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MEDIASTINITIS: A MAJOR CAUSE OF MORBIDITY AND MORTALITY AFTER CARDIOPULMONARY BYPASS PROCEDURES

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Median sternotomy is the preferred approach to operations done under Cardiopulmonary Bypass (CPB). Mediastinitis after open heart surgery is a serious complication with high associated morbidity and mortality rates. Our aim was to identify the prevalence and factors responsible for the deep seated sternal infection after CPB Procedures and to find out the various means by which morbidity and mortality can be reduced.

MATERIAL AND METHODS

925 patients who underwent open heart surgery for coronary artery disease or valvular heart disease between July 2001 and June 2002 at National Institute of Cardiovascular Diseases, Karachi were reviewed for the presence of mediastinitis. Patients who underwent operation for congenital heart diseases or miscellaneous pathologies were excluded from the study. Records were reviewed for age, sex, weight, diagnosis, operation, outcome and follow up duration.

Preoperative preperation of all patients included, shaving the patients chest and both lower limbs and a bath with diluted antiseptic a night before the operation. Cefotaxime 1gm BD, was used for prophylaxis, which was continued postoperatively, till the central lines were taken out.

The patients were assessed clinically for the development of fever, pain and wound discharge. A total and differential leucocyte count and a CXR were evaluated every 24-48 hours if there was a suspicion of infection. A diagnosis of mediastinitis was made with evidence of a purulent discharge from the sternal wound, an unstable sternum, unresolving pyrexia and a high white cell count. Once the diagnosis was made, patients were re-explored. Pus was taken for culture and sensitivity, the wound was thoroughly excised and mediastinal irrigation with a weak povidone iodine solution was instituted using multiple drains. A reinforced sternal closure was performed, the sternum being approximated with multiple figure of eight wires. All patients were extubated as soon as safely possible.

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RESULTS

12 (1.3%) of these 925 patients developed surgically proven mediastinitis. All these patients had been reopened after surgery for bleeding and/or tamponade. More females 7/12 (58%) than males 5/12 (42%) were affected. 10 of these patients underwent CABG surgery, while 2 underwent valve replacement surgery. Ten (83%) of these patients had Diabetes mellitus, all of whom had undergone CABG surgery.

Prolonged ventilation was required in 2 patients(17%). The average hospital stay for these patients was four weeks. 8 patient succumbed to this complication (67%).

DISCUSSION

Median sternotomy is employed for most cardiac surgical procedures. Mediastinitis after median sternotomy in cardiac surgery is an infrequent but a serious problem. The reported incidence of this complication ranges from 0.4% to 5.1% (1). Despite the relatively low incidence, the morbidity, mortality, economic and social strains incurred by these patients, make every preventive and curative measure worthwhile.

It was the end of the eighteenth century when Milton first used the sternotomy incision to explore the mediastinum. It was however, first employed in cardiac surgery in 1957 (2). Since then it has become the preferred approach for exposing the heart and great vessels. The main advantages offered by this incision include quick access, excellent exposure, less postoperative pain and minimal pulmonary dysfunction. The one major disadvantage is that the incision is at right angle to Langer's lines and can gives a wider scar.

Median sternotomy infections represent a continuum, ranging from superficial abscesses to life threatening suppurative mediastinitis. Numerous risk factors can precipitate these wound infections. These risk factors include diabetes mellitus (19%), obesity (39%), hypertension (65%), COPD (31%), smoking, malnutrition, age, sex, immunocompromised states, steroids and irradiation (3). Simultaneously cardiac surgical patients have specific risk factors. Harvesting both internal mammary arteries for coronary re-vascularization (74%), re-operation to control bleeding (17%) prolonged bypass time, length of the procedure, sternal opening and immobilization technique, excessive diathermy, use of bone wax, felts and synthetics, bleeding and haematoma collection, multiple blood transfusions, closed chest compressions, low cardiac output states, pre-op NYHA functional class, type of the operation, tracheostomy, pneumonia or respiratory insufficiency have all been incriminated as the potential risk factors (4,5).

El Oakely Wright developed a classification for mediastinitis (6) that occurred in patients after cardiopulmonary bypass surgery (table-1).

