

## ALTERATION OF COMPLEMENT LEVELS FOLLOWING THERMAL INJURY AND SURGERY

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### SUMMARY

The value of serial complement measurements for early diagnosis of sepsis, determination of septic complications and prognosis have been investigated on patients who were operated and patients with burns. The investigation was made at the Department of General Surgery, Faculty of Medicine, Cumhuriyet University on 63 patients. They were divided into two groups. Thirty-three patients with burns formed group A. Group B was formed by 30 operated patients. Both groups were classified as septic and nonseptic.

In septic patients of both groups, C3c significantly decreased at the end of the first day ( $p < 0.05$ ) and insignificantly increased to admission levels at the 120th hour except septic patients in Group A ( $p > 0.05$ ). There were no statistically differentiations of C4 in this group.

In conclusion, measurements of C3c provide guidelines for prognosis and adequacy of therapy; but serial complement measurement after the 24th hour seems to be even more valuable in the early diagnosis of sepsis. On the other hand, C4 determination is not necessary.

**Key Words :** Complement levels, thermal injury, surgery

### INTRODUCTION

Nowadays, local and systemic infection continues to be a major cause of morbidity and mortality following thermal injury, trauma and surgical procedures (1,2). The improvements on surgical techniques and antibiotics have not altered the impact of complications of severe sepsis (1). The infection remains a significant problem in patients suffering from burns, with 75 to 80% death due to sepsis (3,4). The incidence of postoperative sepsis was 3.9% with a total infection rate of 13.5% (2).

Immune system can be depressed following thermal injury, trauma and operation. Interest in this trauma-induced immunosuppression stems from the increased susceptibility of patients to infection (2).

Early diagnosis and management of sepsis are important for surgeons. Posttraumatic anergy,

decreased neutrophil chemotaxis and serial C3c estimation have been used to predict septic complications of trauma and prognosis (2,5,6).

In this study, we planned to determine whether C3c and C4 levels are important in diagnosis of septicemia, treatment and prognosis in patients who have been burned or have undergone surgery.

### MATERIAL AND METHOD

Two groups of patients were studied at the Department of General Surgery, Faculty of Medicine of Cumhuriyet University, Sivas: 63 patients who had more than 20% burn area or electively operated patients. Patients were divided as 33 burned patients, Group A and 30 operated patients, Group B. These groups were classified as septic and nonseptic. The category of documented sepsis included patients with positive blood cultures, or positive burn wound biopsy specimens yielding greater than 10 organisms per cubic centimeter or showing evidence of tissue invasion by bacteria. According to this definition, 11 patients of Group A and 10 patients of Group B showed septic signs and symptoms. Venous blood samples were obtained by venapuncture preoperatively, at 24th and 120th hours postoperatively in patients who had undergone elective operation and at the time of admission in patients with burn. These samples were centrifuged and C3c and C4 levels were measured immediately.

Serum levels of C3c and C4 were estimated quantitatively by single radial immunodiffusion technique of Mancini et al (7). Nonpartigen C3c and immunodiffusion plates of Behring Institute were used. Results were expressed as IU/ml.

First, second and third values of septic and nonseptic patients in Group A and B were statistically compared by Analysis of Variance for repeated measurements and Tukey test (8).

### RESULTS

Depletion of complement C3c levels in nonseptic patients of Group A and B at first 24 hours and a significant increase to first measurement levels at 120th hour were determined ( $p < 0.05$ ) (Table I). C4 like C3c showed differences in nonseptic patients of

Group A ( $p < 0.05$ ) (Table II), but alterations of C4 levels in nonseptic patients of Group B was found to be insignificant.

C3c significantly decreased in septic patients of Group A and B at first 24 hours ( $p < 0.05$ ) (Table I) but did not reach the initial levels at 120th hour.

levels of operative and thermal injury have been decreased in the first 24-48 hours and normalized at the 72nd hour and later increased (12,13). In our study, complement levels of nonseptic patients in Group A and B are in conformity with those reported in literature.

