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HYPOALBUMINEMIA IN CARDIAC SURGICAL PICU PATIENTS

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ABSTRACT

Objective: The aim is to study frequency of hypoalbuminemia and examine factors associated with hypoalbuminemia in critically ill-children.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: Armed Forces Institute of Cardiology & National Institute of Heart Diseases Rawalpindi, from Jan 2016 to Sep 2016.

Material and Methods: This prospective study measured the serum albumin concentration of 153 children admitted to Peads intensive care unit after congenital heart disease surgery. Data was collected from PICU registry included demographic profile (age, sex, and weight), clinical findings and postoperative complications. Data was entered and analyzed in IBM SPSS Statistics 22 (statistical package for social sciences).

Results: Mean albumin level was 31.8 mg/dl (Range 8-56 mg/dl). Patients with albumin more than 25 mg/dl were 132 (86%) and patients with albumin less than 25 mg/dl were 21 (14%). 13 (62%) patients with hypoalbuminemia were females. Average ICU stay of patients with hypoalbuminemia was 211 ± 458 hours. Average ventilation time of patients with hypoalbuminemia was 49 ± 103 hours.

Conclusion: Hypoalbuminemia is the prominent factor in post operative congenital heart disease patients. It is strongly correlated with the type of defect, cyanosis and it effects the post operative complications like ICU stay, ventilation duration and urine output of the patients.

Keywords: Hypoalbuminemia, ICU, Peads intensive care unit.

INTRODUCTION

Albumin is a highly water soluble protein, it constitutes up to two-third of total plasma protein and is responsible for the transport and binding of many molecules[1]. Serum albumin has been extensively evaluated as a biomarker for predicting adverse outcomes and mortality in patients undergoing high risk surgery[2-4]. Various studies have shown that low blood levels of albumin can indicate malnutrition and a poorer prognosis in terms of increased morbidity and mortality[5-8]. Hypoalbuminemia was defined as an albumin level of less than 2.5 g/dL at any time during PICU stay[9]. Hypoalbuminemia is a frequent and early biochemical derangement in critically ill-patients. Cardiac surgery and cardiopulmonary bypass (CPB) induced inflammatory response syndrome leads to endothelial dysfunction and edema secondary to capillary leak across all major organ systems all of which manifest in the immediate postoperative period[9]. Besides dietary intake, nonnutritional factors such as chronic inflammation, recurrent infections, hepatic failure, renal dysfunction, altered gastrointestinal function, increased right sided heart pressures, dilution from fluid overload, and medications can influence serum albumin concentration. Such states are frequently encountered in patients with long standing cyanotic congenital heart disease (CCHD)[10-13].

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MATERIAL AND METHODS

This prospective study, conducted from January to September 2016, measured the serum albumin concentration of 153 children admitted to Peads intensive care unit after congenital heart disease surgery. The protocol of the study was approved by the hospital Institutional Ethical

Review Board Committee. It's the unit's policy to perform comprehensive metabolic profile including serum albumin level of all admitted patients at the time of admission in intensive care unit. Serum albumin concentration was measured from 0-6 hours post surgery. Hypoalbuminemia was defined as an albumin level of less than 2.5 g/dL at any time during PICU stay[9]. Data was retrieved from PICU registry included demographic profile (age, sex and weight), clinical findings, postoperative mortality, length of ICU stay, ventilation time, GI complications, urine output, TLC levels, arrhythmias, cyanosis and major cardiac complications were evaluated.

The statistical analysis was carried out using SPSS software version 22 (IBM corporation,

Table-1: Relation of albumin levels with categorical variables.

S.No	Variable	Albumin levels		*p*-value
		>25 mg/dl (n=132)	<25 mg/dl (n=21)	
1.	Gender: Male Female	90 (68%) 41 (31%)	8 (38%) 13 (62%)	0.008
2.	Ethnicity: Punjabi Pakhtun Kashmiri Hindko	 74 (56%) 39 (30%) 11(8%) 1(0.7%)	 17 (81%) 2 (9.5%) 2 (9.5%) 0	0.314
3.	RACHS categoray Class 1 Class 2 Class 3 Class 4	 18(14%) 106 (80%) 6 (4.5%) 2(1.5%)	 2 (9.5%) 19 (90%) 0 0	0.629
4.	Primary procedure: ASD closure BDG Fontan- Primary Modified BT shunt PA Banding PDA closure PPM placement Senning/ Mustard Procedure Sub Aortic Membrane TAPVR/PAVSD/AVSD Repair VSD Total correction Valve replacement COA repair	 17(13%) 7(5.3%) 1(0.7%) 7(5.3%) 4(3%) 0 3(2.2%) 2(2%) 3(2.2%) 11(8.3%) 45(34%) 24(18%) 06(4.5%) 2(1.5%)	3 (14%) 1 (4.7%) 4 (19%) 2 (9.5%) 1 (4.7%) 0 0 1 (4.7%) 0 2 (9.5%) 5 (24%) 1 (4.7%) 1 (4.7%)	0.0850
5.	Diagnosis: VSD PDA TGA TOF COA DORV	 48(36%) 0 4 (3%) 31 (23%) 2 (1.5%) 3 (2.2%)	 4 (19%) 1(4.7%) 1 (4.7%) 8 (38%) 1(4.7%) 1 (4.7%)	0.046
6.	Cyanosis	69 (52%)	16 (76%)	0.033
7.	Major complication CPR Shift to OT	 2 (1.5%) -	 4 (19%) 1 (4.7%)	0.548
8.	Fever	5 (%)	0	0.663
9.	Stool passed	59 (%)	7 (33.3%)	0.403
10.	Bradycardia Tachycardia	1 (0.7%) 28 (21%)	1 (4.7%) 8 (38%)	0.113
11.	Reopening	1 (0.7%)	0	0.858
12.	Mortality	6 (4.5%)	3 (14%)	0.109

USA) and statistical tests applied were Chi-square and T test for comparing various groups. Descriptive statistics was applied to calculate mean, standard deviation and percentages.

