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Original Article

The combination of inferior pedicle method and dermal suspension sling technique: one new efficient method for breast reduction

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Abstract: Objective: To explore a method of breast reduction which ensures well nipple and areola lactation function, adequate blood supply and good medial fullness and projection. At the same time, this study could evaluate the advantages of the combination of inferior pedicle method and dermal suspension sling technique for breast reduction. Methods: From 2011.11 to 2013.8, 13 women have undergone breast reduction using utilizing inferior pedicle combined with the dermal suspension sling technique. The inferior pedicle was designed with medial and lateral triangular flaps in the areas where normally be excised. These triangular flaps were deepithelialized and defatted. The flaps were attached to the chest wall above the inferior pedicle to create a dermal "cage". Results: After operation, Sensation of nipple and areola complex, breast projection and shape were sustained during follow-up, of which the median interval was 12 months. No patient had poor projection and bottoming out. Conclusion: Dermal suspension and horizontal dermal placation provides a structural foundation to the inferior pedicle. It is an effective method of treatment for breast reduction, in that the sensation and lactation function of nipple and areola complex get further guaranteed, have nice breast projection and shape, and can be applied to all cases of breast reduction.

Keywords: Inferior pedicle, dermal suspension sling technique, breast reduction

Introduction

Female breast is an important secondary sexual characteristic, and oriental female breast is beautiful for its moderate size. Young breast used Cooper ligament to support and maintain the plump breast shape. For the old patients with breast hypertrophy, their breasts are easy to sag with the influence of gravity and expansion factors under the skin, and the elasticity loses of Cooper ligament. Undoubtedly, this would also cause bloated body, action inconvenience, shoulder and back pain and other complications, thus affect patients' normal work and life [1-4]. In 1977, the inferior pedicle breast reduction surgery was firstly built by American scientist Robbins [5]. Later in China, this operation has been improved by Ma et al. and Guo et al. and overall, this method is good for shaping, could remove more breast tissue, convenient operation, wide indication. But this method is easy to have complication such as less plump for the upper part of breast, breast ptosis, and etc.

Base on the simple "inferior pedicle method", in the study, not only more deep tissue of nipple and areola, but also the dermis after removal of tissue in the inner side and the outer side of inferior pedicle flap were kept. And then two triangle dermis flap connected with inferior pedicle flap were formed and fixed to the chest wall fascia, this both flaps wrap around the dermis. In other word, the function of Cooper ligament was replaced by the use of vascularized autologous dermis.

With detail, the dermis cap has many functions. Firstly, it could prevent the subdermal vascular network around the nipple and areola complex from damage, and thus further ensure the blood supply of the nipple and areola. Secondly, it is convenient for the fixation for the remaining gland tissue and chest wall suture and plays the role of supporting the remaining glands, and thus to be beneficial for re-shaping the perfect round breast. Last, it could make the areola smooth and perfect.

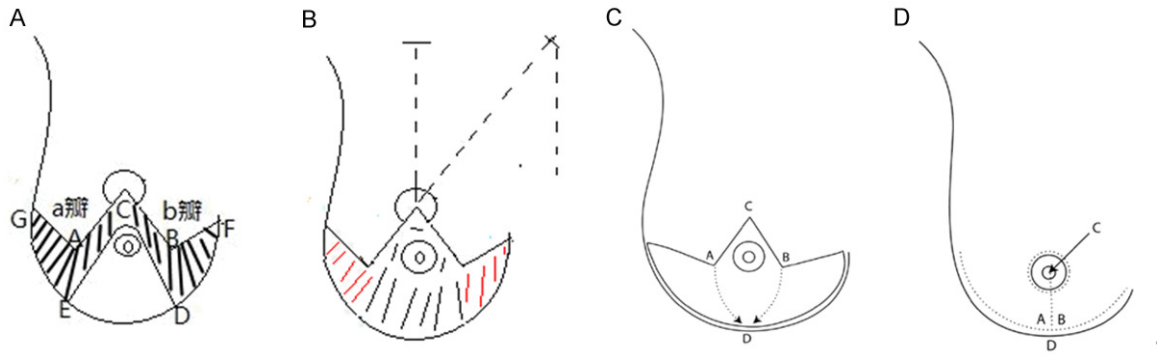

Figure 1. Schematic diagram of operation design.

