ORIGINAL RESEARCH

A prospective study of serum albumin as a prognostic factor in head injury

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Received: 14 June, 2023 Accepted: 19 July, 2023

ABSTRACT
Background: Head injury is a major cause of disability and death in the society, however no effective biochemical prognostic markers are available. **Aims:** To assess the prognostic significance of admission serum albumin levels in patients of head injury**. Material and methods:** Prospective cohort study with control group. Within 24 hours of head injury, 115 patients underwent serum analysis for albumin. Statistical analysis was made on the basis of data collected. **Results:** Mean serum albumin in head injury and control were 3.24 and 4.15 g/dL respectively ($p < 0.001$). Admission albumin had significant positive correlation with Glasgow coma score (GCS) ($p < 0.001$). Hypoalbuminemia (≤ 3.5 g/ dL) at admission was noted in 88%, 52% and 33% of patients with severe, moderate and mild head injury respectively ($p<0$ .001). **Conclusions:** Admission hypoalbuminemia is an effective indicator of the severityof head injury
Key words: Hypoalbuminemia, severe head injury and human plasma proteins

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INTRODUCTION

Head injury, defined as brain damage caused by externallyinflicted trauma to the head, can result in significant physical, cognitive and behavioral impairment. Head injury secondary to road traffic accidents is one of the most common causes of mortality and morbidity in India (Dawodu ST)[1]. Other causes include fall, assault and fall of heavy object. Following head injury all neurological impairment does not occur at the moment of impact but develops over the ensuing hours and days, with the primary injury leading to secondary injury[2]. These processes include alterations in cerebral blood flow and pressure within the skull (Saatman KE et al)[3]. Albumin is the main protein of human plasma.. Studies have suggested serum albumin to be a valuable prognostic indicator in critically ill patients and not necessarily just a marker of nutritional status. (McClain et al) 4 One such study is of Belayev and coworkers in which they support that serum albumin could have a direct effect on outcome in patients with traumatic brain injuries.

In ischemic and traumatic models of head injury, administration of albumin decreases the volume of brain infarction and edema, improves perfusion and coupling of perfusion and metabolism, and decreases histologic damage to neurons. But, it is associated with better clinical outcome(Belayev L et al)[5]. Considering the fact thatlimited biomarkers of the severity of head injury are clinically available, it is imperative to study each in relation to outcome. In view of the above facts, this is a prospective study intends to evaluate the changes in the serum albumin levels in head injury patientsalso to demonstrate the vital role of albumin (hypoalbuminemia) on neurological outcome and as an independent prognostic indicator in patients with mild, moderate and severe traumatic head injuries within 24 hrs of admission.

MATERIAL AND METHODS

The proposed study titled "**A PROSPECTIVE STUDY OF SERUM ALBUMIN AS A PROGNOSTIC FACTOR IN HEAD INJURY**" was conducted on 115 patients of head injury who were admitted in the surgicalwards Hospital M.P

STUDY DESIGN

Prospective study

STUDY PERIOD

This study was conducted between 1st June 2019 – 31st May2020

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CASE SELECTION

EXCLUSION CRITERIA

- Patients aged less than 12 yrs
- Alcoholics
- Polytrauma patients
- Hepatic diseases, chronic renal failure and patients withcardio-respiratorydiseases.

All the patients with traumatic head injury who were admitted under Department of General Surgery through casualty and transferred from other departments were considered for this study. Out of these individuals, patients who fulfilled the exclusion criteria were included in this study. The patients who had trauma within 24hrs of admission were included in this study. The patients (if conscious) or the accompanying attenders were asked for brief history and then patients were clinically examined while simultaneously resuscitating them. Later on detailed history regarding the date and time of the incidence, mode of injury and the demographic details were obtained. During clinical examination central nervous system was thorough examined. Glasgow Coma Scale (GCS) was used to assess the severity of the injury. The predesigned proforma was filled using these informations.

Patients once resuscitated were subjected to complete secondary examination to rule out any associated systemic injuries/ diseases. Then patients had emergency and routine hemotological investigations, Xrays and NCCT head. Patient's serum albumin levels were recorded.Definitive surgical management was given if required depending on the reports thus obtained. The patients were monitored during their course of critical illness. Final outcome either favourable (complete recovery) or unfavourable (death or vegetative state) were documented.

