

Deep Inferior Epigastric Perforator Flap for Successful Simultaneous Breast and Chest Wall Reconstruction in a Poland Anomaly Patient

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Abstract: Breast reconstruction in female Poland anomaly remains a surgical challenge with variable chest wall deformity and nipple position. Pedicled latissimus dorsi myocutaneous flap with implant reconstruction may have several drawbacks and complications.

Free deep inferior epigastric flap (DIEP) flap is a reliable option for postmastectomy breast reconstruction, but rarely reported in Poland anomaly. We presented a 52-year-old Poland anomaly patient who underwent successful reconstruction for breast and chest wall deformity using DIEP flap. Preoperative ultrasound Doppler study for internal mammary vessels is recommended for microsurgical anastomosis. Care should be taken with regard to the flap inset and the location of the nipple areolar complex.

Key Words: deep inferior epigastric perforator flap, Poland anomaly, breast reconstruction, chest wall reconstruction

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Poland syndrome comprises congenital unilateral absence of the sternocostal head of the pectoralis major muscle combined with variable defects of other pectoral and chest wall muscles, as well as ipsilateral symbrachydactyly with other defects of the hand and arm.^{1,2} Isolated absence of pectoralis major muscle with breast hypoplasia is a variant of the Poland anomaly and is not an uncommon condition in women seeking breast augmentation.³

The breast reconstruction in Poland anomaly exhibits distinctions from postmastectomy breast reconstruction and requires unique considerations. The reconstructive goals in female Poland anomaly patients are to achieve breast symmetry, correct chest wall deformity, recreate an anterior axillary fold, and provide adequate infraclavicular fullness for esthetic and psychosocial aspects.⁴

Several techniques such as latissimus dorsi (LD) muscle flap alone^{5,6} or in combination with autologous rib grafts⁷ and prosthesis customized chest wall implants⁸ or free flaps^{9–11} have been proposed to achieve the reconstructive goals. However, each technique has its own limitations and can be associated with complications.

Deep inferior epigastric perforator (DIEP) flap has become one of the reliable options for postmastectomy breast reconstruction. However, its use for Poland syndrome has rarely been reported. In this report, we present successful chest wall and breast reconstruction in a case with Poland anomaly with DIEP flap.

CASE REPORT

An otherwise healthy 52-year-old woman presented with a significant right-side breast hypoplasia, smaller nipple-areola complex, and chest wall deformity (Fig. 1A–C). The patient had an asymmetric chest wall and discrepant nipple sizes since childhood. During adolescence, she experienced breast growth only on the left side. On physical examination, the sternal head of the pectoralis major muscle was detected to be absent, and the clavicular head was relatively atrophic. Computed tomography of chest revealed hypoplastic right breast, absence of pectoral muscles, and marked thinning of the right chest wall (Fig. 2). The intact sternum exhibited mild rotation, and the right lung was slightly hypoplastic (Fig. 2). The deformity of right 3 to 5 ribs was also noted, which showed up with a marked chest wall depression (Fig. 3).

Preoperative ultrasound Doppler evaluation had revealed patent and consistent internal mammary artery and vein with external diameters of 1.8 mm and 2.8 mm, respectively.

Operative Technique and Specific Considerations

Preoperatively, the upper limit of breasts, inframammary folds, and midsternal line was marked in standing position (Fig. 4). The perforators from deep the deep inferior epigastric artery ipsilateral to the defect site were identified using a handheld pencil Doppler, and an abdominal ellipse,

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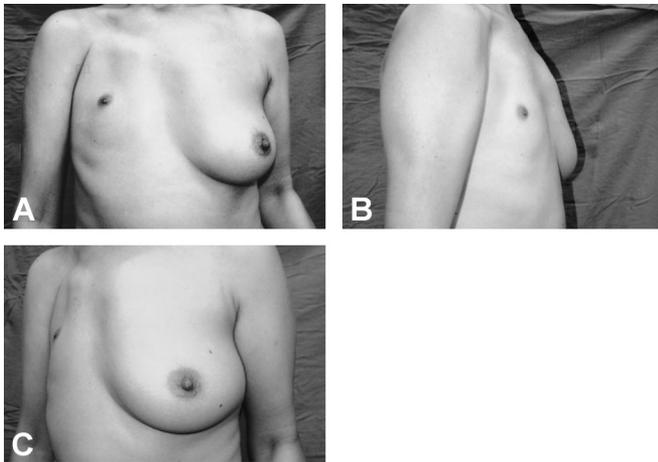


FIGURE 1. Isolated unilateral breast and chest wall anomaly in a 52-year-old patient with Poland anomaly exhibiting hypoplastic breast, a vestigial nipple areolar complex, and ill-defined anterior axillary line. A, anterior view; B, lateral view; C, oblique view.