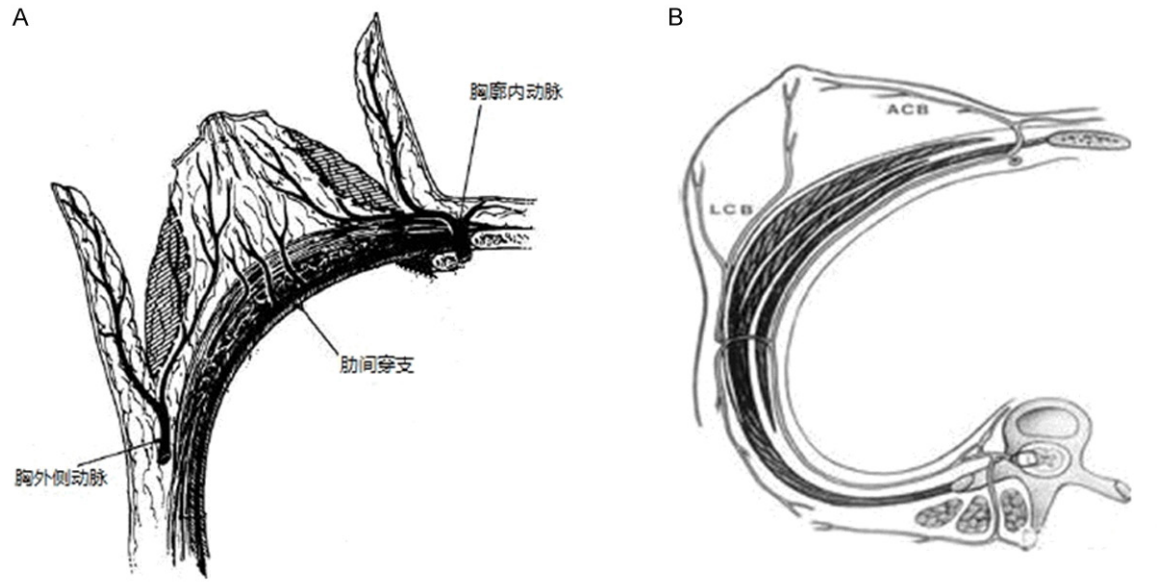

Figure 2. The basis of inferior pedicle vascular, nerve anatomy.

In this study, 13 cases of breast reduction for the patients with breast hypertrophy by using the inferior pedicle method combined with the dermal suspension sling technique were reported. Overall, the breast rebuilt after this operation had reliable blood supply, and well recovered sensation function, and more lasting effect for long term observation, and thus this methods is effect method for correction of breast hypertrophy.

Information and methods

Clinical data

In this work, 13 patients were chosen for study (from 2011.11 to 2013.8). These patients aged from 25 to 49and average age 38. Among these patients, 12 had babies already while one other has not. Total 13 patients had bilateral breast hypertrophy accompany with breast ptosis at moderate or serve degree by detail classification. 7 cases of patients had hyperplasia of mammary glands, and others had no history of breast. After operation, the follow-up with median interval for 12 months were carried out for these patients. The data was handled with analysis of variance by Microsoft Excel.

Operation method

Nipple and areola positioning and operation design: Patient sat and faced the operator, and then the new position of nipple and areola was determined on the intersection of clavicular

