

Immunologic alterations in children undergoing surgery*

Nuran SALMAN, F. Tansu SALMAN, Işık YALÇIN, Ülker ÖNEŞ, Alaaddin ÇELİK
Istanbul School of Medicine, Departments of Pediatrics and Pediatric Surgery. Çapa, Istanbul

Özet

Cerrahi tedavi uygulanan çocuklarda immünolojik değişimler.

Erişkin hastalarda yapılan çalışmalara göre cerrahinin immunodepresan etkisi olduğuna inanılmaktadır. Bu konuda çocuk cerrahisi hastaları üzerine az sayıda çalışma olduğundan, çocuklarda cerrahinin etkisini araştırmak için bu çalışma yapıldı. Elektif cerrahi uygulanacak 26 sağlıklı çocuk çalışma kapsamına alındı. Bu çocukların nötrofil sayımları, opsonik ve bakteri öldürme kapasiteleri ve NBT testi değerlendirilerek nötrofil fonksiyonları çalışıldı. Ayrıca hepsinde lenfosit sayımları, total T hücresi ve immunoglobulin seviyeleri çalışıldı. Nötrofil ve lenfosit sayımlarında önemli değişiklikler saptandı. Ameliyat sonrası, nötrofil sayımında artma ($p<0.02$), total lenfosit sayımında da azalma ($p<0.01$) gözlemlendi. Bu değişiklikler, fonksiyonel bir depresyondan çok immun sistemin cerrahi strese olan normal cevabına bağlandı.

Anahtar kelimeler: Immunodepresyon, cerrahi travma

Summary

Based upon studies of adult patients, surgery is believed to be an immunodepressant. As little data is available in pediatric surgical patient, this study was undertaken to examine the effects of surgery in children. 26 healthy children undergoing elective surgery were randomly selected for study. These children underwent assays of neutrophil function by determining absolute neutrophil count, opsonic capacity, bacterial killing and NBT test. All the children underwent also lymphocytic quantitation by determining absolute lymphocyte count, total T cells and immunoglobulin levels. Significant alterations were only detected in neutrophil counts, showing postoperative increase ($p<0.02$) and in total lymphocytic counts showing postoperative decrease ($p<0.01$). These alterations indicate the normal activities of the immune defense system to surgical stress rather than the functional depression.

Key words: Immunodepression, surgical trauma

Introduction

Even in immunologically intact patients, postoperative sepsis and infection still continues to be an important cause of morbidity and mortality. Although there are contradictory investigations, operation has been shown to alter the immunologic defenses of the adult patient. Based on these

studies, it is assumed that surgery is an immunodepressant. There is little data available regarding the pediatric surgical patient. In this study, we examined the short-term effects of surgery and anesthesia on the immune system of children.

Materials and methods

26 children undergoing elective surgery at Istanbul School of Medicine, Department of Pediatric Surgery, were randomly selected for study (13 inguinal herniorrhaphy, 6 orchidopexy, 3 inguinal herniorrhaphy + hydrocelectomy and 4 hypospadias repair).

None of the children had evidence of acute or chronic infection, chronic disease and/or malnutri-

Adres: Dr. F. Tansu SALMAN, İstanbul Tıp Fakültesi Çocuk Cerrahisi Anabilim Dalı. Çapa, İstanbul.

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tion. Blood was collected from all children 1 hour before and 2 hours after operation.

Assays of neutrophil functions including absolute neutrophil count, opsonic activity (phagocytic index), bacterial killing, and NBT test were performed. Opsonic activity was assayed by the phagocytic index⁽¹⁾. A ratio less than 1.7 indicated decreased activity. Bacterial killing index was measured using *Staphylococcus aureus*. A ratio greater than 0.2 indicated defective bacterial killing⁽¹⁾. NBT test was quantitated by Bachner's method⁽²⁾.

Lymphocytic quantitation including absolute lymphocyte count, total T cells (E-rosette), and immunoglobulin (IgG, IgM, IgA) levels was determined. Total T cells were determined utilizing sheep red blood cell rosette formation described by Brain et al (3).

Immunoglobulins were quantitated by radial immunodiffusion method of Mancini⁽⁴⁾.

All results were analyzed for statistical significance by paired t-test.

