

Braided Polyester versus Standard Wire in Sternal Closure in High Risk Patients

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ABSTRACT

Objective: The aim of this study was to compare braided polyester sternal closure versus standard wire closure in high-risk patients who are more susceptible to have deep sternal wound infections and mediastinitis after cardiac surgeries. **Patients and Methods:** Between February 2017 and December 2019 risk factors for postoperative deep wound infections and mediastinitis and mortality was collected for 100 adult patients undergoing open-heart surgery under cardiopulmonary bypass. Patients were divided to two groups, those who underwent sternal closure using either braided polyester or standard metal wire. Follow-up data on sternal wound healing and deep sternal wound infections were assessed for up to two months after surgery in the Outpatient Clinics. **Results:** The following risk factors were associated with a higher incidence of deep sternal wound infections and mediastinitis in both groups. There was no mortality in both groups, the number of deep sternal infection and mediastinitis with sternal dehiscence was 4 patients from group A (Ethibond) and 5 from group B (standard wire). **Conclusion:** This study showed that braided polyester could be used safely in sternal closure the same as standard wire in high risk patients.

Keywords: Braided polyester, Mediastinitis, High risk patients.

INTRODUCTION

Deep wound infections and mediastinitis are of the major complications after cardiac surgeries ⁽¹⁾. The incidence of deep sternal wound infection of course becomes much higher in high-risk patients as diabetic, obese, redo surgeries and other risk factors.

Over decades the stainless steel is the main material used in closure of the sternum in cardiac surgeries and although this material was effective to maintain the sternal stability but it has some drawbacks as development of sinuses related to the wire in some patients ^(2,3,5). Different materials other than standard wire were used to close the sternum after cardiac surgeries to avoid the drawbacks of the standard wire ^(4,6,7).

PATIENTS AND METHODS

Between February 2017 and December 2019 in Cairo University Hospital, 100 patients with high risk of postoperative mediastinitis and deep sternal wound infections who were going to open heart surgery using cardiopulmonary bypass were chosen to be involved in this study. Patients were divided in 2 groups; Group (A): 50 patients the sternum was closed using number 5 braided polyester and Group (B): 50 patients the sternum was closed using standard wire number 7. Proper history taking for all patients were obtained including: age, sex, BMI, diabetes, previous surgery,

impaired renal or liver functions, familial dyslipidemia, smoking and family history. All patients in both groups had routine preoperative laboratory investigations, echocardiography, chest X-ray PA, carotid duplex for patients above 60 years old and coronary angiography in male patients more than 40 years old and female patients more than 45 years old. All patients in both groups received intravenous broad-spectrum antibiotics after worm blood cardioplegia. Group (A): The sternum was closed using braided polyester number 5 by 6 figure of 8 stitches. Group (B): The sternum was closed using standard wire number 7 by 4 figure of 8 stitches. In both groups the subcutaneous tissues was closed in 2 continuous layers using Vicryl 2/0 sutures and skin was closed with Monocryl 4/0 in continuous and subcuticular manner.

All patients were followed up daily during hospital stay, one and two month postoperatively in the Outpatient Clinic for sternal healing, deep sternal wound infections and mediastinitis. Follow up of the patients was done by clinical examination, chest X-ray and C.T scan.

Ethical approval:

The study was approved by the Ethics Board of Cairo University and an informed written consent was taken from each participant in the study.



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RESULTS

Table (1): Preoperative risk factors

Characteristic	Group A	Group B	p Value
Age (Years)	60 ± 5	60 ± 5	NS
Male / Female	32/18	34/16	NS
BMI > 35	6 (12%)	5 (10%)	NS
Diabetes Mellitus	8 (16%)	10 (20%)	NS
Creatinine > 1.8	3 (6%)	2 (4%)	NS
Redo surgery	1 (2%)	1 (2%)	NS
COPD	5 (10%)	6 (12%)	NS
Emergency surgery	3 (6%)	4 (8%)	NS
Acute endocarditis	2 (4%)	1 (2%)	NS

Regarding statistical analysis for the preoperative risk factors for postoperative sternal dehiscence and deep sternal wound infections, the mean age in both groups was 60 ± 5 years, which was statistically non-significant. Male/female ratio in group (A) was 32/18 and in group (B) was 34/16, which was statistically non-significant. Obese patients with BMI > 35 were 6 (12%) in group (A) and 5 (10%) in group (B), which was statistically non-significant. Diabetic patients were 8 (16%) in group (A) and 10 (20%) in group (B), which was statistically non-significant. Impaired renal functions were 3 (6%) in group (A) and 2 (4%) in group (B), which was statistically non-significant. Redo cardiac surgery was 1 (2%) in group (A) and 1 (2%) in group (B), which was statistically non-significant. COPD patients were 5 (10%) in group (A) and 6 (12%) in group (B), which was statistically non-significant. Emergency cardiac surgeries were 3 (6%) in group A and 4 (8%) in group (B), which was statistically non-significant. Acute endocarditis was 2 (4%) in group (A) and 1 (2%) in group (B), which was statistically non-significant (Table 1).