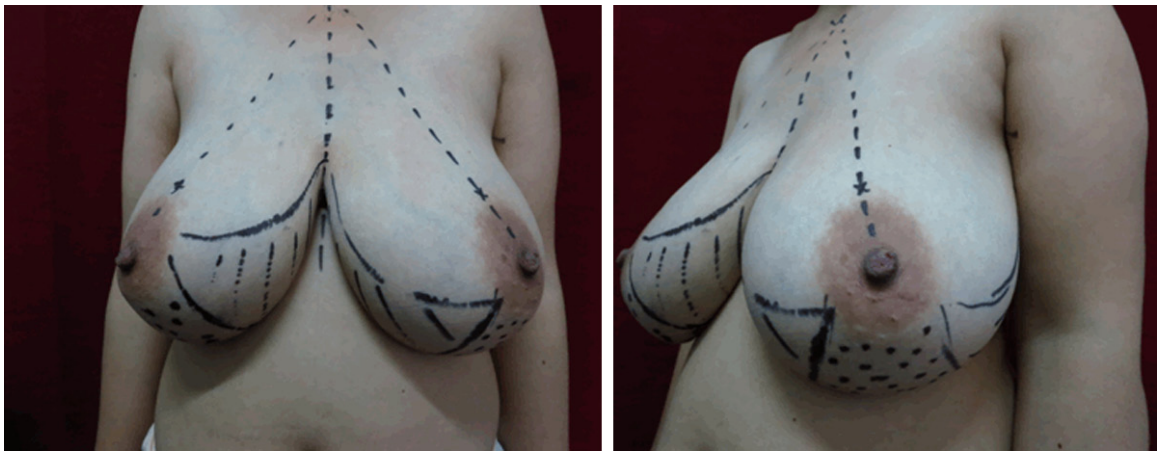

Figure 3. Mark before operation.

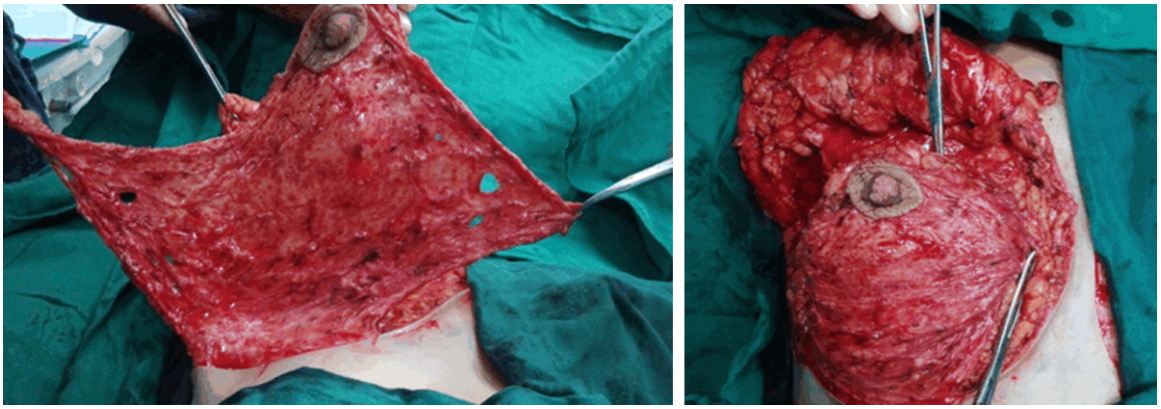

Figure 4. Inferior pedicle combined with the dermal suspension sling technique.

center line and the projection line of folds under breast on the breast surface (Also some scholars determine the new position of nipple and areola by the intersection of clavicular center line and the breast line or the level line 1 cm under the midpoint of the upper arm).

The preoperative design and positioning was done by using self-made breast operation designer (**Figure 1**): Point C is the new nipple position, points A, B are the folded back of designer arms, and points G, F are the intersection of designer both arms and folds under breast. And then, the patient was set supine. A vertical pedicle with width of 10-12 cm was designed using the connection from center point of under fold to nipple point as axis. The both sides of pedicle connected the folds under breast at points D and E, and the limit was on the edge of the areola. The epidermal area for removal was inferior pedicle with black mark and the shadow region with red marker (namely leather cap, see **Figure 1B**). During the operation, the gland adipose tissue in the shadow region GACBFD was removed depended on different situation (**Figure 1A**). Design line was marked by mark pan.

Operation method: Operations were performed under general anesthesia, incision line and epidermal region for removal were injected with 0.5% lidocaine (including 1:10 adrenaline) swelling liquid.

The vertical inferior pedicle and the epidermis in region of both triangular flaps expect for the areola (**Figure 3**). Then, the subcutaneous fat and breast tissue within the shadow were removed. When the thyroid gland tissue was cut, the glandular tissue in the region of point 4 at left and point 8 at right should be kept in order to facilitate the blood supply of the nipple

Figure 5. Typical cases. A: Normotopia image (one month) after operation; B: Lateral image (one month) after operation; C: Stimulation of nipple erection (one month) after operation; D: Normotopia image (one year) after operation; E: Lateral image (one years) after operation; F: Inverted "T" shaped scar healing (one years) after operation.

and areola (**Figure 2**). The region for breast tissue resection was depended on breast hypertrophy degree, shaping and other requirements.

