

## Analysis on the Effect of Application of the DIEP Flap in Breast Reconstruction Surgery

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### ABSTRACT

Breast reconstruction surgery means using autologous tissue grafts and breast prosthesis to rebuild chest wall deformities and the absence of breast caused by post mastectomy, which are possibly due to burns, trauma, infections, congenital dysplasia and sex reassignment surgery etc., with the prevalence of unilateral breast reconstruction. After attempting to carry out breast reconstruction with latissimus dorsi, many surgeons constantly improved, designed, and modified multiple forms of operation programs and thus promote increasing improvement in repair and reconstruction of the breast after breast reduction surgery and mastectomy for breast cancer [1]. Currently, breast reconstruction after breast cancer surgery is just in the early stage while it has occupied an important position in developed countries, therefore, the knowledge of breast reconstruction needs to be enhanced and publicized in our country. Some data show the quality of life in patients following breast reconstruction surgery is significantly higher than that in patients undergoing lumpectomy plus radiotherapy or simple mastectomy. More and more patients pursue breast reconstruction after mastectomy for breast cancer. Breast reconstruction is roughly divided into lost chest wall skin repair, hemispherical breast reconstruction, anterior axillary fold repair, plastic surgery for subclavian depression, nipple and areola reconstruction and asymmetrical breast repair. In the reconstruction of breasts, it is necessary to endeavor to make the rebuilt breast symmetrical to the healthy side so that future adjustment will be simple and easily feasible.

Breast cancer is a malignant tumor whose incidence rate is the highest among women. Absence of the breast resulting from post-mastectomy for breast cancer causes significant

psychological trauma to patients, affecting the quality of life seriously. Breast reconstruction synchronizing with mastectomy for breast cancer breasts can prevent patients from suffering from pain in absence of the breast, and needs less times and cost of operation compared to delayed breast reconstruction. Using abdominal flaps to rebuild the breast is an ideal surgery mode for breast reconstruction, and deep inferior epigastric perforator (DIEP) flaps cause minimal trauma to the abdominal donor area. The Breast Plastic and Reconstruction Center of the Plastic Surgery Hospital of the Chinese Academy of Medical Sciences and the Breast Center of the Cancer Hospital of the Chinese Academy of Medical Sciences cooperated in breast reconstruction and achieved satisfactory results<sup>[2]</sup>.

## 1 Surgical methods

### 1.1 Surgical process

Surgery is carried out simultaneously in two groups. Abdominal recipient area group: The incision is made according to the designed line, the incision scar of mastectomy on the chest is excised and peeling is performed towards the two sides to form a correct-size soft tissue pocket to accommodate the flap. The third costal cartilage with a size of around 3cm on the sternum is bitten off, the perichondrium on the back of the costal cartilage is cut open and the internal thoracic artery and vein behind the perichondrium are exposed as a blood vessel in the recipient area. For patients undergoing immediate breast reconstruction, the thoracodorsal artery and vein at the same side can also be used as a blood vessel in the recipient area. Abdominal flap harvest group: Incision is made according to the designed line and outside-in peeling is performed on the superficial surface of external oblique muscle and the fascia of the rectus abdominis muscle. When the external edge of the rectus sheath is reached, peeling should be done with care, and attention shall be paid to protecting the perforator vessel that run through the rectus sheath and stems from the inferior epigastric artery and vein, with one or two groups of perforator vessels reserved, peeling is continuously carried out inward until the midline in the abdominal wall is reached. The rectus sheath surrounding the perforator vessel is cut open along the direction of rectus abdominis muscle fibers, and the perforator vessel is dissociated through the main blood vessel of the inferior abdominal wall. With the same method, the contralateral flap is peeled, the whole flap is lifted, the blood vessel of the inferior abdominal of sufficient length is dissociated, and then the bilateral inferior epigastric artery and vein are cut off, and the flap is taken down. The rectus sheath is sewn

up and repaired. Peeling is performed stealthily along the top and bottom of the incision of the abdominal wall to reduce tension at the time when the incision is sutured. The umbilicus is reconstructed on the appropriate position of the abdominal wall on the top of the incision. The incisions in the abdominal wall are closed on a stratified basis.

