ORIGINAL RESEARCH PAPER

Plastic Surgery

ASSESSMENT OF MICROALBUMINURIA AND BLOOD PLATELET COUNT AND ITS ASSOCIATION WITH THE SEVERITY OF BURNS AND OUTCOMES

KEY WORDS: Burn injury; Microalbuminuria; Thrombocytopenia; Prognosis

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ABSTRACT

Background: Burn injury causes a systemic inflammatory response, leads to reduced platelet count, and leakage of a significant amount of albumin in the interstitium and urine. Prognostic indicators play a critical role in patient management. There are not set prognostic factors indicating the outcome of a patient post burn injury. **Objective:** Correlate microalbuminuria and platelet count with clinical variables in the post-burn injury patients. It is carried out in an attempt to find a simple, cost-effective and at the same time reliable prognostic factor in burn patients. **Methodology:** This is a Prospective Cohort study conducted from May 2017 to December 2018. Any patient presenting with thermal burn injury fulfilling the inclusion criteria was included. Patients with a history of renal dysfunction or co-morbidities precipitating were excluded. Inhalational injury, Systemic inflammatory response, renal failure were assessed along with microalbuminuria and platelet count to outcome variable of survivors and non-survivors. **Results:** A total of 49 patients were included. The presence of microalbuminuria showed a strong association with outcome variables but quantitative analysis of the same was not indicative more over microalbuminuria was strongly positive in presence of Inhalational injury and renal failure. Platelet count reached minimum value at 3 - 5 days from injury showing a strong correlation with outcomes. **Conclusion**: Microalbuminuria and Platelet count are promising prognostic factors and can be used to direct the management of the patient with burn injury.

INTRODUCTION

Burns is one of the most serious injuries inflicted on mankind. This appears to be the price of civilization that man is paying today. India is amongst the few countries of the world where there is an increase in the incidence of burns even though it is on the decline in the western world. Half a century ago commonest cause of death following a burn greater than 20% was a surgical shock, with a better understanding of post-burn surgical shock it is possible to treat this rationally and effectively.

Burn injury causes a systemic inflammatory response with the release of histamine and arachidonic acid-derived cytokines which lead to endothelial cell contraction and inter endothelial gap formation. This process leads to leakage of a significant amount of albumin in the interstitium and urine. In 1961 Arthurson demonstrated this process in animal models and showed that the leak predominately occurs in the first 24hours of burn injury.[1] The amount of albumin protein escape depends on the severity of burns; a 100fold increase in protein is seen in burns involving thirty percentage of body surface area or more. Even though proteinuria has been demonstrated after burn injury there is a paucity of literature correlating microalbuminuria with the severity of burns.[2]
Thrombocytopenia in burns has been thought to be a consequence of inflammatory mediators leading to increased platelet consumption/destruction and decreased platelet production from bone marrow suppression. However, studies by Baughman et al demonstrated no evidence of bone marrow suppression with bone marrow aspiration and, subsequently, support a consumptive/destructive role for platelet decline in the ICU patient. Thrombocytopenia was commonly seen among the critically ill, and several studies have reported its association with a worse prognosis. [3, 4] the study aimed to correlate microalbuminuria and platelet count with clinical variables in post-burn injury patients. It is carried out in an attempt to find simple, cost-effective and at the same time reliable prognostic factors in burn patients.

MATERIALS AND METHODS

This is a Prospective Cohort study conducted from May 2017 to December 2018. Approval by the institutional ethics committee was obtained (Project no. JIP/IEC/2017/30/0022). Patients with Total body surface area(TBSA) burn of 20% and more of both genders and all age groups admitted in our burns center and 10% TBSA in pediatric and over 50yrs were included in the study.

Patients presenting with a delay of more than 24 h, burn other than a thermal injury like electrical burns, chemical burns, patients with a history of any disease that affect renal function such as diabetes, hypertension and systemic lupus erythematosus were excluded.

Age, Gender, Percentage of burns, Inhalational injury, Systemic inflammatory response syndrome, Renal failure, Duration of hospital stay, Microalbuminuria, Platelet counts were the parameters studied.