Glands and adipose tissue in epidermis region for removal in areola upper edge and triangular flap area of both sides of inferior pedicle was removed respectively. The dermis flap was kept for the thickness of about 3-5 mm. The inferior pedicle tissue was raised to normal height, Epidermis caps in the upper, medial and lateral of inferior pedicle were fixed on the deep fascia on the chest wall (**Figure 4**). This technology could further support and shape the inferior pedicle and overcome the breast ptosis, breast upper pole empty, and other complications caused by gravity after breast reduction using "inferior pedicle method".

Adjusting during operation. After suture of CA and CB, by location and drawing (**Figure 1C**), the breast shape was initial shown, and the ICP tissue flap can move up at the same time. If possible, the bed could be adjusted to approximate seat position, and then the breast shape (whether symmetry or not) and size were checked for feasible further adjustment. After basic satisfaction for breast shape, the nipple fixed point was adjusted properly on the longitudinal incision according to the original nipple location, and then the best position for nipple and areola was found and marked.

The skin and subcutaneous tissue within new areola were removed, and it was then sutured with the nipple areola complex by different layers. Then the tightness of the vertical arm of the CA and CB after suture was checked that if the skin is still rich, one more vertical skin could be removed. The skin on the connection of the central pedicle under breast dermal glands and the folds under breast was cut to the fat layer. When the inner and outer side flap level was consistent, the area around the areola and the inverted T shape incision (**Figure 1D**) was sutured one by one, and then drainage and dressed with pressure.

Results

Basic results

In this study, 13 patients recovered well after breast reduction, and their breast hypertrophy and ptosis have been corrected obviously. Overall, their nipples left for 4.5~8.5 cm, their breast reduced for 215~975 g for average of 643.5 g. After operation, all patients had follow-up for average 12 months. Overall, the patients had follow-up were satisfied with the breast shape and for one patient who was nul-

Table 1. The Breast-Q score of macromastia patients before and after operation

Number	Difference (d1)	Difference (d2)	Difference (d3)	Difference (d4)
1	16	28	17	6
2	10	23	15	5
3	9	27	11	7
4	11	25	14	8
5	15	19	18	6
6	8	21	14	5
7	17	14	15	3
8	11	23	21	6
9	13	17	13	7
10	18	20	19	5
11	9	19	11	10
12	14	17	9	7
13	12	22	12	9
P	<0.05	<0.05	<0.05	<0.05

d1, d2, d3, d4 is the score for the satisfaction on breast appearance, breast symptoms, self-confidence, sexlife of patients before and after operation. The data was handled with analysis of variance by Microsoft Excel.

Table 2. Overall satisfaction scores (a total of 24 points) schedule for the operation patients

Group	Average	Standard deviation	Maximum	Minimum
Breast reduction	21.35	3.75	23	18

liparous retained the function of lactation after operation. The sensation of nipple and areola of one patient declined mildly at the early period after operation and then recovered well. For the follow-up after one month, the sensation of nipple and areola to external stimulation showed significant contraction reaction. Breast-Q score investigation done before and after breast reduction for the patients with follow-up showed that the patients all had significant differences in the satisfaction on the morphological changes in breast, symptom scores, self-confidence, and sexual life. Overall, the patients had great stratification on the operation.

Typical case

One patient, female, age 30, had bilateral breast hypertrophy associated with shoulder and back pain for more than 6 years, which influence the beautiful and daily life. Before operation, the patient has been checked carefully: she had serious hyperplasia of breast glands with ptosis but without tumor like change. After general anesthesia, the patient was taken bilateral breast reduction mentioned in this study. The follow-op was carried for the 1 year after operation and showed that the sensation of nipple and areola had well recovery, and the inverted "T" shaped scar was not obvious (**Figure 5**). Overall, the effect of operation was satisfied.

As can be seen from **Tables 1** and **2** there are statistically significant differences in the postoperative morphological changes of the breast, breast symptom score, self-confidence and sex life satisfaction among the patients. The overall satisfaction level of the patients on the surgery is high, and the average satisfaction level reaches 86.5%.

