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Assessment of prognosis in head trauma patients by Madras Head Injury Prognostic Scale (MHIPS)

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ABSTRACT

Background *Traumatic head injuries are the most common cause of mortality and disability among patients suffering trauma. Applying proper trauma scoring systems plays an important role in the management of these patients thus by means of special treatment guidelines, we can improve traumatic patient's prognosis.*

Objective *To determine prognosis in head trauma patients by Madras Head Injury Prognostic Scale (MHIPS) and to compare this scale with Glasgow Outcome Scale (GOS) at discharge.*

Methods *In this cross-sectional study we evaluated 117 patients with head trauma who were admitted in Shahid Mohammadi Emergency Department (ED) in Bandar Abbas. MHIPS (containing 6 prognostic factors) was used to determine patient's prognosis at the initial visit in the ED. We used GOS in order to measure patient's outcome at discharge. All patient's data were recorded through questionnaire with two separate section: Demographic and Clinical data. We compared the correlation of these two prognostic scales.*

Results *Of 117 patients, 98 (83.8%) were male and 19 (16.2%) were female. The mean age range of patients was 31.15±17.7. 61 patients (52.1%) had intracranial injuries with subdural hematoma (SDH) being the most common. The highest rate of full recovery (67 patients (87%)) was observed in the group with MHIPS score above 15 and the highest rate of mortality (26 patients (86.7%)) was observed in the group with MHIPS less than 12. There was a significant difference between the two scale when comparing patient's prognosis (p-value<0.001). MHIPS had correctly estimated patient's prognosis in 92.3% of cases.*

Conclusions*: MHIPS has the ability to determine patient's prognosis in head trauma with high sensitivity and specificity. Thus, it is suggested that an appropriate scale like MHIPS should be provided for the emergency physicians to determine patient's prognosis in head trauma.*

KEYWORDS : Head trauma, Prognosis, MHIPS, GOS

INTRODUCTION

Head injury is the most common cause of death in traumatic patients and is the leading cause of disability especially among young communities.[1,2] Estimating prognosis after head trauma is the basis of clinical decisions and will help physicians to allocate available resources for patients with better prognosis.[3] By predicting the severity in head trauma patients, physician can inform their families about the outcome well ahead of time. Determining prognosis of head trauma patients is helpful in the triage of mass casualties.[4] By considering the fact that the majority of trauma victims are under 50 years old, determining their mortality and morbidity is very important.[5] Understanding and proper usage of trauma scoring systems by means of special treatment strategies play an important role in improving patient's prognosis with severe head injuries.[6] Some studies have focused on the increasing usage of predictive models that can verify the risk of mortality and morbidity after trauma.[2]

Ramesh et al in 2007 introduced one of the scoring systems named Madras Head Injury Prognostic Scale (MHIPS). This scale is based on six factors: age, motor response, pupillary reaction to light, Occulocephalic response, brain CT scan findings and other systemic changes. Each item can be scored from 1 (the worst response) to 3 (the best response). MHIPS is based on four simple clinical factors, one demographic data and one imaging findings which are all readily available and simple to calculate.[4] Reliability and validity of MHIPS were determined and confirmed both retrospectively and prospectively in Ramesh study.

One of the scoring systems used widely to predict outcome in head trauma patients, is GCS. Many researchers nowadays are doubtful about the accuracy of GCS especially in patients who can't talk or are intubated.[7]

Many scoring systems are suggested in predicting severity in trauma patient. There are studies indicating that The Trauma and Injury Severity score (TRISS), Acute Physiology and Chronic Health Evaluation II (APACHE II) and Simplified APACHE Score (SAPS II) have been successful in predicting mortality in this special population.[8,9] There are some disadvantages when evaluating these scores, for example: failure of APACHE II score to predict outcome beyond 24 hours, or APACHE II and SAPS II vary among different populations thus their validity is controversial.[10]

Glasgow Outcome Scale (GOS) is a good prognostic scale in trauma patients at the time of hospital discharge. It consists of 3 stages and shows us the final outcome of patients.

The outcomes are:
Good outcome with full recovery or relative disability. Full recovery refers to having the ability to return to prior workplace. Relative disability refers to having the ability to live independently but not the ability to return to prior workplace.

Poor outcome with sever disability or stable vegetative status. Sever disability refers to having the ability to execute commands, but not to live independently.

Worst outcome, which includes patients who have died.[11]

Thus it seems that one simple, ready and objective scoring systems should be used in order to predict outcome in the most proper way that most specialists have agreed on its validity. Since there wasn't any similar study in Iran, we decided to use MHIPS scale in our head trauma patients at Shahid Mohammadi Emergency center in Bandar Abbas.

Materials and methods:
In this cross-sectional study we enrolled all head trauma patients, with the indication for performing brain CT scan, who were admitted to Shahid Mohammadi trauma center from Jan to Dec 2012. Patients with concomitant neck injury were excluded from the study, because we couldn't evaluate their response in occulocephalic test. We also excluded patients unwilling to participate in our study. In our study 130 patients with head trauma were enrolled but 13 patients were excluded because of concomitant neck injuries.