FIGURE 3. X-ray of thorax showing the deformed third, fourth, and fifth ribs.

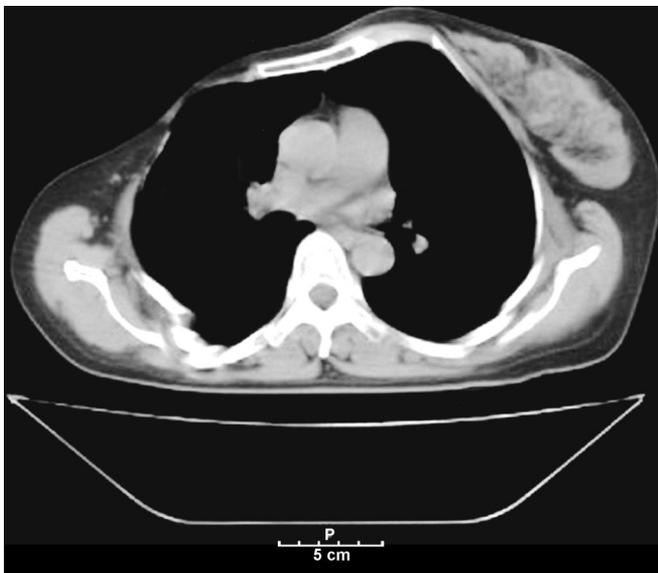


FIGURE 2. Axial computed tomography section of the thorax revealing thinned chest wall with hypoplastic breast and aplastic pectoral muscles and associated skeletal anomalies consisting of mild rotation of the sternum and carinatus deformity.

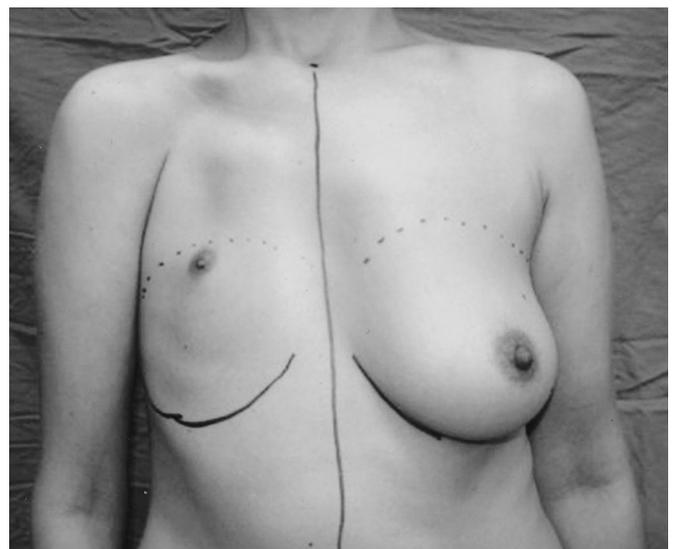


FIGURE 4. Preoperative markings showing the upper limit of breasts, inframammary folds, and midsternal line.

measuring 38.0 × 12.0 cm in size was designed (Fig. 5). The dissection of the DIEP flap was performed similarly as previously described by others.^{12,13} A 2-team approach was used. The first team raised the flap, and the second team prepared the chest skin pocket and recipient vessels. Two sizable perforators were selected, and the anterior rectus fascia was incised at the rim of the gap through which the distal perforating vessel arose. The incision in the fascia was extended caudally to reach the other perforator in the same

row. The rectus muscle was split following its fiber direction to expose and dissect the deep inferior epigastric artery and venae comitantes, and 14 cm of pedicle length was attained (Fig. 6A, B).

The normal left breast covered the area from the fourth rib to the ninth rib and from the lateral border of the sternum to the anterior axillary line, and the nipple-areola complex (NAC) was ptotic and located in the seventh rib space, approximately 9 cm lateral to the midline (Fig. 1). In the abnormal right breast, there was a complete absence of the glandular tissue with a hypoplastic NAC located on marked depression chest wall between the third and fifth ribs. The NAC was rather superomedially located at the fifth intercostal space and 6 cm lateral to the midline (Fig. 1). An S-shaped incision was made; then the breast pocket was created and