The term 'microalbuminuria' (MAU) refers to the excretion of pathologically significant amounts of normal-molecular weight albumin in the range of 30–200mg over 24hrs or 30-300mcg/mg of creatinine

Thrombocytopenia is categorized according to severity as

- Grade 1: 75 – 150 x 109/L
- Grade 2: 50- 75 x 109/L
- Grade 3: 25 – 50 x 109
- Grade 4: < 25 x 109/L.

Sample for Microalbuminuria was collected within 24hrs of burn injury, and blood sample for platelet count was collected at 20 -24hrs and 43-48hrs from the time of burn injury and subsequently every other day at morning 8-9 am for the 1st week, the 3rd day for the second week and weekly once after that till the patient was discharged or expired. Urine microalbuminuria was assessed by the nephelometry method Continuous data such as age, Percentage of burns, level of Microalbuminuria, and Blood Platelet Count, Time interval between the injury and presentation were measured as mean with SD. Subgroup analysis based on age was done under 3 broad categories a) up to 18yrs, b) 18 – 50yrs and c) above 50yrs. The comparison of the status of the Microalbuminuria with the categorical variables mentioned above was carried out by using the Chi-Square test. The change in Blood Platelet Count during the course was

measured using the Chi-Square test. Student t-test was used for comparing Microalbuminuria and outcome. All statistical analysis was carried out at a 5% level of significance and P-value < 0.05 was considered significant.

The Statistical software SPSS version 19 was used for the analysis of the data and Microsoft Word and Excel have been used to generate graphs and tables.

RESULTS

A total of 49 patients with ages ranging from 1- 72 years were included in our study. Nearly 77.6% of the patients lay in the age range of 19-50 years and 67.3% of the patients were females. Majority of the patients (46.9%) had 20-40% burns, followed by >60% burns (40.8%). The mean duration of hospital stay was 11.90 (±10.85) days.

Microalbuminuria was present in 48.3% of patients. Ranging from 10.0 to 1220mg/dl (SD 247.5). [Table 1. Figure 1] While a significant association was noted with the presence of microalbuminuria with outcomes, no association was found with the level of microalbuminuria in our study. [Table 2 Figure 2]

The inhalational injury was present in 67.3% of the patients. SIRS was seen in 77.6 %. Renal failure was present in 36.7% of the patients. Chi-square test showed a significant association of inhalational injury, SIRS, and renal failure with the outcome. [Table 3, Figure 3]

Platelet count showed a significant association with outcomes between day 3 to day 6 counts and the minimum value of platelet count during the study variation from baseline was also significant as per the chi-square test [Table 4].

There was no significant association between outcome and Microalbuminuria/Thrombocytopenia (p = 0.246). [Table 5, Figure 4]

Table 1: Assessment of microalbuminuria

	Minimum	Maximum	Mean	SD
Microalbuminuria	10.0	1220.0	103.5	247.4

Microalbuminuria	N	%
Present	14	48.3 %
Absent	15	51.7 %

Microalbuminuria was present in 48.3% of patients.

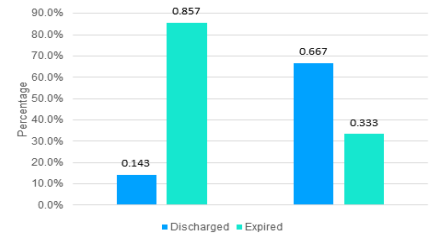

Figure 1: Distribution of Microalbuminuria

Table 2: Association between outcome and presence of microalbuminuria

	Discharged		Expired		Student's t-test	
	Mean	SD	Mean	SD	t	p
Microalbumin Levels	21.03	10.88	161.64	313.59	1.847	0.083

	Outcome				Statistical Association	
	Discharged		Expired			
	N	%	N	%	x^2	p-value

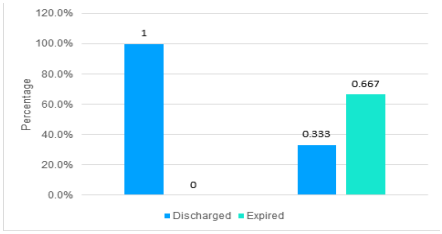

Figure 2: Distribution of Association between outcome and presence of microalbuminuria

Table 3: Association between outcome and Microalbuminuria/Inhalational Injury

		Outcome				Statistical Association	
		Discharged		Expired			
		N	%	N	%	x^2	p-value
Microalbuminuria and Inhalational Injury	Both Microalbuminuria and Inhalational Injury Present	2	14.3%	12	85.7%	10.390	0.006
	Microalbuminuria Absent, Inhalational Injury Present	2	40.0%	3	60.0%		
	Both Microalbuminuria and Inhalational InjuryAbsent	8	80.0%	2	20.0%		

There was a significant association between outcome and Microalbuminuria/Inhalational Injury(p = 0.006).

