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Lymphocytic Immune Response of Children After Thermal Burn Injury in Duhok Burn and Plastic Hospital, Iraq

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Abstract

Objective: To evaluate the immune response to pediatric thermal injury admitted to Duhok Burn and Plastic Surgery Hospital, Duhok, Iraq. Methods: 118 participants were recruited in this prospective cohort study. In this study, patients with thermal burns who were 18 years of age or younger and had at least 10% of their total body surface area burned were enrolled. The medical records were used to collect the patients' demographics, mechanism of burn, laboratory results, and outcomes. About 4 ml of blood samples were taken from each participant and collected in an EDTA tube at two time intervals (24 hours of burn and 72 hours or longer after burn). To determine whether a patient's total white blood cell count, neutrophils percentage, and lymphocyte percentage were normal or abnormal. Results: At the first day, (59%.4) patients had abnormal lymphocyte percentage, while (40.6%) patients had normal lymphocyte percentage. Nevertheless, this difference was not significant (p value 0.42). At the third day, (64.5%) of patients had abnormal lymphocyte percentage, while (35.5%) of patients had normal lymphocyte percentage, which was statistically not significant (p value 0.38). Conclusion: After three days in the hospital, the higher numbers of voluntaries showed no improvement. No significant correlation was found between normal and abnormal lymphocyte percentage between first and third day of burn. Further research is required by including all age groups with bigger sample size to study the whole immune response during thermal burn.

Keywords
Lymphocyte, Immune response, Burn, Duhok

The most severe types of traumatic injuries, with both local and systemic impacts, are thermal burns. The host's defense system may become malfunctioning as a result of such damage, which increases the risk of infection and mortality[1, 2]. As even the leading source of morbidity following thermal injury, bacterial complications are particularly dangerous for burn patients[3, 4, 5, 6]. The immune system, and particularly cellular immune response, undergoes dramatic modifications as a result of thermal injury-related critical disease[7]. The systemic inflammatory response syndrome (SIRS), which is defined by at least two of the following four symptoms: fever, tachycardia, tachypnea, and leukocytosis or leukopenia, is what designates this as an initial pro-inflammatory phase[8]. A homeostasis known as the compensatory anti-inflammatory response syndrome (CARS) coexists with this process. Many immune cell types, including neutrophils, monocytes, macrophages, lymphocytes, and natural killer cells, are significantly reduced both numerically and functionally as a result of CARS. An increase in neutrophils and white blood cells

(WBC) and a decrease in lymphocyte count characterize the typical post-traumatic cellular response. It is thought that prolonged CARS-induced immunosuppression increases the risk of nosocomial infection in critically injured children and contributes to morbidity and mortality in critically ill patients[9]. Negative outcomes in both sepsis and trauma have been linked to immune cellular counts that do not return to normal after 72 hours[10, 11]. Peripheral blood lymphocytes serve as the primary line of defense for humans against harmful microorganisms[12, 13]. Strongest, most dangerous, and potentially fatal infections are likely to exhibit protracted lymphocyte dysfunction[14]; in particular, type I T-cell responses are crucial for the host defense against intracellular pathogens[15]. The aim of this study was to evaluate the lymphocyte response to pediatric thermal injury admitted to Duhok Burn and Plastic Surgery Hospital, Duhok, Iraq.

Material and methods

Design of the study

This is a prospective cohort study was conducted in Duhok Burn and Plastic Surgery Hospital, Northern of Iraq.

Study period

The study was conducted between October 2019 and April 2020.

Sample of the study

In this study, 118 patients with thermal burns who were 18 years or younger that had at least 10% of their total body surface area burned were enrolled. The medical records were used to collect the patient's demographics, mechanism of burn, laboratory results, and outcomes.

Laboratory work

About 4 ml of venous blood were collected from each participant into EDTA tubes at first and third day from admission for measuring hematological parameters that include (Hb, WBC and differential count, and platelets). Complete blood count was measured by automated blood analyzer machine coulter (MEDONIC), Sweden.

