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IDEAS AND INNOVATIONS

Breast

Intentional Lower Pole Rotation of Anatomic Breast Implants in Chest Wall Deformities

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Summary: Several methods have been described for the correction of congenital thoracic wall deformities. Our aim was to investigate the feasibility and clinical results of using standard anatomic breast implants with modified anatomic positioning according to the defect in congenital thoracic wall deformities. Between 2014 and 2015, 5 patients diagnosed with pectus excavatum (PE, $n = 4$) or pectus carinatum (PC, $n = 1$) and breast asymmetry or hypoplasia were evaluated. In all patients, a submammary incision and dual-plane subpectoral placement of texturized, anatomic implants were performed. In patients with PE, the lower pole of the implant was positioned medially to compensate for the caved chest. In patients with PC, the lower pole of the anatomic implant was positioned laterally to compensate for the prominent sternum. Outcome measures were satisfaction, minor and major complications, and morbidity. The mean surgery time was 95±14 minutes, and the mean implant volume was 287±56 cm^3 (273±60 cm^3 on the right side and 305±60 cm^3 on the left side). After a median follow-up of 25 months (range: 2–35), all patients healed uneventfully, and a satisfactory correction of the thoracic wall deformity was achieved. Thus, by adjusting the lower pole of anatomic breast implants in a horizontal plane according to the thoracic defect, we showed satisfactory results. Our technique has a low complication rate and can be recommended for the correction of mild to moderate PE or PC. *(Plast Reconstr Surg Glob Open 2017;6:e1605; doi: 10.1097/GOX.0000000000001605; Published online 28 December 2017.)*

INTRODUCTION

Among congenital thoracic wall deformities, pectus excavatum (PE) is by far the most common, occurring in 1 of every 400 white male births, with women being affected 5 times less frequently.[1] Pectus carinatum (PC) is the next most common chest wall deformity and is 5 times less frequent than PE.[1]

Several methods have been reported to correct PE. In 1949, Ravitch introduced a technique based on sternum turnover.[2] This was the state-of-the-art repair until 50 years; later, a less-invasive technique with temporarily placed retrosternal steel bars through a lateral chest incision was described by Nuss.[3] First case reports about prefabricated silicone implants to fill the sternal defect in PE were published in the 1970s.[4]

The aim of this retrospective study is to describe a technique to camouflage a chest wall deformity and to correct breast asymmetry or hypoplasia in 1 single procedure by using standard anatomic breast implants.

PATIENTS AND METHODS

To patients with either PE or PC, we recommended using anatomic implants, which were rotated according to the defect. Patients presenting with functional problems related to the chest wall deformity were not included. Primary outcome measures were patient satisfaction evaluated by a Likert scale from 0 to 10 (0 = poor result; 10 = very satisfied) and complications within 30 days of initial operation. Moreover, satisfaction of surgeons was assessed by 2 independent investigators who reviewed blindly the outcomes using a Likert scale from 0 to 10 (0 = poor result; 10 = very satisfied). Long-term complications including seroma, infection, dislocation, or distortion of the prosthesis were evaluated clinically or by magnetic resonance imaging (MRI), when required. The values are shown as the

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mean and standard deviations or median and range where appropriate. Statistical significance was determined by a value of $P \leq 0.05$. Written consent was obtained from all patients.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Surgical Technique

A dual-plane subpectoral pocket was dissected in all patients. Then, anatomic implants with a textured shell surface (Mentor Worldwide LLC, Zug, Switzerland) were inserted. In patient with PE, we detached the muscle insertions medially in the most caudal part and performed minimal dissection to the lateral side, to so fill the medial part of the breast with the implant. Then, the lower pole of the implant was positioned with a 30° to 45° medial rotation to compensate for the caved chest, according to the orientation of the defect. In patients with PC, pocket dissection was performed more laterally, and medial muscle insertions were preserved. The lower pole was positioned 30° to 45° laterally to compensate for the prominent sternum and according to the orientation of the prominence. In each case, the new inframammary fold (IMF) was adjusted, with the ultimate goal to achieve an optimal ratio between the base width, the volume of the selected implant, and the new nipple-to-fold distance on stretch. In case of patients presenting with more tuberous breast, after the new IMF was adjusted, a sturdy suture repair including deep sutures from the chest wall to the fascia, followed by deep dermal sutures and skin, was performed, hereby minimizing inferior malposition and keeping the incision well hidden in the new IMF.

