# New Trends In The Management Of Acute Mediastinitis Following Open Heart Surgery



An Assay Submitted For
Partial Fullfillment Of Master Degree
In General Surgery

By

*Yasser Arafat Abu El Yazeed*

M. B., Ch. B. El Minia University

Under Supervision Of

**Prof. Dr. Medhat Mostafa Sabet**

Professor of General Surgery

El Minia University

**Prof. Dr. Mohammed Fahmy Sassiony**

Professor of Cardio-Thoracic Surgery

Ain Shams University

**Ass. Prof. Dr. Ahmed Bahieg El-Kerdany**

Assisstant Professor of Cardio-Thoracic Surgery

Ain Shams University

**1997**

بسم الله الرحمن الرحيم

﴿ وما أوتيتم من العلم إلا قليلاً ﴾

صدق الله العظيم

# ACKNOWLEDGMENT

First of all thanks to Allah , that this work has been completed .

I wish to express my sincere thanks and deep appreciation to Professor. Dr. Mohammed Fahmy Bassiony Professor of Cardio-Thoracic Surgery Ain Shams University for his valuable suggestions and contineous co-operation throughout this work.

My deep heartfull feelings of appreciation and sincere thanks to Professor Dr. Medhat Mostafa Sabet Professor of General Surgery El Minia University for his keen supervision , wisc guidance , generous advice and valuable suggestions concerning this work .

I wish also to thank Assisstant Professor Dr. Ahmed Bahieg El-Kerdany Assisstant Professor of Cardio-Thoracic Surgery Ain Shams University for his guidance, support and supervision of this work .

# CONTENTS

# INTRODUCTION

# INTRODUCTION

## Historical backgrounds

Median sternotomy has been described first by Milton in 1897 for exploration of the posterior mediastinum *(Sirivella et al., 1987)*. Julian and associates, in 1957 introduced the use of median sternal incision for intracardiac surgery *(Julian et al., 1957)*.

Since 1957, median sternotomy has become the most commonly used incision in cardiac operations. The rapidity and ease with which it can be performed, the relatively limited pain associated and the excellent access it provides to the heart and great vessels as well as other mediastinal structures have been major factors contributing to its wide acceptance (*Barnhorst, 1973)*. Post-operative complications of this approach, although infrequent, result in significant morbidity and mortality *(Cohen et al., 1987)*.

## Epidemiology of deep poststernotomy infection

The incidence of wound complications and mediastinitis following cardiac surgical procedures performed through a medium sternotomy is reported to be between 0.5 to 6% (*Jurkiewicz et al., 1980*)(*Grossi et al., 1984*). A lower rate has been attributed to the use of prophylactic antibiotics and improved surgical techniques. A higher incidence of mediastinitis is seen in patients who require reoperation for postoperative bleeding, prolonged mechanical ventilatory support, external cardiac massage and tracheostomy. *(Jurkiewicz et al., 1980)(Grossi et al., 1984)*. Despite its low

incidence, mediastinitis remains a serious complication of median sternotomy which requires prompt and aggressive surgical management.

**Poststernotomy complications can be classified into three categories :**

i) Superficial wound infection without involvement of the sternum or mediastinum.

ii) Sternal dehiscence without evidence of infection.

iii) Sternal dehiscence accompanied by mediastinitis.

Although Mediastinitis is a rare complication of the sternal wound incision but remains the most threatening difficulty because of the potential of extension of infection to aorot-coronary grafts and cardiotomy incision and intracardiac prostheses.

In the past the consequences of such infection have been death or prolonged convalescence *(Pairolera et al., 1984)* as in some instances patients require multiple operations over a period of months or even years *(Grossi et al., 1985)*.

The treatment of infected sternotomy wound by convential method during the early years of cardiac operation was largely unsuccessfull.

The signs and symptoms of mediastinitis following median sternotomy can be obscure. However, once the diagnosis is made or strongly suspected, prompt open debridement of the wound, sternum, and mediastinum with

closed irrigation and drainage will be effective in 50-80% of patients. *(Grossi et al., 1984)*

Many techniques have been developed in the management of deep poststernotomy infections that varied from closed irrigation to open drainage and plastic surgery, using modern techniques with new generations of antibiotics decreared the mortality and morbidity of deep poststernotomy infections.