The patients who went LAMA, Absconded or transferred to higher center were considered under unfavorable outcome. Patients were advised to followup in neuro-surgery/general surgery OPDs regularly.

METHODOLOGY

The patients who were included in the study were graded based on the severity of Traumatic Brain Injury (TBI).

Severity of TBI was defined using GCS at admission:

- Mild : 13 -15
- Moderate : 9-12
- Severe : <9

The Serum Albumin level was documented as -

- Hypo-proteinemia - <3.5 g / dl
- Normal - >/= 3.5g/dl

The final outcome was documented as favorable if there was complete recovery and unfavorable if there was mortality or vegetative state of the patient.

STATISTICAL ANALYSIS

All the above data was tabulated and analysed. Compared with the relevant literatures. Appropriate statistical test were applied to arrive at the results and conclusions.

RESULTS

Table 1: Gender wise distribution of cases

S.No.	Sex				
			Serum albumin<3.5	**Serum albumin>3.5**	**% of hypoalbuminemia**
1	Male	96	30	66	31%
2	Female	19	09	10	47%
Total		**115**	**39**	**76**	**33%**

Out of total 39 patients with hypo-proteinemia, 30 patients were male and 9 cases were female; 47% of female patients had hypoalbuminemia whereas 31% of male patients had hypoalbuminemia.

Table 2: Age wise distribution of cases

S.No.	Age Groups(in yrs)				
		No.	**Serum albumin <3.5**	**Serum albumin >3.5**	**% of hypoalbuminemia in age group**
1	0 to 20	23	08	15	34%
2	21 to 40	67	23	44	34%
3	41 to 60	22	07	15	31%
4	>60	03	01	02	33%
	Total	115	39	76	33%

It is evident from above table that the age group of 0-20 and 21- 40years had equal amount of incidence of hypoalbuminemia. Next common age group was of >60years . Third common group was of 41-60 years .

Table 3: GCS Vs Outcome

GCS	Cases	Favourable outcome	Unfavourable outcome (comorbid/died patient)	%Favourable
Mild	64	50	14	78%
Moderate	23	10	13	43%
Severe	28	10	18	35%

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Total	115	70	45	60%
Chi-square= 18.3599. P-value = 0.000103.				

78% of mild GCS patient had favourable outcome, followed by 43%in ModerateGCS and 35% in severe GCS. It shows that higher GCS leads to better outcome.

Table No: 4 Outcome Vs Albumin

	Favourable outcome		**Unfavourable outcome(died /comorbid patient)**	
No. of patients	70		45	
Albumin level	Serum albumin<3.5	Serum albumin>3.5	Serum albumin <3.5	Serum albumin >3.5
	20	50	19	26
% of hypoalbuminemia	28%		42%	

42% of unfavourable outcome had hypoalbuminemia whereas28% favourable outcome hadhypoalbuminemia.

Table No. 5: Distribution of cases according to NCCT finding

Computerized Tomography Scan (CT Scan)	**Total**
1.Extradural Hemorrhage(EDH)	13
2.Subdural Haematoma(SDH)	22
3.Subarachnoid Hemorrhage(SAH)	18
4.CONTUSION	48
5.Diffuse Axonal Injury(DAI)	7
6.OTHERS	7
TOTAL	115

DISCUSSION

The study titled "A prospective study of serum albumin as a prognostic factor in head injury" was conducted on 115 patients whowere admitted in Department of General Surgery, from 1st June 2019 to 31st May 2020. The patients were included into study once they fulfilled all the inclusion and exclusion criteria. The Aims andObjectives of the study was to assess the role of serum albumin in the outcome of traumatic head injury patient.Head injury associated mortality and morbidity contributes immensely to socioeconomic losses in various developing countries (Gururaj G) [93]. TBI initiates a complex cascade of metabolic sequelae which determine the recovery and final outcome of the patients. Serum albumin is the most abundant protein in plasma and makes up approximately 60% of the total plasma protein.(Johnson et al)[94] Thenormal range for serum albumin is 3.6 - 5.5 g/dL. It is one of the negativeacute phase reactants, that falls as a component in the Metabolic Response to Injuryor Infection (MRII), not dependent of the effects of nutrition (Johnson et al)[94]. Fleck et al[95], reported the major cause of hypo-albuminemia in systemic injury due to increased vascular permeability and not necessarily due to malnutrition.

