

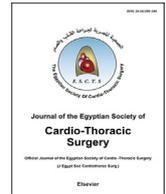
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Plating versus wiring for fixation of traumatic rib and sternal fractures

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ABSTRACT

Background: The fracture of ribs is a common injury presenting to trauma centers and hospitals. Along the years, a lot of methods have been introduced to stabilize the rib and sternal fractures, as most of studies reported that the treatment of these cases is warranted. In spite of the large number of methods for fixation introduced; no definitive method has been presented yet.

Patients and methods: From July 2015 to November 2016, the data of 30 patients with rib or sternal fractures or both who fulfilled the inclusion criteria were collected prospectively. Those patients were assigned into two groups; (group A) the fractures were fixed by plates and (group B) were fixed by stainless steel wires. The choice of method of fixation depended on surgeon's experience. The variables evaluated included stability of chest wall, intensive care unit stay, hospital stay and ventilator days.

Results: The chest wall stability in (group A) was achieved in 100% of the patients, while in (group B) it was achieved in 60% of patients. Intensive care unit stay for group A was 9 ± 4.37 days and for group B 13.8 ± 7.61 ($p = 0.031$). Hospital stay for group A was 11.6 ± 5.27 days and for group B 17.1 ± 6.77 ($p = 0.021$). Ventilator days for (group A) were 6.38 ± 3.83 days, while in (group B) 10.3 ± 8.82 days, however this difference was statistically insignificant ($p = 0.129$).

Conclusions: Plating of rib and sternal fractures had better outcome than wiring, regarding better chest wall stability and restoration of chest contour; also it had shorter intensive care unit, hospital and ventilator days.

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1. Introduction

Blunt trauma of chest is a major cause of morbidity and mortality, especially if results in a flail chest where paradoxical inward movement of the flail segment in inspiration is found [1].

In patients with isolated blunt chest trauma who have severe flail chest without significant pulmonary contusion, prolonged internal pneumatic stabilization is not suitable because of the risk of ventilator-related infectious complications.

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Moreover, mechanical ventilation is not always successful in preventing chest wall deformities that may result in a subsequent respiratory restrictive dysfunction [1,2].

Several advantages of open reduction and internal fixation have been detected. These include decreased duration of intubation [3,4]; shortened intensive care unit and hospital stays [1,3], and declined likelihood of clinically significant long-term respiratory dysfunction and chest wall deformity [3].

In spite of large number of methods introduced to stabilize the chest in order to fix the rib and sternal fractures no definitive solution has been presented yet [4].

The fixation of chest by plates may provide better therapeutic method for flail chest and rib fractures as was suggested by recent studies done by Graznety et al. [5].

Fixation by wiring was common surgical technique which involved simple wire suture stabilization of the fracture ends of the flail segment [6]. Variable methods of wiring have been reported. In spite of that, these methods generally do not offer adequate stability of the fracture, and non-union may occur [7].

The clinical rationale of our study was to guide the surgeon to choose the best method for fixation, by comparing the benefits and harms of surgical fixation by plates to surgical fixation by stainless steel wires.

In the current study we tested the hypothesis that, outcomes of rib and sternal fractures fixation by plates are better than outcomes of fixation by stainless steel wire, which was the most popular method in our institute [8].

2. Materials and methods

The study took place at trauma unit of Assiut University Hospital in Assiut, Egypt, from July 2015 to November 2016. Assiut university hospital trauma unit receives about 3550–4000 trauma patients per year.

The data of patients who presented to trauma unit with rib or sternal fractures or both and fulfilled the inclusion criteria were collected prospectively. Those patients were randomly allocated to one of two parallel groups; (group A) in which the fractures were fixed by plates and screws, and (group B) were fixed by stainless steel wires.

Inclusion criteria: Eligible participants were adults aged 18 years or over with one of the following criteria:

1. Flail chest with deteriorating pulmonary function in spite of aggressive physiotherapy, adequate pain control, requiring mechanical ventilation and without massive lung contusions.
2. Ventilated flail chest patient, with failure to wean from mechanical ventilation.
3. Displaced sternal fractures.

Exclusion Criteria:

1. Posterior flail chest (e.g. fractures beside spinal column).
2. Fractures of floating ribs (ribs 11, 12).
3. Massive lung contusion (Defined as PaO₂/FIO₂ ratio <200 with radiological signs of pulmonary infiltrates within 24 h of chest injury).
4. Traumatic brain injury (Glasgow coma scale (GCS) ≤ 8 at 48 h post trauma. If GCS could not be calculated properly as for intubated patients, GCS motor ≤ 4 at 48 h post trauma).

When the patients reached the hospital, they were admitted to the intensive care unit (ICU) and received general, local, radiological and laboratory assessment including arterial blood gases. Then, they received the medical care of severe thoracic trauma. The same assessment was repeated 24 h after management. Patients were randomly assigned either for surgical treatment by plates (group A) or by stainless steel wires (group B) depending on the attending surgeon's experience. Informed consents were taken from the patients or their relatives after detailed explanations. Patients in both groups underwent surgical stabilization of the flail chest or sternal fracture within 1–3 days of the ICU admission.

Postoperative variables that were assessed included: chest wall stability, pain intensity scale, restoration of chest wall contour, radiological alignment of fixed ribs, ICU stay, hospital stay, ventilator days and morbidity and mortality.

The study was approved by the Ethical Committees of faculty of medicine, Assiut University, Egypt. Advanced statistical package for social sciences (SPSS) program version 22.0.0 (IBM Corporation-<http://www.spss.com>) was used for analysis of data. Comparative statistics and tests of significance including the paired Student's test, Mann-Whitney test, Chi-square test or Fischer's exact test were used. P value was considered statistically significant when it was (<0.05) and highly significant when it was (<0.001). Quantitative data were reported as the mean "standard deviation (S.D.)".

3. Results

From July 2015 to November 2016, there were 4655 trauma patients presented to Assiut university hospital trauma unit, from which 850 patients had blunt chest trauma, among them only 30 patients fulfilled the inclusion criteria and underwent surgical fixation. These patients were included into two groups; (group A) were fixed by plates and those were 20 patients from which 17 patients were fixed by 3.5 mm Reconstruction plate and 3 patients were fixed by 1/3 tabular plate. (group B)

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