CASE REPORTS

THE SANDWICH TECHNIQUE FOR MINIMALLY INVASIVE REPAIR OF PECTUS CARINATUM

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Abstract

Introduction: *Minimally invasive repair of pectus carinatum (MIRPC) has been performed using the Abramson technique in which the bar that compresses the sternum is fixed with steel wires on the ribs. A 14-year-old patient underwent to a MIRPC using a sandwich technique in which two metallic bars fixed with bridges were implanted below the sternum under thoracoscopic vision, and another bar in a subcutaneous tunnel was implanted above. This technique has the potential to avoid specific problems related to the original technique like loosening of support for correction (broken wire), avoidance of induction of pectus excavatum or subcutaneous tissue adhesion.*

Keywords: *pectus carinatum, minimally invasive repair, surgical technique*

INTRODUCTION

Although already described[1] the sandwich technique to treat pectus carinatum (PC), with bars above and below the sternum fixed with bridges, it has not been routinely used in MIRPC. Reports are based on Abramson's technique in which the sternum compression bar is tied to the ribs with steel wires[2]. This report describes a MIRPC case in which the compression bar above the sternum is fixed to transverse bars (bridges) that stabilize two bars implanted below.

CLINICAL CASE

This is a 14-year-old male patient with mild autism and PC which worsened his emotional disturbance. His respiratory function tests were unremarkable. Conservative treatment (bracing) was indicated, but he did not adhere. In this scenario, surgical treatment was accepted by family and the patient as the only repair option. Signed authorization from the patient's legal representative has been obtained.

Through two 3 cm transverse incisions in the midaxillary line on each side, a subcutaneous path was dissected to the anterior axillary line where the 2 hinge points were made on each side. Under thoracoscopic vision, retrosternal tunnels were created from the left to right side[3] joining the hinge points through which the two metal bars were implanted and fixed with bridges on each side creating a quadrangular structure below the sternum. A third bar was passed through a subcutaneous tunnel over the sternal deformity and fixed to the bridge (crossbar) on the right side. To fix the other side, it was necessary to press downwards the sternum. To compress it, a steel wire strap was made at the end of the bar implanted above it. A fully open Bayley rib approximator was hooked onto the steel wire strap and the other end of the Bayley was secured to the side support of the operating table. As the Bayley was being closed, the assembly pulled the metal bar downwards, until