Concerning statistical analysis for follow up of patients for both groups, there was no mortalities in both groups. Sternal dehiscence without infections was 1 (2%) in group (A) and 2 (4%) in group (B), which was statistically non-significant and patients did not need interventions or any surgical debridement. Deep sternal wound infections with mediastinitis was 2 (4%) in group (A) and 3 (6%) in group (B), which was statistically non-significant. The 5 patients with

mediastinitis all of them underwent vacuum suction of the wound with change of antibiotics according to culture and sensitivity for 3 weeks and only one of them from group (B) needed surgical intervention in the form of wound debridement and omental flap. Prolonged postoperative mechanical ventilation > 2 days was 3 (6%) in group (A) and 2 (4%) in group (B) which was statistically non-significant (Table 2).

Table (2): Postoperative follow up

Characteristic	Group A	Group B	P-Value
Sternal Dehiscence	1 (2%)	2 (4%)	NS
Deep sternal wound infections with mediastinitis	2 (4%)	3 (6%)	NS
Change of Antibiotics	2 (4%)	3 (6%)	NS
Vacuum suction of the infected wounds	2 (4%)	3 (6%)	NS
Surgical intervention in deeply infected wounds	0	1 (2%)	NS
Prolonged postoperative mechanical ventilation > 2 days	3 (6%)	2 (4%)	NS
Mortality	0	0	NS

BMI = Body mass index, COPD = Chronic obstructive pulmonary disease, NS = Non-significant

DISCUSSION

One of the most serious and fatal complication following cardiac surgery is deep sternal wound infections with mediastinitis (7,8). Sternal stability is a corner stone and the most important factor to avoid sternal dehiscence and subsequently deep sternal wound infections and mediastinitis. It is also argued by some that operative morbidity is not the only important outcome measure, that patients who survive, cardiac operations may still have high complications and a poor long-term outcome (12-13-15). Although the incidence of this complication is rare, however it is associated with a high mortality ranging from 15 to 25%. Therefore, it was important to have a study to assess the quality of the material used in closure of the sternum especially in patients having many risk factors associated with high incidence of postoperative deep sternal wound infections and mediastinitis (9,10,11).

Our study is a trial to detect if sternal closure using braided polyester similar to results seen with standard wire closure or not. There was no statistical difference seen in the incidence of sternal dehiscence and deep sternal wound infections, in the early postoperative period of follow up. The most important factors to avoid postoperative deep sternal wound infections is to control the risk factors as much as we can before surgery. For example, tight glycemic control for 2 weeks before surgery in diabetic patients even in patients with high HbA1c will definitely lower the risk of mediastinitis. Use of skeletonized internal mammary artery instead of the pedicle one will maintain better vascularity of the sternum that allow better healing and subsequently lower incidence of postoperative deep wound infections. Cessation of smoking and improving chest condition before surgery to avoid postoperative sever cough of course will help to maintain sternal stability⁽¹²⁾.

The aging process is accompanied by significant changes in different body organs, which may affect the healing process. The age-related changes in other than cardiovascular body organ systems need drastic measures to minimize the effect of these changes on the healing process. For example, the age-related changes in lung structure and function (e.g. Weakness in respiratory muscles, decrease elasticity of alveoli and others) may be associated with higher incidence of complications in elderly patients undergoing cardiac surgery^(10, 11, 13). Vascular age-related changes as thickening of the intima of the vessels wall and subsequently dilation of the large vessels and spasm in the micro vessels^(14, 15). The previously mentioned changes will impair the healing process in the elderly^(12, 16). Cardiac surgeons get to much experience from previously mentioned age hidden factors, which are very important in the outcome, results as well as clinical findings.

CONCLUSION

We concluded from our study that there are no differences between braided polyester and standard wire as material used for sternal closure in the incidence of postoperative sternal dehiscence and deep sternal wound infections.

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