Transaxillary Endoscopic Breast Augmentation With Shaped Gel Implants

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Abstract

Background: At its inception, transaxillary breast augmentation was a blind technique associated with complications and unpredictable outcomes. The transaxillary approach now involves electrocautery dissection with direct endoscopic visualization and yields excellent aesthetic outcomes with a concealed scar. Shaped implant devices can be combined with transaxillary augmentation for natural-appearing results that can be individualized to the patient.

Objectives: The authors sought to improve the results of transaxillary endoscopic breast augmentation by placing shaped gel implants in patients with an indistinct or absent inframammary fold (IMF), who wished to avoid a breast scar.

Methods: One hundred sixteen Asian women underwent transaxillary endoscopic breast augmentation with electrocautery dissection and were evaluated in a prospective study. A partial retropectoral plane pocket was created in 4 sequential dissection steps with direct endoscopic visualization and careful control of bleeding. Shaped cohesive gel implants were placed to produce smooth, natural-appearing breast mounds and well-defined IMFs.

Results: Patients were monitored for 6 to 24 months after surgery (mean, 10 months; median, 12 months). There were no instances of pneumothorax, instrument-related skin burns, or severe implant deformation due to rotation or displacement of the implants postoperatively. Three of 116 patients (2.6%) experienced Baker 3 unilateral capsular contracture. One patient developed a unilateral hematoma at 3 weeks after surgery.

Conclusions: Endoscopic breast surgery is associated with shortened recovery times, a reduced need for drainage, and excellent outcomes, including a well-defined and symmetric IMF. This approach, combined with shaped gel implants, can yield natural-appearing results of transaxillary breast augmentation.

Level of Evidence: 4

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Breast augmentation by the transaxillary approach has been practiced for 4 decades but remains more problematic than augmentation by the inframammary or periareolar approaches because it involves blind dissection. Specifically, the transaxillary approach does not enable the surgeon to predict the extent of dissection or to produce a distinct inframammary fold (IMF) and is more likely to result in complications such as hematoma and trauma. To avoid these shortcomings, we advocate endoscopic assistance during transaxillary breast augmentation.[1-3] Early descriptions of this procedural modification involved insertion of the endoscope through a stab incision and partial visualization of the pocket by means of an air- or glycine-filled optical cavity. Compared with the blind technique, surgical outcomes with endoscopy included reduced bleeding and more precise dissection. However, tissue damage from blunt dissection under partial visualization remained inevitable. Moreover, failure to completely dissect the inferomedial region of the pocket or the costal origin of the pectoralis major could result in upward or downward displacement of the implant, and the process of reconnecting the muscles could create an inconsistent or asymmetric IMF.[1]

Currently, transaxillary breast augmentation is performed by electrocautery dissection with direct endoscopic visualization throughout the surgical procedure. The benefits of this method include the creation of a bloodless pocket and nontraumatic visualized electrocautery dissection. By this

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method, the costal origin of the pectoralis major is completely divided to create a partial retropectoral plane.[4] Each pocket is prepared according to precise dimensions, and shaped, textured, cohesive gel-filled implants are placed.

Shaped implants create natural-appearing results that can be individualized to meet the expectation of diverse patients.[5] Asian skin tends to be tight and thin with relatively little breast tissue in the lower pole. In these patients, breast augmentation with round implants often results in breasts that appear artificial with prominent upper poles. The placement of shaped gel implants by the transaxillary approach with endoscopy has greatly improved the outcomes of Asian women undergoing breast augmentation, enabling rapid recovery, a reduced need for drainage, and a well-defined and symmetric IMF.

METHODS

A prospective study was conducted on 116 patients who underwent transaxillary breast augmentation with endoscopy from December 2009 to December 2012. Most of the patients included in the study had small breasts with indistinct IMFs and without ptosis. None of the patients had constriction in the lower pole of the breast. Patients with significant chest wall irregularities were excluded from the study. Indications for the transaxillary approach included the patient's desire to avoid a scar on the breast and an areola diameter of 3 cm or less. All possible surgical approaches were discussed with the patients, and all patients provided informed consent.

Shaped implants were selected preoperatively based on the base width of the breast and the body morphology.[6] Implants with a round base and an anatomic profile were suitable for most of the patients. Patients who had a sternal notch-to-nipple distance exceeding 21 cm or who desired upper bulging received full-height shaped implants.

Operative Technique

The surgical maneuvers performed in this study are similar to those we described previously.[7] Patients received general anesthesia and were positioned supine with the arms abducted 90 degrees. Nipple shields were applied, and preoperative evaluations of anatomic landmarks were verified. An incision line of approximately 4 cm was marked in the deepest part of the axilla 1 cm posterior to the lateral border of the pectoralis major to ensure that the posterior end of the incision was high in the axilla. A skin incision was made to expose the subcutaneous fat, and shallow subcutaneous dissection then proceeded 3 cm toward the lateral border of the pectoralis major.

Step 1: Dissection of the Axilla Pocket

Under direct visualization, the pectoral fascia was opened to access the layer between the pectoralis major and pectoralis minor (Figure 1). Hemostasis was achieved for the lateral thoracic vessels with bipolar forceps. Care was taken to avoid damaging the axillary fat pad, thereby protecting the intercostobrachial nerve and the medial brachial cutaneous nerve. The clavipectoral space was prepared with visualization through the axilla, and an endoscope enclosed within a tubing work space (Richard Wolf GmbH, Knittlingen, Germany) was introduced. The working channel enabled the surgeon to move the cannula freely and safely and to avoid penetrating between the ribs. Subpectoral dissection then was performed with a straight needle-tipped electrocautery device and a curved cannula.[7] Blunt dissection was avoided, and all surgical procedures involved electrocautery dissection with endoscopy.

