Original Research Paper

Volume - 13 | Issue - 03 | March - 2023 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

General Surgery

DIAGNOSTIC VALUE OF PROCALCITONIN IN PREDICTING SEPSIS IN BURNS PATIENTS

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KEYWORDS : Procalcitonin, Burns, Sepsis

Introduction:
Patients who have suffered from burns are at an increased risk of dying from sepsis. The combination of a systemic inflammatory response and a recognised infection is what medical professionals call sepsis. If the infection is not treated, then it will lead to severe sepsis, which is characterised by organ dysfunction, low perfusion, and low blood pressure. The systemic inflammatory response syndrome, often known as SIRS, may have an infectious or a noninfectious origin. When dealing with patients who have suffered serious trauma or burns, it is often difficult to determine whether SIRS is the consequence of the injury itself or whether it is related to a superimposed infection. In patients with SIRS, the majority of the clinical symptoms of infection, including fever, tachycardia, and leukocytosis, were also present. As a result, in order to circumvent this problem, the American Burns Association established a consensus panel, and criteria were drafted in order to define sepsis in burns patients. In the past, a number of research have been carried out to determine the value of the PCT in both burns and non-burns related situations . Even in the absence of sepsis, the value of PCT may be modestly elevated due to the localised infection. Therefore, the diagnostic threshold for sepsis is quite low when using the cut off value that was examined in the earlier investigations. This study was carried out to determine the PCT value in burns patients and also to locate a threshold value that may be used to suspect sepsis in its early stages. We intend to incorporate this threshold value as a protocol into our existing set up – .

Aims and Objectives:
The purpose of this study was to:

1) To determine the diagnostic validity (sensitivity and specificity) of procalcitonin in individuals suffering from burns and sepsis.
2) To determine a procalcitonin threshold value that can be used to identify sepsis in people who have burns.

Methodology:
This is a prospective study done for a period of 12 months from March 1st, 2021 to February 28th, 2022 in the Department of General Surgery, Siddhartha Medical College, Vijayawada. This study was approved by the Institutional Review Board. There were 36 patients involved in this study. Inclusion criteria: All patients with more than or equal to 20% burns. Exclusion criteria: All patients with less than 20% burns. All patients presented with 20% or more of burns admitted in the burns ward of our Hospital were included in the study. If the patient got admitted within 24 hour of injury the resuscitation protocol of our burns unit was started.

American burn association consensus definition of sepsis and infection- 3 or more of the following:

1. Temperature >39°C or 110/min)
2. Progressive tachycardia (> 110/min)
3. Progressive tachypnoea (>25/min)
4. Thrombocytopenia < 1 lac (only applies 3 days after initial resuscitation)
5. Hyperglycemia (in the absence of pre-existing diabetes mellitus)
6. Inability to continue enteral feeding >24 h

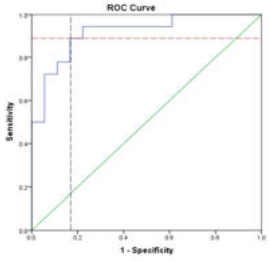
The above, along with documented infection with one or more of the following:

1. Culture positive infection
2. Pathologic tissue source identified
3. Clinical response to antimicrobials

An estimation of the patient's PCT baseline level was performed at the time of admission, when the patient was not yet experiencing sepsis. The subsequent PCT level estimation was performed if it was determined that the patient met the criteria for sepsis. Therefore, the PCT of each patient was evaluated about three times, once upon admission, once during sepsis, and once after the patient had recovered from sepsis.

The following statistical analysis were used:
1) Fisher exact test for categorical data
2) ROC curve to assess the diagnostic performance
3) t-test
4) Mann-whitney U test to know the significance.
To analyse the data SPSS software was used.

Results:
Out of the 36 patients, 20 were males (55.55%), 16 were females (36.11%). The mean age of the study population was 38.32 ± 10.22 years. Majority of the patients sustained thermal burns (82%) followed by electrical burns (18%). 26 percent had burns within 30% of Total body surface area. There was no correlation between the percentage of burns and PCT values though higher values were noted in early phase of electrical injuries. 18 patients had sepsis and 18 patients did not have sepsis.



Sensitivity – 88.9%, Specificity – 83.3%

Analysis with Mann Whitney U test for the relationship between Procalcitonin and sepsis revealed significant correlation (p value < 0.0001). The cut off value was 5ng/ml based on the ROC analysis with area under the curve of 91%. AUC was 0.91.

Discussion:
Infection is one of the most common factors that might lead to sepsis in the general population. It's possible that bacteria, viruses, or fungi are to blame for the infection. The progression of sepsis is a consequence of a certain chain of events. SIRS can develop from any illness,

whether it is localised or systemic, if the infection is not treated. SIRS is characterised by the activation of a wide variety of inflammatory mediators and its criteria for diagnosis were discussed earlier. The systemic inflammatory response syndrome (SIRS) is essentially a natural physiological response of the human body to a noxious stimuli. If the agent that is causing the SIRS is not eliminated, this will result in an even more severe case of SIRS, which in turn will lead to the development of sepsis and severe sepsis, which will finally lead to MODS (Multi Organ Dysfunction Syndrome), and then death(3).

At patients with burns, SIRS first manifests as a direct thermal injury to the skin, then in a later stage, as a result of repeated injuries brought on by infection. Therefore, it is seldom easy to tell if SIRS in patients with extensive burns occurs as a result of the injury itself or as a result of a superimposed infection after the resuscitation period. Since there is no perfect sepsis test, procalcitonin may be more accurate than other indicators. In a healthy person, PCT has a concentration of less than 0.1 ng/ml and is a 13 kD protein. The PCT test is used to distinguish between infections with bacterial and nonbacterial origins. This has been demonstrated by numerous investigations in the past, such as those used to distinguish between bacterial and viral meningitis, bacterial pneumonia, fever of unclear origin, and sterile vs. infected necrosis owing to acute pancreatitis (4). Clinically, PCT has an advantage over other markers due to its half-life and inflammatory stimulus-responsive behaviour. It has a half-life of 24 hours, and 4 hours after infection, PCT begins to rise, peaks at 6 hours, reaches a plateau at 8 to 24 hours, and then takes 2 to 3 days to return to baseline. It will be beneficial clinically to repeat the PCT investigation every three days(5).

According to a study by Barati et al (6) comparing the serum levels of WBC, ESR, CRP, and PCT in burn cases that were septic and non-septic, PCT is a highly effective laboratory parameter that involves a quick and easy bedside test for the diagnosis and prognosis of severe infectious complications after burn.

Serum PCT is a better indicator of sepsis than other inflammatory markers, and the area under the ROC curve has a tolerable accuracy, according to a study by Athina Lavrentieva et al(7). The study divided the cases into sepsis with SIRS and sepsis without SIRS groups and evaluated serum PCT, CRP, leukocyte count, and temperature as markers of sepsis.

In a different study by D. von Heimburg et al (8) they evaluated the PCT values and compared them to the Baltimore sepsis score in severe burn injuries (BSS). The rise in PCT level and the BSS showed a strong link. Even when the blood culture was negative, a PCT result of 10ng/ml and more is suggestive of a serious systemic infection. Patients with a cutoff result below 3ng/ml, which suggests bacterial infection, will have a better prognosis.

Conclusion:

- PCT provides strong diagnostic validity to diagnose sepsis in burn victims with Sensitivity 88.9%, and Specificity 83.3%.
- The cut off value for PCT to identify sepsis in burns patients is 5 ng/ml.

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