**Table I- C3c profile of patients in both groups (IU/ml)**

	PATIENTS WITH MAJOR OPERATION		PATIENTS WITH 20% BURNED AREA	
	SEPTIC n:10	NONSEPTIC n:20	SEPTIC n:11	NONSEPTIC n:22
ADMISSION SAMPLES	132.0 ± 39.4	142.5 ± 84.7	101.6 ± 28.0	135.7 ± 70.8
24th HOUR SAMPLES	109.3 ± 33.4	107.8 ± 29.8	76.4 ± 24.2	95.6 ± 33.0
120th HOUR SAMPLES	116.9 ± 27.9	124.8 ± 32.5	84.1 ± 16.9	139.2 ± 60.0
STATISTICAL ANALYSIS	1. $p < 0.05$	$p < 0.05$	$p < 0.05$	$p < 0.05$
	2. $p > 0.05$	$p < 0.05$	$p > 0.05$	$p < 0.05$
	3. $p < 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
STATISTICAL ANALYSIS				
1. Differences between the admission and 24th hour samples				
2. Differences between the 24th hour and 120th hour samples				
3. Differences between the admission and 120th hour samples				

**Table II- C4 levels of patients in both groups (IU/ml)**

	PATIENTS WITH MAJOR OPERATION		PATIENTS WITH 20% BURNED AREA	
	SEPTIC n:10	NONSEPTIC n:20	SEPTIC n:11	NONSEPTIC n:22
ADMISSION SAMPLES	129.0 ± 34.9	145.4 ± 54.1	99.7 ± 61.3	134.0 ± 69.0
24th HOUR SAMPLES	121.3 ± 33.0	131.6 ± 49.6	90.8 ± 45.6	83.2 ± 32.3
120th HOUR SAMPLES	121.6 ± 28.0	133.5 ± 35.7	106.8 ± 20.2	114.9 ± 54.5
STATISTICAL ANALYSIS	1. $p > 0.05$	$p > 0.05$	$p > 0.05$	$p < 0.05$
	2. $p > 0.05$	$p > 0.05$	$p > 0.05$	$p < 0.05$
	3. $p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
STATISTICAL ANALYSIS				
1. Differences between the admission and 24th hour samples				
2. Differences between the 24th hour and 120th hour samples				
3. Differences between the admission and 120th hour samples				

While this decrease was found to be significant ( $p < 0.05$ ), when compared with Group A septic patients, it was not found to be of significance in Group B septic patients. Changes of C4 levels of septic patients in both groups were not statistically significant ( $p > 0.05$ ), (Table II),(Fig.1).

## DISCUSSION

The complement system plays a crucial role in antibacterial defense, neutralization of viruses, changes in vascular permeability, leucocyte chemotaxis and opsonization (2,3,9). The most important step of phagocytosis is opsonization (4,10). Decrease in opsonin level suppresses phagocytosis (11). Inhibition of phagocytosis and suppression of humoral and cell-mediated immunity following trauma has been demonstrated in operated and traumatized patients (5). It has been determined that complement

It has been determined that serum levels of C3 were significantly reduced in patients with shock secondary to bacteremia caused by gram negative organisms, but uncomplicated bacteremia did not diminish C3c levels (14). In a study, four patients were found to be predictive of septic complications on complement estimation: Greater than average fall in 24 hours postoperatively, failure of levels to arise at 48 hours postoperatively, delayed fall of levels at 72 hours postoperatively and persistence of low levels in patients operated on for intraabdominal sepsis (5). Persistent complement depletion has been shown to correlate with the presence of nonviable tissue and sepsis (5). Persistent depletion of C3c levels is apparently a poor prognostic sign (5,12). Adequacy of therapeutic intervention would be signalled by a prompt return of the levels to near normal values (5). In our study, C3c levels of septic patients in Group B were not statistically different at the 120th hour

( $p > 0.05$ ), but was significant in septic patients of Group A ( $p < 0.05$ ). Increase of C3c concentrations at the 120th hour with respect to first levels was accepted as indicator of good prognosis and adequacy of therapy in our patients. Gradual clinical recovery of patients supported this situation. Since there was no mortality in both groups C3c levels of these patients could not be compared. Moreover, serial complement determination in the period between 24th and 120th hours could not be performed to make any diagnosis possible.

