Original Research Paper

Neurosurgery

ANALYTICAL CORRELATIVE STUDY OF GCS AND MARSHALL CLASSIFICATION AS PROGNOSTIC FACTORS IN TRAUMATIC BRAIN INJURY

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ABSTRACT Care of head injured patients forms an important aspect of emergency neurosurgical practice especially in developing countries with optimal facilities. The maintenance of adequate and evidence based standards in head injury care is a multifactorial approach with the whole gamut of social, educational, attitudinal and medical aspects being involved and hence prognostication of the severity and outcome of head injury is paramount in evolving adequate guidelines for care. The aim of the study is to study the significance of Glasgow Coma Scale and Marshall Classification of CT criteria as prognostic factors in traumatic brain injury. This analysis was done in a cohort of patients in the age group of 18 to 40 admitted with head injury during the two year period. The main prognostic factors in traumatic main injury were analyzed. Patients with diffuse injury IV in the Marshall Classification had worse outcome across all age groups with high mortality rates in intraparenchymal injuries and patients with sub dural hemorrhages and linear correlation between age, surgical intervention and degree of injury. The study validates the importance of the basic clinical and radiological examination as quintessential prognostic markers in traumatic brain injury.

KEYWORDS : Traumatic Brain Injury, Glasgow Coma Scale(GCS), Marshall Ct Classification, Prognostic Outcome In Head Injury, Glasgow Outcome Score (GOS)

INTRODUCTION
Care of head injured patients forms an important aspect of emergency neurosurgical practice especially in developing countries with optimal facilities. More than 3.5 million people die worldwide as a result of head injuries and road traffic accidents being the most common cause. The development of modern neurosurgical intensive care with efficient clinical monitoring and adequate supportive ventilation care as well as advanced imaging modalities like 64 slice CT has made enormous impact on the morbidity and the mortality of the patients with traumatic brain injury. The post traumatic sequelae result in huge socioeconomic and family burden and strain. The maintenance of adequate and evidence based standards in head injury care is a multifactorial approach with the whole gamut of social, educational, attitudinal and medical aspects being involved and hence prognostication of the severity and outcome of head injury is paramount in evolving adequate guidelines for care.

AIM OF THE STUDY
The aim of this study is to analyze the demographic profile of head injury in a cross section of patients and to study the prognostic factors in traumatic brain injury and to analyze the correlation of Glasgow Coma Scale and the Marshall CT classification in the prognosis of traumatic brain injury with respect to the outcome in terms of morbidity and mortality.

MATERIALS AND METHODS
The study was done in a cohort of patients in the age group of 18 to 40 years old admitted with traumatic brain injury at Government Rajaji Hospital, Madurai during a two year period. The control cohorts were the patients in the age group 3 to 17 years and another above 41 years treated in the same institution for traumatic brain injury. Patients with polytrauma, alcohol/ substance abuse, cerebrovascular accidents, post ictal state patients and patients with spinal cord injuries were excluded from the study. Patients were divided into three groups, Group A being the study group 18 to 40 years old, control group 3 to 17 years old as Group B and older patients above 41 years old being Group C. All patients were managed with standardized treatment protocol. Stratification was done based on age, sex, neurological assessment especially Glasgow Coma Scale on admission, pupillary reactivity, oculocephalic response(OCR), oculovestibular response(OVR) and other neurological deficits. All patients were subjected to baseline hematological and biochemical investigations and the CT findings were also stratified according to the Marshall CT classification criteria. The outcome was based on the effectiveness of Glasgow Outcome scoring with relevance to the morbidity and the mortality of the patients. All prognostic factors having significant impacts over outcome were recorded and analyzed on univariate analysis basis of individual factors with outcome with special emphasis on GCS and Marshall CT classification.

RESULTS
The results of the study with respect to the demographic profile revealed road traffic accidents to be the main etiology in traumatic brain injury (66.46%) with the mean age of patients in the study group being 29.6 and the male to female ratio of 3.88. The Glasgow Coma

TABLE 1. CT Brain MARSHALL CT CLASSIFICATION

MARSHALL CT CLASSIFICATION	GROUP A		GROUP B		GROUP C		TOTAL	
	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%
Diffuse Injury I	42	26.1	16	29.6	23	27.1	81	27
Diffuse Injury II	24	14.9	8	14.8	10	11.7	42	14
Diffuse Injury III	22	13.7	6	11.1	8	9.4	36	12
Diffuse Injury IV	42	26.1	10	18.5	18	21.2	70	23.3
Evacuated mass lesion	22	13.7	11	20.4	18	21.1	51	17
Non evac. mass lesion	9	5.6	3	5.6	8	9.4	20	6.7
TOTAL	161	100	54	100	85	100	300	100

Scale stratification was 13.66% in GCS above 13, 29.81% in GCS 9 to 13, 32.91% in GCS 5 to 8 and 23.6% in GCS of below 5 in the study group. The pupillary reaction was found to be normal in 50.31% of patients in the study group with the OCR present in 78.26% and OVR present in 80.75%. The Marshall CT classification was grouped as

shown in Table 1 with Diffuse Injury I and Diffuse injury IV being the most predominant.

