



Repair of pectus carinatum by a modified Ravitch technique combined with postoperative bracing



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ABSTRACT

A 13-year-old boy with pectus carinatum was successfully treated by modified Ravitch's techniques combined with short-term orthotic bracing. No sternal osteotomy and less extensive resection of costal cartilage were performed. This minimally invasive surgery is safely and effectively in pubertal patients with pectus carinatum.

1. Introduction

Pectus carinatum (PC) is rare disorder characterized by the protrusion of the anterior chest wall and predominantly occurs in pubertal boys [1]. The pathogenesis of PC has been proposed to be the abnormal growth of the costal cartilage [2,3], and surgical correction of PC includes resection of the costal cartilage and sternal osteotomy [3–5]. We herein report a boy with pectus carinatum who was successfully treated by minimally invasive surgery combined with short-term orthotic bracing.

2. Case report

A 13-year-old boy presented with pectus carinatum. He had been observed by another hospital over the previous 12 months, showing deformed thoracic imaging findings without respiratory symptoms. The chest wall showed chondrogladiolar-type pectus carinatum with prominence from the fourth to the seventh cartilage on both sides (Fig. 1). Chest X-ray revealed a 'keel chest' appearance of the sternum (Fig. 2A), while chest computed tomography (CT) demonstrated no rotation of the sternum (Fig. 2B). The patient and his parents strongly desired correction of the chest wall deformity for cosmetic reasons. The patient did not want to wear an orthotic brace for a long period, so we decided to perform surgical treatment for his thoracic protrusion.

3. Operative technique

A small butterfly incision was made transversely across the top point of the sternal protrusion (Fig. 3), and the pectoralis major was reflected laterally using electrocautery. The fourth, fifth, sixth and seventh cartilage were all exposed on both sides. A longitudinal perichondral incision was made on the anterior surface of the costal cartilage, and then subperichondral resection of the deformed costal cartilages was performed from the fourth to seventh costal cartilage. The remaining redundant perichondrium was straightened and sutured to the anterior edge of the sternum to produce a taut support for pulling the sternum posteriorly (Fig. 4). The pectoral major was re-sutured, and the skin was closed.

Postoperatively, the patient wore a breast band 12 h per day for 2 months to brace the chest wall. Twelve months after surgery, chest X-ray showed a flat sternum (Fig. 5A), and he is satisfied with his corrected chest wall appearance (Fig. 5B).

4. Discussion

PC is almost entirely asymptomatic, and treatment is mainly performed for aesthetic reasons [1], although some patients complain of respiratory or cardiac symptoms [1,2]. Ravitch's technique and modified Ravitch's techniques have been performed to correct chest wall deformity as a surgical treatment of PC [3–5]. Resection of the de-

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Fig. 1. The patient showed chondrogladiolar-type pectus carinatum.



Fig. 2. A. Chest X-ray revealed a 'keel chest' appearance of the sternum. B. Computed tomography demonstrated no rotation of the sternum.

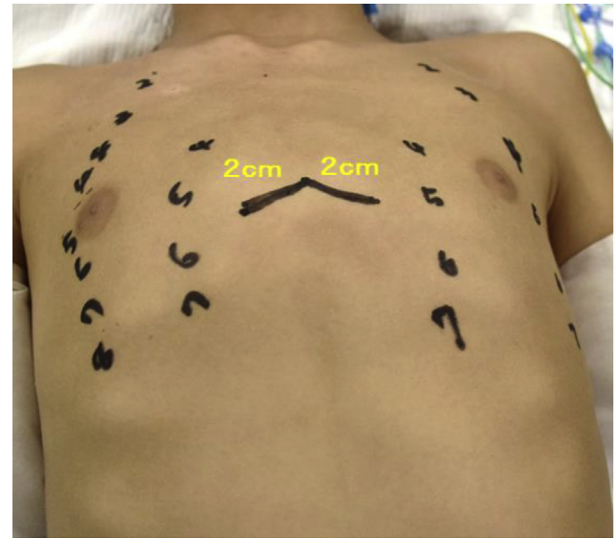


Fig. 3. A small butterfly incision (2 × 2 cm) was made transversely across the top point of the sternal protrusion.

formed costal cartilage is performed along with sternal osteotomy in Ravitch's or modified Ravitch's procedures. Fonkalsrud used a stainless bar to compress the sternum after less-extensive resection of the costal cartilage [4]. Although most cases of PC are successfully corrected by Ravitch's or modified Ravitch's procedures, large operative scarring frequently remains [3–5].

Abramson et al. have used a long bar to compress the sternum as the internal bracing methods, they placed a curved bar anterior to the sternum through lateral chest wall incisions and fixed the bar to the ribs using small fixation plates which was fixed to the ribs by subperiosteal wires [6]. This bar technique was useful in appropriate cases, but some troubles (skin adherence, seroma and wire breakage etc.) were reported in bar procedures [6]. On the other hands, some authors successfully performed external orthotic bracing as a nonoperative treatment of PC [7,8]. Although orthotic bracing has been effective in young patients, the brace must be worn for a long time and patients' compliance is critical to the success of this management strategy [8].

In the present case, neither osteotomy nor resection of the sternum was performed to displace the sternum posteriorly. After sub-perichondrial resection of the deformed cartilage, the straightened perichondrium sutured to the anterior edge of the sternum produces a taut support for correcting the sternum posteriorly. This can reduce the postoperative time needed to wear a chest band in order to compress the sternum.

No complications were observed during or after operation in our patient, except for some slight scarring. Minimally invasive surgery combined with a short postoperative time wearing a chest band may be effective in young patients with PC.

Patient consent

Consent to publish the case report was not obtained. This report does not contain any personal information that could lead to the identification of the patient.

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Authorship

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