# CHAPTER I

# POTENTIAL RISK FACTORS

# CHAPTER I

## Potential Risk Factors

| A) Preoperative variables | B) Operative and Postoperative variables |
|---|---|
| 1) Age | 1) Type of operation |
| 2) Gender | 2) Emergency operation |
| 3) Entering surgery unit from ICU | 3) ASA score |
| 4) Obesity | 4) Duration of operation |
| 5) NYHA score | 5) Reoperation |
| 6) Diabetes Mellitus | 6) Intropic agents |
| 7) Previous sternotomy | 7) Mechanical ventilation |
| 8) Antimicrobial use before operation | 8) Early postoperative bleeding and reexploration |
| 9) Hair removal | 9) Duration of cardiopulmonary by pass |
| 10) Debilitation and malnutrition | 10) Faulty colusure of the sternum |
| 11) Long prepoerative hospital stay | 11) Tracheostomy |
| | 12) Prolonged ICU stay |

Table 1 : Potential risk factors for deep poststernotomy infection *(The Parisian Mediastinitis Study Group, F. Brunet. et al., 1996).*

**1- Age**

The risk of mediastinitis increases with age in a study made on 1789 patients it was found that incidince of mediastinitis is higher in older patients *(The Parisian Mediastinitis Study Group, F. Brunet, et al., 1996).*

| Age (yr) | Patients without infection (n = 1747) | | Patients with DSWI (n = 42) | | Relative risk | 95%CI | p |
|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | | | |
| < 45 | 304 | 17.4 | 7 | 16.7 | 1.68 | 0.57-4.95 | |
| 45-54 | 282 | 16.1 | 7 | 16.7 | 1.81 | 0.61-5.33 | |
| 55-64 | 442 | 25.3 | 6 | 14.3 | 1.00 | - | >0.25 |
| 65-74 | 563 | 32.2 | 17 | 40.4 | 2.19 | 0.87-5.51 | |
| ≥ 75 | 156 | 8.9 | 5 | 11.9 | 2.32 | 0.72-7.49 | |
| ≥ 65 | 719 | 41.2 | 22 | 52.4 | 1.56 | 0.80-2.82 | 0.14 |
| < 65 | 1028 | 58.8 | 20 | 47.6 | | | |

Table 2 : Assessment of Age as a risk factor associated with DSWI in 1789 patients *(The Parisian Mediastinitis Study Group, F. Brunet, et al., 1996).*

**2- Gender**

Females are four times liable to mediastinitis *(Ottio et al., 1987)*

Other studies showed much less ratio.

| Gender | Patients without infection (n = 1747) | | Patients with DSWI (n = 42) | | Relative risk | 95%CI | p* |
|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | | | |
| Male | 1219 | 69.8 | 36 | 85.7 | 2.55 | 1.12-5.82 | 0.03 |
| Female | 528 | 30.2 | 6 | 14.3 | | | |

Table 3 : Assessment of Gender as a risk factor associated with DSWI in 1789 *(The Parisian Mediastinitis Study Group, F. Brunet, et al., 1996).*

### 3- Preoperative condition of the patient

Malnutrition debilitating diseases , diabetes mellitus ... enhance the possibility of Mediastinitis.

| | Patients without infection (n = 1747) | | Patients with DSWI (n = 42) | | | | |
|---|---|---|---|---|---|---|---|
| **Variables** | **No.** | **%** | **No.** | **%** | **Relative risk** | **95%CI** | **p*** |
| *Obesity (body mass index)* ≥ 30 | 170 | 9.7 | 10 | 23.8 | 2.79 | 1.43-5.47 | 0.003 |
| <30 | 1577 | 90.3 | 32 | 76.2 | | | |
| *NYHA score* ≥3 | 742 | 42.5 | 15 | 35.7 | 0.75 | 0.40-1.41 | >0.25 |
| <3 | 1000 | 57.5 | 27 | 64.3 | | | |
| *Diabetes* Yes | 192 | 11.0 | 7 | 16.7 | 1.60 | 0.72-3.54 | 0.25 |
| No | 1555 | 89.0 | 35 | 83.3 | | | |

Table 4 : Assessment of Preoperative condition of the patient as a risk factor associated with DSWI in 1789 patients *(The Parisian Mediastinitis Study Group, F. Brunet, et al., 1996).*

### 4- Antibiotic prophylaxis

- In the Department of Cardiac Surgery, University of Torino, they use cephaloridine, cephalothin sodium ampicillin plus cloxacillin and cefamandol nafate. However, they found that different antibiotics prophylaxis do not influence the incidence of wound infection. *( Ottino et al., 1987)*

- In the study of the parisian mediastinitis study group on 1779 patients it was found that 10 days of antimicrobial therapy preoperatively slightly decreased the incidince.

