

**CONTROL OF INFECTION IN A CARDIAC
SURGICAL UNIT**

*A review Article Submitted for Partial Fulfillment
of the Master Degree in General Surgery*

By

NASSER FAROUK ALY ABOU-SEADA

M.B., B.CH

Under Supervision of

Prof. Dr. ISMAIEL SALLAM
F.R.C.S., L.R.C.P. "ED. & Lond."

F.A.C.C., F.I.A.S.

PH. D. "GLAS."

Prof. of Cardiothoracic Surgery.
Ain-Shams University

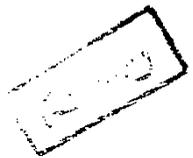
Dr. MOGHAZY TANTAWY

M.D.

Lecturer in Cardiothoracic Surgery
Ain- Shams University

FACULTY OF MEDICINE
AIN - SHAMS UNIVERSITY

1986



22817



6/11/86

Handwritten signature or initials.

Handwritten signature or initials.

Handwritten signature or initials.

ACKNOWLEDGEMENT

I wish to express my deepest and sincere appreciation, first and in full measures, to Prof. Dr. ISMAIEL SALLAM. The time he awarded me, his guidance, valuable comments, tolerance, understanding constructive criticism and experienced advise can't be rewarded. His standards in seeking the very best in accuracy, expression, style and content will always guide me.

I also am grateful for Dr. Moghazi Tantawi for the much efforts and help he gave me. I'm much obliged to Prof. Dr. Muhammed Abdel Moneim and Dr. Samir Ibrahim for their courtesy in granting me many of the valuable references.

I also wish to thank all the staff of the cardiothoracic surgery department for their cooperation, and Mr. Sadek and Mr. Muhammed for their great help and co-ordination.



DEDICATION

THIS WORK IS DEDICATED
TO Prof. Dr. HAMDY EI SAYED
AND Prof. Dr. ISMAIEL
SALLAM, for their invaluable
efforts and help.

" انى رأيت أنه لا يكتب أحدا كتابا
فى يومه الا قال فى غده : لو غير
هذا لكان أحسن ، ولو زيد هذا لكان
يستحسن . ولو قدم هذا لكان أفضل ،
ولو ترك هذا لكان أجمل ، وهذا من
أعظم العبر ، وهو دليل على استيلاء
النقص على جملة البشر "

العماد الأصفهاني

CONTENTS

ACKNOWLEDGEMENT

DEDICATION

CONTENTS

ABBREVIATIONS

AIM OF WORK

LITERATURE	1
* INTRODUCTION & BACKGROUND	1
<i>Historical notes</i>	1
<i>Current Perspective of Surgical infection</i>	3
<i>Cost of Infection</i>	7
<i>Microbial evolution of Surgical Infection</i>	8
<i>Host defensive mechanisms and immune response to infection</i>	13
* POST-OPERATIVE CARDIAC INFECTIONS	20
<i>Classification</i>	21
<i>Incidence</i>	22
<i>Pathogens</i>	24
<i>Mediastinitis & Wound Infection</i>	26
<i>Pericardial Infection</i>	31
<i>Endocarditis</i>	34
* RISK FACTORS.	
<i>Clinical Factors</i>	45
<i>Malnutrition</i>	45
<i>Other Factors</i>	47
<i>Investigational Factors</i>	48
<i>Peroperative Factors</i>	52
<i>Bacterial Contamination</i>	52
<i>Cross infection in theatre</i>	54
<i>Cross infection in wards</i>	60
<i>Role of hospitalization</i>	68

(2)

	<i>Surgical Technique and operative complexity</i>	69
	<i>Risk index</i>	72
*	<i>PREVENTION AND PROPHYLAXIS</i>	73
	<i>Minimizing Contamination</i>	75
	<i>Prevention of theatre exogenous contamination</i>	75
	<i>prevention of ward exogenous contamination</i>	90
	<i>prevention of theatre endogenous contamination</i>	103
	<i>prevention of ward endogenous contamination</i>	105
	<i>Enhancement of host resistance</i>	107
	<i>Correction of malnutrition</i>	107
	<i>Specific immunization</i>	108
	<i>Non-specific immunomodulators</i>	109
	<i>Attention to technical details</i>	109
	<i>Use of antimicrobial prophylaxis</i>	112
*	<i>PRINCIPLES OF MANAGEMENT</i>	127
	<i>Cardio-respiratory support</i>	128
	<i>Nutritional support</i>	131
	<i>Surgical intervention</i>	132
	<i>Antibiotic Considerations</i>	138
*	<i>CONCLUSION</i>	148
*	<i>REFERENCES</i>	156
*	<i>ARABIC SUMMARY</i>	