Discussion

The rule for breast reduction

The concept that blood supply of nipple and areola comes from subdermal vascular network is stated at 1930s by Schwartzman. And then the breast reduction operation was in its new era by overcoming the disadvantages of early breast reduction that merely had excision of skin and subcutaneous tissue and made the nipple and areola to be necrosis. According to the dermal glands, the breast reduction could be divided into many methods including "upper pedicle method", "inferior pedicle method", "lateral pedicle method", "horizontal double pedicle method", "vertical double pedicle method", "double ring method", and etc. However, all these methods had disadvantages such as having obvious scar after operation, not suitable for severe macromastia, loss of lactation function and breast areola sensation, necrosis of breast tissue, etc. [6]. The postoperative effect is affected greatly by different design of pedicle and operation incision. However, no matter which kind of dermal glandular pedicle is applied, breast reduction should abide the following six principles: breast reduction requires appropriate size and position; the reduced breast hemispherical, zygomorphic, and with good shape; the nipple and areola feels good; the incision of skin is hidden and with less scar; to retain the function of lactation as much as possible; the reduced breast has well texture and with elasticity tissue of normal breast.

Comparison the advantages and disadvantages of different breast reduction operation

Traditionally, the Mckissock Method and Strombeck Method were applied widely due to their advantages of large amount for breast tissue resection and easy for shaping [7]. However, both methods have great damage when cutting excess breast tissue and easy to destroy the fourth intercostal nerve and mammary duct of breast. Thus, after both operation, the function of nipple areola would drop, lactation function would be affected, and the inverted "T" shaped scar would left.

To overcome this advantage, the modification of breast reduction was finished by Ma et al. on the derma mammary single pedicle flap under breast. By this operation, the rate of normal feeling is completely 100%, but the rate for the patients with Mckissock Method at the same age period is merely about 60%. To avoid the "T" shaped scar generated during classical operation, the technology is further modified by Lassus C and Lejour M by using upper pedicle for breast reduction with vertical incision. However, the upper pedicle method also had disadvantages such as too breast position after operation, too long vertical incision, easy to form the cat's ear and have obvious fold on the lower part of the breast skin.

In 1990, one breast reduction method using circum areola incision was reported by Benelli et al., and this method is relatively simple, and it require no processing for all scar outside of the circum areola scar. Because this method was satisfied by Chinese female patients with their psychological needs, it was widely used in China. However, this operation also had disadvantages. On the one hand, the breast early after this operation is easy to have form shape and usually looks like a "meat bun". On the other hand, when long after operation, areola would enlarge, and it is possible to have breast ptosis, slack skin, and etc. and thus needing further operation.

Overall, although breast reduction with vertical incision or annular incision have less and hidden scar, both operation usually require further operation, and are difficult for the treatment of patients with severe breast hypertrophy, skin relaxation, or other cases with poor quality.

The breast reduction method so called "inferior pedicle method" using leather and glands as inferior pedicle was firstly reported by Robbins et al. in 1997. This method is easy to operate, has great flexibility in resection of breast tissue volume, can make the nipple areola up greatly with reliable blood supply [8], and beneficial for breast to be reshaped [9]. Overall, this method is suitable for the patients with breast hypertrophy in light, moderate, and severe degree. Many researches showed that "inferior pedicle method" is suitable for breast reduction. The study carried out by Hamdi [10] show that the pedicle had more nerve branches after breast reduction using "inferior pedicle method" than "upper pedicle method". This study compared 20 cases of "inferior pedicle method" and 18 cases of "upper pedicle method" and found that before operation, different breast's parts of two groups of patients had no significant difference, but 3 months after operation, the breast sensory sensitivity was obvious higher for the patients with "inferior pedicle method". In another study [11], it is shown that the nipple sensation and lactation function could be better recovered by using "inferior pedicle method" for breast reduction. The "inferior pedicle method" had been improved and recognized by North American plastic surgeon and nowadays, the breast reduction using "inferior pedicle method" has become the most popular type of breast reduction operation in North America [12]. However, as the time after operation to be longer, the breast after reduction with "inferior pedicle method" is easy to be less plump in upper part of the breast, breast ptosis or other complications.