**5- Type of surgical procedure**

Valve operations, coronary artery bypass and valve operations plus coronary artery bypass have been shown to carry a high risk of infection. However, in some report the type of surgical procedures has not demonstrated a significant association *(Sarr et al., 1984 and Sanfelippo et al., 1972)*. Engleman and associates , in 1973 showed a threefold higher incidence of mediastnitis in patients who underwent saphenous vein bypass operation as compared with non coronary operation, also Culliford and associates , in 1976 reported that only coronary operations that used the internal mammary artery had a high incidence of mediastinitis and the bilateral implants of the internal mammary arteries carried a higher incidence then the use of single internal mammary graft. They found an 8.5% increase in infection rate when bilateral internal mammary arteries implants are used. This could be due to the blood supply of the sternum that is derived predominantly from the internal mammary arteries and anastomose with the intercostal and superior epigastric arteries. Numerous segmental sternal branches arise from the internal mammary arteries to form a periosteal plexus. The periosteal plexus is the sole blood supply of the sternum, no intramedullary nutrient system comparable to that found in long bones has been demonstrated *(Arnold, 1972)*. Obstruction of the internal mammary arteries by encircling wires or disection of those arteries for coronary artery

bypass remarkably decrease the blood supply to the sternum. The excessive use of the diathermy destroyes the periosteum, the origin of the bony blood supply *(Cordell et al., 1979)*.

From the department of surgery, New York university school of medicine, a study was done to detect the incidence of sternal wound infection and mediastinitis in relation to the type of open heart procedure performed (*Culliford et al., 1976*). A total of 38 cases of mediastinitis occurred in 2594 cases reviewed in the 4 years period under consideration (over all incidence 1.5%). Four deaths are directly related to infection (over all mortality rate 10.3%). Table 5 outlines the incidence of infection noted to occur following four different categories of open heart surgery. Congenital heart procedures as could be predicted, has lowest incidence of sternal wound infection and mediastinitis (0.4%). Over all incidences of infection following coronary bypass and valvular disease were 1.9% and 2.2% respectively. Significant variations in infection rates are noted among patients with coronary disease and appeared to be related to the nature of the vessel used for by pass.

Mediastinitis occurred in 1.1% of patients in whom only aortocoronary saphenous vein bypass are employed. In comparison with vein bypass alone addition of a single internal mammary artery implant resulted in a dubling of the infection rate (2.3% incidence) and use of bilateral implants is associated with an almost eightfold increase in infection rate (8.5%).

| Category | Total number of patient | Incidence of infection (96) |
|---|---|---|
| *Entire group* | *2594* | *1.5%* |
| 1) Coronary bypass surgery | | |
| i- Entire group | 956 | 1.9% |
| ii- Saphenous vein by pass | 524 | 1.1% |
| iii- Lt. internal mammary by pass | 385 | 2.3% |
| iv- Both internal mammary by pass | 47 | 8.5% |
| 2) Elective valve surgery | 600 | 2.2% |
| 3) Combined procedure | 811 | 0.7% |
| 4) Congenital heart procedure | 227 | 0.4% |

Table 5 : Incidence of sternal wound infection in relation to type of open heart procedure.*(Ottino et al., 1986)*

- Emergency operations carrying no higher risk in the New York school of medicine study but show higher incidence of mediastinitis in the parisian group study 1996.

**6- Early Postoperative bleeding and reexploration of the chest**

Postoperative bleeding played a significant role in causing mediastinitis, this may be due to haematoma formation by excessive bleeding that is considered a perfect environment in which bacteria can grow and hence becomes a source of mediastinal infection. Among patient who underwent one operation the incidence of mediastinitis is 1.5%, among those requiring re-operation for bleeding, the incidence rises to 6% *(Serry et al., 1980)*.