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A prospective study of platelet count as a prognostic indicator in burn septicemia

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Abstract
Background: Septicemia is the most important cause of mortality in burns. Burn patients can only be saved if septicemia is detected early which requires very sensitive prognostic indicator. In this study, platelet count was studied as a prognostic indicator.
Material and Methods: Present study is to be carried out on 50 burn cases (age > 15 years and burn surface area 20% to 70%) in Department of Surgery, J.L.N. Medical College and Associated Group of Hospitals, Ajmer during the period 2013 to 2016.
Results: In non-survivors gradual decline in platelet count was observed on subsequent post-burn days till death of these patients. While in survivors gradual rise in platelet count was observed
Conclusion: Declining platelet count is a very sensitive prognostic factor in early detection of post burn septicemia.

Keywords: Septicemia, platelet count, prognostic indicator, burn

Introduction
Platelets play an important role in severe homeostasis disorders and immune response impairments in burn patients. Platelets are small fragments of megakaryocyte cytoplasm, which play a fundamental role in primary and secondary homeostasis, as crucial reactions of the coagulation cascade occur on their phospholipids surface. Although their primary function is haemostatic regulation, they also act as inflammatory cells. They release inflammatory mediators, express pro inflammatory surface molecules, interact with leukocytes and endothelial cells, thus taking part in the induction of acute and chronic immune responses [1].
Burn injury is very common and the incidence of burn is 1.1 per 1,00,000 populations according to Michael Peck in epidemiology of burn injuries globally. The majority of burn injuries are minor although painful. In contrast, a small number of individuals receive massive, deep burns that are accompanied by permanent disfigurement or death. Traditionally, burn area and patient's age have been employed as the primary predictors of mortality after thermal injury. Other factors identified during the course of hospitalization also may help to predict accurately those patients who are likely to die [2].
Thrombocytopenia is almost universal in bacterial infections associated with bacteremia and is usually the result of increased platelet consumption. The reduced platelet count may be an isolated finding or may be associated with disseminated intravascular coagulopathy. Thrombocytopenia usually occurs early and can be an early indication of bacteremia in burn patients [3].
Sepsis remains the major cause of death in burn patients. The moment there is invasion of microorganisms into the systemic circulation, the patient develops septicemia. Once the patient develops septicemia, it affects almost all the organ systems of the body, leading to systemic inflammatory response syndrome, followed by multiple organ dysfunction syndrome with death as an ultimate effect.
Hence, burn patients can only be saved in early phase of septicemia before the occurrence of irreversible damage to various organs. Declining platelet count occurs very early in septicemia even before clinical signs and symptoms develop. This requires the presence of sensitive parameters which can detect septicemia in its early phase, so that early detection and institution of treatment can save the life of burn patients.

Material & Methods

Present study is to be carried out on 50 burn cases in Department of Surgery, J.L.N. Medical College and Associated Group of Hospitals, Ajmer during the period 2013 to 2016.

Inclusion criteria

1. All adult (age ≥15 years) burn cases, irrespective of sex admitted in burn ward.
2. Burns 20% to 70% of total body surface area. Burns < 20% and >70% excluded from the study. This study has background of septicemia in burn patients.

Exclusion criteria

1. In < 20% burns cases septicemia is seen in very less number of patients hence excluded >70% burns cases have very high and early mortality due to hypovolaemia and die even before developing septicemia. So they were excluded from the study.
2. Children were excluded from the study, because of very less number of such patients available for the study making statistical inference difficult.

Investigations

1. Platelet count: By visual methods/ automated analyzer XP100.
2. TLC and DLC (by automated analyzer XP100).
3. Pus culture and sensitivity.
4. Serum creatinine.
5. Blood sugar

The culture studies were performed on 50 patients admitted in surgical wards of J.L.N. Hospital, Ajmer (Raj), having more than 20% of burn and of any age & sex were selected for present study. The cultures were collected from the burn area within 48 hours after occurrence of burn & then 7th day's interval, thereafter maximum up to 21st post burn day of Hospitalization. Simultaneously the patient Blood collected and processed to isolate the bacteria. Topical antibiotics were applied in all patients for first 24 Hrs.

In these cases the swab culture, blood culture & full thickness burn tissue biopsy cultures & culture sensitivity tests were considered as the next logical step for diagnostic & therapeutic work up.

A detailed clinical history was taken in every case. The percentage and degree of burn were also recorded. History of past illness, personal history, family history and mental status of the patients was also taken.

Routine laboratory investigations were carried out for getting extra information about the patients conditions like

Hb, TLC, DLC, ESR, platelets counts.