In order to make the breast shape to be more lasting, in this study, breast reduction used inferior pedicle combined with the dermal suspension sling technique. By this operation, the leather of medial and lateral sections after remove of fatty breast tissue was kept, and form two triangle dermis flap connected with the inferior pedicle flap which was fixed to the chest wall fascia. And then, the inferior pedicle flap were around by both dermis flap and thus to be fixed. By this "fixed" function, the effect of operation was better than the method merely using dermal suspension sling [13].

The dermal suspension sling technique

The fixed shaping processing for the residual breast tissue after breast reduction would directly affect the postoperative breast shape and lasting effect. Because a great number of breast Cooper ligament was damaged by the

free skin and mammary gland during breast reduction, how to re-fix the residual breast tissue and regain the satisfactory appearance is very important. Thus, many researchers focused on this. In 1992, RA Bustos put silica gel plates under the subcutaneous tissue of residual breast, and then sutured to the pectoral fascia surface for breast shaping. In China, Sun et al. used polyethylene net on the surface of residual breast tissue to fix and shape the breast. Considering the reaction of human tissue to alien material and the softness of postoperative breast texture, at present, most scholars tend to form the dermal suspension sling by keeping a circle of dermal tissue in around the areola, and then the dermal cap was sutured to the pectoral fascia for shaping the remaining breast tissue.

The dermal suspension sling technique was firstly reported by Lalardrie in 1982 [14], the operation used residual gland to form a leather cap cylinder and then the cylindrical gland is folded to form a new breast shape. In this study, breast reduction used inferior pedicle combined with the dermal suspension sling technique. This technology used vascularized autogenous dermis package and fix mammary glands thus could replace the ligament of Cooper function. Undoubtedly, this technology could overcome the sagging breasts, upper breast empty and other complications and thus with great novelty.

Overall, there are three advantages for dermal suspension sling [15, 16]. Firstly, it could keep the subdermal vascular network around the nipple areola complex from being damaged, and thus further ensure the blood supply of the nipple and areola of breast. Secondly, it is convenient for the fixation of the remaining gland tissue and chest wall suture, and also plays the role of supporting the remaining glands, and reshape the perfect and round breast. Last, it could make the areola smooth, perfect, and the postoperative effect more lasting. In this study, some patients are followed up for 3 years: all the breast shape is good, no obvious breast ptosis happen, thus the effect was satisfied.

Outlook

Reconstruction of breast incision scar is one of the major problems for doctors and patients' considering. For the old experience, the postoperative scar was not generally apparent when the flap was made with small incision tension and lasting anti-scar treatment (**Figure 5F**), and thus the patients could accept this. For future study on the breast reduction, more aspects should be focused.

Firstly, the breast appearance should be improved. The short-term effect of most breast reduction is usually good by correct mastering of operation indications, careful operation, preoperative design, but the long-term effect was unsatisfied due to the bad breast shape and breast ptosis. Therefore, the future modification of this operation should focus on lasting maintaining the shape of breast.

In addition, the breast reduction should keep the sensation of nipple and areola, and the young ladies' function of lactation as much as possible. The feeling of nipple and areola is one of most issue today's women care about after breast operation.

Finally, the scar after operation should be further diluted. Because the postoperative scar hyperplasia is one of the main issue for the breast reduction, it should be focused for its further modification.

Conclusion

In summary, breast reduction surgery requires appropriately reducing the breast volume, reshaping appearance, small and concealed scar after operation, and good feeling [17]. This paper finished breast reduction by utilizing inferior pedicle combined with the dermal suspension sling technique. Overall, it satisfied the rule for breast reduction that the nipple raised greatly; it is convenient for shaping for remaining glands; and the shape of breast is good after the operation. For the blood supply of nipple and areola, sensation erection, and the protection of lactation, this method is more reliable than that of pure "inferior pedicle method". At the same time, using dermal suspension sling technique could reduce the postoperative complications of breast ptosis and make the lower part of breast to be plump and natural. Thus, its effect is more lasting than that of pure "inferior pedicle method". Overall, the patients were satisfied with the operation method in this study and this method is suitable for macro-

mastia in light, moderate, and severe degree, and thus worthy of further promotion and communication.

Disclosure of conflict of interest

None.

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