Case report

Osteosynthetic thoracic stabilization after complete resection of the sternum

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Abstract

We present a case of a 66-year-old diabetic patient with chronic non-healing sternum after CABG operation. After four attempts of sternum refixation within 2 years, the need of bone debridement resulted in a nearly complete loss of sternum. Finally, a mesh graft and a pectoralis muscle flap were used to bridge the sternal space. Despite good wound healing, the thoracic instability led to intolerable chest pain persisting over the next years. In this case report, we describe the successful thoracic stabilization by using transverse plate fixation, which resulted in perfect thoracic stabilization and immediate cessation of pain.

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1. Introduction

Sternal dehiscence with or without infection is a rare but serious complication of median sternotomy. In case of reduced bone vitality, efforts of sternal refixation can be a challenging problem. The repeated need of bone debridement can result in a loss of sternal bone. If a reunion by simple rewiring is impossible, muscle flaps or mesh grafts can be used to close the sternal defect [1]. But in the long term, many patients complain of chronic pain from the sternal separation [2]. We describe a successful thoracic stabilization by transverse plate fixation in a patient after complete resection of a non-healing sternum.

2. Patient

Six years prior to presentation, a 66-year-old obese male patient (105 kg/185 cm, body mass index: 31) with insulin-dependent diabetes mellitus, hypercholesterolemia and nicotine abuse (42 pack-years) underwent a quintuple coronary artery bypass using the left internal mammary artery and saphenous vein grafts. The operation was uneventful and the patient was discharged on the seventh postoperative day in good condition and with stable sternum.

Two months postoperatively, the patient presented with sternal pain caused by dehiscence requiring surgical revision. Intraoperative examination revealed complete sternal non-union without any evident signs of infection; wound smears taken for microbiologic analyses did not reveal bacterial growth.

The edges of the sternal bone were mobilized and cut with an oscillating saw until bleeding from the bone marrow was visible. Finally, the sternum was readapted by using steel wires again. Subsequently, because of poor compliance of the patient, physical hyperactivity and persisting high blood glucose values, sternal instability recurred. In consequence, second and third sternum refixations were necessary 3 and 12 months later, performed in the same way as described before; sternal debridement was necessary once again. Two months later, the sternum became instable for the fourth time. Now the residual sternum was multiply fractured by wire cutting. There were no signs of infection, but large areas of non-vital bone made it necessary to remove almost the whole sternum. The sternal gap was closed by interposition of a mesh graft covered by pectoralis muscle flaps, without any bony thorax fixation being possible. In the future course, the patient developed increasing chest pain again. Four years later, the patient was not able to stand the pain any more, and he was heavily restricted during daily activities. Patency of the coronary grafts was documented angiographically. The physical examination revealed an extensive thoracic instability with paradoxical chest movements. A computed tomographic scan documented a nearly complete loss of sternal bone (Fig. 1A). Encouraged by the introduction of the...
Synthes® Titanium Sternal Fixation System, we performed a new attempt of thoracic stabilization. The operation was performed under general anesthesia. The sternotomy wound was excised in toto. The mesh graft in the sternal gap was removed and the sternal edges of the ribs were carefully dissected until they were free from devitalized tissue and started bleeding (Fig. 2A). Bilaterally, the pectoralis major muscle was elevated from the insertion along the medial aspects of the ribs to the mid-clavicular line until it was mobile enough for later approximation. The ribs of the left and right side were approximated by using five surgical steel wires. After counteracting Synthes titanium plates with a thickness of 2.4 mm to the best fitting shape, they were fixed transversely on the second to sixth rib level with three to four locking screws on each side. An additional H-plate was fixed on the first rib level. The holes for the screws were drilled with the aid of a drill guide. The right length of each screw was identified by measurement of the bone diameter with a depth gauge; the necessary screw lengths varied from 12 to 18 mm. All plates consisted of two parts joined by U-shaped release pins permitting a quick and easy sternal re-entry in cardiac emergencies (Fig. 2B). Through small stab incisions, 12 mm redon-drains were placed under each pectoralis muscle flap. The muscles were approximated at the midline and the wound was closed in layers. The patient was extubated 4 h postoperatively. On the eighth postoperative day, the patient was discharged from hospital. Fifteen months postoperatively, the patient is in good condition without chest pain, the clinical examination reveals a stable thorax (see Fig. 1B for postoperative CT scan).

3. Comment

Stable fixation after median sternotomy is particularly crucial in the growing "high-risk" population with severe risk factors, such as obesity, diabetes, smoking and peripheral vascular disease [3]. Sterile sternal non-union, with an incidence of less than 1%, is less common than wound infection or mediastinitis [4,5]. In general, sterile sternal non-union can successfully be treated by simple rewiring after bone debridement. However, in case of poor quality of
bone, multiple transverse sternal fractures or inability to reduce risk factors leading to instability, steel wires or bands often failed to prevent excessive motion preventing bony union during healing [6]. After multiple attempts of refixation or debridement resulting in wide defects of sternal bone and cartilage, steel wires or bands cannot be used any more. In the absence of infection, pectoral or latissimus muscle flaps and additional synthetic mesh grafts may be used to cover the sternal space [1]. The use of muscle flaps has been shown to provide reliable reconstruction of median sternotomy wounds; however, studies dealing with the long-term outcome of this treatment revealed that more than 40% of the patients complained of chronic chest wall pain and persisting sternal instability [2]. More than 50% of patients were unable to perform at the same physical level as compared to their preoperative abilities [7]. The technique of transverse sternal reconstruction had been successfully performed earlier by plastic surgeons in a series of 50 patients [8].

In our patient, thoracic instability led to intolerable pain despite good wound healing without infection. With the use of transverse plate fixation, it was possible to stabilize the bony thorax and to relieve chest pain; the patient was able to return to his normal daily activities with minor restrictions only. Thus, we recommend rigid osteosynthetic fixation in any case of chronic non-healing sternum or complete loss of sternum after median sternotomy.

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