55.9% of patients in the study group were conservatively managed 44.1% had surgical intervention. The outcome was stratified by

Glasgow Outcome scale scoring with good in 49.06% of patients, poor in 13.66% of patients and death in 37.26% of patients.

DISCUSSION

The importance of various prognostic factors in traumatic brain injury was analyzed with specific correlation to the Glasgow Coma Scale and Marshall CT classification. Age specific mortality and favorable outcome is one of the most important prognostic factor in outcome of traumatic brain injury (table 2)

GCS and outcome had a linear correlation with regard to outcome in the study group as shown by the relatively poor outcome in all groups

TABLE 2. Age And Outcome

OUT COME	GROUP A		GROUP B		GROUP C		TOTAL	
	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%
GOOD	79	49.1	37	68.5	33	38.8	149	49.7
POOR & DEATH	82	50.9	17	31.5	52	61.2	151	50.3
TOTAL	161	100	54	100	85	100	300	100

with regard to lower GCS with strong significance and in correlation with previous studies.(Table 3)

TABLE 3 Gcs And Outcome

GCS	GROUP A				GROUP B				GROUP C				TOTAL			
	GOOD		POOR/ DEATH		GOOD		POOR/ DEATH		GOOD		POOR/ DEATH		GOOD		POOR/ DEATH	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
9 TO 15	51	72.9	19	27.1	31	91.2	3	8.8	21	56.8	16	43.2	103	73.1	38	26.9
3 TO 8	28	30.8	63	69.2	6	30	14	70	12	25	36	75	46	28.9	113	80.1

There was also strong correlation between the bilateral absence of pupillary light response and poor outcome across all groups (Table 4).The study also showed that oculocephalic response was a powerful predictor of outcome in all age groups (Table 5).The presence of Oculovestibular response was also associated with good outcome in all age groups(Table 6).

TABLE 4 Pupillary Reaction And Outcome

PUPILLARY REACTION	GROUP A				GROUP B				GROUP C				TOTAL			
	GOOD		POOR/ DEATH		GOOD		POOR/ DEATH		GOOD		POOR/ DEATH		GOOD		POOR/ DEATH	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
NORMAL	50	61.7	31	38.2	33	76.7	10	23.3	20	55.6	16	44.4	103	64.4	57	35.6
ABNORMAL	29	36.3	51	63.7	4	36.4	7	63.6	13	26.5	36	73.5	46	32.9	94	67.1

TABLE 5 Ocr And Outcome

OCR	GROUP A				GROUP B				GROUP C				TOTAL			
	GOOD		POOR/DEATH		GOOD		POOR/DEATH		GOOD		POOR/DEATH		GOOD		POOR/DEATH	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
YES	75	59.5	51	40.5	36	75	12	25	29	50.9	28	49.1	140	60.6	91	39.4
NO	4	11.4	31	88.6	1	16.7	5	83.3	4	14.3	24	85.7	9	13	60	87

TABLE 5 Ocr And Outcome

OVR	GROUP A				GROUP B				GROUP C				TOTAL			
	GOOD		POOR/DEATH		GOOD		POOR/DEATH		GOOD		POOR/DEATH		GOOD		POOR/DEATH	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
YES	77	59.2	53	40.8	36	72	14	28	30	50.8	29	49.2	143	59.8	96	40.2
NO	2	6.5	29	93.5	1	25	3	75	3	11.5	23	88.5	6	9.8	55	90.2

Patients with diffuse injury IV had poor outcome across all age groups which correlated with previous studies (Table 7).

TABLE 7 Marshall Ct Classification And Outcome

MARSHALL CT CLASSIFICATION	GROUP A				GROUP B				GROUP C				TOTAL			
	GOOD		POOR DEATH		GOOD		POOR DEATH		GOOD		POOR DEATH		GOOD		POOR DEATH	
	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%
Diffuse Injury I	29	69.1	13	30.9	12	75	4	25	6	26.1	17	73.9	47	58	34	42
Diffuse Injury II	14	58.3	10	41.7	6	75	4	25	4	40	6	60	24	57.1	18	42.9
Diffuse Injury III	13	59.1	9	40.9	4	66.7	2	33.3	4	50	4	50	21	58.3	15	41.7
Diffuse Injury IV	7	16.7	35	83.3	3	30	7	70	4	22.2	14	77.8	14	20	56	80
Evacuated mass lesion	14	63.6	8	36.4	10	90.9	1	9.1	13	72.2	5	27.8	37	72.5	14	27.5
Non evac. mass lesion	2	22.7	7	77.8	2	66.7	1	33.3	2	25	6	75	6	30	14	70

The non evacuated lesions with midline shift also had a poor outcome. Early surgical evacuation of especially acute SDH in patients with GCS more than 9 resulted in a more favorable outcome. The overall mortality rate of acute SDH and intracerebral hemorrhage was high across age groups and more so in older ages and in patients with poor GCS. Surgical evacuation of EDH showed better recovery across all age groups.

CONCLUSION

This study showed strong correlation of age, motor score and pupillary reactivity with improved outcome in all age groups with traumatic brain injury. Mild and moderate TBI according to GCS had better prognosis. Diffuse injury IV of Marshall CT classification showed poor outcome. The study validates the importance of the basic clinical and radiological examination as quintessential prognostic markers in traumatic brain injury.

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