In conclusion, measurements of C3c serve as an aid for prognosis and adequacy of therapy, but in the early diagnosis of sepsis. It is believed that serial complement measurement after the 24th hour may even be more valuable. On the other hand necessity of C4 measurements remains to be controversial.

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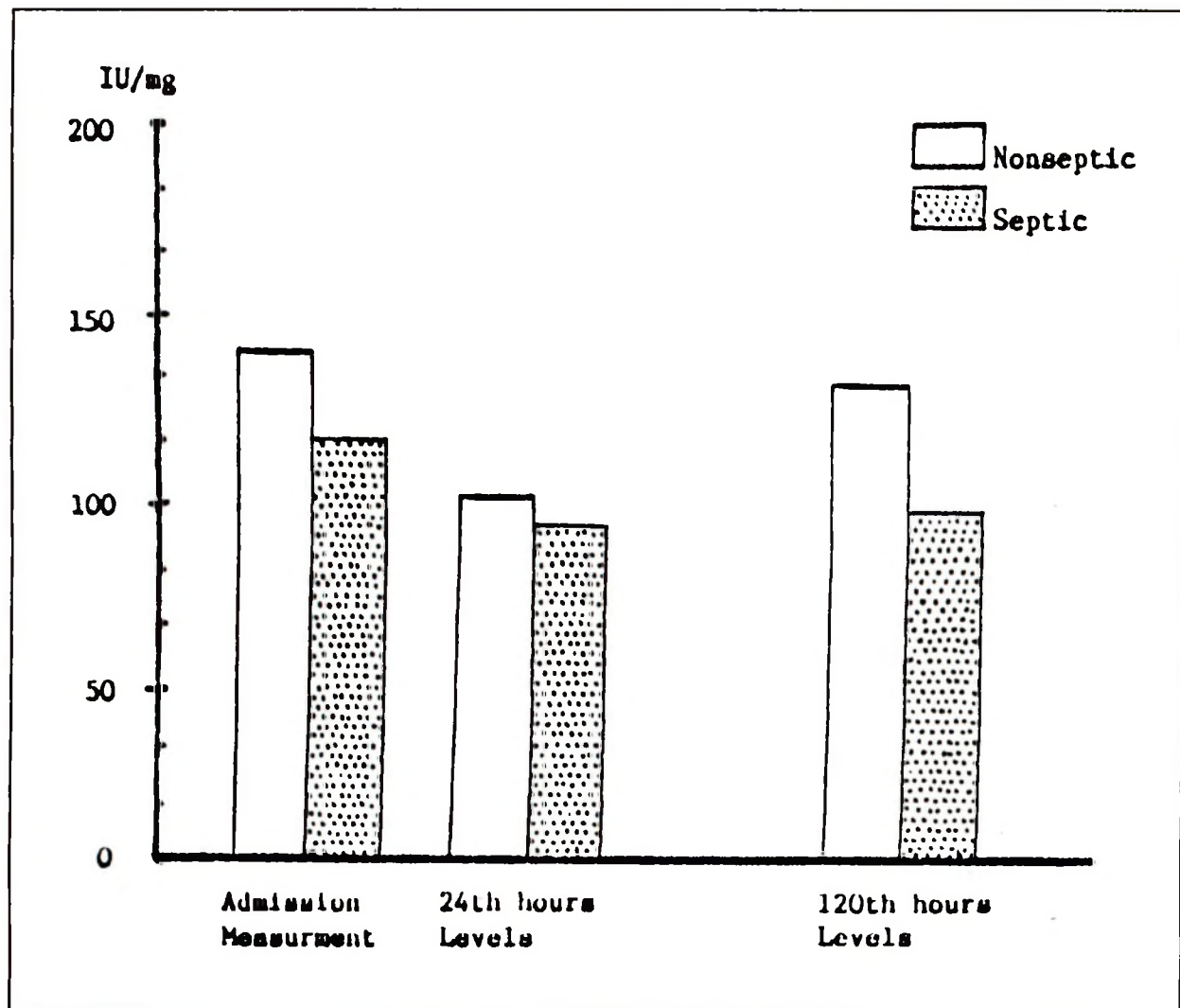


Fig 1. Alterations of C3c levels in septic and nonseptic patients

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