

# **A Study of Postoperative Sepsis in Ain Shams University Children's Hospital**

## **Thesis**

Submitted for partial fulfillment of master degree  
in **Pediatrics**

**By**

**Nashwa Esam Mohamed**

M.B.B.CH

Faculty of Medicine, Ain Shams University – ٢٠٠٧

**Under Supervision of**

**Prof. Dr. Mahmoud Tarek Abdel Monem**

Professor of Pediatrics

Faculty of Medicine - Ain Shams University

**Dr. Mervat Gamal El Din Mansour**

Assistant Professor of Pediatrics

Faculty of Medicine – Ain Shams University

**Dr. Rania Ali Ammer**

Assistant Professor of Clinical and Chemical pathology

Faculty of Medicine – Ain Shams University

**Faculty of Medicine  
Ain Shams University**

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

(...رَبِّ أَوْزَعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ  
الَّتِي أَنْعَمْتَ عَلَيَّ وَعَلَى وَالِدَيَّ  
وَأَنْ أَعْمَلَ صَالِحاً تَرْضَاهُ وَأَدْخِلْنِي  
بِرَحْمَتِكَ فِي عِبَادِكَ الصَّالِحِينَ)

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# List of Contents

<b>Subject</b>	<b>Page No.</b>
List of Abbreviations .....	i
List of Tables .....	iii
List of Figures .....	v
<b>Introduction</b> .....	١
<b>Aim of the Work</b> .....	٤
<b>Review of Literature</b>	
Postoperative sepsis .....	٥
Risk Factors for Postoperative Sepsis .....	١٠
Specific consideration of Postoperative Sepsis .....	٢١
Interleukin-٦:biomarker of Postoperative Sepsis .....	٤٣
<b>Patients and Methods</b> .....	٤٦
<b>Results</b> .....	٥٦
<b>Discussion</b> .....	٧٥
<b>Summary</b> .....	٩٣
<b>Conclusion</b> .....	٩٦
<b>Recommendations</b> .....	٩٧
<b>References</b> .....	٩٨
<b>Arabic Summary</b> .....	—

# List of Abbreviations

<b>CBC</b>	Complete blood count
<b>CDC</b>	Center for disease and prevention
<b>CI</b>	Confidence interval.
<b>CLABSI</b>	Central line associated blood stream infection.
<b>CVC</b>	Central venous catheter
<b>ETT</b>	Endotracheal tube
<b>ICU</b>	Intensive care unit.
<b>IFN</b>	Interferons.
<b>IL-<math>\gamma</math>r</b>	Interleukin- $\gamma$ receptor.
<b>LBW</b>	Low birth weight.
<b>MODS</b>	Multiorgan dysfunction syndrom.
<b>NNIS</b>	National nosocomial infection surveillance.
<b>NO</b>	Nitric oxide.
<b>OR</b>	Odd ratio.
<b>PICCS</b>	Peripheral inserted central catheter
<b>PICU</b>	Pediatric intensive care unit.
<b>Pt</b>	Platelets
<b>SDD</b>	Selective decontamination of digestive tract.
<b>SD</b>	Stander deviation
<b>SHP-<math>\gamma</math></b>	Srchomology $\gamma$ -contaning tyrosine phosphase.
<b>SIRS</b>	Systemic inflammatory response syndrom
<b>SSI</b>	Surgical site infection.
<b>TLC</b>	Total leucocytic count
<b>TNF</b>	Tumor necrotic factor.
<b>TPN</b>	Total parenteral nutrition.
<b>VAP</b>	Ventilator acquired pneumonia.
<b>WHO</b>	World health of organization.
<b>Wt</b>	Weight

# List of Tables

<b>Table No.</b>	<b>Title</b>	<b>Page No.</b>
<b>Table (١):</b>	Pathogens Commonly Associated with Wound Infections and Frequency of Occurrence .....	٢٦
<b>Table (٢):</b>	Recommendations for Prophylactic Antibiotics as Indicated by Probable Infective Microorganism Involved.....	٢٩
<b>Table (٣):</b>	Descriptive data of all examined population as regard demographic data. ....	٥٧
<b>Table (٤):</b>	Admission diagnosis all examined population as regard admission diagnosis.....	٥٧
<b>Table (٥):</b>	Comparative results between studied groups as regards demographic data .....	٥٨
<b>Table (٦):</b>	A) Preoperative risk factors .....	٥٩
<b>Table (٧):</b>	B) Intraoperative risk factors.....	٦١
<b>Table (٨):</b>	C) Postoperative risk factor .....	٦٤
<b>Table (٩):</b>	Relation between different risk factors versus occurrence of sepsis among the studied cases by logistic regression model .....	٦٦

