



The new steel bar in pectus carinatum repair and a review of current methods of correcting chest deformations

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Introduction

In their paper, Zhang and colleagues described the favorable results of correcting the pectus carinatum (PC) after using the new steel bar in the anti-Nuss procedure (1).

Pectus excavatum (PE) and PC are the most common chest wall deformities accounting for more than 95% of all chest wall defects in humans (2,3). PE affects 0.1% of all live births, while PC is less common and occurs in 0.06% (2,3).

The precise etiology of both deformities remains unclear. The main hypotheses are developmental disorder, costal cartilage overgrowth, or genetic predispositions (2). Moreover, PC may frequently accompany certain diseases, such as Marfan disease, homocystinuria, osteogenesis imperfecta, Noonan syndrome, or mitral valve prolapse (4).

A decreased quality of life characterizes patients with either PE or PC in their mental and physical areas (5). Although some PE patients are asymptomatic, others may complain of physical disorders (dyspnoea, chest pain, and palpitations) or psychosocial symptoms (body image concerns and depression) (5-7). Patients with PC mainly suffer from cosmetic issues, resulting in a reduced self-image and a lower quality of life than patients without this deformity (5). Both cosmetic and functional impairments are indications for surgical correction (5-7).

Treatment

Currently, PE and PC could be repaired with both surgical and conservative methods, which are available. The Nuss

procedure is one of PE's most commonly performed surgical corrections. It is a well-described, effective and safe method, making it the preferred treatment worldwide for children and adults (8-10). The efficiency of the Nuss procedure in PE exceeds 90% and provides favorable long-term cosmetic results (7,11). The perfect age for surgery remains a controversial issue, but many authors prefer to operate the teenagers (7,12).

The papers describing the use of less invasive methods in treating chest wall deformities are also worth mentioning. In PE, an attempt is made to use a vacuum bell, which may provide the cosmetic improvement in some cases, especially in younger patients with mild or moderate deformities (13,14).

The history of modern treatments for PC dates back to 1949 when Ravitch described his technique of removing the abnormal costal cartilage and sternal osteotomy (15). This method has become the standard treatment of PC for the next over 50 years (15).

The disadvantages of this method: extensiveness and the formation of an unaesthetic scar in the medial line of the sternum resulted in the search for less aggressive methods for treating this benign condition. A related point to consider is the recurrence rate after the Ravitch procedure, which could reach even 30% (16-18).

In growing patients, the compressive external bracing is a high-profile, non-invasive PC treatment method that could succeed and help avoid the operation (19,20). In some departments, the results were so favorable that the brace therapy was introduced as a first-line treatment for PC,

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followed by surgery once the effect was not satisfying (21).

In 2005, Abramson described the minimally invasive surgical technique for correcting PC first in Spanish (22) and later in English (23). In the next 15 years, the minimally-invasive techniques such as the Abramson procedure (or reversed Nuss procedure) (23) have gained in popularity and are frequently performed as the alternative to the more extensive Ravitch procedure. It should be emphasized that the Ravitch method involves a significant interference with the thoracic skeleton (15), in contrast to the Abramson method, which is essentially based on the compression effect (22). According to Abramson (22), the most challenging part of the operation is the subpectoral bar placement, requiring a PVC tube with a trocar during dissection. Therefore, the authors of this procedure's modifications decided to use the two curved Doyen intestinal clamps to prepare a submuscular tunnel (24).

The new steel bar

Zhang *et al.* used a novel steel bar type in the anti- Nuss procedure (1). The main modification was the bar's composition, consisting of three parts with different elasticities. According to the authors, such a structure significantly increases its plasticity and makes it easier to design the shape of the bar for the patient's deformity type. As the authors reported, removing the newly designed bar was less time-consuming and traumatic for the patient. From a practical point of view, another significant advantage of this new bar is the ability to modify the steel bar's shape further, even once it is placed in the body.

Furthermore, the newly designed stabilizer and multiple wires enabled the authors to stabilize the bar firmly and reduce the number of complications related to its displacement. The satisfaction of patients was confirmed by using the questionnaires in the follow-up. The idea of this paper fits perfectly into performing the beneficial modifications of the thoracic deformation procedures: simplifying them, individualizing the therapy to a type of deformation, and ensuring maximum safety.

Considering that most patients are children and young adults, it is tempting to hypothesize that modifications of available techniques: reducing scarring, postoperative pain, and the risk of other complications, will be of increasing interest to patients and doctors in the following years (25). The availability of various treatment methods also allows for a wider choice and better adaptation of the method to the type of deformation. Therefore, the presented paper

creates a background for the future, further attempts would compare various types of steel bars and minimally invasive methods, as well as evaluate their effectiveness with the emerging reports on the possibilities of non-invasive treatment of chest wall deformations.

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