Can absorbable stabilizers be used routinely in the Nuss procedure?

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Abstract

Objective: During minimal invasive surgical correction of pectus excavatum the metal bar is rotated 180° and fixed by one or two stabilisers. Previously, all stabilisers were made from metal, but they often caused chronic pain and had to be removed. Recently, a slowly absorbable stabiliser made from Lactosorb® has been introduced. Methods: From 2001 to 2008 a total of 507 patients underwent minimally invasive repair of pectus excavatum at Aarhus University Hospital. Since February 2007 we routinely used absorbable stabilisers made by Lactosorb®. We always used shorter pectus bars than originally suggested and always placed one stabiliser close to the entry in the thoracic cavity on the left side. All operations were performed by the same surgeon and all patients were seen 6 weeks after surgery. Patient records were reviewed for retrospective analysis. Results: In 422 patients we used a metal stabiliser while 85 patients received a Lactosorb® stabilizer. Seven patients received two stabilisers. During the follow-up period one metal stabiliser broke after 2(1/2) years (0.2%), but within 6 weeks after surgery three Lactosorb® stabilizers broke (3.5%) and another three dislocated laterally (3.5%). Conclusions: Absorbable stabilisers may be used for minimal invasive surgery for pectus excavatum but they are more vulnerable and break easier than metal stabilisers. This is likely a consequence of high stress forces that may be more pronounced in patients who receive a shorter pectus bar, but further research is needed.

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Keywords: Pectus excavatum; Chest wall; Nuss procedure

1. Introduction

In 1998 a minimally invasive repair of pectus excavatum was reported by Dr Nuss [1]. It involves remodeling of the anterior chest wall by employing a retrosternal metal bar with avoidance of cartilage resection and has rapidly gained acceptance as the preferred method in children and young adolescents [2—4] because the procedure is associated with small skin incisions, shorter operation time, minimal blood loss, and early return to full activity. During the surgical procedure the metal pectus bar is rotated 180° and fixed by one or two stabilisers which decrease the risk of dislocation of the pectus bar [5]. The indication for surgery has been extended to adults [6—11] even though complications and postoperative pain appears to be higher [7,9,12,13]. Pain related to the stabiliser which is used to fix the pectus bar occurs in approximately 7% of patients older than 18 years of age and disappears following removal of the stabiliser [14]. This consideration led us to use absorbable stabilisers made of L-lactic and glycolic acids (LactoSorb®), which retains 70% of its initial strength for the first 8 weeks. We have used absorbable stabilisers routinely since February 2007 and the present study reports our initial experience. Bioabsorbable fixation devices have been used in orthopaedic and maxillofacial surgery for many years [15—17] but to the best of our knowledge this is the first report where it is used in the treatment of pectus excavatum.

2. Methods

From 2001 to 2008 a total of 507 patients underwent minimally invasive repair of pectus excavatum at Aarhus University Hospital. The indication for surgery was disabling cosmetic appearance as described by the patient. All patients were seen preoperatively for a clinical examination. If the pectus excavatum was evaluated to be less than 2(1/2) cm deep the patient was not considered for surgery. From 2001 to 2005 our patients were routinely scheduled for a CT-scan, but we never used the Haller index as a reason to exclude patients for surgery and consequently we stopped these investigations. Preoperative echocardiography was only performed in patients suspected of Marfan syndrome (n = 9).

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absorbable stabilisers made of L-lactic and glycolic acids. We used metal stabilisers, but since February 2007 we used absorbable stabilisers made of l-lactic and glycolic acids. Stabilisers were almost always placed on the left side. In addition, the pectus bar was secured on the right side by two or three 0-polydioxane (PDS) sutures around the ribs. An additional bar was introduced if the cosmetic result was unacceptable with a single pectus bar. If the patient presented with an asymmetric pectus excavatum the metal stabiliser while 85 patients received an absorbable stabiliser. Of these 85 patients 58 (68%) were younger than 18 years and the remaining 27 (32%) were 18 years or older. There was no operative mortality. All but one patient achieved an excellent cosmetic result. Two pectus bars were required in 107 patients (21%) and 2 patients required three pectus bars. The median length of the pectus bar was 11 in (range 7—15 in.). The median duration of the surgical procedure was 36 min (range 16—180 min). The median postoperative length of hospital stay was 5 days (3—29 days).

Information on the postoperative chest X-ray was available from all charts: a pneumothorax was visible in 268 cases (53%) but only 13 patients (2.6%) required chest tube drainage. In the remaining 255 patients, all of whom were asymptomatic, the pneumothorax was treated conservatively and on the day of discharge it had resolved completely. None of the patients where we used an absorbable stabiliser developed persistent pain.