Blood sugar, Blood urea was also done.

Other investigations may be added according to complications occurred after burn.

Material

1. Petri dish
2. Semi-Micro balance
3. Sterile physiological saline solution (0.9%)
4. Dry & sterile culture flasks & test tubes
5. Disposable syringe (10 cc) & needles.
6. Appropriate culture media
7. Platinum Loop
8. Bunsen Burner
9. EDTA bulb
10. Neubauer counting chamber
11. Light microscope

Procedure

To obtained culture of burn surface topical agents were first removed with sterile saline soaked gauze pads, and then patients were told about the procedure performed on them.

Specimen Collections

Swab Culture

After cleaning the selected skin area with saline gauze, the swabs were directly taken from the wound surface by the swab are sticks & they were replaced quickly in the dry & sterile test tubes.

Platelet Count

For estimation of platelet count, 2 ml of venous blood was collected in EDTA bulb (as anticoagulant) and gently mixed without delay. To this 0.1 ml of blood in 1.9 ml of diluent (1 in 20 dilution) was added. The diluent agent used was 10 g/l ammonium oxalate. The Neubauer counting chamber was filled with suspension and placed in moist petri dish and left for 20 minutes to settle the platelets. Platelets appeared under ordinary illumination as small (but not minute) highly refractile particles under the Light microscope. The number of platelets in one or more area of 1 mm2 was calculated as follows:

$$\text{Platelet count /l} = \frac{\text{Numbers of cells counted} \times \text{dilution} \times 10^6}{\text{Volume counted}}$$

All patients were divided into two groups: (A) survivors, (B) non survivors.

Every patient was subjected to following investigations on 1st, 3rd, 7th, 14th, 21st post burn day.

Observations

In our study total 50 patients studied. Out of 50 patients, 26 patients were female and 24 were male patient. In survivors there is initial decline then gradual rise in platelet counts was observed on subsequent post burn days till discharge of these patients. [Table 1]

Table 1: Mean Platelet count (in lakh/mm3) in survivor

	1st day	3rd day	7th day	14th day	21st day
Mean Value±SD	343.13±76	275.97±76	265.87±94	305.35±87	325.29±75

In non-survivors gradual decline in platelet count was observed on subsequent post-burn days till death of these patients. [Table 2]

Table 2: Mean Platelet count (in lakh/mm3) in non-survivor

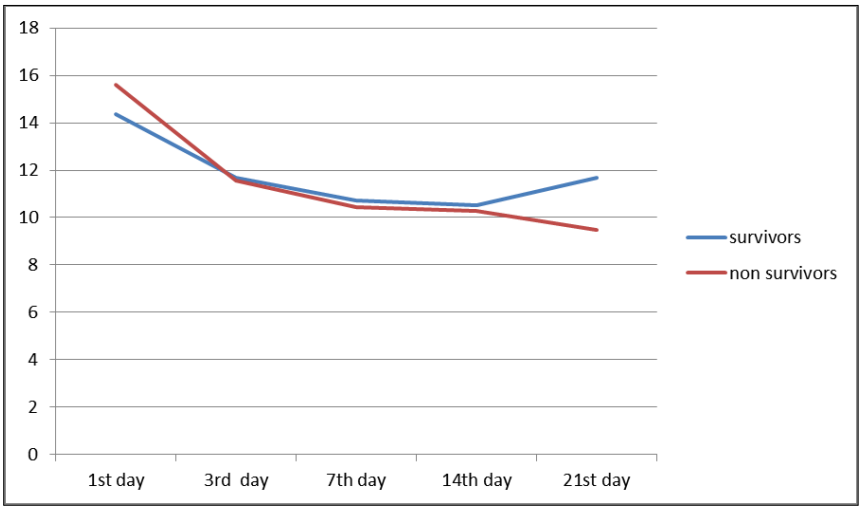
	1st day	3rd day	7th day	14th day	21st day
Mean Value±SD	299.11±81	215.32±94	130.26±37	121.25±36	130.85±29

In a significant number of non survivors (78.95%) platelet count was low before their death, and in a significant number of survivors (90.32%) platelet count was normal before their discharge ($P < 0.001$). [Table 3]

Table 3: Incidence low platelet count in survivors and non survivors

Platelet Count Lakh/Mm3	Survivor	Non- Survivor	Total
‹1.5	3(9.68%)	15(78.95%)	18(36%)
›1.5	28(90.32%)	4(21.05%)	32(64%)
Total	31	19	50

