

Minimally-Invasive Endoscopic Correction of Funnel Chest Deformity Via an Umbilical Incision

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Abstract. Congenital funnel chest deformities (pectus excavatum) are a well known condition that may require surgical correction if repercussions on the respiratory and cardiac dynamics are caused by the compression on the mediastinal structures and by the reduction of the respiratory volume. However, the aesthetic defect may have serious psychological implications and—even if no respiratory impairment is caused—may nevertheless indicate aesthetic correction by implanting a custom-made prosthesis. Alloplastic correction traditionally results in long, visible scars. Since the presternal area is prone to hypertrophic scarring, this type of scar may be a disturbing complication of the intervention. Endoscopically-assisted minimally-invasive implantation of customized implants via an umbilical incision to introduce a customized single-unit silicone implant can avoid unsightly scarring and allows safe hemostasis in the dissection pocket, minimizing well-known side effects and patient morbidity.

Key words: Funnel chest—Minimally-invasive plastic surgery—Endoscopy

The congenital depressive malformation of the sternum (Pectus excavatum) represents the most common deformity of the chest wall. It has been the subject of many studies because of its various inherent problems since the initial description in 1594 by Johannes Schenk [10]. The overwhelming majority of patients with pectus excavatum have no physiologic compromise. The cosmetic defects of pectus excava-

tum and bilateral mammary hypoplasia can be corrected with a single-unit customized silicone implant. We report upon the minimally invasive endoscopically assisted implantation of a customized one piece silicone implant introduced via an umbilical incision.

Case Report

A 19-year-old female patient presented with bilateral hypoplasia of the breast and mild funnel chest deformity. There were no signs of clinically reduced respiratory function, and the patient was not suffering from restrictions in her daily activities. No further pathological signs were found. She complained of severe psychological repression with serious implications, especially for what concerned her affective life and social relationships (Fig. 1).

After three-dimensional CT scanning and molding, a custom-made silicone rubber implant was manufactured according to the desired volume (Fig 2). A small semicircular skin incision was placed around the superior margin of the umbilicus and the dissection of the implant pocket was performed endoscopically (Fig. 3). An extended pocket was created across the anterior chest wall. The prostheses had to be folded tube-like to be passed through the umbilical incision into the final subcutaneous position (Fig. 4a,b). Simultaneous breast augmentation was not desired by the patient. A good cosmetic result occurred with minimal morbidity and no scarring besides the umbilical incision line.

A postoperative seroma formation required two repeated punctions. The further course was uneventful. The patient was very satisfied with the result during the follow up and reported upon a significant improvement in her social activities.

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Fig. 1. Preoperative aspect of 19-year-old female patient with mild funnel chest deformity and bilateral mammary hypoplasia.

Fig. 2. Placement of customized silicon rubber implant over defect.

Fig. 3. Endoscopic dissection of implant pocket via an umbilical incision.



Fig. 4. (A) Folded implant to fit through umbilical incision and (B) endoscopically-assisted placement of a custom-made silicone rubber implant.

Discussion

Only recently have the latest techniques of diagnosis, cardiology, and radiology shed more light on the repercussions of the pectus excavatum deformity on the respiratory and cardiac dynamics caused by the compression on the mediastinal structures and by the reduction of the respiratory volume. The aesthetic defect, often the first aspect to attract the attention of patient and doctor, has serious psychological impli-

cations, especially for what concerns the affective life and social relationships in general.

The surgical therapy usually consists in radical interventions with large sternocostal resections and repositioning of the sternum (turnover), or interventions with a less invasive technique to correct only the aesthetic defect [10]. There has been a controversial debate as to whether surgical interventions should be performed and about advantages and disadvantages of these techniques, especially in relation to the

