Breast Asymmetry and Pectus Excavatum Improvement With Fat Grafting

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Abstract

Background: In women, pectus excavatum malformation can cause modified breast morphology, resulting in mammary asymmetry, which can be increased by placing mammary implants alone. Fat transfer can be an elegant solution to increase the volume and projection of the breast.

Objectives: The authors discuss their experience treating pectus excavatum with fat transfer (lipomodeling) since 2000.

Methods: The charts of 19 consecutive patients with a pectus excavatum breast asymmetry who underwent lipomodeling treatment at the authors’ facility between January 2000 and November 2011 were retrospectively reviewed. Patients were separated using the Chin classification (type 1, 2, and 3). Data points for each patient included age and body mass index, number of interventions and volume of fat injected during each session, total volume transferred, and postoperative complications. The clinical result was evaluated by the patient and the surgical team on a 4-point scale: very good, good, fair, or poor.

Results: Most (74%) patients in this series had type 3 Chin pectus excavatum. The average age was 28 years, and the average body mass index was 20.3. The average number of lipomodeling sessions was 1.63, and the average volume of fat transferred was 230 mL per session and 375 mL total. The patients and the surgical team were very satisfied or satisfied in 95% of cases and considered the result fair in 5% of cases. There were no complications.

Conclusions: Fat transfer for treatment of pectus excavatum yields very good (natural and stable) results and high patient satisfaction rates, which makes this technique our preferred method for treating thoracomammary malformations in pectus excavatum.

Level of Evidence: 4

Keywords
funnel chest, pectus excavatum, breast asymmetry, fat grafting, breast malformation, lipomodeling, breast surgery

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Pectus excavatum is the most common congenital thoracic malformation. Its frequency varies between 1/300 and 1/1000 births, with a sex ratio of 5 to 1 (men/women). Today, many authors, contrary to prior thought, agree that the aesthetic aspect is the main application for the patient, with the cardiopulmonary aspect being a rare application. In women, pectus excavatum is usually associated with breast asymmetry, which is more visible in severe forms because of the osteocartilaginous modifications. Breast asymmetry is the most frequent motivation for consultation in pectus excavatum patients. Placing breast implants alone can make the osteocartilaginous malformation more obvious, causing poor aesthetic results with external dystopia of the areola because of medial implant displacement. However, treating the condition with fat transfer (lipomodeling) can improve the tissue quality and provide a natural and stable result. We have utilized this technique in our department since 1998 in breast reconstruction procedures to provide volume and projection to...
the new breast. In 2000, we extended the indications of lipomodeling to congenital and acquired thoracic malformations, especially pectus excavatum. The purpose of this article is to present our experience in correcting pectus excavatum by fat transfer.

METHODS

The charts of 19 consecutive patients with a pectus excavatum breast asymmetry who underwent lipomodeling treatment at the authors’ facility between January 2000 and November 2011 were retrospectively reviewed. Patients were divided into 3 groups using Chin’s classification (type 1, 2, and 3).7 Type 1 patients had a narrow and symmetrical deformity with acute cartilage angulation that did not cross the mammary line. Type 2 patients had a wide and symmetrical deformity with cartilage angulation that crossed the mammary line and smoothly sloped down to the sternum. Type 3 patients had a unilateral or asymmetrical deformity, including a large or localized depression of the sternum. It should be noted that many other classifications have been described.8 The Chin classification for this deformity relates only to the bony and cartilaginous elements and not to the breast itself. It is possible to have a Chin 1 pectus with relatively severe breast asymmetry or a Chin 3 with reasonably aesthetic-appearing breasts.

During chart review, the age and body mass index of each patient were recorded. All operations were performed in our department using the same protocol. Each patient was treated by fat transfer to improve breast asymmetry. Some patients underwent additional procedures, including bilateral breast augmentation with adjunct round retro-muscular implants, aesthetic breast lipoaugmentation, lipomodeling on sequelae after breast-conserving cancer treatment, or mastopexy to treat mammary ptosis.

Every patient received a document containing information about the risks, advantages, and disadvantages of lipomodeling. Patients then gave their written consent for the operation. A complete clinical examination was performed preoperatively. Breast imaging examinations (ultrasonography, mammography, magnetic resonance imaging) were undertaken preoperatively and 1 year postoperatively.

All procedures were performed under general anesthesia. Fat grafts were harvested from the available areas after infiltration with physiological serum and epinephrine (1 mg epinephrine to 500 mL of saline serum). Luer-Lok syringes (10 mL) attached to 3.5-mm multiperforated canulas were used for liposuction. Until 2006, our technique was to treat the fat tissue by centrifugation at 3000 rotations per minute for 3 minutes; after 2006, it was treated for only 20 seconds.