Dissection of the right breast pocket was performed sequentially from the superomedial side to the inferomedial, inferolateral, and lateral areas in a clockwise fashion (Figure 2). The endoscope was positioned carefully to avoid damage to the ribs and rib cartilage and to minimize bleeding. When necessary, preoperative skin markings were palpated with a finger or the needle to confirm appropriate location of the pocket.

Step 2: Dissection of the Superomedial Pocket

The location of loose areola tissues between the pectoralis major and pectoralis minor was confirmed, and the endoscope was positioned parallel to the clavicle toward the midsternum. The endoscope then was moved forward or backward gradually, and bleeding points were controlled immediately with electrocautery. The main body of the sternal origin was discerned from the white tendinous accessory origins along the medial ribs, and the accessory

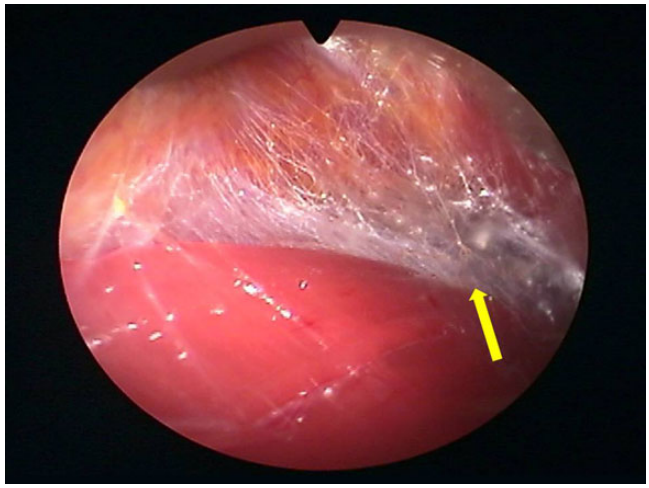

Figure 1. Transition from dissection of the axilla pocket to dissection of the superomedial pocket. Arrow indicates the loose areola tissues between pectoralis muscles and the thoracoacromial fat pad in this 29-year-old woman who underwent endoscopic transaxillary breast augmentation.

origins were divided completely. The dissection was continued to the main body of the sternal origin (Figure 1; part 2 of Figure 2). Dissection was controlled at the superior boundary so that the range of the thoracoacromial artery was not exceeded. An intermammary distance of at least 3 cm was ensured, and excessive dissection medially was avoided.

Step 3: Dissection of the Inferomedial Pocket

The endoscope was moved from the superomedial pocket to the inferomedial pocket (part 3 of Figure 2; Figure 3), and visualized electrocautery dissection from the sternocostal junction at the level of the inferior areola margin was initiated. The costal origin was penetrated with needle-tipped electrocautery under magnification, and care was taken to preserve the glistening pectoral fascia overlying the yellow subcutaneous fat. The costal origin was completely divided by electrocautery medially to laterally, and muscle stumps were coagulated. Hemostasis was achieved at the perforators of the internal mammary artery near the inferomedial sternum. The costal origin of the pectoralis major, which comprises several layers over the fourth and fifth ribs, was divided 1 cm from the chest wall to simplify hemostasis and minimize mechanical damage to the costochondrium. For patients with high IMFs, the dissection was continued downward until the superficial layer of the deep fascia or rectus fascia was reached; the thickness of the envelope was maintained so dissection could proceed under the deep fascia (Figure 4). Supplementary Video 1 demonstrates this procedure and can be viewed at www.aestheticsurgeryjournal.com.

The abdominal head of the pectoralis major often was encountered during the transaxillary endoscopic approach.[7,8] This anatomic site is located laterally to the costal origin and comprises a broad band of thin muscle. The abdominal head of the pectoralis major was divided to prevent it from restricting inferior movement of the breast implant (Figure 5). Supplementary Video 2 demonstrates this procedure and can be viewed at www.aestheticsurgeryjournal.com.

Step 4: Dissection of the Lateral Pocket

Dissection progressed clockwise from the inferolateral region to the lateral region of the new IMF until the lateral

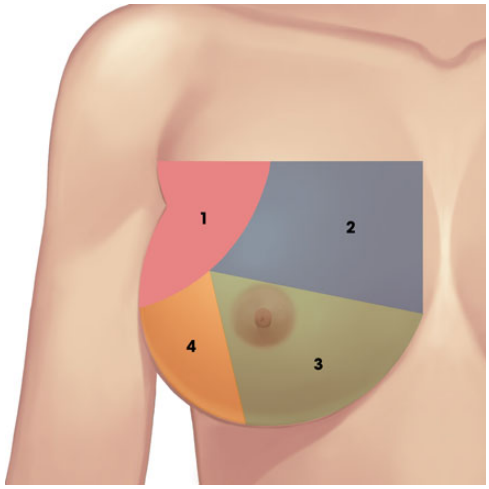

Figure 2. Procedural steps of pocket dissection. (1) The axilla pocket is dissected first, followed sequentially by (2) the superomedial pocket, (3) the inferomedial pocket, and (4) the lateral pocket. Adapted from Sim.[7]

