



A Case Report of a Surgical Stabilization of Anterior Chest Trauma in Ninety Years Old Patient

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Abstract

A 90-year-old patient is taken to the emergency room due to a car injury. The patient's respiratory functionality and hemodynamic worsened, so early surgical splenectomy was performed and a tube thoracostomy was positioned both in the right and left chest. A Computed Tomography (CT) scan did one day after the trauma, showing multiple fractures of ribs, sternal and left clavicle. Two days after the trauma Stabilization of Thoracic Fractures (SSRF) was performed. In this case we used a STRATOS system and Permacol® prosthesis, with a positive outcome. Also in the older patient surgical stabilization of Flail Chest (FC) is an achievable procedure, indeed as in young people reduces morbidity, duration of mechanical ventilation, Intensive Care Unit Length of Stay (ICU-LOS) and the last, but not least the mortality.

Introduction

FC is defined as the fracture of 3 or more adjoining ribs, resulting in a paradoxical movement of the fractured chest [1-3]. The mortality rate ranging from 10% to 33%, so FC is a life-threatening complication of chest trauma [1-7]. The management includes pain and pulmonary dysfunction treatment, just in selected cases surgical fixation [8,9].

Case Presentation

We present the case of a 90-year-old man, who arrived to the emergency department due to a motorway collision. The patient had important and disabling chest and abdominal pain, tachycardia, hypotension. He was in hypoxic respiratory failure with normocapnia (pH 7.35; PaO₂ 60.3 mmHg; pCO₂ 39 mmHg; HCO₃ 22.1 mmol/l; sat 90%). He needed a rapid intravascular volume resuscitation, as well as inotropic and vasoactive infusions, due to hemodynamic instability after 2 h he was subjected an early surgical splenectomy to stop the bleeding. Chest X-ray showed the presence of hypertensive pneumothorax, so two tube thoracostomy were positioned one in the right and one in the left chest. Computed tomography showed multiple fractures of left ribs from 1st to 3rd, fracture of manubrium sternum and the fractures of clavicle (see the 3D reconstruction in Figure 1). The patient had subcutaneous emphysema at the level of the left major pectoral muscle. Two days after the splenectomy we decided to proceed with the surgical stabilization of the anterior thorax, due to worsening in respiratory dynamics.

Surgical Procedure

The patient was positioned in the supine position. The procedure was performed through a Dartevelle's incision. The left pectoral muscle was released from its attachment medially, so as to expose the fractures. The Strasbourg Thoracic Osteosynthesis System (STRATOS) is composed of the connecting bar, positioned between the titanium rib clips, (available in different angles straight, 45°, or 22.5° left and right) [10,11]. Using the STRATOS we started stabilizing the second left rib with one rib clip. After that we proceeded to placing the rib clips on the third left rib and on the second right rib, then we connected them with the titanium bar (Figure 2). The sternal fractures were secured with 3 vycril sutures. We removed a portion of the left clavicle and half of the first left rib. After that we placed Permacol® prosthesis (porcine dermal collagen biological mesh) to close the thoracic gap, fixing it with sutures to the sternum and to the left ribs, so as to distribute the tension evenly on the patch. In the sub-muscular space we placed a one drainage tube of lower caliber. Finally, we covered the prosthesis with the pectoralis major muscles and the overlying skin.

The post-surgery chest-CT scan and Chest-XR (CXR) showed a proper positioning of the STRATOS and the gradual reduction of subcutaneous emphysema (Figure 3 and 4). The day after surgery it was possible to wean the patient from mechanical ventilation. Air leaks were interrupted

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Figure 1: CT scan 3D with sternal and clavicle fractures.



Figure 4: Post-survey CT scan 3D.



Figure 2: Intraoperative images of reconstruction with STRATOS and Permacol® prosthesis.



Figure 3: Post-surgery CXR showed a right position of prosthesis.

in the left chest on fifth postoperative day, while in the right chest on third postoperative day. All chest tubes were removed on day 7 after surgery. On sixteenth day he no longer needed ICU, so he was resigned towards the ward for the rehabilitation. The follow-up with chest X-ray performed at six months was characterized by normal findings and the patient had a good respiratory function test results.

Discussion

The debate continues about the management of FC since many years [5,12]. Severe respiratory failure despite aggressive medical treatment and the FC are the indication of surgery [3,5,13], in the other cases, corresponding to the majority of patients with rib or sternal fractures, the treatment is conservative [2,12,14]. The last guidelines suggested a surgical approach in FC, seen the effects on morbidity and mortality, the reduction of incidence of pneumonia and need of tracheostomy, in addition a reduction in duration of mechanical ventilation, Hospital Length of Stay (HLOS) and ICU-

LOS have been demonstrated [1,3,8,15,16]. On the other hand the operative approach required general anesthesia, which is always a risk for an older patient, but if the thoracotomy becomes necessary for replenished hemothorax or another reason, the indication for SSRF is mandatory [1]. No comparative studies have been performed on SSRF surgical techniques. Many of this techniques have been described in literature, such as the use of metal plates or clips, U-plate, absorbable plates, intramedullary fixation and Judet struts [1,5,7,8,10]. All these techniques could be complicated by wound infection, hardware failure or migration or breaking, and nonunion of the fracture site [3,18]. We preferred to use the STRATOS system together the Permacol® prosthesis, because they are simple to handle and to fix, they avoid instability or paradoxical movement, and the last but not least, we have reported excellent outcomes [10,17-19].

Conclusion

In older patients, anterior thoracic stabilization guarantees the possibility of fast recovery, early mobilization and short hospital stay. Surgical stabilization of thoracic trauma, using STRATOS and Permacol® patch, improves respiratory dynamics; furthermore it is a safety procedure, with beneficial effects on mortality and morbidity.

Author Contribution Statement

Conception and design: A. Farronato; Administrative support: A. Gonfiotti; Provision of study materials or patients: A. Farronato, A. Gonfiotti; Collection and assembly of data: A. Farronato, E. Vokri; Data analysis and interpretation: A. Gonfiotti, A. Farronato; Manuscript writing: A. Farronato, E. Vokri, L. Voltolini, A. Gonfiotti, S. Borgianni; Final approval of manuscript: A. Farronato, E. Vokri, A. Gonfiotti, S. Borgianni, L. Voltolini.

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