The two groups of inferior epigastric arteries and veins are anastomosed with the proximal internal thoracic arteries and the distal internal thoracic veins respectively; for patients undergoing immediate breast reconstruction, the inferior epigastric arteries and veins can be anastomosed with the thoracodorsal arteries and veins. After the blood vessel becomes unobstructed, the location where the flap is placed and the morphology of the breast are shaped and adjusted until the best morphology of the breast is achieved. The DIEP flap ranges from 12cm×8cm to 35cm×22cm<sup>[3]</sup>. The vascular pedicles of the inferior epigastric artery and vein is 7 ~ 12cm long, with an average length of 8.94cm. In immediate breast reconstruction, the thoracodorsal artery and vein are taken as a blood vessel in the recipient area, the thoracodorsal artery and vein, the circumflex scapular artery and vein are considered as a blood vessel in the recipient area, and internal thoracic blood vessels are taken as a blood vessel in the recipient area, the bilateral inferior epigastric artery and vein are anastomosed with the distal internal thoracic arteries and veins that have been cut off; only the unilateral inferior epigastric artery and vein are harvested and anastomosed with the proximal internal thoracic arteries and veins.

### 1.2 Modified radical mastectomy

First lumps are excised completely under local anesthesia with invasive breast cancer shown in all the frozen reports, and then the surgery is changed to one under general anesthesia. After general anesthesia is applied, the incisions for modified radical mastectomy and latissimus dorsi flaps in the donor area are plotted with methylene blue and secured with iodine tincture. Longitudinal incisions, transverse incisions or oblique incisions can be made according to the position of lumps and the upper edge of the incision does not enter into the armpit to prevent upper extremity motion from being affected following the surgery<sup>[4]</sup>. The surgery that retains the areola is performed with the lower edge of its incision along the external edge of the incision. The shape of the latissimus dorsi flap is the same as that of the skin excised in modified radical mastectomy and the area of such flap is enlarged by around 10% to make sure there is no tension in the suture edge after the breast reconstruction. When

modified radical mastectomy is carried out, attention should be paid to retaining *nervi thoracales anteriores* and thoracoacromial arteries to avoid pectoral atrophy that affects aesthetics of reconstructed breasts. The skin in the donor area after the subcutaneous dissociation mostly can be drawn in and sutured. In two case with the width of more than 10cm, after drawn in and sutured partially, defected skin was covered with medium-thickness skin of thigh, the medium-thickness skin is 5cm×4cm size and one drainage tube is set in the flap donor area on the lower back. The selected muscle in the latissimus dorsi flap is thick in the middle and gradually thin in the edge so that the reconstructed breast does not look excessively concave or convex and defects in the muscle in the donor area is reduced. When the myocutaneous flap with vascular pedicle turns from the latissimus dorsi to the colpus, it should be aware that there is no tension in the vascular pedicle and excessive distortion should be avoided so that blood supply is not impacted. According to the size, silicone prostheses are selected and filled into the pectoralis major muscle, one negative pressure drainage ball is provided in the armpit, pedicle muscle flaps are placed in the skin defect following modified radical mastectomy, the upper and lower edge of the incision are sewn up, and the flap and the incisal edge are sutured<sup>[5]</sup>.