RESULTS

Between 2014 and 2015, 4 patients with PE deformities and 1 patient with PC deformity were operated on (Table 1). After a median follow-up of 25 months (range: 2–35), the evaluated patients healed uneventfully, and a satisfactory correction of the thoracic wall deformity was achieved with a mean Likert scale of 9.2±0.8 [Fig. 1; **see Figure, Supplemental Digital Content 1**, which displays a 23-year-old patient with pectus excavatum and breast asymmetry 30 months after insertion of anatomic implants (345 cm^3, medium height, high projection on the right side and 215 cm^3, medium height, moderate projection on the left side) in a dual-plane subpectoral pocket (A–C), **http://links.lww.com/PRSGO/A640**; see **Figure, Supplemental Digital Content 2**, which displays a 27-year-old patient presenting with pectus carinatum and breast hypoplasia. 245 cm^3 anatomic implants (medium height, moderate projection each side) were used for correction in a dual-plane subpectoral pocket (A and B). After a follow-up of 6 months, a satisfactory and symmetric outcome was achieved (C and D), **http://links.lww.com/PRSGO/A641**; see **Figure, Supplemental Digital Content 3**, which displays a 25-year-old patient presenting with pectus excavatum and tubular breasts (A and B). Anatomic implants (280 cm^3, medium height, high projection each side) were inserted in a dual-plane subpectoral pocket. After a follow-up of 2 months, a satisfactory outcome was achieved (C and D), **http://links.lww.com/PRSGO/A642**;

Table 1. Patient Demographics, Etiology, Procedure, Complications, and Outcome

Age	BMI (kg/m^2)	PE	PC	Associated Diagnosis	Implant, Right/Left (cm^3)	Implant	Primary Augmentation	Replacement of Implants	Associated Treatments	Follow-up (mo)	Complications	Outcome, Likert Scale (0–10)*
23	21.5	Yes	—	Breast asymmetry	345/215	Anatomic	Yes	—	—	30	None	10
27	20	—	Yes	Breast hypoplasia	245/245	Anatomic	—	Yes	—	35	None	8
20	20	Yes	—	Breast hypoplasia	350/350	Anatomic	Yes	—	—	33	None	9
48	26	Yes	—	Capsular fibrosis, Baker 4, implant rupture	215/345	Anatomic	—	Yes	Capsulectomy	23	None	10
25	22	Yes	—	Tubular breast	280/280	Anatomic	Yes	—	Periareolar Benelli mastopexy	2	None	9

*0 = poor result; 10 = very satisfied.
BMI, body mass index.

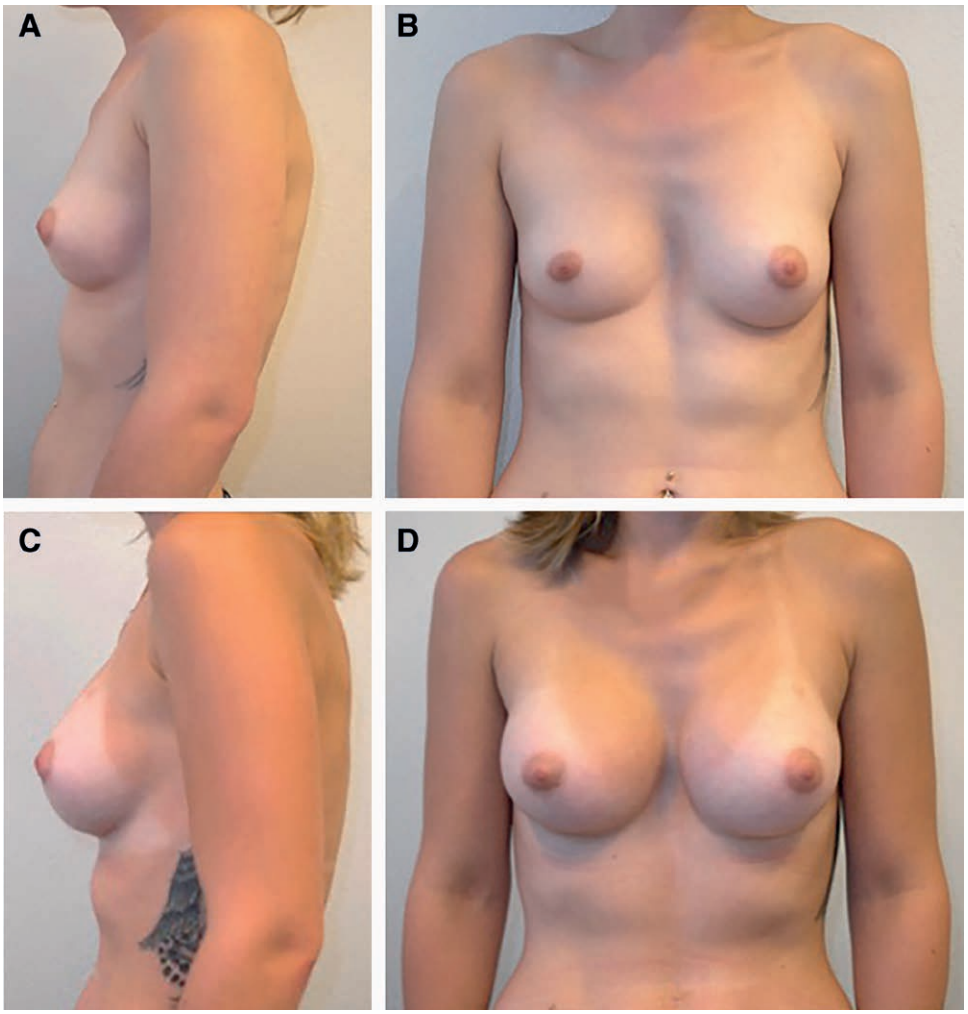

Fig. 1. A 23-year-old patient presenting with PE and breast asymmetry (A and B). Anatomic implants (345 cm^3, medium height, high projection on the right side and 215 cm^3, medium height, moderate projection on the left side) were inserted in a dual-plane subpectoral pocket. After a follow-up of 7 months (C and D), a symmetric and aesthetic pleasant result was achieved.