Incisions in the breast were made with a 14-gauge trocar, and the fat grafts were injected in every layer using a 2-mm monoperforated cannula. Fat grafts were injected from the deep to the superficial plane in the areas with volume defect. Fasciotomies were also performed to release the fibrous strings that can produce retracted scars and to increase the fat volume we could inject. Sutures were placed with very fine, rapidly absorbed suture material. A paraffin gauze dressing alone was used for the whole breast for 15 days, and a compressive dressing was used for the area of liposuction. The compressive dressing was removed 5 days postoperatively. If a second intervention was needed, the interval was between 2 and 3 months. The number of interventions, the volume injected each session, and postoperative complications (infection, hemorrhage, pneumothorax, and fat embolism) were recorded. Patient satisfaction was assessed by the surgeon questioning each patient about the shape, size, and symmetry of her breasts. Patients were asked to classify the results in these areas as very good, good, fair, or poor. The result was also evaluated by the surgical team as very good, good, fair, or poor.

RESULTS

Most (74%, n = 14) patients in this series had type 3 Chin pectus excavatum; 4 patients had a type 2 malformation (21%), and 1 had a type 1 malformation (5%). The average age of patients in this series was 28 years (range, 16-61 years), and the average body mass index was 20.3 (range, 17-25). The average number of lipomodeling sessions was 1.63 (range, 1-3 sessions), and the average volume injected during each session was 230 mL (range, 30-510 mL). In our clinical assessment, we judged that about 70% of volume was maintained 3 months after the first fat grafting procedure. The average total volume transferred was 375 mL (range, 30-820 mL).

There were no concurrent or associated treatments in 58% of cases. In 42% of cases, several types of surgery were associated: 2 patients underwent aesthetic bilateral lipomodeling, 3 had lipomodeling sessions for the sequelae of breast-conserving treatment in unilateral breast cancer, 1 patient had a bilateral breast augmentation with silicone implants placed retropectorally, and 2 patients underwent mastopexy to treat mammary ptosis. The patients and the surgical team were very satisfied or satisfied (rating “very good” or “good”) in 95% of cases and considered the result fair in 1 case (5%) due to the persistence of a small asymmetry after surgery. In this series, we observed no complications such as infection, hemorrhage, pneumothorax, or fat embolism. Imaging examinations were performed preoperatively and 1 year postoperatively; none of the results showed any abnormalities apart from oil cysts.

Clinical results can be seen in Figures 1, 2, and 3.

DISCUSSION

The etiology of pectus excavatum remains unknown. Increasingly, authors consider the functional deficit resulting from the condition to be low or absent, concluding that invasive surgeries such as the Nuss or Ravitch (sternochondroplasty) techniques do not yield the intended improvements.3,5 In fact, none of the patients in our series...
reported preoperative functional problems such as respiratory or cardiac failure, either at rest or during effort. Furthermore, no comparative study could show the benefits of these techniques. A risk-benefit assessment does not support their use, as they are considered significant surgeries for the patients. With this in mind, the most important problem for patients with pectus excavatum remains morphologic and aesthetic.

Endoprosthesis techniques for thoracic malformations have demonstrated efficacy for reconstructive procedures to treat pectus excavatum.\textsuperscript{9,10} Introducing a customized endoprosthesis to cover the chest defect allows a satisfactory correction of moderate to severe breast asymmetry for most patients with pectus excavatum (87.5\% cases).\textsuperscript{9} The major complication rate is null, and the seromas that appear in half of the cases are a minor inconvenience.\textsuperscript{9,10}

Breast asymmetry often motivates patients to seek consultation because it is regarded as a crippling deformity.\textsuperscript{11} To treat isolated breast asymmetry, we can perform a reduction mammoplasty on the bigger breast, a unilateral mammary augmentation, or a bilateral augmentation using implants of different volumes. There have been a limited number of studies regarding breast asymmetry caused by pectus excavatum, but this malformation is still treated today by some thoracic surgeons using the Ravitch technique.\textsuperscript{12-16} Again, this technique is considered significant surgery and carries a high complication rate (20\%-25\%), including adverse events such as pneumothorax, heart injury, and material displacement. Endoprosthesis techniques for thoracic malformations have a lower

Figure 1. (A, C) This 19-year-old woman presented with a pectus excavatum deformity that was classified as Chin type 3. (B, D) Two years after the last of 2 lipomodeling sessions in which a total of 609 mL of fat was transferred (321 mL and 288 mL, respectively).
Figure 2. (A, C) This 26-year-old woman presented with a pectus excavatum deformity that was classified as Chin type 3. (B, D) One year after the last of 3 lipomodeling sessions in which a total of 873 mL of fat was transferred (281 mL, 341 mL, and 251 mL, respectively). (E, F) Six years after placement of bilateral retropectoral silicone implants (260 cc each) for breast augmentation.
complication rate.\(^{17}\) The minor complication is seroma in about half of the patients, but with no infection, wounds, hematoma, exposure, or cardiopulmonary disease.

