid hemorrhage as "sanguinous meningeal effusion". Traumatic sub arachnoid hemorrhage is accumulation of blood in sub arachnoid space. It is caused by mechanical injury to the vessels of subarachnoid space [4], and it is an independent worst prognostic factor [5]. The amount of subarachnoid blood on CT scan representing fisher grade and the GCS on presentation predicts the outcome [6]. Traumatic subarachnoid hemorrhage is associated with cerebral contusions and skull fractures [7].

In a study of Eisenberg [8] with 753 patients of severe head injury, raised intracranial pressure and mortality is associated with CT scan findings of midline shift, obliteration or compression of cisterns, and the presence of blood in subarachnoid space [9]. Also, blood in the basal cistern predicts 70% bad outcome [10].

It is clear from the previous studies that traumatic subarachnoid hemorrhage whether alone or with other injuries is associated with poor outcome. In this study, we compared the grade of tSAH by using modified fisher grade with outcome of the patients using Glasgow outcome score, to our knowledge no previous study is done using modified Fisher grading and predicting outcome of tSAH using Glasgow outcome score.

MATERIALS AND METHOD

Setting

This was a study with data of 923consecutive patients with TBI (road traffic accidents, falls, blunt trauma to head) who were admitted to the Department of Neurosurgery, Liaquat National Hospital Karachi Pakistan were included. Patients were divided according to modified fisher grade and the outcome was assessed by using Glasgow outcome score.

Duration

The duration of the study is from 2014 to 2017, a total of 4 years.

Participants

We analyzed 923 patients with severe, moderate and mild traumatic brain injury.

Ethics

The institutional review board approved the research protocols.

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Outcome assessment

This study analyzed the outcome of patient's falls in different categories of modified fisher grade. The results were formatted, calculated and a p-value was assessed using the SPSS 20 software.

Data retrieval

The demographic data, clinical characteristics and CT scan findings were retrieved from the data bank of Neurosurgery Department and from Health information and management services department by the resident R3 and a medical officer.

Inclusion criteria

- Patient age more than 15 years
- Presents within 12 hours of injury
- First CT scan after injury

Exclusion criteria

- Not given consent
- Previously operated patient

Modified fisher grade

CT scan reports based on Modified fisher grade (Table 2) [12].

Table 2: Modified fisher grade based on CT scan findings.

Grade	Criteria
0	No Subarachnoid Hemorrhage (SAH) or Ventricular Hemorrhage (VH)
1	Minimal SAH, no HV in the 2 lateral ventricles
2	Minimal SAH, HV in the 2 lateral ventricles
3	large SAH[a], no VH in the 2 lateral ventricles
4	large SAH[a], VH in the 2 lateral ventricles

VH: Ventricular hemorrhage; SAH[a]: completely filling at least one cisterna or Fissure

Statistical analysis

Patient's data will be compiled and analyzed through the Statistical Package for Social Sciences (SPSS) Version 25. Frequency and percentage will be computed for qualitative variables such as gender, mode of injury, subarachnoid hemorrhage, modified fisher grade, and Glasgow outcome score. Mean ± SD will be calculated for quantitative variable such as age. The stratification will be done to see the effect of these modifiers using Chi-square test. p-value ≤ 0.05 will be considered significant.

- Patients with intoxication and metabolic derangements
- Age less than 15 years
- Time since injury is >12 hours

Glasgow outcome score

Glasgow outcome is showing the score to assess outcome in patients with traumatic brain injury (Table 1) [11].

Table 1: Glasgow outcome score to assess outcome in patients with traumatic brain injury.

GOS 1	**Good recovery**
GOS 2	Moderate disability (disabled but independent), no assistance with activities of daily living
GOS 3	Severe disability (conscious but disabled), needing assistance with activities of daily living
GOS 4	Persistent vegetative state
GOS 5	Death

RESULTS

In our study total sample size was 923 patients among them 703 (78.1%) were male, 197 (21.9%) were females. TBI includes history of Road Traffic Accident (RTA), History of fall, and assault. 677 pts (75.2%) had a history of RTA, 156 (17.3%) had a history of fall, only 8 pts (0.9%) had a history of assault.

798 (88.7%) had positive tSAH on CT scan brain done in the emergency room. In modified fisher grading, 321 (35.7%) patients had Grade 1 tSAH, 144 (16%) patients had grade 2 tSAH, 221 (24.6%) patients had grade 3 tSAH, 58 patients (6.4%) had grade 4 tSAH.