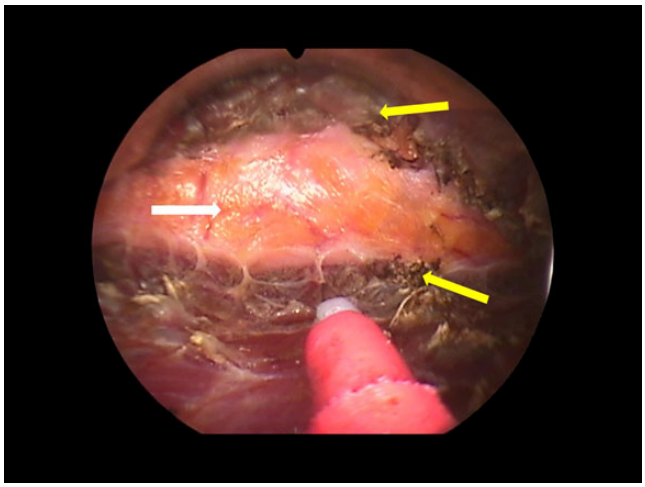

Figure 3. Division of costal origins during dissection of the inferomedial pocket in this 29-year-old woman who underwent endoscopic transaxillary breast augmentation. The edges of the pectoralis are divided and retracted (indicated by the yellow arrow) and the glistening fascia is exposed (white arrow) in front of the yellow subcutaneous fat.

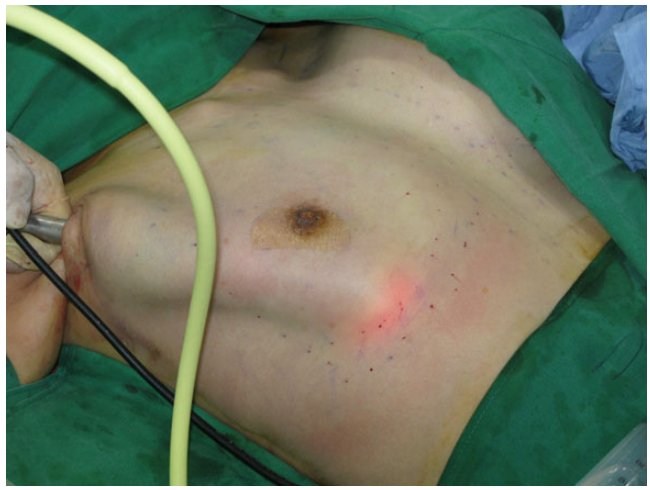

Figure 4. Exterior view of the inferomedial pocket of this 29-year-old woman who underwent endoscopic transaxillary breast augmentation.

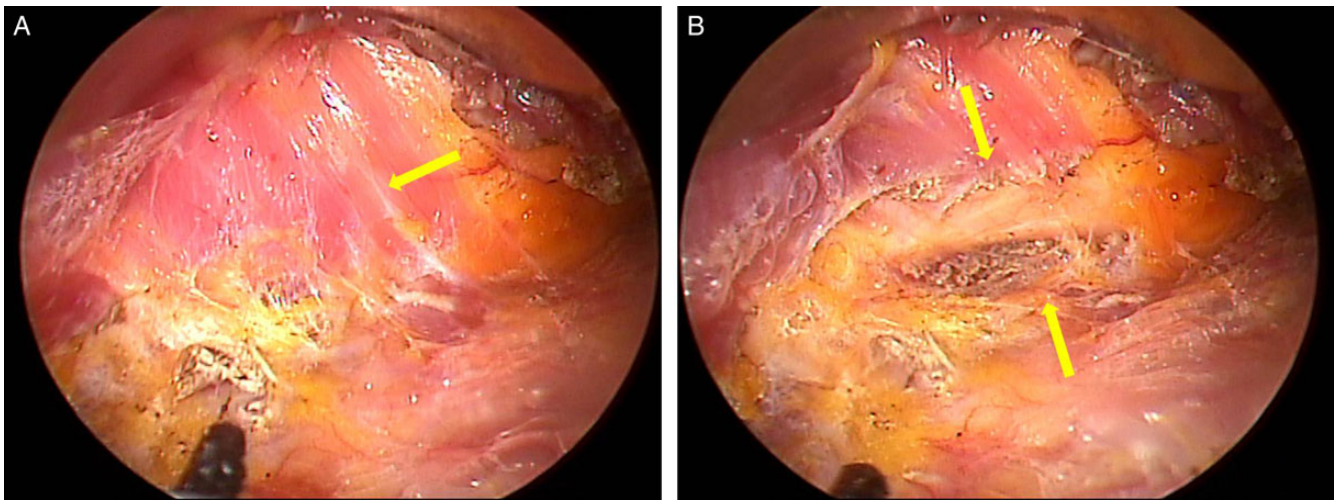

Figure 5. Abdominal head of the pectoralis major. (A) Lateral view near completion of dissection of the inferomedial pocket. Arrow indicates the abdominal head of the pectoralis major. (B) When the abdominal head of the pectoralis is encountered intraoperatively, it should be divided completely. Arrow indicates the divided and retracted pectoral edges in this 29-year-old woman who underwent endoscopic transaxillary breast augmentation.

edge of the pectoralis minor and the superficial layer of the lateral pectoral fascia were exposed (part 4 of Figure 2; Figure 6). In some patients who demand larger volume, the dissection subsequently might be expanded laterally. Care was taken to avoid damaging the pectoralis minor or the serratus anterior, which could be lifted by positioning the endoscope in the oblique direction. Damage to the serratus anterior and intercostal nerves was avoided by performing electrocauterization under precise visualization.[7]