### **1.3 DIEP flap transfer and reconstruction of empty cavity**

According to the incision line designed before the surgery, the flap is excised and lifted from the external edge, the perforator is sought by gradually heading for the region around the umbilicus, the small perforator blood vessel is ligated, and the whole perforator blood vessel is retained. After the whole flap is detached, the blood vessel to be anastomosed is handled first, a sufficiently big empty cavity is separated from the reconstruction surgery area, the perforator blood vessel of the internal thoracic artery is sought, the dissociated perforating blood vessel is anastomosed with the blood vessel in the recipient area through minimally invasive vascular anastomosis, the flap is revised to make it consistent with the contralateral breast as far as possible, finally the incision is sewn up<sup>[6]</sup>. The surgery procedure for patients undergoing phase II breast revision surgery is the same as that in breast reconstruction surgery using latissimus dorsi flaps.

## **2 Discussion**

Breast is an important signature for women, and loss of breast resulting from post-mastectomy for breast cancer causes huge psychological trauma to patients, having a significant influence on the quality of life. Immediate

breast reconstruction following the mastectomy for breast cancer is an integral part of systematical and comprehensive treatment for breast cancer. In recent years, more and more patients require immediate breast reconstruction while undergoing mastectomy for breast cancer in our country. Immediate breast reconstruction can prevent patients from pain in loss of breast, remarkably alleviate or eliminate psychological pressures in patients and is a hot topic in research on the breast cancer and plastic surgery fields.

Performing breast reconstruction while mastectomy for breast cancer takes place retains the best condition for tissue reconstruction. First, axillary lymph node dissection is performed during the radical mastectomy, then the dorsal blood vessel is exposed quite clearly and serves as a blood vessel in the recipient area for micro flap grafting. By contrast, in the phase II breast reconstruction, firstly the dorsal blood vessel usually needs to be anatomized in the tightly adhered scar, which easily causes damages to the blood vessel. For cases where post-operative axillary radiotherapy is performed, problems such as degeneration, reduction in diameter and spasms happen in the blood vessel and make it loss value in use. Secondly, breast reconstruction in the mastectomy for breast cancer avoids the situation of axillary skin adhesions and scar contractures, local tissue is loose, elastic and easy to shape, and the morphology of reconstructed breast is nature, vivid with satisfactory effects. Thirdly, due to perfect conditions for the tissue in the recipient area on the chest, immediate breast reconstruction is faster than the phase II breast reconstruction<sup>[7]</sup>.

Patients undergoing mastectomy not only need to face the threat to life and health from cancer, but seriously affect their own image. They have to be impacted physically and psychologically. These pressures easily cause bad emotions such as tense and anxiety. Surgical excision of breasts can lead to breast deformity and disturbances appear in various functions of the body when radiotherapy is performed. In addition, they fear others' peculiar look and repeated incidence of cancer, the incision after excision is long and detrimental to breast reconstruction and deformity in their chest wall greatly increase the difficulty of reconstruction. In the face of breast cancer, what is primary is to resolve the threat to the life and safety of patients from cancer, endeavor to relieve pain in patients and improve the quality of life. Due its advantages of carrying a large amount of tissues, concealed scars in the donor area in the abdominal wall and plastic functions of the abdominal wall, breast reconstruction using abdominal flaps has gradually become the ideal surgery mode for many plastic surgeons at home and abroad to perform breast reconstruction. The method of breast reconstruction using TRAM+DIEP combined flaps

integrates the advantages of both TRAM flaps and DIEP flaps, appropriately avoids the weaknesses of TRAM flaps and DIEP flaps. Breast reconstruction using TRAM+DIEP combined flaps requires separation of unilateral abdominal wall perforating blood vessels and microvascular anastomosis; therefore it is faster than those using bilateral DIEP flaps<sup>[8]</sup>.

Post-operative design are jointly accomplished by plastic surgeons and oncology surgeons and the size of abdominal DIEP flaps is designed according to the amount of excised tissues, scope of excision and volume of contralateral breast. In the case of mastectomy for breast cancer and modified mastectomy, the direction of incision, size of incision and scope of excision are prioritized according to the requirements of cancer treatment, and on the premise that the curative effect of cancer treatment is guaranteed, the conditions for local tissues is considered to be retained as appropriate, such as the direction of incision, thickness of flaps and scope of excision<sup>[9]</sup>. Generally, as regards the effect of breast reconstruction, transverse incision is better than those for longitudinal incision and oblique incision, and thick fat tissues retained in the chest is better than thin fat tissues.

