Case report - Cardiac general

Sternotomy and crutches

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Abstract

The use of crutches following a sternotomy raises the concern of sternal dehiscence. We discuss secure reinforced sternal closure, classify sternal distractional forces and discuss the postoperative mobilization process.

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1. Introduction

The use of crutches following a sternotomy raises the concern of increased sternal distractional forces and sternal dehiscence.

Management has not been discussed before. Here, sternal distractional forces are classified, postoperative mobilization is discussed and a model for reinforced sternal closure is presented.

2. Case

A 66-year-old male fractured his right lateral malleolus three days before scheduled coronary artery bypass grafting (CABG; displaced Weber B fracture). The fracture was managed with a back slab plaster as an out-patient. The patient was advised to keep the leg elevated and aspirin was continued.

He was readmitted on the scheduled day of surgery. CABG was performed using a midline sternotomy with the left internal mammary artery and saphenous vein graft from the patient’s left leg. Reinforced sternal closure was established with three single wires placed through the manubrium (No. 7 Syneture; Tyco Healthcare, Norwalk, CT, USA), three double wires around the body of the sternum (Myowire; A&E Medical Corporation, Farmingdale, NJ, USA), and two single wires around the lower sternum. Definitive management of the right ankle fracture was accomplished by open reduction and internal fixation on the second day after CABG.

The patient was able to walk on one leg with a pulpit frame, non-weight-bearing on the other fractured leg, on day three, and with axillary or underarm crutches on day eight post CABG (Figs. 1 and 2). Although not expected, he experienced significantly less pain with the axillary crutches compared to the pulpit frame (0 vs. 3–5 on visual analogue score where 0=no pain and 10=unbearable). The postoperative course was uncomplicated except for superficial sternal and leg wound infections. The patient was discharged home eight days after CABG. There was no sternal instability during the entire postoperative course.

3. Discussion

Claes et al. report that excessive distractional forces interfere with bone healing [1]. The need for crutches or walking aids after a sternotomy therefore raises the concern of postoperative sternal dehiscence.

3.1. Sternal distractional forces

We propose classifying sternal distractional forces as internal and external distractional forces.

3.1.1. Internal distractional forces

These result from increased intrathoracic pressure. These are caused by positive-pressure ventilation and the action of the intercostal, abdominal, and laryngeal muscles during forced expiration, coughing, and straining. They are reduced by lowering the pressure of ventilation, early extubation, gentle coughing, and controlled movements.

3.1.2. External distractional forces

These are related to the use of external thoracic (pectoral and serratus) and abdominal muscles and occasional
external thoracic compression. These are reduced by gentle mobilization, limited force of the external thoracic and abdominal muscles, and prevention of external trauma.

3.2. Mobilisation

The use of a pulpit frame during the initial mobilization provides stability. Unfortunately, this is accompanied by some increased use of the external thoracic, abdominal, intercostal, diaphragmatic, and laryngeal muscles, with a resultant increase in sternal distractional forces. The introduction of axillary crutches was associated with significantly less pain. Axillary crutches allow for some relaxation of the pectoral, abdominal, diaphragmatic, and laryngeal muscles, and reduction of the internal and external distractional forces. In addition, lateral oblique placement of the axillary crutches may provide stabilization to the sternum due to bilateral sternal compression.

In a test person, we found significantly less strain and easier control while using axillary crutches compared to the pulpit frame. Forearm crutches were associated with even more effort and strain to obtain a stable position.

Preferably, axillary crutches should be introduced early in the postoperative course.

3.3. Sternal closure

Additional measures in the form of reinforced sternal closure are necessary to prevent sternal dehiscence.

Dasika et al. report that the lower sternum is the site of the greatest instability and that additional wires in this area reduce distraction [2]. They also describe that figure-of-eight steel wires are not superior to single wires. Opie and Stoney advise the use of 10 or more 7 F instead of 6 F wires. They present a series of 350 sternotomy patients without sternal wound problems [3]. Kiessling et al. report a reduced need for sternal refixation in patients with a body mass index >32 kg/m² when using double wires vs. single wires [4]. Losanoff et al. conclude that double wires provide a more stable closure compared to single wires in a human cadaveric model [5]. They also report that they have previously found single-wire closure to be superior to figure-of-eight wire closure.

We established reinforced sternal closure with three 7 F single wires in the manubrium, three double wires around
the sternal body, and two 7 F single wires in the lower sternum. Closure remained stable during the entire post-operative course.

References