The size and shape of each pocket were based on the dimensions of the planned implant device. When the pocket had been prepared, bleeding points were reassessed with the endoscope, and hemostasis was achieved with bipolar forceps. The bloodless pocket then was irrigated with a solution of povidone-iodine, gentamicin, and normal saline.[9] After testing disposable sizers intraoperatively, shaped gel implants were inserted through a narrow axillary tunnel by means of a Keller Funnel 2 delivery device (Keller Medical Inc, Stuart, FL). This device ensured secure no-touch insertion, proper implant orientation, and minimal implant rotation and trauma. Supplementary Video 3 demonstrates this procedure and can be viewed at www.aestheticsurgeryjournal.com. After placement of the shaped gel implants, the shape, size, and symmetry of the breasts were reassessed with the patient in the semi-Fowler's position. The orientation of the shaped implant was confirmed by endoscope (Figure 7) and was further corrected when necessary. Closed-suction drains were not placed. The subcutaneous layers and skin were closed with absorbable sutures, and an Ace bandage (3M) was applied to the armpit area over light dressings. All of the patients were encouraged to shower on the second postoperative day and were allowed to resume light activity on the third postoperative day. At 6 weeks postoperatively, most of the patients were able to perform weight-bearing exercises of the upper limbs.

RESULTS

Of 116 women who underwent transaxillary partial retropectoral plane breast augmentation with endoscopy, the mean age of the patients was 29.5 years (range, 23 to 54 years), the median age of the patients was 31 years, the mean height was 165.5 cm, and the mean weight was 50.3 kg (mean body mass index, 18.5 kg/m^2). A total of 232 shaped gel implants were placed, including 190 (81.9%) round base implants (Sientra, Santa Barbara, CA) and 42 (18.1%) full-height implants (Allergan, Santa Barbara, CA; Table 1). Mean implant volume was 270 cc (range, 220 to 375 cc). In general, Asian patients have relatively short stature and tend to desire smaller implants to yield a B cup breast size.

Patients received follow-up for a mean of 10 months (median, 12 months; range, 6 to 24 months). Major complications such as severe bleeding, infection, breast implant rupture, or severe asymmetry were not detected. Pneumothorax and instrument-related skin burns did not occur. No patients reported severe deformation of the implants due to implant rotation or displacement. No deformities or abnormalities of the IMF were identified. Baker 3 unilateral capsular contracture developed in 3 of 116 patients (2.6%) at 1 to 6 months postoperatively. One of these 3 patients subsequently underwent partial capsulotomy and replacement of the shaped gel implant with a smooth round implant. One patient (0.4%) developed a unilateral hematoma 3 weeks

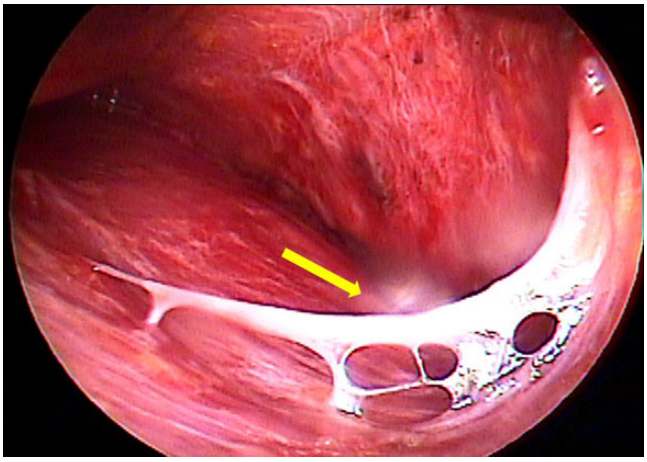

Figure 6. Dissection lateral to the pectoralis minor in this 29-year-old woman who presented for endoscopic transaxillary breast augmentation. Dissection beyond the pectoralis minor may expose the fourth intercostal neurovascular bundle (indicated by the arrow), which should be preserved if possible.

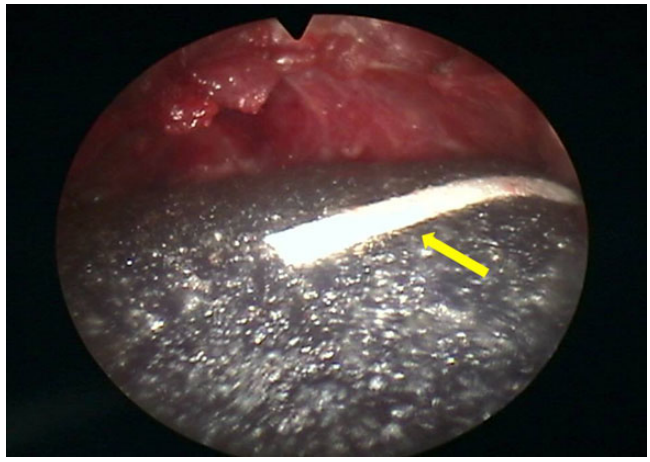

Figure 7. Intraoperative view of this 29-year-old woman who presented for endoscopic transaxillary breast augmentation showing confirmation of implant orientation. Arrow indicates the vertical direction marker of the Sientra shaped implant. The identification marker or palpable knobs on the implant device should be assessed after insertion of shaped implants through a Keller Funnel 2.

postoperatively; this complication was attributed to the patient's noncompliance with recommended exercise restrictions (Table 2; Figures 8-10).

DISCUSSION

Early descriptions of the transaxillary approach underscored the limitations of the blind technique, including difficulty achieving hemostasis and traumatic dissection. In addition, the preparation of pockets with appropriate dimensions and the creation of symmetric IMFs were unreliable with this approach.[1-3] Although the area between the pectoralis major and pectoralis minor contains relatively few perforators, dissection of the costal origin via the blind technique consistently damaged the perforators inside the pectoral muscle, including the perforating vessels near the sternal border and the fourth intercostal neurovascular bundle. In addition, the dissection plane could proceed incorrectly via the blind technique, resulting in erroneous pocket creation under the pectoralis minor or over the pectoralis major. The pectoralis major connected with the external oblique and its fascia and the serratus anterior could have been lifted as 1 layer.[10] The results could include an irregular IMF due to an incomplete division of the costal origin and/or a failure to create a discrete and even line for the fold. The limitations of the blind technique for patients who present with ptotic breasts and wish to undergo transaxillary breast augmentation were described in a study by Howard[11] and include upward displacement of the implant in 8 of 92 patients (8.6%).