During the follow-up period one metal stabiliser broke after 2(1/2) years. This complication occurred while the patient pulled hard with his right arm. In comparison, three absorbable stabilisers broke within 6 weeks of surgery (3.5%). None of these complications occurred while the patients engaged in heavy physical activity. Another three absorbable stabilisers (3.5%) dislocated within 8 weeks of surgery without any connection to physical activity. Of these six failures with absorbable stabilisers two occurred in younger patients and the remaining four occurred in adults.

5. Discussion

Pectus excavatum is the most common chest wall deformity in children with an incidence of 1:800 [19]. For decades the traditional repair was an open procedure, but in 1998 a minimally invasive repair of pectus excavatum was reported by Nuss [1]. It involves remodeling of the anterior chest wall by employing a retrosternal metal bar with avoidance of cartilage resection. The Nuss operation has since rapidly gained acceptance as the preferred method for pectus excavatum repair because the procedure is associated with small skin incisions, a shorter operation time, minimal blood loss, and early return to full activity. Several papers have been published on the results of this technique. Most series are small in numbers but some centres have extensive experience [2,13,20,21] and reports are emerging where the technique has been used in adults [6–11].

Our results confirm previous reports that complications occur frequently following the Nuss operation but this is due to the fact that even the smallest pneumothorax, which is seen in almost half of all patients, is considered a complication. The vast majority of these cases were asymptomatic and resolved spontaneously during the hospital stay without chest drainage, and it is indeed questionable if they should be considered real complications. Other complications were infrequent in our patients but intolerable pain led to early removal of the stabiliser in 7% of our adult patients who received a metal stabiliser [14]. This prompted us to use a newly introduced absorbable stabiliser that is completely absorbed after 1 year. Our results demonstrate that there is a significantly higher incidence of complications with absorbable stabilisers. They break easier and may not fixate the bar laterally as well as metallic stabilisers. Although purely speculative, this is not unlikely a consequence of high stress forces on the stabiliser that may be more pronounced in patients who receive a shorter pectus bar, which all our patients did. We modified the original technique described by Dr Nuss by shortening the pectus bar approximately 5—8 cm which we believe may have reduced the incidence of bar displacement and wound seromas [18]. The rationale was that the stabiliser is placed closer to the entrance of the bar into the thoracic cavity (Figs. 1 and 2) thereby decreasing the risk of rotation or displacement because the point where the stabiliser is attached may

3. Surgical technique

Our surgical technique has previously been described in detail [18]. A stabiliser was normally placed on the left side of the bar as close as possible to the entry into the chest in order to avoid rotation (Fig. 1). During the first 6 years we routinely used metal stabilisers, but since February 2007 we used absorbable stabilisers made of L-lactic and glycolic acids. Stabilisers were almost always placed on the left side. In addition, the pectus bar was secured on the right side by two or three 0-polydioxane (PDS) sutures around the ribs. An additional bar was introduced if the cosmetic result was unacceptable with a single pectus bar. If the patient presented with an asymmetric pectus excavatum the metal bar was bent asymmetrically according to the method described by Park et al. [8].

4. Results

The median age of all 507 patients was 16 years (7—47 years) and 432 were males (85%). In 422 patients we used a metal stabiliser while 85 patients received an absorbable stabiliser. Of these 85 patients 58 (68%) were younger than 18 years and the remaining 27 (32%) were 18 years or older. There was no operative mortality. All but one patient achieved an excellent cosmetic result. Two pectus bars were required in 107 patients (21%) and 2 patients required three pectus bars. The median length of the pectus bar was 11 in (range 7—15 in.). The median duration of the surgical procedure was 36 min (range 16—180 min). The median postoperative length of hospital stay was 5 days (3—29 days).

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function as a hinge. The closer this point is to the centre of the pectus bar the less likely it will rotate. In contrast, if a longer pectus bar is used the stabiliser is inevitably placed more laterally on the chest (Figs. 3 and 4) because it cannot be pushed medially on the curved pectus bar. However, while stress factors may be diminished on a short pectus bar they may consequently be increased on the stabiliser. Further research is needed but our results demonstrate that absorbable stabilisers are associated with an increased risk of failure when used with the short pectus bar technique. It remains to be determined if the incidence of failures is reduced with the conventional technique using a longer pectus bar. Finally, it may be speculated that stabiliser failure is associated with increasing patient age because computer model simulation recently suggested that stress factors on the ribs following the Nuss procedure are higher in adults compared with children [22]. Our results seem to favour this theory as the majority of failures with absorbable stabilisers occurred in adult patients. Thus, one may still consider using metal stabilisers in adults, a patient group which is increasingly treated for pectus excavatum by the minimal invasive approach [6–11,14] even though metal stabilisers frequently cause intolerable pain in this patient group [14]. Again, further research is needed and until we have more knowledge on this issue surgeons may decide to use absorbable stabilisers as stress forces on the stabiliser appear to be low.

References