Results

The effect of operation on neutrophil function are summarized in Table I. At two hours postoperatively, the total neutrophil counts increased significantly ($p < 0.02$). There were no significant alterations in any neutrophil functional parameters assayed (phagocytic index, bacterial killing index and NBT).

Table I: The effect of operation on neutrophil function in the pediatric patient

	Preop.	2 Hours Postop.	P Values
Absol. neutr. count (cells/mm)	5064.28 (SEM 1153)	6610 (SEM 1560)	$p < 0.02$
Phagocytic index	2.28 (SEM 0.72)	2.21 (SEM 0.79)	NS
Bacterial killing index	0.17 (SEM 0.10)	0.16 (SEM 0.11)	NS
NBT (%)	28.2 (SEM 7.17)	26.5 (SEM 7.24)	NS

SEM : Standart error of mean.

NS : Not significant.

The effect of operation on lymphocytes, cellular and humoral immunity in children treated surgically are summarized in Table 2. At two hours postoperatively, absolute lymphocyte count decreased significantly ($p < 0.01$). Although there was a decrease in E-rosette, 57.4% preoperatively to 52.0% postoperatively, this alteration was not statistically significant. There was no significant alteration in IgG, IgM and IgA level either.

Discussion

Although surgical procedures are now performed with more technical skill, postoperative complications still account for a high rate of morbidity and mortality. Infection is one of the most important postoperative complications. Almost 7.5% of surgical wounds may become infected and infection also is the leading cause of 30% of the postoperative deaths⁽⁵⁾.

These findings suggest that host defense mechanism can be altered after surgery. Numerous investigators have shown that surgery causes immunodepression in adult surgical patients. There is little data available on the immune function in healthy children undergoing elective surgery.

There are significant differences in the immunologic defence system of children compared to

Table II: The effect of operation on lymphocytes in the pediatric patient

	Preop.	2 Hours Postop.	P Values
Absolute lymph. count (cells/mm ³)	3041 (SEM 571)	2195.2 (SEM 541)	$p < 0.01$
E-Rosette (%)	57.4 (SEM 7.72) ‡	52 (SEM 6.14)	NS
IgG (mg/dl)	1372.5 (SEM 377.57)	1388.8 (SEM 479.16)	NS
IgM (mg/dl)	169.75 (SEM 66.78)	165.9 (SEM 75.86)	NS
IgA (mg/dl)	141.24 (SEM 71.49)	155.91 (SEM 79.16)	NS

SEM : Standart error of mean.

NS : Not significant.

adults. This is more pronounced in neonates. There is functional immaturity of T and B cells, deficiencies in total complement and defective leucocyte function⁽⁶⁾.

Granulocyte function have been studied in 25 healthy adult renal donors patients by Bowers et al in detail⁽⁷⁾. They demonstrated that granulocyte chemotaxis and adherence are transiently but significantly impaired following surgical trauma. They also found no alteration in phagocytosis and bacterial killing. In a similar study, El-Maallem and Fletcher have shown that there is a decrease in bacterial activity after surgery⁽⁸⁾. However, they have found no significant changes in phagocytosis. We have demonstrated that there were no alterations in any neutrophil functional parameters assayed. There was no change in phagocytosis, opsonic activity, bacterial killing and NBT test following surgery (Table 1).

In adults, during the postoperative period, cellular immunity and B cells were shown to be depressed⁽⁹⁾. Kurz et al⁽¹⁰⁾ studied preoperative and postoperative lymphocytes in children and found a postoperative suppression especially in the T cell population. We have also demonstrated similar to Mollitt et al⁽¹¹⁾ that T cells are not depressed by using the E-rosette test to asses T cell numbers (Table 2).

Absolute lymphocyte counts diminished in our cases postoperatively (Table 2). This indicates a redistribution of lymphocytes to areas vital for antigen processing such as wound and reticulo endothelial organs⁽¹¹⁾.

The total neutrophil count increased significantly in the postoperative period (Table 1). It has been shown that release of the marginated granulocyte pool due to an endogenous catecholamine response contributes to postoperative leucocytosis⁽¹²⁾.

Our study demonstrates that the alterations in the immunologic function of the postoperative child is an appropriate physiologic response to the stress of surgery. This alterations are the normal activities of the immune defense system to trauma rather than the immunologic functional depression.

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