The methods of performing hemostasis with traditional transaxillary augmentation were limited to manual pressure or irrigation. The blood-stained tissues and potential hematomas resulting from poorly controlled bleeding likely increased the risk of capsular contracture.[12] The results of several studies indicate that the incidence of capsular contracture following transaxillary breast augmentation is reduced when endoscopic visualization is involved.[13-16] However, endoscopy is only 1 of several measures to reduce capsular contracture by minimizing bleeding within the pocket. In general, minimally traumatic surgical maneuvers should be performed and sources of contamination should be strictly avoided during the operation.[17,18] In this study, we performed visualized electrocautery rather than blunt dissection throughout the procedure, including for medial and lateral dissection. Tebbetts[19] found that prospective hemostasis and exclusion of blunt equipment allowed the patient to return to normal activities within 24 hours after the operation. All patients in our study were able to return to their normal activity levels within 7 days postoperatively.[17,18]

After dividing the costal origins in patients with a short nipple-to-IMF distance, the surgeon should be especially careful to dissect below the level of the previous IMF. The dissection plane should be beneath the fascia with visualized electrocautery dissection to the planned IMF. The surgeon may need to gradually proceed 2 to 3 cm subfascially under careful endoscopic control. Fascial continuity can strengthen the envelope. If fascial continuity is disrupted and the plane extends subcutaneously, mechanical support from the envelope will be lost and inferior migration of the implants can occur. For the reason mentioned above, Scarpa's fascia should be repaired during closure in the inframammary approach (Figure 5). Supplementary

Table 1. Types of Implants Placed in the Study Population (N = 232 Implants)

Manufacturer	No. of Implants (%)	Features	No. of Implants (%)
Allergan	42 (18.1)	Full height, moderate projection[a]	9 (3.9)
		Full height, full projection[b]	33 (14.2)
Sientra	190 (81.9)	Moderate projection	121 (52.2)
		High projection	69 (29.7)

[a]Style 410 FM. [b]Style 410 FF.

Table 2. Complications of Transaxillary Breast Augmentation in the Study Population (N = 116 Patients)

Complication	No. of Patients (%)	Notes
Capsular contracture	3 (2.6)	Unilateral, Baker 3
Hematoma	1 (0.9)	Unilateral, Baker 1
Seroma	0 (0)	NA
Infection	0 (0)	NA
Total	4 (3.4)	NA

NA, not applicable.