Inclusion and exclusion criteria

Patients under the age of 18 years old or younger who had burns with a surface area greater than 10% were included in this study, while, those of less than 10% burn excluded.

Statistical Analysis

Statistical Package for the Social Science (SPSS) IBM 23 software was used for data analysis. P-value of ≤ 0.05 for the Chi-square test was considered significant.

Ethical consideration

The study has been approved by the Ethics Committee at College of Health and Medical technology-Shekhan, Duhok Polytechnic University, Iraq.

Results

Age distribution of burn

Age group of volunteers were ranged between 1 day and 18 years old. Among them, 81 (68.6%) of them were between 1 day to 9 years. Further, 37 (31.4%) of patients were between the ages of 10 to 18 years old (Table 1)

Table 1: Distribution of patient's by age

Age group	Frequency	Percent
0-9 y	81	68.6
10-18y	37	31.4
Total	118	100

Degree of burn

The results showed that 67 (56.8%) of patients had second-degree burns, 32 (27.1%) patients had third-degree burns, and 19 (16.1%) had first-degree burns (Table 2).

Table 2: Distribution of patients by degree of burn

Degree of burns	Frequency	Percent
First	19	16.1
Second	67	56.8
Third	32	27.1
Total	118	100.0

Outcome patients after three day in hospital

After three days in the hospital 48(40.7%) of patients became well and 70(59.3%) did not develop any signs and symptoms wellness (Table 3).

Table 3: Outcome patients after three day in hospital

Outcome	Frequency	Percent
Well	48	40.7
Deterioration	70	59.3
Total	118	100

Comparison between normal and abnormal lymphocytes count at first and third day of admission

At the first day, 70(59.4%) of patients had abnormal lymphocytes while, 48(40.6%) patients had normal lymphocytes, (p value 0.42). According to data from the third day, 42 patients (35.5%) had normal lymphocyte percentage and 76 (64.5%) of patients had abnormal lymphocytes. Accordingly, there was no significant correlation between them (p value 0.38) (Table 4).

Table 4. Comparison between normal and abnormal lymphocytes count at first and third day

Lymphocytes at first day	Normal	Abnormal	P value
	48 (40.6%)	70(59.4%)	0.42
Lymphocytes at third day	42(35.5%)	76(64.5%)	0.38

Discussion

Infection after thermal burn is a significant source of morbidity in the pediatric population. Abnormal lymphocyte count at day 3 or greater has been associated with mortality in adult septic and/or trauma patients[12, 14]. Usually normalization of lymphocyte count needs about a week to return back to the normal state[12, 14]. The study aimed to identify the response of lymphocytes after pediatric thermal burn at two times intervals; first day and third day, we used CBC data, including the WBC and its differential values, as a proxy for the immune response.

In this study no significant association was found between lymphocyte count and thermal injury among children after 72 hours of burn. Our results were disagreed to results of a study conducted in the USA which showed that (63.1%) of patients had abnormal lymphocytes, with significant differences[17]. This is may be due to small sample size and need farther more including samples to detect the exact association between lymphocyte and thermal injury among child age group.

Conclusion

1. The comparison between normal and abnormal lymphocyte at first day and third day were statistically not significant.
2. Patients those had high burns rate was have had high lymphocytes count.
3. After three days in the hospital (40.7%) of patients became well, and (59.3%) remain worse.

Recommendation

1. Patients of all ages were included in the more sophisticated investigation.
2. We suggest conducting additional research and evaluation to manage infections in burn patients.

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Abbreviations

CARS Compensatory Anti-Inflammatory Response Syndrome
CBC Complete Blood Count
EDTA EthyleneDiamineTetraacetic Acid
Hb Hemoglobin
PLT Platelet
SIRS Systemic Inflammatory Response Syndrome
WBC White Blood Cells

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