Demographic data and clinical characteristics of patients were collected by the emergency physicians who are treating them. These data were recorded in a predesigned questionnaire with two separate parts. Important clinical characteristics were; presence of intracranial injuries, type of intracranial injuries, presence of skull fractures, type of skull fractures, presence of diffuse brain injury, edema, diffuse axonal injury, brain contusion, open skull fracture. History of previous diseases were also recorded. Demographic data included some personal characteristics; age, gender, job, marital status, level of education. Cause of trauma and the mechanism involved were also recorded.

Six important prognostic factors mentioned in MHIPS, were measured at the time of patient's arrival in the emergency department (ED) and after primary resuscitation before any sedative drugs were administered. CT scan findings were reported by a radiologist attending in the ED. Each prognostic factor was scored from 1 (with the worst prognosis) to 3 (with the best prognosis). Data are shown in table 1.

Patients were followed until discharge and the mortality rate was registered. GOS was used to measure and record the results of patient treatment at the time of hospital discharge.[11]

Table 1: Madras Head Injury Prognostic Scale

Factor Score	1	2	3
Age	>45 y/o	15-45 y/o	<15 y/o
Best motor response in GCS	1-2	3-4	5-6
Pupils reaction to light	No reaction	Abnormal	Normal
Occulocephalic response	No response	Abnormal	Normal
CT scan findings	Basal cisterns not seen Midline shift> 5mm Injury volume> 3mm	Basal cisterns partially seen Midline shift< 5mm Injury volume< 3mm	Normal CT scan
Systemic injuries	Thoracic injuries Abdominal injuries Fracture of more than 2 long bones	Fracture of 1 or 2 long bones	No systemic injury

Statistical analysis and sample size calculation
According to Ramesh et al study[4], by considering α=0/05, validity of 87.5% and accuracy (d) of 0/06, the sample size was estimated 117. The data are presented as mean values or proportions, and differences in these values are presented with accompanying 95% confidence intervals (95% CIs). Variables were tested for normality (Kolmogorov–Smirnov test) before analysis. Analytical statistical tests included Chi-square and Kruskal-Wallis. The level of significance was 0.05. SPSS for Windows software (version 22) was used for all data analysis.

Results:
In our study, 130 patients were enrolled, 13 patients were excluded because of having concomitant neck injuries, and finally 117 patients were evaluated. 98 patients (83/8%) were male and 19 patients (16/2%) were female. The mean age of patients was 31/15± 17/7 years old. Motor vehicle collision was the main cause of trauma in our study (63%).

Among patients, 61 (52/1%) had intracranial injuries and the most common injury was subdural hematoma (SDH). Data are shown in table 3.

Table 2: Basic characteristics of patients

Variable		Frequency	Percent
Gender	Male	98	83.8
	Female	19	16.2
Age	Less than 15 years	10	8.54
	years 15-45	87	74.03
	Over than 45 years	20	17.09
Marital status	Single	69	59
	Married	48	41
Level of education	Illiterate	16	13.7
	Reading and writing	15	12.8
	Middle school diploma	18	15.4
	High school diploma	43	36.8
	Higher education	25	21.4
Job condition	Employed	44	37.6
	Unemployed	21	17.9
	House keeping	9	7.7
	Student	31	26.5
	Worker	12	10.3
Mechanism of trauma	Motor vehicle collision	74	63.2
	Falling	43	36.8

Table 3 Clinical characteristics of patients

Variables		Frequency (percent %)	Variables		Frequency (percent %)
Intracranial injuries	ICH°	23 (19.7%)	Skull fractures	Linear	23 (19.7%)
	EDH[1]	16 (13.7%)		Base skull	21 (17.9%)
	SDH[2]	24 (20.5%)		Depressed	14 (12%)
	SAH[3]	15 (12.8%)		No Fracture	59 (50.4%)
Diffuse brain injuries	Edema	25 (21.4%)	Pneumocephalous		21 (17.9%)
	DAI[4]	12 (10.3%)	Contusion		44 (37.6%)

°Intracranial hemorrhage

[1]Epidural hematoma

[2]Subdural hematoma

[3]Subarachnoid hemorrhage

[4]Diffuse axonal injury

Table 4 shows patient's prognosis based on MHIPS and GOS. As it is shown patients with Madras score less than 12 had the most mortality rate. There was a significant statistical correlation between prognosis and patient MHIPS score (p value <0.05).

In our study, maximum recovery rate (90%) was observed in the group younger than 15 years/old and the highest mortality rate (45%) was seen in the group older than 45 years/old. Patient's prognosis had statistically significant correlation with ICH, DAI, contusion and skull fractures (table 5).

Table 6 shows the prediction power, sensitivity and specificity of MHIPS when comparing Madras score and GOS.