Some researchers\(^{18}\) have used the technique of external negative pressure to remodel the thoracomammary deformity. Haecker\(^{18}\) treated a series of 133 patients with the vacuum bell system technique, with chest wall imaging confirming the presence of a sternal deformity of 1 cm. We have no experience with this system. Apparently the vacuum bell system can have certain efficiency in children, and it should probably be continued and further developed in pediatrics.\(^{18}\) However, the patients in our series were adults with a fixed deformity that required morphological correction.

One clinical case report demonstrated correction of a pectus excavatum using fat transfer with good results.\(^{19}\) We also reported this therapeutic approach in “funnel chest” correction.\(^{20-22}\) Our previous results confirmed that the lipomodeling technique\(^{20-22}\) is an alternative for treating thoracomammary malformations.\(^{23,24}\) We have used lipomodeling since 2000; for this indication, we had very good results over the follow-up period. The number of lipomodeling sessions varies between 1 and 3 for each case. In the current series, patients required an average of 1.63 lipomodeling interventions to obtain the desired result. The number of sessions depended on the degree of the deformity, the quality of the injection site, and the quantity of adipose tissue available for harvest.

Data from previous lipomodeling sessions for autologous breast reconstruction allowed for a comparison with the number of sessions needed for pectus excavatum correction. In our experience, performing a latissimus dorsi flap procedure without placing an implant provides the most available tissue to receive the fat grafts because it maintains a very good vascular supply.\(^{24,25}\) Evaluating our results in 200 breast reconstructions by latissimus dorsi flap without implant,\(^{25}\) we showed that an average fat transfer of 176 mL was enough to obtain a 78% satisfaction rate, and 22% of the patients required 2 to 3 procedures. The results were stable up to at least 6 months. The injection site is very important for the fat graft; it is also important for the patient to have a stable weight at the time of the surgery, to increase the constancy of the result. Transferred fat\(^{19}\) retains the memory of the original donor site, and if the patient loses weight after surgery, she will lose part of her breast volume.\(^{20}\) Preoperatively, we study every area of fatty tissue on the patient’s body to identify natural donor sites. Frequently, fat is extracted from the abdominal area not only because the result is appreciated by the patient but also because harvesting from this area does not require us to change the patient’s position on the operating table. Other preferred sites include the trochanter area and the internal area of the thighs and knees.\(^{20}\) Preoperatively, we also discuss with the patient areas that she believes need improvement by liposuction, which informs our selection of a donor site.

Figure 2. (continued) (A, C) This 26-year-old woman presented with a pectus excavatum deformity that was classified as Chin type 3. (B, D) One year after the last of 3 lipomodeling sessions in which a total of 873 mL of fat was transferred (281 mL, 341 mL, and 251 mL, respectively). (E, F) Six years after placement of bilateral retropectoral silicone implants (260 cc each) for breast augmentation.
The high level of patient satisfaction and the absence of complications in this series have made lipomodeling our preferred technique for treating pectus excavatum. The use of fat transfer to correct pectus excavatum deformities has many advantages: it is done only with autologous tissues, costs are relatively small, the technique is reproducible and can be repeated if the result is poor the first time, the final breast result has a natural appearance and consistency, there is good symmetry with the contralateral breast, and there is the secondary benefit of the liposuction on the patient’s body contour.

Postoperative imaging examinations are used as reference for later mammary screening. From a radiological point of view, normal results are found most often, although there are sometimes images of oil cysts. In our experience, these images cannot be confused with cancer.

Figure 3. (A, C, E) This 26-year-old woman presented with a pectus excavatum deformity that was classified as Chin type 3. (B, D, F) Two years after the last of 2 lipomodeling sessions in which a total of 560 mL of fat was transferred (200 mL and 360 mL, respectively).
by radiologists experienced in breast imaging. In case of any doubt, a microbiopsy should always be performed of the suspect lesion. In this series, no patient required microbiopsy.

One limitation of the lipomodeling technique is the small quantity of fat that can be taken. If the deformity is significant compared with the quantity of fat available, the technique of thoracic endoprosthesis, described by Spear et al and Chavoin et al, allows for a morphological correction of the pectus excavatum. This is a good solution for very thin patients without available fat. It is important to highlight that fat grafting is not the solution for all patients, but it is a useful adjunct to established techniques.

CONCLUSIONS

Fat transfer is an important adjunct technique in plastic surgery, especially for breast reconstruction and “funnel chest” deformities. Lipomodeling for treatment of pectus excavatum has yielded excellent aesthetic results and high levels of patient satisfaction. The aesthetic result is natural and stable and does not require placement of a silicone implant. The efficacy of the technique and the absence of complications have made lipomodeling our preferred treatment for correcting thoracomammary malformations such as pectus excavatum.

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