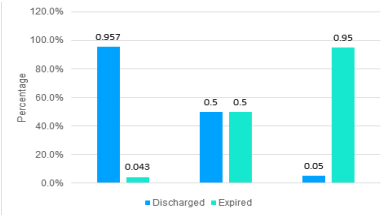

Figure 3: Association between outcome and Microalbuminuria/Inhalational Injury

Table 4: Change in Platelet Count

Change in Platelet Count	Day 2		Day 3		Day 4		Day 5		Day 6	
	N	%	N	%	N	%	N	%	N	%
Increased	10	23.8 %	8	32.0 %	9	32.1 %	14	70.0 %	12	52.2 %
Decreased	32	76.2 %	17	68.0 %	19	67.9 %	6	30.0 %	11	47.8 %

Table 5: Association between outcome and Microalbuminuria/Thrombocytopenia

		Outcome				Statistical Association	
		Discharged		Expired			
		N	%	N	%	x^2	p-value
Microalbuminuria and Thrombocytopenia	Both Microalbuminuria and Thrombocytopenia Present	0	0.0%	3	100.0 %	2.362	0.246

	Microalbuminuria Present, Thrombocytopenia Absent	12	46.2%	14	53.8 %		

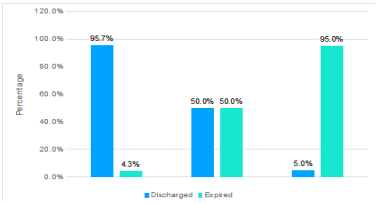

Figure 4: Association between outcome and Microalbuminuria/Thrombocytopenia

DISCUSSION

Prognostic indicators help in determining the likely course of the condition (improving, deteriorating), mode of treatment (conservative, aggressive, need for surgical intervention) including expectancy of survival. The prognostic indicator should be reliable, reproducible, less cumbersome, and bedside test easy to perform the test. These prognostic indicators play a critical role in patients needing intensive care, which include burns. To date, no single clinical or laboratory parameter has fulfilled the criteria of the ideal prognostic indicator in burns.

Burns's injury patient undergoes rapid physiological changes over a short duration. To assess these changes and aid in clinical decision making various prognostic indicators have been described. [5] The Acute Physiology and Chronic Health Evaluation (APACHE) score commonly used for all intensive care patients excluded burns patients, Moore et al analyzed mortality with APACHE III score on burns patients and it was found to be a better mortality indicator but the findings were limited to a small group and less severe burns patients.[6]
Critical illnesses such as burns invoke a wide systemic inflammatory response to the ongoing insult. This response of the body can lead to multiple organ failure and death.[7] The ongoing inflammatory response can lead to damage to the endothelium and hence loss of endothelial barrier and systemic leakage. This process of damage also affects the kidney wherein glomerular permeability is increased with the excretion of albumin.[8] Platelets are associated with the process of inflammation and well documented.[9]

Asmat et al studied the utility of microalbuminuria in pediatric burns and found it to correlate with the severity of burns, length of stay, and predict multi-organ failure. [10] Vlachou et al studied hourly urine samples for microalbuminuria in adult patients showing a correlation between the percentage of total burn surface area, inhalational injury, and mortality.[11] Platelet count trends in burn injury patients were analyzed, thrombocytopenia in burns was observed to follow a pattern of nadir at 2- 5days and peak at 11 – 17days.[12] Hemodilution post fluid resuscitation, consumption of platelet for microthrombi formation, suppressed bone marrow contribute to thrombocytopenia.[13]

In this prospective study, we attempted to find simple, reliable investigations as a prognostic factor in burns patients, which can be applied even in facilities with minimal resources.