Our study was conducted to assess the role of albumin in theoutcome of thetraumatic brain injury patients and the following observations were made

AGE

In the study done by Kalagate et al.,[(96)] the mean age of the patientswas 53.34 years (± 20.04 years). The mean age of favourable outcome was 47.8 years (± 21.7 years) and that of non favorable was 62.3 years (± 13.0 years). There wasa significant difference (p = 0.011) between the2 groups indicating a higher age at admission for unfavourable outcome. In this present study the mean age of thepatients was 32.4 yrs and the mean age of the patients who survived was 32 yrs.Age groups 0-20 & 21- 40 had equal amount of highest 34% (8 cases and 23 cases respectively) incidence of hypo-albuminemia. Next common age group was > 60yrs.

GENDER

In our study 96 individuals were male amongst which 30 (31%) individuals hadserum albumin level <3.5 and 66 individuals had serum albumin level more than 3.5. Among the 19 females involved in this study 47% (9 cases) had hypoalbuminemia. A prospective study done by Pandey[91] et al., Department of Neurosurgery, Government Medical College Haldwani, Nainital, Uttarakhand

MODE OF INJURY

In our study the commonest mode (70%) is RTA which has maximum hypo- albuminemia (37%). Next common mode is assault (16%) which has 21% hypo-albuminemia cases. Third common mode is fall (13%) which has 33% hypo- albuminemia cases.

NCCT FINDINGS

In our study the commonest NCCT finding was Contusion (41%)in which 8% hypo- albuminemia occur. Next common NCCT finding was SDH (19%) in which 29% hypo- albuminemia cases seen. Third common NCCT finding wasSAH (13%) in which 21% hypo- albuminemia cases seen. Our study results were comparable with results obtained in Pandey et al., study in which contusions (28%) was the most common NCCT finding followed by SAH (14%) and SDH(12%).

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HYPO- ALBUMINEMIA VS GCS

In our study total number of patients in severe, moderate and mild categories were 28, 23 and 64 respectively. Out of 28 patients with severe TBI 15 patients had hypo-albuminemia (p=0.0115). Statistical significance was present between admission serum albumin levels and GCS with p value =0.0070 (p value <0.05= significant). A retrospective study completed by Bernard et al[87], 70% of the patients in cohort has favourable outcome while 16% of them died. Patients with a favourable outcome were younger and higher GCS score at time of admission. The serum albumin levels remained below 2.5 g/dl for a longer period of time in the group with a bad outcome (3 days vs. 6 days; p 0.012). Serum albumin was especially low (2.5 g/dl) for a greater proportion of time spent in the ICU (p= 0.047) in patients with an poor outcome. One more prospective cohort study done by Dhandapani et al[88], showed similar results where significant falling trend in admission albumin levels was present with fallin the patients GCS, with p value < 0.001.

HYPO- ALBUMINEMIA VS MODE OF TREATMENT

In our study, 57% of the surgically managed patients had hypo- albuminemia. This was statistically significant (p value=0.05). Thus patients who required surgical intervention were found to have significantly lower serum albumin levels (mean 3.36) compared to those having conservative management (mean 3.99). It shows that operative patients had more hypo-albuminemia when compared to non operative patients. Thus association was stronger in surgical patients. Similar study done by Dhandapani et al[88], showed patients who required surgical intervention were found to have significantly lower serum albumin levels (mean 3.15±0.5 g/dL) compared to those who were treated conservatively(mean 3.35 ± 0.5 g/dL). Our results were similar to that obtained by Kant et al[92]., in their prospective observational study. This showed that out of all operated patients, 70.73% had hypoalbuminemia which was much higher compared to conservatively managed patients (p value = 0.006).

CONCLUSION

The study titled **"A prospective study of serum albumin as aprognostic factor in head injury"** was carried out on 115 patients admitted in Department of General Surgery, from 1st June 2019 to 31st May 2020 with aims and objectives to assess the role of serum albumin in outcome of head injury patients. 115 patients admitted for headinjury in surgical wards were selected for study with their consent. . The patients included in study who had trauma within 24hrs of admission were included in this study, during which serum albumin level estimated. The final outcome was documented as favourable if there was complete recovery and unfavourable if there was mortality or vegetative state ofthe patient.

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