<b>Table (١٠):</b> Comparative results of sepsis marker between studied groups .....	٦٧
<b>Table (١١):</b> Correlation between serum IL-٦ level and the risk factors of postoperative sepsis.....	٦٨
<b>Table (١٢):</b> Comparative results between studied group as regards to laboratory analysis in preoperative and postoperative period .....	٦٩

## **List of Tables (Cont...)**

<b>Table No.</b>	<b>Title</b>	<b>Page No.</b>
<b>Table (١٣):</b>	Correlation between serum IL-٦ level and other parameters in (Group A) and (Group B).....	٧٠
<b>Table (١٤):</b>	Distribution of isolated microorganism from blood culture in patients with sepsis (group A).....	٧١
<b>Table (١٥):</b>	Comparative results between the patients with positive bacterial blood culture and the patients with no- growth blood culture in group A as regard to IL-٦ .....	٧١
<b>Table (١٦):</b>	The site of sepsis in group A patients .....	٧٢
<b>Table (١٧):</b>	Comparison between studied groups as regards to outcome .....	٧٣
<b>Table (١٨):</b>	Correlation between IL-٦ and whole length of stay .....	٧٣

<b>Table (١٩):</b> Comparison between survival and non-survival in group A as regard level of IL-٦ level.....	٧٤
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# List of Figures

<b>Figure No.</b>	<b>Title</b>	<b>Page No.</b>
<b>Figure (۱):</b>	Pathophysiological pathways of sepsis .....	۷
<b>Figure (۲):</b>	Medical Illustration .....	۲۲
<b>Figure (۳):</b>	Comparison between group A and B as regards to number of previous operations .....	۶۰
<b>Figure (۴):</b>	Comparison between group A and B as regards to operative duration.....	۶۳
<b>Figure (۵):</b>	Comparison between group A and B as regards to type of wound.....	۶۳
<b>Figure (۶):</b>	Comparison between group A and B regards to IL-۶ level .....	۶۷
<b>Figure (۷):</b>	Distribution of isolated microorganism in patients with sepsis (group A) .....	۷۲
<b>Figure (۸):</b>	Comparison between ratio of survival and non survival patients.....	۷۴

## *Introduction*

Sepsis and septic shock are common conditions in the surgical intensive care unit (ICU). Sepsis is a generalized activation of the immune system in the presence of clinically suspected or culture-proven infection associated with extreme manifestation of infectious process that leading to increasing resource utilization and poor outcom. Severe sepsis is sepsis with organ system dysfunction. Septic shock is sepsis with hypotension without other causes (*Levy et al., 2003*). Surgical patients can be defined as a high risk group for developing sepsis, as procedures evoke substantial metabolic, hematologic and immunologic responses (*Todd et al., 2010*).

Surgical patients compose 28,6% of all severe sepsis patients and have similar mortality to medical patients (*Angus et al., 2001*). Surgical site infections (SSI) occur in 2% to 6% of all patients who undergo inpatient surgery, and are associated with increases in morbidity and health-care expenditures (*Anderson et al., 2004*). The National Healthcare Quality Reports estimated 11,6 cases of post-operative sepsis per 1,000 elective surgery discharges with hospital length of stay longer than 3 days (*Agency for Healthcare Research and Quality, 2009*).

The rate of postoperative sepsis increased from 0,4% in 1997 to 1,3% in 2006. During the same period the rate of severe sepsis actually tripled from 0,3% to 0,9%. The major underlying cause was pneumonia which was followed by wound infection

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but mortality related to sepsis decline from 44% in 1997 to 34% in 2006 (*Caroline* 2009).

Surgery in newborns poses a major challenge all over the world. The poorly developed anatomical, physiological, metabolic and immunological functions and the stress of adjusting to postnatal life makes the newborn a unique patient (*Rowe, 1994*), (*Osifo and Oriifo, 2004*).

Postoperative sepsis result in significant morbidity (due to antibiotic usage, reoperation, prolonged hospital and intensive care unit [ICU] stays and longer periods of mechanical ventilation and inotropic support), and contribute to an increase in mortality (*Guardia et al., 2004*).

Incidence of surgical site infection is an important indicator for surgical outcome, particularly in pediatric surgery. The incidence of postoperative wound infection in children varies significantly from 1.6% to 18.7% (*Brown and Eremm, 2004*) even up to 27% for contaminated operations and up to 30-40% for dirty infected operation (*Sangrasi and Leghari, 2004*).