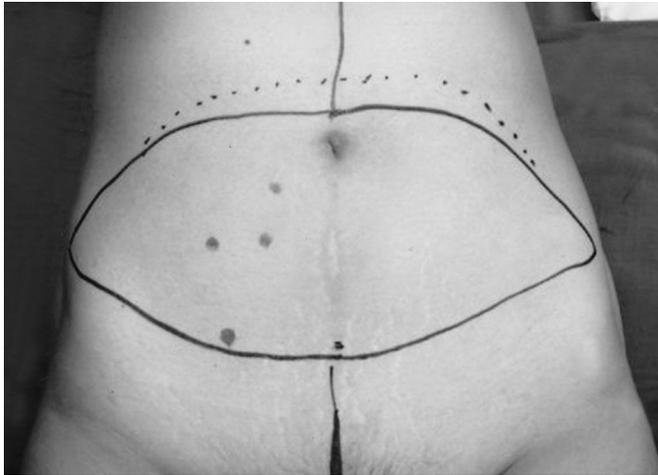


FIGURE 5. Markings showing the skin perforators from the deep inferior epigastric artery and design of the DIEP flap in the abdominal region.

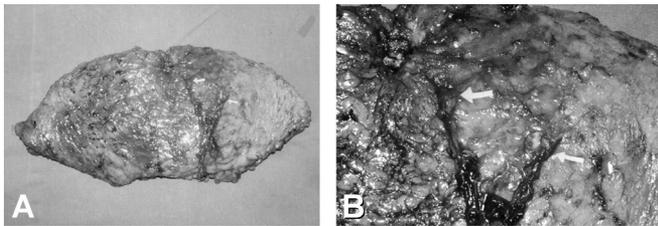


FIGURE 6. DIEP flap after division of the pedicle. A, DIEP flap based on 2 perforators and a long pedicle. B, Closer view of the perforators showing the sizable diameters.

extended to the clavicle superiorly, the anterior axillary line laterally, sternal border medially, and inframammary crease inferiorly. The cephalic border of the flap was inset downward, pointing to the inframammary crease. The skin paddle measuring 13 cm × 5 cm was adapted transversely to relocate the NAC inferiorly. Part of the flap, 25 cm × 7 cm, was deepithelialized and buried in the skin pocket to augment the depressed area, to form the anterior axillary line, and to provide the breast projection and pendulous appearance.

Following the temporary inset of the flap with few stitches, a 2-cm segment of the third costal cartilage was removed to expose internal mammary artery and vein as recipient vessels. At this stage, no internal mammary vessels anomaly was experienced due to deformed ribs that was corresponding to preoperative ultrasound Doppler finding. The vessels were prepared for microsurgical anastomosis under the operation microscope. Then microsurgical end-to-end anastomoses between deep inferior epigastric vessels and internal mammary vessels were performed with 10-0 nylon. A suction drain was placed in the donor site and rectus fascia and abdominal wall was closed in layers.

Postoperative course was uneventful and the patient was discharged at the 10th postoperative day. Satisfactory

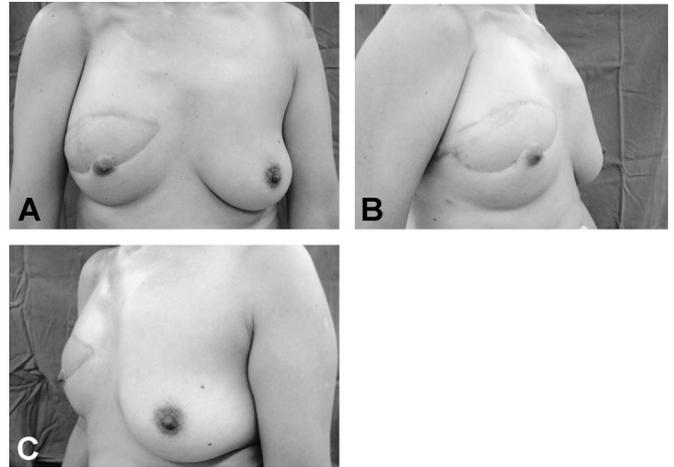


FIGURE 7. The appearance of the reconstructed breast at 1-year follow-up with good symmetry, adequate projection, corrected chest wall deformity, and a well-formed anterior axillary line. A, anterior view; B, lateral view; C, oblique view.

symmetry of the breast was achieved with adequate projection and a well-defined anterior axillary line. At a 1-year follow-up, the patient was highly satisfied with the procedure, and no donor-site morbidity was encountered (Fig. 7A–C).

DISCUSSION

The breast reconstruction in Poland anomaly has its own specific considerations and presents a surgical challenge with the varying severity of the underlying chest wall deformity and aplasia of the pectoral muscles. A reliable reconstructive method should provide a consistent success and be adaptable to altering conditions of the anomaly.