In Glasgow outcome score, most of the patients had good recovery 480 (53.3%), 113 (12.6%) had moderate disability, 79 (8.8%) had severe disability, 40 (4.4%) persistent vegetative state, death occurred in 32 (3.6%) patients (Table 3).

Table 3: Frequency distribution.

Characteristics	N (%)
Mean Age	36.25± 20.27
Gender	
Male	703 (78.1)
Female	197 (21.9)
Mode of injury	
RTA	677 (75.2)
Fall	156 (17.3)
Assault	8 (0.9)
Other	59 (6.6)
Subarachnoid hemorrhage	
Yes	798 (88.7)
No	102 (11.3)
Modified Fisher	
Grade 1	321 (35.7)
Grade 2	144 (16)
Grade 3	221 (24.6)
Grade 4	58 (6.4)
Glasgow outcome score	
Good Recovery	480 (53.3)
Moderate Disability	113 (12.6)
Severe Disability	79 (8.8)
Persistent vegetative state	40 (4.4)
Death	32 (3.6)

There was a significant relation with modified Fisher grading and Glasgow Outcome Score (GOS), we have found inverse relation between GOS and modified fisher grading as p-value was <0.001 (Table 4).

Figure 1 is showing the gender of GOS and modified Fisher grade. Figure 2 is showing the subarachnoid hemorrhage. Figures 3 and 4 are showing the percentile of Modified fisher grade and Glass outcome score. Figure 5 is showing the comparision between modified fisher grade and GOS.

Table 4: Association of gender and modified fisher grade with GOS.

	GOS					p-value
	Dead	Persistent vegetative	Severe disability	Moderate disability	Good recovery	
Gender						<0.00*
Male	27 (4.7)	24 (4.2)	68 (11.9)	103 (18)	351 (61.3)	
Female	5 (2.9)	16 (9.4)	11 (6.4)	10 (5.8)	129 (75.4)	
Modified Fisher Grade						<0.00*
Grade 1	0 (0)	6 (1.9)	6 (1.9)	12 (3.7)	297 (92.5)	
Grade 2	0 (0)	0 (0)	12 (8.3)	42 (29.2)	90 (62.5)	
Grade 3	3 (1.4)	29 (13.1)	43 (19.5)	53 (24)	93 (42.1)	
Grade 4	29 (50)	5 (8.6)	18 (31)	6 (10.3)	0 (0)	

Chi-square test is applied; *Significant at p-value<0.05

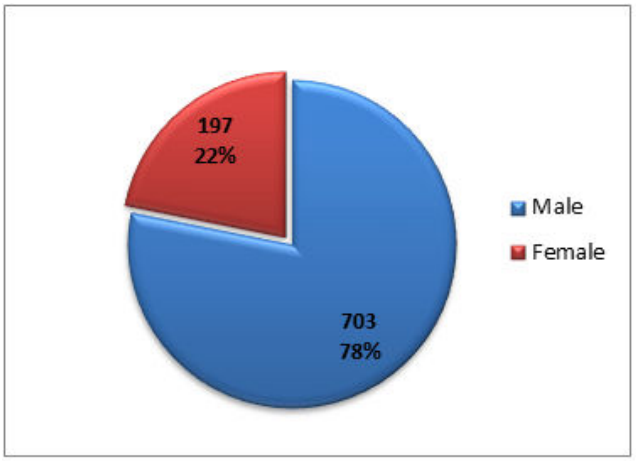

Figure 1: Gender.

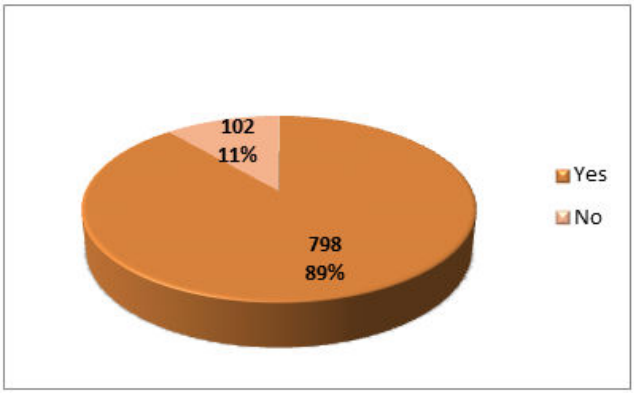

Figure 2: Subarachnoid hemorrhage.