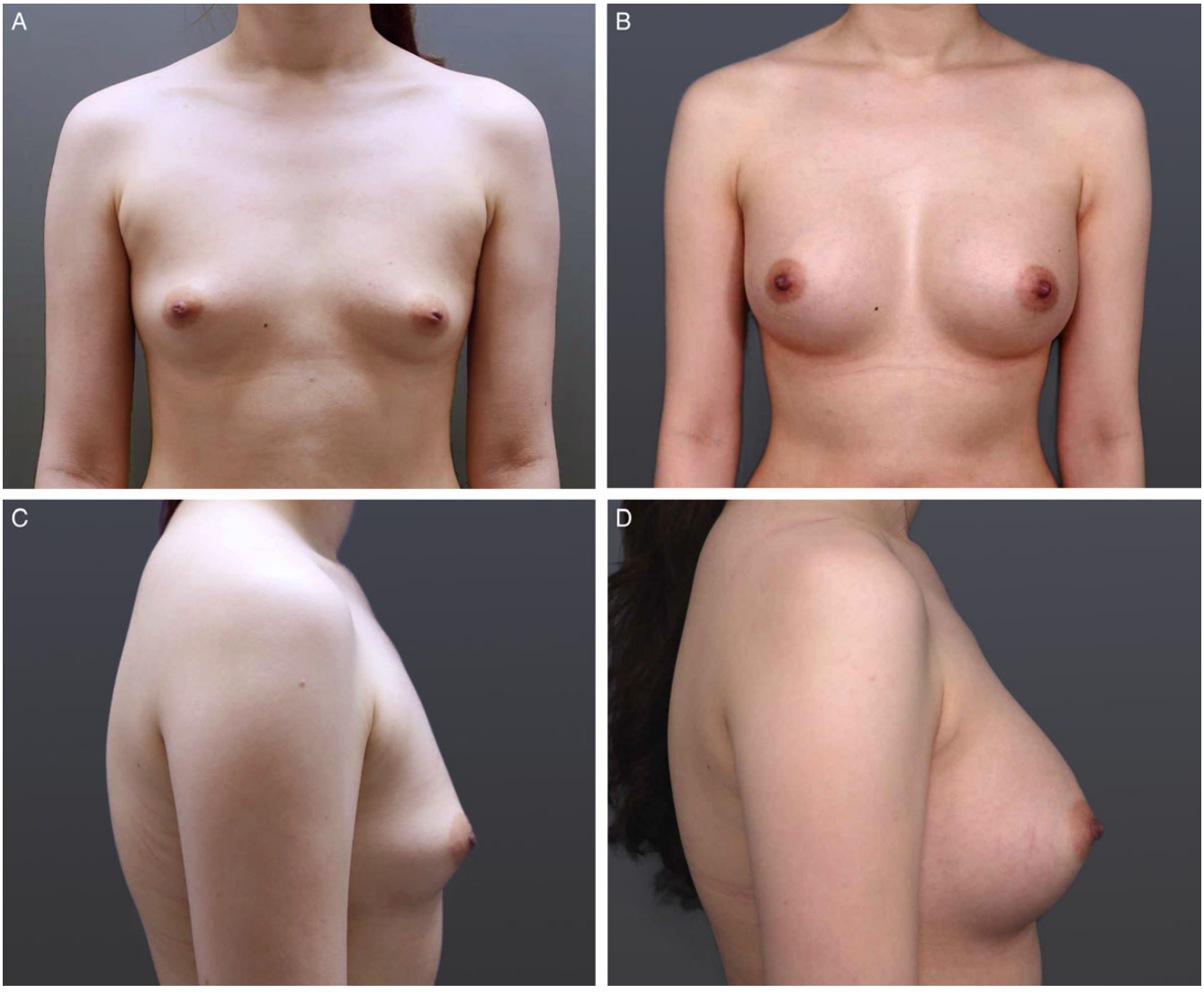

Figure 8. (A, C) This 28-year-old woman (height, 166 cm; weight, 55 kg; body mass index, 20 kg/m^2; sternal notch-to-nipple distance, 19.5 cm; base width, 12.5 cm) presented with bilateral breast hypotrophy and underwent endoscopic transaxillary breast augmentation with shaped gel implants (Sientra, natural moderate 320 cc implants, placed bilaterally). (B, D) One year postoperatively.

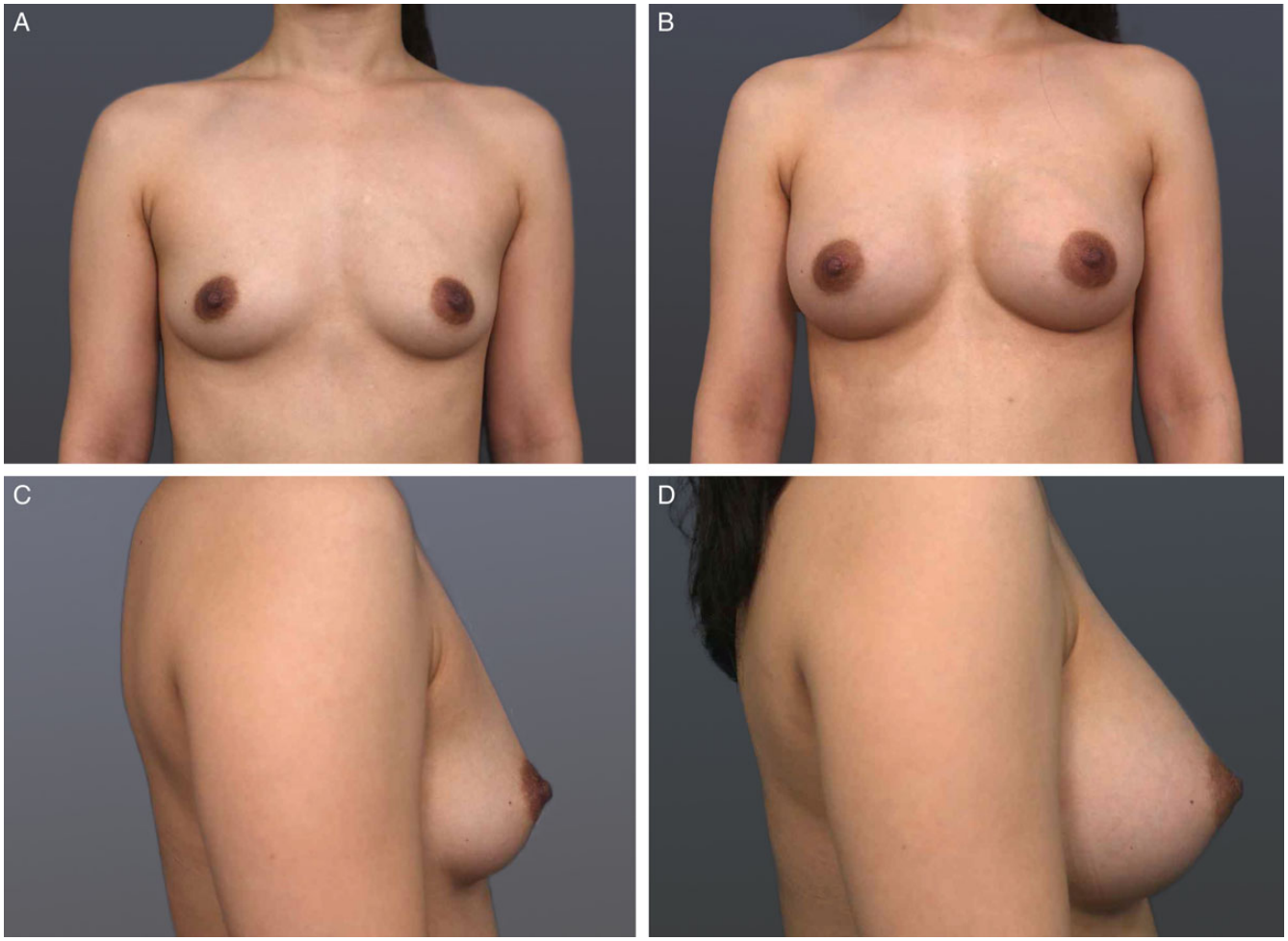

Figure 9. (A, C) This 38-year-old woman (height, 158 cm; weight, 50 kg; body mass index, 20.8 kg/m^2; sternal notch-to-nipple distance, 18.3 cm; base width, 12.0 cm) presented with bilateral breast hypotrophy and accessory breasts. She underwent endoscopic transaxillary breast augmentation with shaped gel implants (Sientra, natural moderate 275 cc implants, placed bilaterally). (B, D) Fifteen months postoperatively.