TABLE 1

Presentation after surgery	No. of Risk Factors	Treatment	Type
<2 weeks	0	Untreated or treated successfully	I
2-6 weeks	0	Untreated or treated successfully	II
<2 weeks	>=1	Untreated or treated successfully	IIIA
2-6 weeks	>=1	Untreated or treated successfully	IIIB
<=6 weeks	>=0	1 failed therapeutic trial	IVA
<=6 weeks	>=0	>1 failed trial	IVB
<6 weeks	>=0	Untreated or treated	V

Risk factors for mediastinitis include
(1) Diabetes Mellitus
(2) Obesity (Body weight > 120% of normal weight for height and gender).
(3) Immunosuppressive therapy

Like any other surgical infections, median sternotomy wound infection result from a complex interplay between the host (patient), the available systemic and local defence mechanisms and pathogenic organisms. The most common micro organisms causing infections are those indigenous to the patients and their environments. The microbiology of mediastinitis is mixed, but most commonly involves the staphylococcal species. Cultures are positive in approximately 60% of cases. The reported incidence of Coagulase negative staphylococci is 42-48%, Staphylococcus aureus 22% and gram negative bacilli 18%, whereas some cases can be mixed, fungal or culture negative (8). Suppurative mediastinitis does not present in the immediate postoperative period (10). Manifestations generally appear between 4 days and 3 weeks.

Although discharge of pus is an obvious sign, suspicion of mediastinitis should be heightened in a patient in whom sternal pain begins to increase towards the end of the first week rather than decreasing. in addition to this, the wound may appear red and swollen. A spiking fever suggests an abscess.

Cardiac surgery is associated with other types of perioperative infections which may mask the systemic signs, Careful and meticulous attention to the chest wound itself is required to make an early diagnosis.

Patients who develop fever and leucocytosis must be suspected of harbouring mediastinal sepsis, even if drainage has not appeared and sternum is still stable. Aspiration of the mediastinum is a simple diagnostic manoeuvre that is of value when positive. Any drainage must be immediately cultured both aerobically and an-aerobically and antibacterial sensitivity determined. Routine chest films are usually difficult to interpret; computed tomographic scans may be helpful, particularly if gas forming organisms are present (11).

Based on the clinical findings and investigations, Gul et al (12) categorized the patients into five stages (table-2).

TABLE 2

Clinical & radiological findings	Statge
Persistent soft tissue infection	I
Sinus tract to foreign body	II
Involvement of external plate or sinus to sternal medulla	III
Involvement of internal plate or signs of infection in paramedian incision	IVA
Costochondral infection	IVB
Mediastinal infection	V

Suppurative mediastinitis represent a real and factual threat to life. Subsequent to open heart surgery mortality is high and figures as high as 10-70% has been reported (13). Mediastinitis following cardiac surgery should be considered a surgical urgency. Although respiratory, circulatory and other system supportive care is critical and specific anti-microbial agents are vital. Most of the affected needs some form of surgical intervention. The surgical approach has been devised to various modes (14) based on the stage of the staging mentioned earlier (table-3).

TABLE 3

Statge	Therapy	Reconstruction
I	Conservative treatment or soft tissue debridement	1, 2 or 3
II	Sinusectomy and foreign body removal	1, 2 & 3
III	Resection of sternal external plate	4and/or5
IV a	Semi-total or total sternectomy	4 and/or 5 and /or6
IV b	Resection of ribs or clavicle	1 or 7
V	Debridement or irrigation	6 and/or 7 and /or 8

Based on the operative findings and the state of the patient, the reconstruction options after sternectomy are as follows :

1. Primary closure.
2. Secondary closure.
3. Local skin flap.
4. Bilateral pectoralis major muscle advancement.
5. Unilateral pectoralis major and/or rectus abdominus turnover.
6. Omental flap.
7. Pectoralis major muscle flap.
8. Rectus abdominus muscle flap.

CONCLUSION:

Mediastinitis after cardiac surgery is a serious complication with high associated morbidity and mortality rates. Managing these patients has to be thorough and painstaking and with meticulous attention, a significant number of these patients can be saved. Proper care requires an early diagnosis, prompt surgical intervention and rigorous and prolonged intensive care, as these patients are prone to further complications during the course of their disease.

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