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DOES ANTIOXIDANT STATUS IN TRAUMATIC BRAIN INJURY CORRELATE WITH THE SEVERITY OF INJURY?

Neurosurgery

Ogunleye OO* Regional Centre for Neurosurgery (RCN), Usmanu Danfodiyo University Teaching Hospital, Sokoto. Nigeria. *Corresponding Author

Ismail NJ Regional Centre for Neurosurgery (RCN), Usmanu Danfodiyo University Teaching Hospital, Sokoto. Nigeria.

Lasseini A Regional Centre for Neurosurgery (RCN), Usmanu Danfodiyo University Teaching Hospital, Sokoto. Nigeria.

BB Shehu Regional Centre for Neurosurgery (RCN), Usmanu Danfodiyo University Teaching Hospital, Sokoto. Nigeria.

ABSTRACT

BACKGROUND: Traumatic brain injury (TBI) is a common cause of death. This study was aimed to identify the relationship between severity of head injury and total antioxidants status of the patients.

METHOD: The recruitment was through systematic sampling technique. Serum antioxidants status was evaluated by measuring Total antioxidant status (TAS) level. TAS level was correlated with varying degree of severity of head injuries using Glasgow Coma Scale (GCS) Scoring system.

RESULTS: Sixty (60) patients (mean age 35.1± 11.4 years; 83.3% male, 16.7% female).

This study showed that patients with mild head injury have high TAS level while those with moderate to severe head injury have low TAS level and this result is statistically significant Correlations of Glasgow coma scale (GCS) score with TAS level showed high TAS levels in patients with mild head injury and lower levels were found among the moderate and severe head injured patients which was significant statistically

CONCLUSION Oxidative stress plays vital role in severity of traumatic brain injury and TAS level may be useful in predicting prognosis of traumatic brain injury.

KEYWORDS

INTRODUCTION

Traumatic brain injury (TBI) is a leading cause of morbidity and mortality and represents a major public health burden for the individuals under the age of 45 years old (1). Two mechanisms determine the degree of damage following TBI. The primary insult occurring at the moment of impact, while secondary insult represents consecutive pathological processes such as oxidative stress, which is initiated at the moment of injury (1, 3).

Oxidative stress is referred to as imbalance between cellular production of free radicals and the ability of cells to defend against them (4). It has been known to begin immediately after TBI and initiates the events resulting in neuronal dysfunction and death. It has a significant role in secondary damage and the underlying molecular mechanisms of oxidative stress are complex and remain unclarified (4,5).

OBJECTIVES

This study is aimed to identify the relationship between severity of head injury and total antioxidants status of the patients.

METHODOLOGY

Sixty (60) patients with TBIs were recruited into the study using systematic sampling technique. The research was conducted between March – August 2016. The patients with other systemic injuries and previously known illnesses e.g. Diabetes, Hypertension, etc. were excluded.

Demographic data, post resuscitation GCS score and 3mls venous blood was taken within 48hrs of injury and Serum Antioxidant Status was evaluated by measuring TAS levels in the patients. TAS levels were measured using commercially available kits (Rel assay, Turkey)

The novel automated method is based on the bleaching of characteristic colour of a more stable ABTS (2, 2-Azinobis (3-ethylbenzothiazoline-6-sulfonic acid) radical cation by antioxidants (6). The results were expressed as mmol Trolox equivalent/L.

RESULTS

The mean age is 35.05 ± 11.35 years; 83.3% male, 16.7% female and the mean time of presentation (hours) is 15.28 ± 11.24.

Descriptive statistics of the patients is shown with Figure 1 and 98.3% of the patients sustained injury following Road Traffic Accident (Figure 2).

Post resuscitation Glasgow Coma Scale Score (GCS) and serum level of Total Antioxidant Status (TAS) of the patients are shown with Figures 3 and 4 respectively.