Normal hemoglobin values Adult males(13.3–16.2 g/dL) Adult females (12.0–15.8 g/dL).This line diagram shows that, no changes in hemoglobin values in survivors was observed on subsequent post-burn days till discharge of these patients and that in non-survivors gradual decline in mean hemoglobin values was observed on subsequent post burn days till death of these patients. [Graph 1]



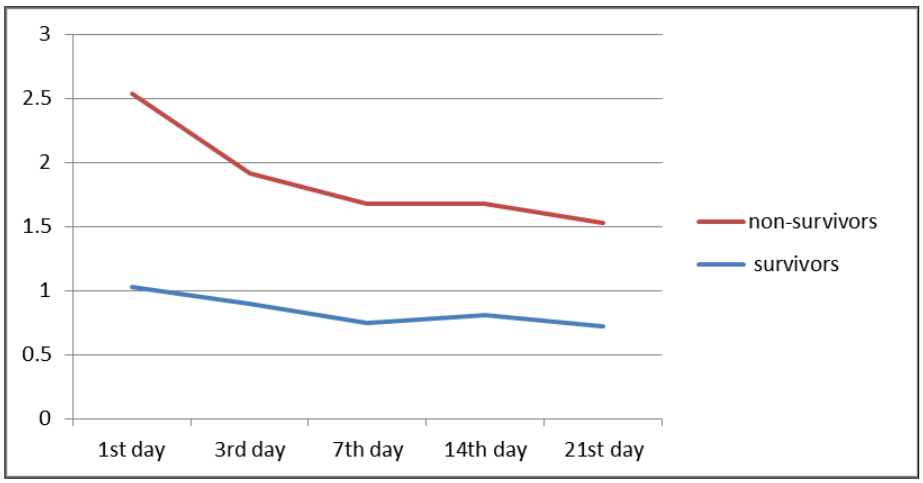
Graph 1: Shows comparison hemoglobin level in survival and non survival groups

In a significant number of non survivors (68.42%) total Incidence abnormal value of leucocyte count was before their death, and in a significant number of survivors (77.42%) total Incidence of normal value of leucocyte count was before their discharge ($P < 0.001$).[Table4]

Table 4: Shows comparison of leucocyte counts in survival and non survival groups.

	Survivor	Non- Survivor	Total
Abnormal value >12,000/µl or <4000/µl	7(22.58%)	13(68.42%)	20(40%)
Normal value (12,000/µl -4000/µl)	24(77.42%)	6(31.58%)	30(60%)
Total	31	19	50

no significant changes in survivors in mean creatinine values was observed on subsequent post-burn days till discharge of these patients and mean value of creatinine was within normal limit. And in non-survivors there is gradual decline in mean creatinine values was observed on subsequent post-burn days till death of these patient and mean value of creatinine was within normal limit. This decline is insignificant. [Graph 2]



Graph 2: Shows comparison creatinine level in survivor and non survivor groups.

Total swab culture taken from burn patient (191) and total swab culture were sterile in burn patient (37). Total swab culture were positive for organisms in burn patient = 191-37=154.

Total Organisms isolated from 154 positive swab cultures samples were 177. Gram +ve organisms were 37.29% & gram –ve organisms were 62.71%. [Table 5]

Table 5: Number of microbial flora of burn wounds obtained by swab culture.

Organisms isolated (Gram +ve)	No. of Organisms	Percentage	Gram –ve Organisms	No. of Organisms	Percentage
Coagulase +ve staphylococcus	39	22.03%	E.coli	27	15.25%
Coagulase –ve staphylococcus	24	13.56%	P. Aeruginosa	52	29.378%
Streptococcus	3	1.695%	Klebsiella	19	10.73%
			Citrobacter	4	2.259%
			Proteus	9	5.085%

Discussion

Our study shows that in survivors gradual rise in platelet counts was observed on subsequent post burn days till discharge of these patients and, in non survivors gradual decline in platelet count was observed on subsequent post burn days till death of these patients., in a significant number of non survivors (78.95%) platelet count was low before (≤1.5 lakh/mm3) their death, and in a significant number of survivors (90.32%) platelet count was normal (≥1.5 lakh/mm3) before their discharge ($P < 0.001$) [Table 3] Akca, Serdar (2002) *et al*. [4] done study showed that platelet count changes in the critically ill have a biphasic pattern that is different in survivors and non survivors. Late thrombocytopenia is more predictive of death than early thrombocytopenia. A relative increase in platelet count after thrombocytopenia was present in survivors but not in non survivors [4]. In our study this biphasic pattern was seen in survivors and in non survivors only gradual decline was seen in our study. Both studies showed that thrombocytopenia is associated with high mortality.