In all the breast reconstruction cases, MDCT angiography and ultrasonic Doppler blood flow detection were performed before surgery to identify the location and amount of perforators and routes of main blood vessels and guarantee the positioning accuracy of intraoperatively anatomized blood vessels. As to the adaptation of flaps, the author argues that, for patients with a large healthy-side breast, a large amount of excised tissues or who reject breast prostheses, sufficient amount of tissues can be offered to perform tissue reconstruction only when abdominal flaps are used; if patients simultaneously have high requirements and even have fertility desires, the method with DIEP flaps can be used, which can minimize the influence on the abdominal functions and maximally prevent the occurrence of complications related to the donor area<sup>[10]</sup>.

That immediate breast reconstruction using DIEP flaps is performed under the ideal conditions for tissues in the recipient area not only shorten surgical time, but can rebuild breasts with natural morphology and maximally protect the deep structure of the abdominal wall, and is an ideal method for immediate breast reconstruction. But this method has high requirements for surgical technologies with a long period of surgical time, which is its weakness<sup>[11]</sup>.

Deep inferior epigastric perforator, DIEP is the further improvement of free transverse rectus abdominis myocutaneous flaps. Only skin and fat are harvested intraoperatively to separate the vascular pedicle from the rectus abdominis and its biggest advantage is that it retains

the integrity of the rectus abdominis and its stealth, avoids occurrence of postoperative abdominal weakness and abdominal hernia, and allow patients to recover quickly and postoperatively with good long-term effects. This method is an ideal for breast reconstruction using autologous tissue<sup>[12]</sup>. The combination of transverse rectus abdominis myocutaneous flaps and deep inferior epigastric perforator flaps has advantages like reliable blood circulation, provision of considerate tissues, highly flexible shaping, less damage to the donor area, especially suitable for patients who require large-volume grafting and suffer from damage in internal thoracic blood vessels. The disadvantage of breast reconstruction using DIEP flaps is difficulty in flap anatomy, long period of surgical time and requirements for a good basis of microsurgical technology. It can be seen from the results of the study that, complications following breast reconstruction using DIEP is significantly reduced with better postoperative symmetry, and transparently increases the quality of life in patients. Due to the intraoperative application of reconstruction of autologous tissues in the method with DIEP, the contralateral breast is less likely to get involved, it is possible to flexibly adjust the size and shape of breast to make the breast comes with drooping shape and equivalent to the contralateral one, eliminating the need to handle the contralateral breast, and even in the phase I surgery, the breast in question has not become consistent with the contralateral breast in morphology, but there is big room for adjustment in the phase II repair surgery<sup>[13]</sup>. Reconstruction with latissimus dorsi flaps needs prosthesis implantation and is easy to operate with a short length of hospital stay, but makes the contralateral breast to become symmetrical to the rebuilt breast with difficulty and look more unnatural compared with the method with autologous tissue grafts. It often needs reconnection of the contralateral breast, which increases the incidence of postoperative complications, and the latissimus dorsi will squeeze the prosthesis when it is transferred due to large muscle tension, moving up the implanted prosthesis. However, unlike autologous tissue grafts, breast implanted with prostheses will not change with changes in the body, and breast with autologous tissue grafts can sag naturally over time and after the prosthesis implantation, there will be a chance of breast deformity resulting from capsular contractures.

In short, when breast reconstruction is performed, the application of transfer surgery with DIEP flaps can better guarantee the symmetry of bilateral breasts, but it is required to assess patients postoperatively and accurately and maximally ensure the consistence of postoperative bilateral breasts and reduce pain and psychological burdens in patients.

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