Figure 1 *Preoperative aspect and immediate postoperative result.*

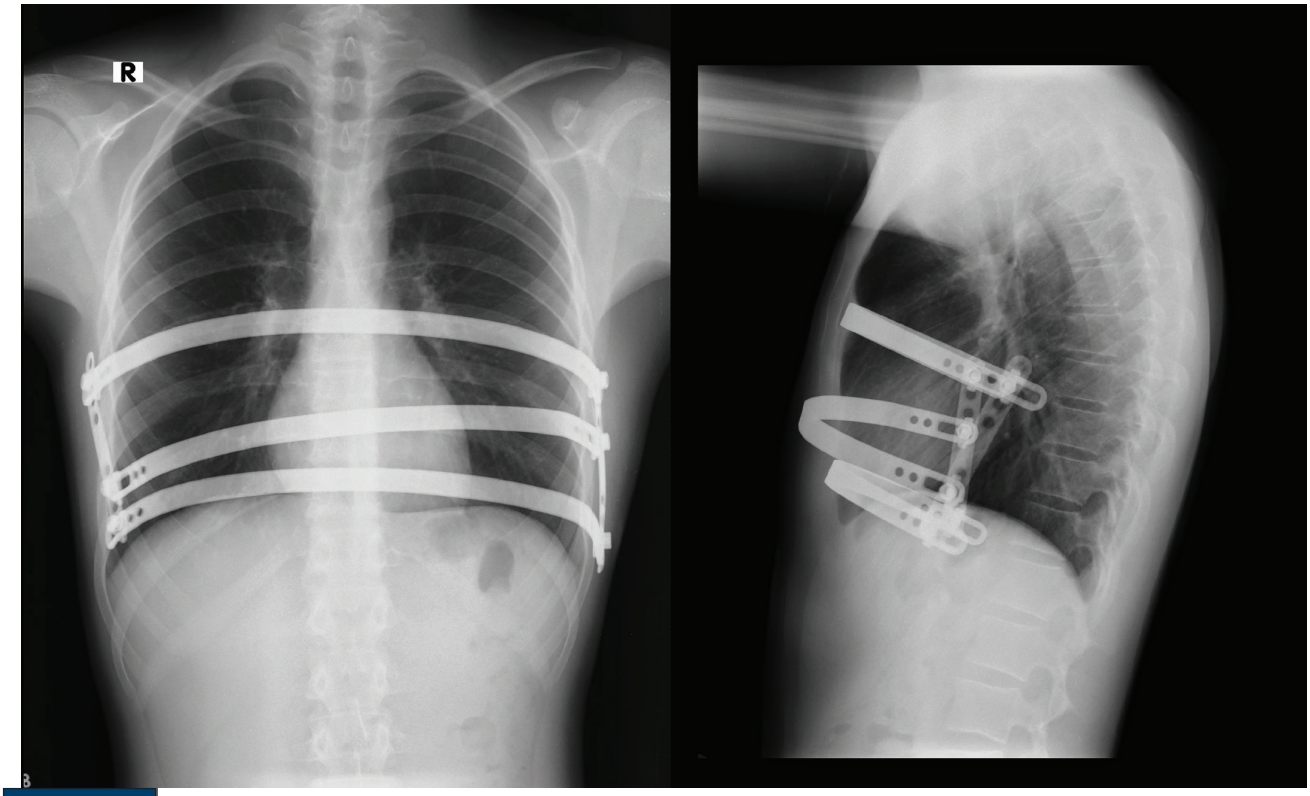

Figure 2 *Chest radiograph on 7th postoperative month. In the lateral view, it is observed that the middle bar is more anterior than the others as it was positioned in a suprasternal level.*

the end of the bar was at the level of the crossbar. The suprasternal bar was then fixed with a screw and nut to the transverse bar, correcting the deformity (Fig. 1). Inpatient analgesia regimen was based on epidural block with venous painkillers (metamizole, and nonsteroidal anti-inflammatory drugs). He was discharged on the fourth postoperative day with oral acetaminophen and codeine. The postoperative result was good and he progressed well 7 months after the procedure (Fig. 2).

DISCUSSION

MIRPC is based on a metal bar implanted over the sternum and fixed laterally to the ribs can apply downward pressure to correct the deformity[2]. The scarce literature on MIRPC does not specify for which type of PC this technique would be most suitable. Regarding age, it is said that it would be suitable for all ages[4]. To do this, it is necessary to implant bar fixators

onto the ribs laterally, exert pressure on the sternum to reduce deformity, and lock the bar in these fixators. Although effective, in addition to the general complications such as pleural effusion, pneumothorax or infection, three specific complications may occur with this method: breakage of the steel wires used to tie the fixators to the ribs, induction of pectus excavatum and bar adhesions in the subcutaneous tissue[5].

The stimulus to perform MIRPC sandwich technique was the development of a surgical material (Traumec, Rio Claro, Brazil) for the minimally invasive treatment of pectus[6]. In this technique, it is not necessary to fix the compression bars to the ribs with steel wires because the bar is fixed to the bridges that stabilize the bars in the retrosternal position. Therefore, we believe that the complication mentioned in the literature as breaking of the steel wires, but which in practice represents the loss of support for the compressor bar, will no longer occur.

In this technique, the two bars implanted below the sternum will exert a force opposing the pressure above the sternum. Therefore, there is an expectation that pectus excavatum induction will be avoided[7].

Another reported complication is subcutaneous tissue adhesions to the compressor bar, which caused Abramson to change to a submuscular tunnel instead, which is more difficult to dissect[2]. It probably occurs because these authors used steel bar, while authors with large series using titanium bars don't observe these adhesions complications[4].

CONCLUSION

Our initial impression is that sandwich MIRPC is an effective technique in terms of exerting pressure and providing correction of the thoracic deformity, and it can avoid the three specific complications presented by the original technique.

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