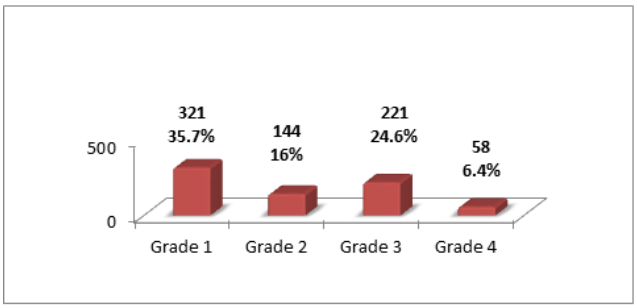

Figure 3: Modified fisher grade.

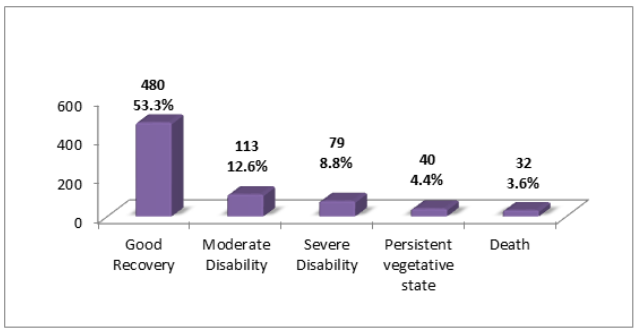

Figure 4: Glasgow outcome score.

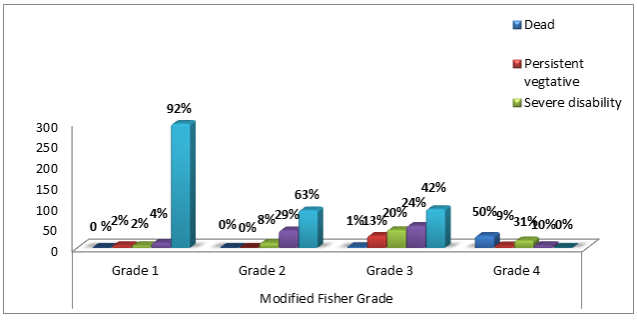

Figure 5: Modified fisher grade v/s GOS.

DISUCSSION

This may be the first study to relate outcome by using the Glasgow outcome score with modified fisher grade. Vasospasm after TBI occurs in around 40 percent of the patients as a result of blood in subarachnoid space [13]. Cisternal subarachnoid hemorrhage and intraventricular hemorrhage are known predictors of vasospasm [14,15]. Resolution of the clot also reduces the incidence of vasospasm [16,17]. The CT Fisher grade is commonly used to assess subarachnoid hemorrhage [18] and is now replaced by modified fisher grade which gives detailed assessment of blood on CT scan.

Possible mechanism of tSAH is rotational acceleration, stretching of vertebrobasilar artery, rise of intra-arterial, tearing of the bridging veins or pial vessels; and diffusion of blood from contusion [8]. Occasionally no obvious pathology was found. tSAH is associated with other brain injuries like subdural hematoma or cerebral contusions etc. The blood in subarachnoid hemorrhage also decreases the absorption of CSF leading to hydrocephalous.

CT scan brain is the investigation for the acute phase. Subarachnoid hemorrhage can be appreciated as hyperdense area between sulci and gyri. MRI can also be used to detect subarachnoid hemorrhage. The best sequence for detecting SAH mostly in acute phase is FLAIR sequence [19]. However they are not suitable for rapid assessment of injuries.

Modified fisher grade is widely used as a prognostic tool for vasospasm [20]. Clinically the severity of injury can be assessed by using the Glasgow coma score [21]. In fisher scale, confusion has arisen because some patients can have thick SAH in addition to significant amounts of ICH or IVH . To overcome this problem modified fisher scale was developed and it was separately explaining the components.

In our study the majority of the patients belonged to mild and moderate TBI as described earlier. CT scan of all the patients was done and categorized in fisher grade accordingly. On discharge outcome was assessed by using Glasgow outcome score. A large number of our patient has good outcome as described earlier representing the fact that majority of the patients belongs to mild and moderate TBI. A small number of patients had a poor outcome. Patients with intraventricular hemorrhage had slow recovery. Low GCS on admission, severe other injuries, and associated other TBI e.g. contusions, subdural hematoma or cerebral edema were associated with poor outcome.

We observed that modified fisher grade 1, 2 and 3 were associated with good outcome clinically and higher the grade the worst is the prognosis.

LIMITATIONS

Our study is single-center study and we have seen only clinical features and have not compared the same with radiological finding of vasospasm.

CONCLUSION

Traumatic subarachnoid hemorrhage is an independent negative prognostic factor. Modified fisher grade predicts vasospasm and indirectly predicts the clinical outcome. There is an inverse relationship found between modified fisher grade and Glasgow outcome score.

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