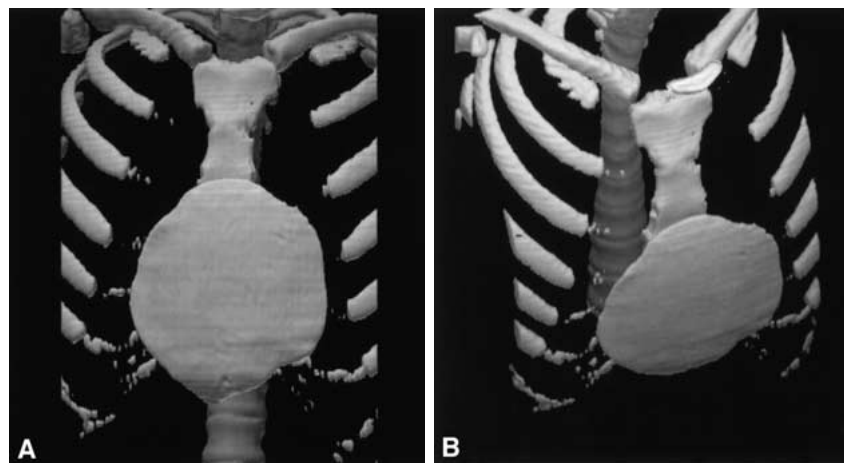


Fig. 5. Three-dimensional computerized tomography of inserted implant showing the relation of the customized device to sternal contour and chest wall (A) oblique cranio-caudal view (B) lateral aspect with section through the middle of the implant.



Fig. 6. Postoperative aspect two weeks after endoscopic correction of funnel chest.

methods of stabilizing the reduction if invasive resections and repositioning is performed. Good results with rib corrections have been propagated for patients with severe malformations with physiopathological implications and secondary pulmonary disorders. This intervention is especially indicated if the patient is young, to prevent further disabling complications. Several authors have shown the importance of early correction of severe malformations [1].

Although there are conflicting data to support and reject the concept that physiologic improvement can be a consequence of surgical repair, correction is frequently indicated for aesthetic improvement alone. Modern aesthetic and reconstructive procedures lead

to significant improvements in the quality of life [4]. Therefore, the individual gain of relief from secondary psychological consequences of such disfigurements even in mild funnel chest syndromes allows the indication to be extended to purely aesthetic needs [3]. Reported data on patient satisfaction and improvement of quality of life with enhancement of her or his own self-image show that operative corrections of mild funnel chest deformities for aesthetic reasons seem to be highly justified and that this surgery is worthwhile [2,8].

The rational solution to the problem is to produce a custom made Silastic implant that adheres optimally to the defect in each individual case. In our routine management, the desired shape of the implant is

performed by a preliminary mold and a customized pliable silicone rubber implant is then manufactured. We have employed computed tomography to reconstruct the pectus deformity in order to improve implant design and fit [6]. The procedure can be markedly supported by such means of preoperative three-dimensional spiral-computed tomography for the purpose of improved preoperative planning in order to avoid unnecessary tissue mobilization (Figs. 5 and 6). It is also helpful to enhance the patients' comprehension regarding the operative requirements.

Such implants may be placed subcutaneously or subpectorally, representing relatively minor procedures with a short hospital stay and minimum morbidity [5,8,9,11]. Postoperative seromas are a well known side effect of silicone implant placement and have been reported previously by others in a high frequency of patients who needed repeated aspirations postoperatively [8,11]. However, the traditional approach using incisions located presternally, in the inframammary fold or the upper abdomen may be followed by hypertrophic scarring, especially in younger patients, and may well result in unsightly scars.

We therefore make use of a minimally-invasive technique using the endoscopically controlled dissection from a periumbilical incision that results in almost invisible scars that are well hidden around the umbilicus. By this technique standard incisions can be avoided, and during the dissection hemostasis can be achieved securely under direct vision. The dissection of the pectoralis muscle can also be safely performed if subpectoral placement is attempted. This technique allows to delay the incision away from the final point of implant placement.

Conclusion

The cosmetic defects of pectus excavatum and bilateral mammary hypoplasia can be corrected with a single-unit customized silicone implant inserted through an umbilical incision. Minimally-invasive

methods should be applied to all cases with mild deformities, considering the higher degree of tolerance of the intervention, the low rate of postoperative complications and the minor costs, thanks to a shorter hospital stay. The advantages of endoscopic pectus excavatum correction are an almost invisible scar around the umbilicus, safe dissection, control of bleeding, and minimal patient discomfort.

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