Video 1 demonstrates this procedure and can be viewed at www.aestheticsurgeryjournal.com.

In this study, the costal origin of the pectoralis major was completely separated without dissecting between the pectoralis major and the breast tissue. For patients with an upper-pole tissue thickness exceeding 4 cm, subfascial dissection may be applied in the transaxillary approach.[20] However, young Asian women tend to be slim and without much native breast tissue. Following augmentation, these patients' breast may appear artificial and prominent at the upper pole without sufficient muscle padding.

Disadvantages of transaxillary breast augmentation include the possibility of nerve and lymphatic damage in the axilla. To minimize trauma to the intercostobrachial nerve and medial brachial cutaneous nerve, the lateral edge of the pectoralis major should be approached through thin subcutaneous dissection after the incision. Dissection of the axillary fat pad should be avoided. In addition, any of the surgical maneuvers may damage the lymphatic system, affecting the proper diagnosis and staging of breast cancer. Many efforts to address these problem have been proposed.[15,17,21,22] However, the soft-tissue triangle should be protected when possible, and the Keller Funnel may be helpful for implant delivery to avoid lesions to the axillary lymphatic system.

It is important to plan a dissection sequence when performing endoscopic surgery (Figure 2) to ensure the preparation of a sufficient visual field and prompt access for control of bleeding.[7] After achieving hemostasis of the highly vascularized medial pocket, the transition to the lateral pocket becomes easier. In addition, the movements of the endoscope must be consistent and limited with the objective of minimizing tissue damage and bleeding. Adhering to a planned sequence of dissection can minimize unnecessary motion of the endoscope and shorten the operating time.[15] Endoscopic visualization is most crucial for dissection of the

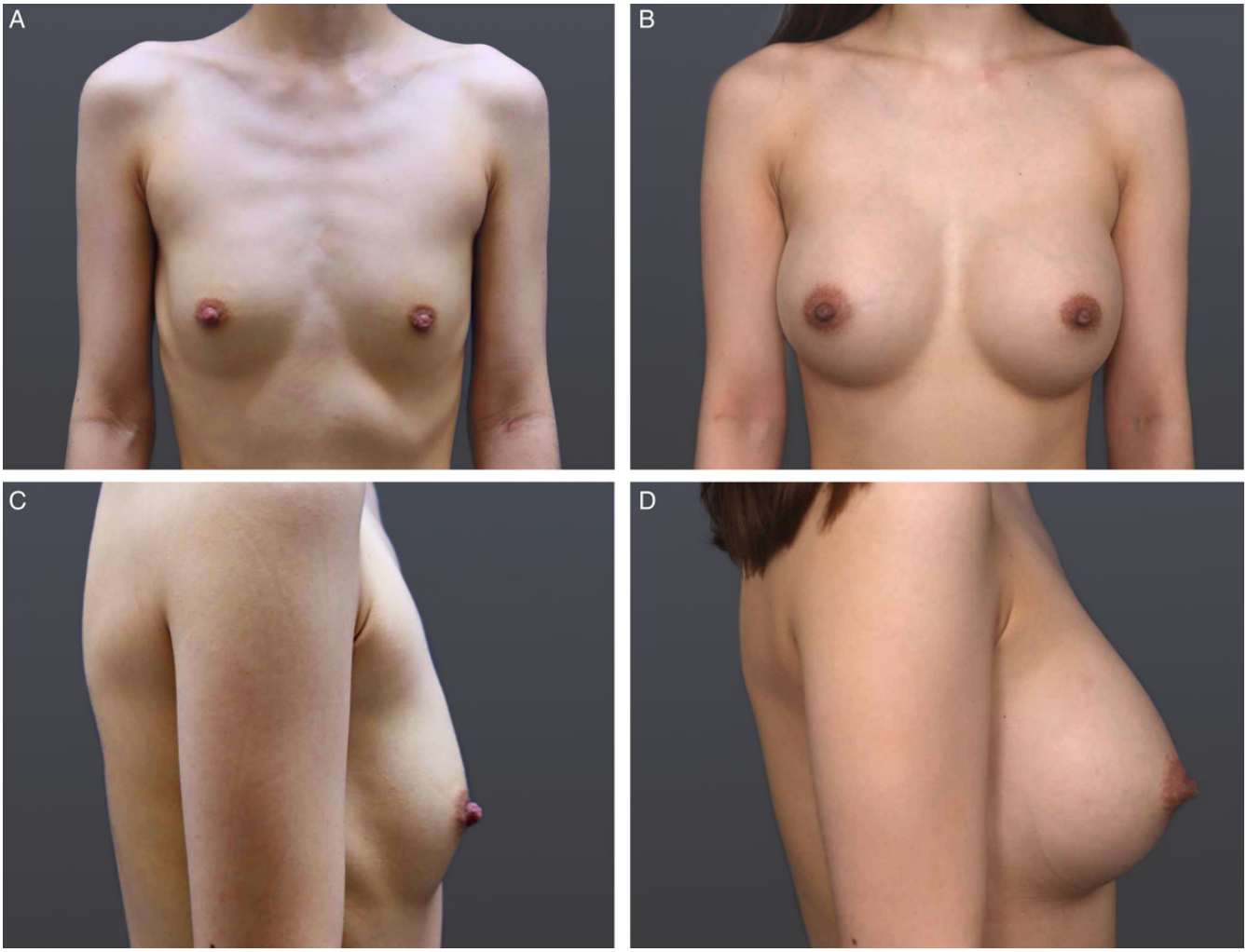

Figure 10. (A, C) This 26-year-old woman (height, 168 cm; weight, 49 kg; body mass index, 17.4 kg/m^2; sternal notch-to-nipple distance, 21.0 cm; base width, 12.5 cm) presented with bilateral breast hypotrophy and underwent endoscopic transaxillary breast augmentation with shaped gel implants (Allergan, Style 410 FF, 335 cc, placed bilaterally). (B, D) One year postoperatively.

inferomedial pocket, where the surgeon starts to divide the costal origin and choose the level of the new IMF.