Few studies to date have identified risk factors associated with the development of postoperative sepsis in the pediatric population. Casanova and colleagues prospectively studied 3,700 children admitted postoperatively to a single university hospital. They identified 8 factors associated with development of an postoperative sepsis: wound classification, type of operation, duration of operation, use of peripheral venous

catheter, use of central venous catheter, use of urinary catheter, number of diagnoses and postoperative length of stay (*Linam et al.*, ۲۰۰۹), ICU stays, younger age and use of ventilator (*Valera et al.*, ۲۰۰۱).

Gram-positive organisms, particularly methicillin-sensitive *Staphylococcus aureus* (MSSA) and methicillin-resistant *Staphylococcus aureus* (MRSA), are the most common pathogens involved in postoperative sepsis (*Weigelt et al.*, ۲۰۰۹).

Interleukin ۶ is a protein encoded by IL۶ gene, it act as both a pro-inflammatory and anti-inflammatory cytokine through its inhibitory effect on TNF-alpha and IL-۱ and activation of IL-۱۰, IL-۶ is one of the most important mediators of fever and acute phase response (*Mastorakos and Ilias*, ۲۰۰۷).

## *Aim of the Work*

To assess frequency of postoperative sepsis among infants during the first year of life and its relation to the following risk factors. Moreover, to assess the value of IL- $\gamma$  as a predictive marker for post-operative sepsis.

- ١) Number of previous operations.
- ٢) Operation time > ١ hour.
- ٣) Type of operation, preoperative prophylactic antibiotics.
- ٤) Use of ventilator and other invasive procedures.
- ٥) Use of central venous catheter.
- ٦) Use of total parenteral nutrition.

## **Chapter (I)**

### ***Postoperative sepsis***

#### ***Stages of sepsis:***

##### ***Systemic inflammatory response syndrome (SIRS):***

SIRS is defined by the presence of 2 or more of the following:

- 1) Temperature greater than  $38,0^{\circ}\text{C}$  or less than  $36,0^{\circ}\text{C}$
- 2) Heart rate  $> 2$  SD above normal age value.
- 3) Respiratory rate  $> 2$ SD above normal age value or arterial carbon dioxide tension below  $35$  mm Hg
- 4) White blood cell (WBC) count higher than  $12,000/\mu\text{L}$ , or lower than  $4,000/\mu\text{L}$ , or including more than  $10\%$  bands

(*Gustot, 2011*).

**Sepsis:** SIRS plus a culture documented infection; it must result from infection rather than from any of the noninfectious insults that may cause SIRS (*Harrois et al., 2009*).

**Sever sepsis:** sepsis plus organ dysfunction, hypotension or hypoperfusion (including but not limited to lactic acidosis, oliguria or acute mental status changes), organ dysfunction syndrome is the presence of altered organ function in an acutely ill patient such that homeostasis cannot be maintained without intervention. Primary MODS is the direct result of a well-defined insult in which organ dysfunction occurs early and can be directly attributable to the insult itself. Secondary MODS develops as a consequence of a host response and is identified

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within the context of SIRS. The inflammatory response of the body to toxins and other components of microorganisms causes the clinical manifestations of sepsis (*Brun-Buisson et al., 1997*), (*Ali, 2012*).

**Septic shock:** is sepsis with hypotension (systolic blood pressure  $< 90$  mm Hg or a reduction of  $40$  mm Hg from baseline) despite adequate fluid resuscitation (*Adrie et al., 2009*).

### ***Epidemiology:***

Estimating the exact incidence of sepsis throughout the world is difficult. Studies vary in their methods of determining the incidence of sepsis. Current estimates suggest that the incidence of sepsis is greater than  $500,000$  cases per year. Reported prevalence rates for SIRS of sepsis range from  $2\%$  to  $6\%$  (*Adrie et al., 2009*).

A French study found that severe sepsis was present in  $6.3\%$  of all admissions to the intensive care unit (ICU). Approximately  $4\%$  of patients with sepsis may develop septic shock. Patients who are at risk include those with positive blood cultures (*Martin et al., 2009*).

### ***Prognosis***

In one study, mortalities were  $4\%$  with SIRS,  $16\%$  with sepsis,  $20\%$  with severe sepsis and  $46\%$  with septic shock.

A multicenter prospective study published in the *Journal of the American Medical Association* reported a mortality of  $56\%$ .