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Original article

Titanium plate fixation versus wire sternal closure in coronary artery bypass graft patients: Need for rigid sternal fixation

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Abstract

Background: Sternal dehiscence and deep sternal wound infection mostly coincide. Approximation and rigid fixation are cornerstones in supporting good bony union. Wire cerclage is adequate for approximation but may be inadequate for sternal stability. So there is a need to study other methods of sternal fixation (titanium plate fixation) and to compare with the traditional wire cerclage method.
Methods: Thirty isolated coronary artery bypass graft (CABG) patients were followed in this study regarding closure of their sternums; 15 with our method of concern: the Sternalock plates (group A) and 15 with the conventional stainless steel wiring (group B). The two groups were compared in a prospective non randomized study in the period of Jan 2013 to Jan 2015. Patients were followed up over 6 months postoperatively regarding pain among other factors.
Results: The two groups' demographics and perioperative variables were properly matched. They were followed in-hospital, at one month and over 6 months postoperatively: no mortalities; pain was much less in group A during in-hospital and at 1 month follow but at six months; no significant pain difference was detectable. Less narcotic need in group A but hospital stay was almost the same. Both groups demonstrated good healing at the end of the study with slightly higher incidence of wound infection and need for refixation in group B.
Conclusion: Sternal plating following CABG is reproducible; easy to apply, not time consuming, easy reopening in case of emergency, inert, with the benefit of less early postoperative pain and narcotic use.

Keywords: Chest wall; Sternotomy; Dehiscence; Mediastinitis; Sternalock

1. Introduction

Median sternotomy is the preferred approach for cardiac surgeons. Despite of good access and exposure, infectious complications resulting in post-sternotomy mediastinitis have devastating consequences; mortality rate can be as high as 15% [1].

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Sternal dehiscence and deep sternal wound infection (DSWI) mostly coincide, suggesting that instability in the early postoperative period predisposes to infection [2].

Approximation and rigid fixation are cornerstones in achieving good bony union; this allows for the formation of blood vessels which carry nutrients and initiates the repair process to the injury site. This is also applicable to fixation of the sternum following a sternotomy [3].

While stainless steel wire cerclage stands as the most popular method for primary sternal closure being familiar, simple and relatively of low cost [4], some in vitro reports show that wire cerclage is adequate for approximation but may be inadequate for sternal stability [4–6].

Due to the dramatic changes in characteristics of patient population undergoing cardiac surgery in the current era, including older, multi-morbid patients with more serious cardiac disease, making them more risky to develop sternal non-union and infection [7], new ideas for sternal closure have been introduced to the field. The use of plate fixation is one modality that provides the rigid fixation needed to support healing following approximation [8].

The aim from this prospective study was to evaluate the efficacy of titanium plate fixation for sternotomies after CABG regarding sternal healing and stability, need for refixation and the incidence of sternotomy-related complications then to compare these data with a matched group of patients who had their sternotomies closed in the traditional wire cerclage technique.

2. Patients and methods

Of 76 total cardiac cases performed during the period of this study, 30 patients undergoing CABG met the criteria and were enrolled, 15 had titanium plate fixation (*group* A) versus 15 patients who had their sternotomies closed in the conventional wire cerclage (figure of eight) technique (*group* B) in the period of Jan 2013 to Jan 2015 in King Fahd university hospital, Dammam University.

2.1. Inclusion criteria

Cases in need for isolated CABG *including* patients having:

- Diabetes mellitus.
- Renal failure and dialysis patients.
- Obesity (Body mass index (BMI) > 30 kg/m2).
- Chronic obstructive pulmonary disease (COPD).
- Prolonged cardiopulmonary bypass (CPB) time> 120 min.

2.2. Exclusion criteria

- Emergency operations.
- Redo operations.
- Non-central sternotomies (closed using the Robicsek weave technique).
- Other concomitant cardiac surgical procedures, e.g. valvular or aortic surgery.

All patients had routine preoperative evaluation:

- History and clinical examination.
- Routine laboratory work, chest X ray (CXR), ECG, Transthoracic echocardiography, coronary angiography and pulmonary function tests.

Perioperative Patients' characteristics and variables evaluated were: age, sex, diabetes, HbA1c levels, COPD (FEV1/FVC measurement), BMI, renal function, CPB time and duration of mechanical ventilation.

HbA1c results were aligned to the assay used in the Diabetes Control and Complications Trial (DCCT), shown as a percentage: Non-diabetic 'normal' range was 4–6%. An HbA1c of (6.5%) was recommended as the cut-off point for