Figure 1: Descriptive statistics

VARIABLES	FREQUENCY (%)
Age of Respondents (years)	
18 – 40	49 (81.7)
41 – 65	11 (18.3)
X = 35.50 ± 11.35	
Gender	
Males	50 (83.3)
Females	10 (16.7)
Tribe	
Hausa	45 (75)
Yoruba	8 (13.3)
Igbo	6 (10)
Igala	1 (1.7)
Religion	
Islam	49 (81.7)
Christian	11 (18.3)
Mechanism of injury	
RTA	59 (98.3)
Assault	1 (1.7)
GCS	
Mild	21 (35)
Moderate	20 (33.3)
Severe	19 (31.7)
X = 11.12 ± 3.36	

Figure 2: TBI from RTA

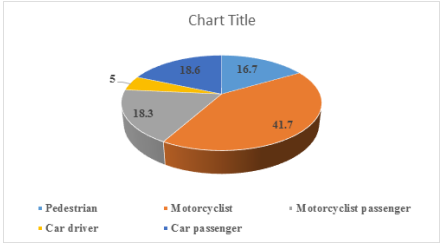

Figure 3: GCS distribution of TBI patients

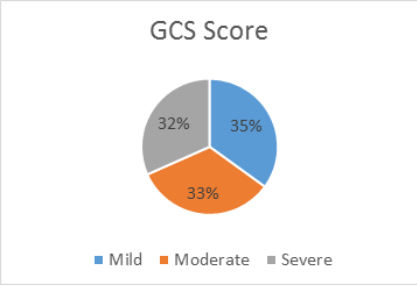

Figure 4: Serum Antioxidant Level of varying degree of TBI

Variables	Mild (14 – 15) Mean ± SD	Moderate (13 – 9) Mean ± SD	Severe (3 – 8) Mean ± SD
Catalase	314.95 ± 41.90	296.83 ± 41.77	293.80 ± 46.35
SOD	733.00 ± 80.77	696.90 ± 120.88	567.00 ± 100.81
GPx	21.33 ± 3.09	20.04 ± 3.37	20.04 ± 3.37

Correlation analysis was assessed for the relationships between TAS levels and the GCS scores using one way ANOVA (Figure 5).

For statistical evaluation, we used SPSS for Win. Ver. 20.0 (SPSS Inc., Chicago, IL., USA). The value of $p \leq 0.05$ was accepted as statistically significant.

Figure 5: Association between Traumatic Brain Injury (TBI) and Serum Antioxidants

Variables	Traumatic Brain Injury (GCS)			p value
	Mild (14 – 15) Mean ± SD	Moderate (13 – 9) Mean ± SD	Severe (3 – 8) Mean ± SD	
Catalase	314.95 ± 41.90	296.83 ± 41.77	293.80 ± 46.35	P = .003*
SOD	733.00 ± 80.77	696.90 ± 120.88	567.00 ± 100.81	P = .000**
GPx	21.33 ± 3.09	20.33 ± 2.95	20.04 ± 3.37	P = .013*

***p = <.05; **p = <.001; One – way ANOVA test**

DISCUSION

Under physiological conditions, the endogenous defence system is able to prevent the formation of free radicals or scavenge these harmful molecules, protecting tissues from oxidative damage (7). In TBI there is a considerable increase in the production of free radicals, supporting the idea that oxidative stress plays a decisive role in the pathophysiology (7, 8).

In this study we demonstrated a higher TAS level among mild head injured patients and lower TAS level among moderate and severe head injured. While a lower TAS level was found among severe head injured patients when compared with moderate head injured patients.

This study is in line with study done by Eghwrudjakpor where decrease in serum TAS levels was noted in patients with the most severe TBI, compared with moderate head injured patients(5).

Our findings support the notion that severe brain injury induced by trauma is associated with excess oxidative stress and reduces the activity of the antioxidant defence system (5, 9). In contrast to our study, study done by Ansari et al (11) showed a significant high TAS level among patients with severe head injury.

Our study also supports severe oxidative stress hypothesis in TBI which are also seen in studies by Eghwrudjakpor (5), Kavakli et al (10) and Awathil et al (12). Results of the current study implies that there is a strong relationship between severity of TBI and oxidative stress.

CONCLUSION

Our results showed there is oxidative stress following TBI in early period. Oxidative stress plays vital role in severity of traumatic brain injury and TAS level may be useful in predicting prognosis of traumatic brain injury.

The results bring to fore the need for antioxidant assay and therapy for TBI patients in early posttraumatic phase. Theoretically this form of treatment may reduce neuronal damage from free radicals and improve outcome in TBI.

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