RESULTS

Mean age of patients with hypoalbuminemia was 81 ± 113 months, height 97 ± 36 centimeters and weight 18 ± 19.9 kg. Mean albumin levels was 31.8 mg/dl (Range 8-56 mg/dl) (table-I). Patients with albumin more than 25 mg/dl were 132 (86%) and patients with albumin less than 25 mg/dl were 21 (14%). Ninety four (62%) patients with hypoalbuminemia were females. 8 (38%) patients with hypoalbuminemia were diagnosed with TOF and 4 (19%) with VSD. 16 (76%) hypoalbuminemic patients were cyanotic. Most of the hypoalbuminemic patients fall in class 2 of RACHS category (Risk adjustment for congenital heart surgery) i.e. 137 (90%). Average ICU stay of patients with hypoalbuminemia was 211 ± 458 hours (Range: 16-2160 hours) and patients with normal albumin levels stayed in ICU for average 64 hours (Range: 8-665 hours). Average ventilation time of patients with hypoalbuminemia was 49 ± 103 hours (Range: 3-365 hours). Average urine output of patients with hypoalbuminemia was 8538 ml (Range: 1 ml-35155 ml) and patients with normal albumin levels average urine output was 2478 ml (Range: 1 ml-19095 ml). Mean postoperative TLC levels of hypoalbuminemic patients were 15.95 ± 7.8 (table-II).

Table-II: Relation of albumin levels with continuous variables.

Continuous variables	Serum Albumin (0-6 hrs)	Mean	Std. Deviation	*p*-value
Age in Months	<= 25	81.38	113.087	0.537
	26+	70.13	70.483	
Height in Centimeters	<= 25	97.52	36.731	0.651
	26+	101.02	32.097	
Weight in Kilograms	<= 25	18.22	19.968	0.998
	26+	18.21	16.361	
CPB Time in minutes	<= 25	67.29	62.844	0.446
	26+	76.13	46.443	
X-Clamp time in minutes	<= 25	55.05	76.740	0.785
	26+	58.77	52.729	
Total ICU stay in hours	<= 25	211.38	458.076	0.001
	26+	64.33	79.501	
Total ventilation time in hours	<= 25	49.29	103.428	0.084
	26+	23.83	53.105	
Urine Output - ml (0-6 hrs)	<= 25	8538.29	11050.745	<0.001
	26+	2478.83	3243.342	
PD Drainage - ml (0-6 hrs)	<= 25	4208.29	6441.715	0.768
	26+	2942.02	10996.137	
Fluid Balance - Negative / Positive (0-6 hrs)	<= 25	14244.50	47780.819	0.003
	26+	1377.98	3240.811	
Post op TLC	<= 25	15.95	7.80	0.744
	26+	18.1	31.09	

DISCUSSION

Hypoalbuminemia is common amongst children who have heart disease and can affect the outcome of cardiac surgery[14]. We found

hypoalbuminemia in about one-seventh of the total patients.

Davari etal. observed a significant decrease in serum albumin concentration, especially in the male and cyanotic patients,[15] which was related to the severity of metabolic responses. In our study hypoalbuminemia was observed more in females and cyanotic patients.

Murray etal. established that serum albumin level was associated with longer ICU and hospital stay in sick patients. Furthermore in the adult trauma population, patients with a lower serum albumin level (<2.6 g/dL) were found to have significantly longer ICU and hospital lengths of stay, prolonged ventilatory support and greater mortality when matched for age and injury severity[16]. In our study, hypoalbuminemic patients had prolonged PICU stay, high incidence of respiratory failure requiring mechanical ventilator and prolonged ventilatory support.

Abumin concentration at 48 hours after surgery had a positive correlation with the duration of cardiopulmonary bypass establishing the role of the extracorporeal circuit in systemic inflammatory response activation and causation of endothelial cell injury[17]. The patients exposed to longer durations of CPB progressively developed lower serum albumin levels 48 hours after the surgery[18]. In our study there was no relation found in cardiopulmonary bypass duration and X clamp time with hypoalbuminemia.

Fluid balance is also influenced by hypoalbuminemia in the severely ill patient due to inflammation, vasodilatation or increased vascular permeability, increased nonspecific catabolism, malnutrition or liver dysfunction leading to reprioritization of synthesis, or increased protein loss. Increased vascular permeability encountered in sepsis leads to loss of albumin in the interstitial space, thereby reducing vascular oncotic pressure and contributing to the altered fluid compartmental distribution and slow vascular refilling[19]. According to our findings patients having hypoalbuminemia have comparatively higher urine output than normal patients.

CONCLUSION

Hypoalbuminemia is the prominent factor in post operative congenital heart disease patients. It is strongly correlated with the type of defect, cyanosis and it effects the post operative complications like ICU stay, ventilation duration and urine output of the patients.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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