In this study, the authors placed shaped gel implants through the axillary approach. Compared with the inframammary approach, it is more difficult to determine the appropriate location of the new IMF and set the new fold in a planned position with transaxillary breast augmentation. Placement of smooth round implants with axillary approach tends to have unpredictable aesthetic results, and the implant may migrate downward. Textured surface implants are more stable postoperatively, an outcome that is attributed to tissue adherence. The results of a meta-analysis showed that capsular contracture occurred approximately 5 times more frequently with smooth surface implants than with textured surface implants.[5,23]

Disadvantages of endoscopic surgery include the need for special equipment and the learning curve. The operating time for endoscopic surgery may be longer than the blind technique; however, Ho[2] and Tebbetts[15] found that a skilled endoscopic surgeon can complete the operation in a similar or shorter duration compared with the non-endoscopic procedure. Disadvantages of the transaxillary approach include that reoperation may not be possible through the same incision site to treat capsular contracture. Instead, an additional incision site would be needed.

The thickness of the patient's soft tissue should be considered in partial retropectoral plane surgery. If the skin thickness of the IMF is less than 4 mm by the pinch test, partial retropectoral plane surgery should not be performed. In general, the transaxillary approach is not recommended for patients with glandular ptosis, constriction of the lower pole, or for any type of reoperation.[15,17]

Giordano et al[24] determined the incidences of capsular contracture with the transaxillary approach to be 5 of 306

patients (1.63%) and Namnoum et al[25] reported relative risk of capsular contracture with the transaxillary approach subpectoral plane was 2.42%, respectively. Jacobson et al[26] and Stutman et al[27] found that the incidence of capsular contracture following transaxillary augmentation was 3 of 47 breasts (6.4%) and 1 of 14 patients (7.14%), respectively. These authors found no statistically significant association between incision location and specific complications such as capsular contracture, rippling, implant rupture, hematoma, or infection.[26,27] These authors noted that they have more experience with the inframammary approach, which may explain the higher incidences of capsular contracture. In addition, these studies were limited by small patient populations and short follow-up periods.[26,27] We acknowledge the fact that many of the patients were not followed for 12 months as a limitation of the study. We plan to present our updated results when we accumulate more cases and have longer term follow-up. The primary causes of capsular contracture are subclinical infection and hematoma. Therefore, surgeons should minimize any potential sources of contamination and take care to create a bloodless-pocket and reduce the possibility of tissue trauma.

The transaxillary technique for breast augmentation is selected most often by Korean women. Asian skin complexion tends to leave scars visible, and young Asian women tend to be slim, have relatively little breast tissue, and have a tight skin envelope. These characteristics favor anatomically shaped implants, which can produce a natural-appearing upper-pole contour.

Rotation of shaped implants has been described with the transaxillary approach.[6] Precise pocket dissection is an essential requirement for the use of shaped implants.[28] However, precise pocket preparation is not sufficient to prevent rotation. Shaped implants may be displaced intraoperatively at time of insertion. Manual insertion of shaped implants might cause trauma along the axillary tunnel and cannot ensure correct orientation of the implants. We suggest delivering shaped implants through a Keller Funnel to properly position and orient the devices with the benefit of no-touch introduction. In addition, endoscopic confirmation of implant orientation is recommended. The placement of implants with palpable knobs can be confirmed by palpation. Some breast prostheses are supplied with identification lines or markers on the surface. Aggressive texturing may induce firm tissue adhesion to prevent rotation. In general, reduced-height shaped implants should be avoided to prevent implant displacement with muscle movements. Round-base and full-height shaped implants provide more stability when placed under the muscle through transaxillary delivery.

Shaped implants have many advantages but are not applicable to every patient. Shaped implants can create a natural-appearing upper pole and can be customized to the patient's expectations, but these devices tend to exacerbate significant chest wall irregularities and may compromise stable results when they are placed under the remaining capsule in patients undergoing secondary augmentation. Transaxillary endoscopic breast augmentation is applicable if the surgeon has sufficient anatomic knowledge and experience with endoscopic equipment. The combination of endoscopy and the placement of shaped implants has greatly improved the aesthetic outcomes of transaxillary breast augmentation, particularly for young Asian women.

CONCLUSIONS

One hundred sixteen Asian women underwent transaxillary partial retropectoral plane breast augmentation with electrocautery dissection under direct endoscopic visualization. The aims of this method included the creation of a bloodless pocket and nontraumatic visualized electrocautery dissection to minimize tissue damage. Shaped gel implants were placed to produce a natural appearance. The authors regard the combination of shaped implants and the endoscopic transaxillary approach as an excellent choice for young Asian patients with an indistinct or absent IMF who wish to avoid a scar in the aesthetic unit of their chest.

Supplementary Material

This article contains supplementary material located online at www.aestheticsurgeryjournal.com.

Disclosures

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