Although custom-made prostheses^{8,14} or pedicled LD flap with or without implant reconstruction^{5,7} has been proposed and used with different success rates, these methods still have their own drawbacks. In Poland syndrome, ipsilateral LD muscle can be attenuated or even may turn out to be an avascular fibrous sheet, and this condition is not rare.^{7,15} Therefore, LD muscle may be inadequate to provide a satisfactory reconstruction for breast and chest wall projection. Further, the procedure produces a visible and long scar on the back.¹⁴ Seyfer et al⁶ reported higher complication rates including migration, erosion of local tissues, and adverse cosmesis in breast and chest wall reconstructions using implants. The implant may present an unnatural appearance since the skin and soft tissue is often thinner than the contralateral side. In addition, tissue expander or implant may not be suitable in patients with aplasia or hypoplasia of ribs since compression of lungs and heart might possibly be encountered due to lack of the adequate support.

In 1989, Shamberger and Welch¹⁶ categorized chest wall deformity in Poland syndrome into 4 types. Type A is entirely normal rib cage with only absence of the pectoral muscles. Type B is depression of the involved side of chest wall with rotation of sternum in combination with carinate

protrusion of the contralateral side. Type C is hypoplasia of ribs on the involved side without significant depression. Type D is aplasia of 1 or more ribs, with depression of adjacent ribs on the involved side and rotation of the sternum. In type A and type C, the reconstruction is similar to the postmastectomy patients presenting with only breast deficiency. However, in types B and D, a considerable amount of soft tissue may be required for satisfactory reconstruction due to associated chest wall volume deficiency. If rotation of sternum and carinate protrusion of the contralateral side are significant, the severely protruding costosternal cartilage needs to be resected or repositioned for cosmetic concerns. Our case presented with type B chest deformity, which was revealed by hypoplasia of the ribs, mild rotation of the sternum, mild carinate deformity in the normal site, and significant chest wall depression in the involved side. Since carinate deformity is mild, no corrective procedure was considered in our case.

The usefulness and superiority of using various free autologous tissues such as free superior gluteal myocutaneous flap and free transverse rectus abdominis flaps over implant reconstruction in Poland anomaly had been reported in several reports.^{11,17,18}

The DIEP flap has recently emerged as a refinement of the free TRAM flap.¹⁹ The DIEP flap not only provides the advantages of the free TRAM flap but also decreases postoperative pain and recovery period, since the rectus abdominis muscle and fascia are protected. Retrospective studies showed that the umbilical and abdominal asymmetries, hernias and bulging are significantly higher in TRAM flaps compared with DIEP flaps.^{12,20,21} In addition, strength to flex and rotate the upper trunk was found significantly reduced in TRAM flap.^{12,20,21} Long-term results in DIEP flap are more predictable as there is no muscle atrophy involved.^{13,22} It is also suitable for patients who want to get abdominoplasty and breast reconstruction together. It provides ample amount of tissue, adaptable and applicable to each setting of breast and chest wall deformity of Poland anomaly and offers supreme reconstruction and symmetry with great capability of tailoring the autologous tissue. Its significantly longer pedicle permits more freedom in designing and inseting the flap with tension-free anastomoses.^{12,13} Since the autologous tissue is used, no foreign-body reaction or capsular contractures are encountered, and as the ingredients of the flap are similar to the normal breast, a more natural reconstruction is achieved.¹² The only disadvantage of this technique is the tedious dissection of small vessels and hence the prolonged operating time.¹³ However, it is worthwhile to invest in the additional time and effort to be able to preserve the function of the rectus abdominis muscle and avoid long-term complications. The amount of abdominal tissue may not be adequate if the Poland anomaly patient receives reconstructions at adolescence or early adult age.

Recognition of the internal mammary vessels involvement is of fundamental importance when a free flap is considered in Poland anomaly. Bavinck and Weaver³ pre-

sented a hypothesis to explain the pathogenesis of Poland anomaly in 1986. They proposed that interruption of the subclavian artery proximal to origin of the internal thoracic artery but distal to the origin of the vertebral artery leads to Poland anomaly.³ Bouvet et al²³ used impedance plethysmography to study children with Poland anomaly and found marked decreases in arterial blood flow velocities in the affected side, suggesting hypoplasia in the subclavian artery. Longaker et al¹¹ also found 1 free flap loss in their series, which may be due to anomalous subclavian vein. Therefore, preoperative ultrasound Doppler study for internal mammary vessels is recommended.

In summary, DIEP flap can be a useful and a reliable option for breast and chest wall reconstruction in a patient with Poland anomaly if the patient's abdominal tissue is adequate.

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