We stratified age into 3 groups for analysis and burn injury was found in 77.6 % of patients belonging to the age group of 19 – 50 years. Mean age 29.51(SD 15.38) Females accounted for 67.3% of burns of whom 81.8 % of a woman belong to the age group of 19 – 50 years. Self-inflicted injuries, accidental cooking injuries were the common mode of burn injuries. The result is comparable to the results of Bhansali et al mean age 28years (SD= 14.7years) and male to female ratio of 0.6 [14].

In our study, microalbuminuria was present in 48.3% of patients, and the mortality rate was 85.7% among those with positive microalbuminuria. Statistical analysis showed a significant association between the presence of microalbuminuria and the outcome of the patient (p=0.008). Roham et al investigated microalbuminuria in burns patients in 62 patients and the mortality rate was found to be 41.9% for the first 24hour as compared to 85.7% in our study and 71% in the next 24 hours.[15] High mortality in our study attributed to 40.8% of burns patients sustaining burns of more than 60% of total body surface area.

Absolute values of microalbuminuria ranged from 10.0 to 1220microgram/dl with a mean of 103.5 and a standard deviation of 247.7. The mean value in patients discharged was 21.03 (SD 10.28) and 161.64 (SD 313.59). No significant associations were found between the absolute value of microalbuminuria with the outcome as an absolute value was skewed but the presence or absence of microalbuminuria had a significant association with outcomes.

The inhalational injury was seen in 67.3% of our study. Mortality was seen in 63.6% of patients. Association of inhalational injury with microalbuminuria was assessed, 73.7% of patient with inhalational injury were found to have microalbuminuria and 85.7% of these patients had mortality as compared to Sheriff et al and Cochrane et al in whose studies microalbuminuria was seen in 100% and 33% patients of inhalational injury.[16,17]

Systemic inflammatory response syndrome (SIRS) is commonly seen in patients with a burning surface of more than 20. 77.6% of our patients had SIRS and mortality of 60.5% was found. 35.9 % of patients with SIRS were found to have microalbuminuria. The chi-square test showed a significant association of SIRS with the outcome of the patient. 67.7% of patients had SIRS with microalbuminuria in a study conducted by Roham et al.[15]

Renal failure was seen in 36.7% of the patients. All patients with renal failure had mortality. 92.3% of patients with renal failure had microalbuminuria as compared to 61.3% by Roham et al significant association was seen with renal failure and outcome. 88.8% of a patient having renal failure sustained a burn injury of >60% of TBSA. 46.2% having post burn SIRS developed renal failure.[15]

In our study, day 3 – day 6 platelet showed a falling trend, minimum platelet during this period of hospital course was studied with the outcome and it showed a significant association, suggesting mortality directly proportional to fall in platelet to baseline value recorded at admission. Lower platelet counts were seen in patients with multiple organ dysfunction and non-surviving patients. Variation of platelet counts was assessed w.r.t baseline value not amounting to thrombocytopenia and found a significant association with the outcome. The mortality rate depends not just on inpatient having fallen in platelet below normal but also in a patient having variations in values within the normal range as seen in study 22.7% of our patients had normal platelet counts. Our results are inconsistent with Marck et al who showed that platelet count reaches nadir during day 3- 5 post burns and rises thereafter. Fall in platelet count is attributed to dilution by resuscitation fluid, consumption coagulopathy, bone marrow suppression. Drugs like silver sulfadiazine, heparin, morphine are known to produce thrombocytopenia which is regularly used in burns patients were not included in analysis.[9]

Association between outcomes with combined microalbuminuria thrombocytopenia was analyzed and no significant association was found. No studies combining microalbuminuria and thrombocytopenia exist so far.

CONCLUSION

The presence of microalbuminuria has been shown to have a strong association with the outcome of burns. The absolute value of microalbuminuria has not been shown to correlate with the severity but the presence is of prognostic value. Microalbuminuria is significantly associated with inhalation injury, renal failure, and the onset of SIRS. Platelet count reaches nadir on day 3 – 5 of burns followed by a rise, the minimal value on these days has shown to influence the outcome of the patient.

Considering the limited size of the sample, of this present study, a similar study with a larger sample size for better prognostic correlation can be undertaken and serial assays of microalbuminuria throughout therapy can be further evaluated.

Although Microalbuminuria and Platelet count together have not shown to be significantly associated with burn outcomes in our study but are promising prognostic factors individually.

Declaration of interest: None

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