see **Figure, Supplemental Digital Content 4**, which displays a 20-year-old patient presenting with pectus excavatum and breast hypoplasia (A and B). Anatomic implants (350 cm^3, medium height, high projection each side) were inserted in a dual-plane subpectoral pocket. After 8 months, a symmetric and aesthetic pleasant result was achieved (C and D), **http://links.lww.com/PRSGO/A643**]. The patients rated their result higher than the assessors (8.7±1.2 vs 7.6±1.7; $P = 0.14$). In patients investigated at final follow-up, no seroma, infection, dislocation, or distortion of the prosthesis was observed. Also, patients who were contacted by phone for follow-up reported no dislocation or distortion subjectively.

DISCUSSION

To date, surgical and nonsurgical methods for the treatment of PC are available, including bracing, the classic method by Ravitch, a modified Nuss procedure involving presternal placement of a metal bar attached to both sides of the chest wall, with metal plates for compressing the sternum, and a uniform technique of internal stabilization employing stainless steel struts.[5] For the correction of the PE, the Ravitch technique is usually recommended than Nuss procedure, as the flexibility of bone will be difficult to handle.[6]

Several authors used custom-made prefabricated silicone implants to fill the sternal defect in PE, either alone or with concurrent breast augmentation with silicone implants.[7] For placement of breast implants in PC, it has already been recommended to place them as high and as lateral as possible to camouflage the bony middle chest.[8] The same recommendation exists for PE with detachment of the muscle insertions medially and minimal dissection of the pocket to the lateral side so the implant fills the medial part of the breast.[9] However, caution should be taken in not performing too much medial detachment at the sternal border because this could result in increased visibility, palpability of the implants, and symmastia, especially in slender patients.

Even if we experienced few complications in our rather small population of females, wound infections, seroma, capsular contraction, and displacement of the implant must be ex-

pected at the same or potentially even higher rate compared with conventional breast augmentation. Thus, a profound understanding of the associated risks and postoperative morbidity is most important to enhance preoperative counseling.

We consider subpectoral positioning superior to the subglandular approach to limit visibility of the implant.

In literature, there are data on implant rotation in anatomic implants (Mentor Worldwide LLC, Santa Barbara, CA and Allergan Inc., Irvine, CA) of 42% of patients and 27% of the implants on average follow-up time of 5 years verified on high-resolution ultrasound (HRUS).[10] We must suspect having the same rate of malrotation in our patients if imaging was performed. It might even be higher considering the lower pole moving downward by gravitational force from its medial or lateral position as placed intraoperatively. Because our patients showed no clinical suspicion of implant rotation, no further imaging studies were ordered.

Clearly, more large-scale and long-term observational studies using clinical, quantitative, and reproducible methods using MRI and/or HRUS should be conducted.

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REFERENCES

1. van Aalst JA, Phillips JD, Sadove AM. Pediatric chest wall and breast deformities. *Plast Reconstr Surg.* 2009;124(1 Suppl):38e–49e.
2. Ravitch MM. The operative treatment of pectus excavatum. *Ann Surg.* 1949;129:429–444.
3. Nuss D, Kelly RE Jr, Croitoru DP, et al. A 10-year review of a minimally invasive technique for the correction of pectus excavatum. *J Pediatr Surg.* 1998;33:545–552.
4. Stanford W, Bowers DG, Lindberg EF, et al. Silastic implants for correction of pectus excavatum. A new technique. *Ann Thorac Surg.* 1972;13:529–536.
5. Saxena AK, Willital GH. Surgical repair of pectus carinatum. *Int Surg.* 1999;84:326–330.
6. Shaalan AM, Kasb I, Elwakeel EE, et al. Outcome of surgical repair of pectus excavatum in adults. *J Cardiothorac Surg.* 2017;12:72.
7. Ho Quoc C, Chaput B, Garrido I, et al. [Management of breast asymmetry associated with primary funnel chest]. *Ann Chir Plast Esthet.* 2013;58:54–59.
8. Hodgkinson DJ. The management of anterior chest wall deformity in patients presenting for breast augmentation. *Plast Reconstr Surg.* 2002;109:1714–1723.
9. Moscona RA, Fodor L. How to perform breast augmentation safely for a pectus excavatum patient. *Aesthetic Plast Surg.* 2011;35:198–202.
10. Sieber DA, Stark RY, Chase S, et al. Clinical evaluation of shaped gel breast implant rotation using high-resolution ultrasound. *Aesthet Surg J.* 2017;37:290–296.