Strauss, Richard (2002) *et al*. [5] done study showed that thrombocytopenia is common in medical intensive care unit patients. A drop in platelet counts of ≥30%, but not thrombocytopenia per se, is independently associated with intensive care unit death. Serial measurements of platelet counts are important and readily available markers for monitoring the patient's condition [5]. Our study shows that continuous decline and platelet count below ≤1.5 lakh/mm3 is associated high mortality.

Vanderschueren, Steven (2000) *et al*. [6] study concluded that thrombocytopenia is common in ICUs and constitutes a simple and readily available risk marker for mortality, independent of and complementary to established severity of disease indices. Both a low platelet count and a large fall of platelet count predict a poor vital outcome in adult ICU patients and results of this study is similar to our study.

Shanti Prakash Kujur, Devpriya Lakra *et al*. [7] carried out a study. Investigated 480 burn patients within the ages of 18 and 60 Years and the percentage of the burn was between 20% and 70%. Platelet count was investigated in all patients. The investigation of the platelet count was done on day 1, 3, 7, 14 & 21 of the patients. Other parameters TLC, neutrophil count & Serum creatinine estimation was also done. In this study was found that the platelet count gradually increased towards normal count and maintained till the discharge in survival patients, and in non-survival the platelet count gradually declined. The statistical significant of difference in mean platelet counts on different post burn days in survivors and non survivors were studied by using standard t test. It was observed that the actual difference between two means is more than double of the SED between two means in different post burn days –i.e., (Day 1, 3, 7, 14 &, 21). So difference is significant ($P<0.05$). These results are in support to our study.

Shanti Prakash Kujur, Devpriya Lakra *et al*. [7] showed that other laboratory parameters such as TLC, Neutrophil count and serum Creatinine does not vary significantly with appearances and progression of septicemia, so its use as prognostic indicators of septicaemia is of less significance.

But our study results showed that in a significant number of non survivors (68.42%) total Incidence abnormal value of leucocytes count was before their death, and in a significant number of survivors (77.42%) total Incidence of normal value of leucocytes count was before their discharge ($P < 0.001$). [Table 4] These observation were against the Shanti Prakash Kujur, Devpriya Lakra *et al*. study. [7]

EI-Sonbaty M.A., EI-0tiefy M.A *et al*. (1996) study showed that haemoglobin concentrations significantly high levels immediately after the burn, especially in the non-survivors. This high level decreased gradually to below control level by day 4 post-burn in the non-survivors and by day 6 post-bum day in the survivors [8].

Our study observation showed that, there is significant difference was observed in haemoglobin values in non survivors (in 73.68% pt. below normal) before their death, and in survivors (in 54.84% pt. normal) before their discharge ($P >0.05$). [Graph 1] Our study observation also showed that haemoglobin concentrations significantly high levels immediately after the burn, in the non-survivors & survivors. This high level decreased gradually to below normal level on subsequent post-burn days in the non-survivors and survivors. These observation are similar to above study.

Our study observation showed that there is no significant changes in non-survivor and survivor in mean creatinine values was observed on subsequent post burn days till discharge/death of these patient and mean value of creatinine was within normal limit. These results were similar to the Shanti Prakash Kujur, Devpriya Lakra *et al*. study [7].

In our study total swab culture were positive 154, showing that gram +ve organism isolated were 37.29% and the gram -ve isolates were 62.71%. Pseudomonas aeruginosa (29.378%) was the most frequent single organism isolated and gram negative organisms (62.71%) outnumbered the gram positive ones (37.29%). Staphylococcus. [Table 5]

In 2013 study conducted at PGIMER Chandigarh. of 215 wound swabs collected from 71 patients, 72 were sterile and 143 yielded 214 isolates. Overall Staphylococcus aureus was the predominant isolate (45%) followed by Pseudomonas aeruginosa (13.9%), beta hemolytic Streptococci (9.4%). [9].

Conclusion

Rebound rise in platelet count on the subsequent post-burn days occurs in survivors. While declining trend is maintained till the death of the patients in case of nonsurvivors. The monitoring of the platelet count is of great importance during the resuscitation and care of severely burned patients. So serial declining of

platelet count can be used as prognostic indicator in burn patients for early detection of septicaemia. It helps in early institution of treatment against septicaemia resulting in favourable outcome of the patient.

Whenever the platelet count begins to decline, all measures to support the general condition of the burned patient should be initiated, including the administration of intravenous fluids and antibiotics, optimal care of the burn wound, debridement or escharectomy, and blood transfusion, so serial platelet count in post-burn period can be used as a prognostic indicator in burnt patients.

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