LIST OF TABLES

1. Analysis of the cost of infection	7
2. Microorganisms in postoperative wound infection	9
3. Cross infecting microorganisms	10
4. Host defensive mechanisms	13
5. Types & Features of postoperative cardiac infections	21
6. Frequency of cardiovascular prosthesis associated infections	22
7. Causative agents of infections associated with cardiac and arterial prostheses	24
8. Frequency of various organisms causing infective endocarditis	24
9. Prosthetic valve implants and infections	37
10. Organisms cultured from patients with prothetic valve endocarditis	37
11. Clinical findings in patients with Prosthetic valve endocarditis	41
12. Mortality by time of onset and site of prosthetic valve.	43
13. Causes of death in prosthetic valve endocarditis	43
14. Infecting organisms of prosthetic valve endocarditis, fequency and relation to mortality	43
15. Nutritional markers	46
16. Effects of weight loss on postoperative sepsis	46
17. Effects of body composition on postoperative sepsis	46
18. Clinical outcome and skin responses in surgical patients	50
19. % of wound sepsis according to contamination	52
Sources of cultures in open heart surgery	53

(2)

21. Relations of recovered organisms to the sites of recovery	53
22. Gloves perforation ratio	54
23. 3 min. vs. 1 min. hand washing	81
24. Comparison of 2 sponges in hand washing	82
25. Effects of topical antibiotics applied to skin cannula puncture site	94
26. Peak serum concentrations after parenteral administration of cephalosporins	115
27. Comparative trials of antibiotic prophylaxis in heart surgery	119
28. Suggested regimen for prophylaxis of endocarditis	126
29. Effect of catecholamines after volume loading in septic shock patients	130
30. Risk of prompt valve replacement versus medical treatment	133
31. P.V.E. Mortality by causative organism according to method of treatment.	134
32. Results of treatment of P.V.E. by valve replacement versus antibiotics alone, for patients who survived at least one week after diagnosis.	134
33. Results of treatment of P.V.E. by valve replacement versus antibiotics alone.	134
34. Basic treatment for infective endocarditis	142

LIST OF FIGURES

1. Sites of pacemaker associated infections	35
2. Risk factors	44
3. I.V. therapy related contamination	62
4. Technique of I.V. line introduction	95
5. Antibiotic prophylaxis in cardiothoracic surgery in U.K., current practice	125
6. Approach to management	127

Abbreviations

B.P.	blood pressure
CABG	Coronary artery bypass graft
CHD	Chlorohexidine
COP	Cardiac output
CPB	Cardiopulmonary bypass
CSF	Cerebrospinal fluid
CVP	Central venous pressure
GIT	Gastrointestinal tract
HCP	Hexachlorophane
HR	Heart rate
IM	Intramuscular
IPPV	Intermittent positive pressure ventilation.
IV	Intravenous
MBC	<i>Minimal Bactericidal Concentration</i>
MIC	Minimal inhibitory concentration
NVE	Native valve endocarditis
PAWP	Pulmonary artery wedge pressure
PNL	Polymorphonuclear leucocyte
Povid-iod	Povidone iodine
PT 12	Plasma half life time
PVE	<i>Prosthetic Valve Endocarditis.</i>
SBC	Serum bactericidal concentration
Staph.	Staphylococci
Strept	Streptococci



AIM OF WORK

AIM OF THE WORK

Postoperative cardiac infections, may be associated with considerable morbidity and mortality. This review article is an attempt to provide the broad outlines of the prophylaxis and control of these infections. The common organisms causing surgical sepsis are discussed, in association with their potential sources. The immune response to infection has been outlined with respect to the function of eliminating the invading contaminants. Postoperative cardiac infections are outlined to show their serious consequences. Other extracardiac infections are outlined in association with their potential risk factors. Predisposing risk factors are discussed. Prophylactic measures depend on the rigorous application of certain basic principles. Contamination must be prevented, the ability of the host to fend off invading contaminants must be protected and enhanced. Prophylactic antibiotics are discussed and the results of many clinical trials are summarized. Broad outlines of the management of established infections are mentioned to stress the value of an aggressive combined approach.

INTRODUCTION AND BACKGROUND

Historical notes:

Since the beginning of medicine, surgeons have made major and ever continuing efforts to eliminate sepsis and strived for achieving a zero level postoperative bacterial infection rate. The concepts conceived to solve this problem varied according to the current state of knowledge concerning bacteria. Today, the whole scene is totally changed in a way hard for most to imagine due to the work of many people, among whom Pasteur, Lister, Ehrlich, Domagk and Florey are the best known names. There have been two phases of intense, almost revolutionary development, in the means employed by surgeons against infections. The first phase was centered on the discovery of the causes of infection and methods of prevention. Pasteur, Koch and Lister are great names associated with this phase. The second phase was that of effective systemic treatment, associated with Domagk and Florey. No real known progress against infection had been made till 1795 when Alexander Gordon published in London "A Treatise on the Epidemic Puerperal Fever of Aberdeen" in which he made clear the relevance of puerperal fever-to surgical infection and pointed out three crucial points: the cause, transmission and prevention of the infection. In 1843, Oliver Wendell Holmes published "The Contagiousness of Puerperal Fever" evidencing that the medical attendants carried the infection. In 1840 Ignaz Semmel Weiss in Vienna established the relations between surgical sepsis, puerperal fever and the role of medical attendants. By