Table 4: Patient's prognosis (Comparison of MHIPS and GCS)

Prognosis ≥15 Frequency (%)		Madras score			P-value
		13-14	≤12		
		Frequency (%)	Frequency (%)		
Good	Complete recovery	67 (87%)	0	0	<0.05
	Partial disability	9 (11.7%)	2 (20%)	0	
Poor	Severe disability	1 (1.3%)	4 (40%)	1 (3.3%)	
	Vegetative state	0	2 (20%)	3 (10%)	
Death	Expired	0	2 (20%)	26 (86.7%)	
Total		77 (100%)	10 (100%)	30 (100%)	

Table 5: Patient's prognosis based on other important factors

Patient characteristics		Prognosis						P-value
		Complete recovery	Partial disability	Severe disability	Vegetative state	Death	Total	
Age (years/old)	<15	9 (90%)	0	0	0	1 (10%)	10 (100%)	<0.05
	15-45	51 (58.6%)	7 (8%)	6 (6.9%)	5 (5.7%)	8 (20.7%)	87 (100%)	
	>45	7 (35%)	4 (20%)	0	0	9 (45%)	20 (100%)	
Intra-Cranial injuries	ICH	4 (17.4%)	3 (13%)	0	3 (13%)	13 (56.5%)	23 (100%)	<0.001
	SDH	7 (29.2%)	4 (16.7%)	1 (4.2%)	3 (12.5%)	9 (37.5%)	24 (100%)	>0.05
	EDH	5 (31.3%)	3 (18.8%)	3 (18.8%)	1 (6.3%)	4 (25%)	16 (100%)	>0.05
	SAH	4 (26.7%)	3 (20%)	1 (6.7%)	0	7 (46.7%)	15 (100%)	>0.05
Diffuse brain injuries	Brain edema	10 (40%)	2 (8%)	2 (8%)	1(4%)	10 (40%)	25 (100%)	>0.05
	DAI	0	1 (8.3%)	1 (8.3%)	3 (25%)	7 (58.3%)	12 (100%)	<0.05
Skull fractures		28 (48.2%)	6 (10.3%)	4 (6.9%)	5 (8.6%)	15 (25.8%)	58 (100%)	<0.05
Pneumocephalous		10 (47.6%)	2 (9.5%)	1 (4.8%)	3 (14.3%)	5 (23.8%)	21 (100%)	>0.05
Contusion		16 (36.4%)	5 (11.4%)	3 (6.8%)	2 (4.5%)	18 (40.9%)	44 (100%)	<0.05

Table 6: Prediction power, sensitivity and specificity of MHIPS

Prognosis	Prediction power of Madras score	Sensitivity	Specificity
Good	97.4%	97%	97%
Poor	92.3%	55%	96%
Death	95%	93%	96%

DISCUSSION

In this descriptive analytical study we aimed to investigate the predictive power of MHIPS in determining prognosis of head trauma patients. Most patients were male (83.8%), in the age range of 15-45 years/old (74.37%).

In a similar study by Izadi et al,[12] the highest incidence of traumatic brain injuries was seen among males, active and young communities (16-30 years old). The reason could be performing more risky behaviors in this group of patients.

Our study showed a significant statistical difference when Comparing patient's prognosis with their age ranges (p value <0.05). Young patients (less than 15 years/old) had the maximum recovery rate (45%) and only 10% of them had died. In contrast, patients older than 45 years/old had the highest mortality and the lowest recovery rates (45 and 7% respectively).

Reviewing literature shows that age is a powerful predictor of outcome in trauma. In Gan's study comparison of elderly and non-elderly people in terms of mortality, declared significant statistical differences.[13] Reasons for this could be the aging process, systemic diseases and comorbidities.

According to our results, 61 patients (52.1%) had intracranial injuries with the most common type being SDH 24%. Generally 37.7% of patients had died of intracranial injuries. A significant statistical correlation was observed between intracranial lesions and prognosis of patients (p value <0.05). Patients with ICH had the highest mortality rate among patients with intracranial injuries (56.5%).

Many studies have also identified intracranial injuries as an effective prognostic factor (14-16). Kemal et al reported that the mortality and recovery rates of patients with SDH were about 60% and 38% respectively.[17] The obtained results in our study didn't support Kemal conclusion. SDH didn't lead to the same high death rate in our study. It was may be due to the surgical intervention in this specific group of patients.

In this study, MHIPS had a good prediction power with desirable sensitivity and specificity. Many predictive models have been designed. Most of these models have good predictive power, but they may not be suitable for routine clinical assessment in the ED. For example, they may use parameters such as intracranial pressure measurement or evoked potentials, which are not readily and simply accessible in many centers. In addition, some models are based on many complex mathematical computations, which are time consuming; hence a simple predictive model may be needed with high diagnostic value that can be more applicable in clinical setting. MHIPS is based on clinical factors that are available and measurable and it has a high diagnostic value.

Conclusions:

Current data indicate that, MHIPS has the ability to determine patient's prognosis in head trauma with high sensitivity and specificity. Thus, it is suggested that a scale like MHIPS should be designed for emergency medical centers in order to determine prognosis in the most accurate way. This scoring system can help physicians to triage head trauma patients in an appropriate way.

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