

Perioperative nursing for immediate breast reconstruction with deep inferior epigastric perforator flap after breast cancer resection

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Background: To investigate the value of the nursing cooperation workflow for immediate breast reconstruction with deep inferior epigastric perforator (DIEP) flap after breast cancer resection.

Methods: The clinical data of 29 patients who had undergone immediate breast reconstruction with DIEP flap after breast cancer resection in our center from January 2016 to December 2017 were retrospectively analyzed. In particular, the nursing cooperation workflow was reviewed.

Results: All the 29 patients were emotionally stable before surgery and were able to cooperate well with the surgery. The surgery was smooth. In 27 patients, the flaps survived after surgery and primary healing was achieved at the wounds. The remaining two cases presented with venous vascular crisis within 24 h after the surgery, and the flaps survived after active rescue. The patients were followed up for 4 months to 3 years. Neither complication such as local tumor recurrence, incision infection, flap necrosis, or upper limb lymphedema in the surgical area nor complication such as abdominal wall bulging, abdominal wall hernia, or fat liquefaction of incision in the donor area was reported. The shape of the reconstructed breasts was natural and satisfactory.

Conclusions: Immediate breast reconstruction with DIEP flap after breast cancer resection involves two disciplines: tumor resection and plastic repair. It is time-consuming and difficult to perform. Before the surgery, nurses in the operating room should carefully assess the patient's disease condition, communicate well with the operator, fully understand and be familiar with the surgical procedure and its special requirements, and formulate the surgical cooperation plan. During the surgery, the nurses should strictly implement cancer-free technique and be ready to assist for every next step, so as to effectively shorten the operative time, prevent local tumor recurrence, and thus pave the way for a successful surgery.

Keywords: Breast cancer; breast reconstruction; deep inferior epigastric perforator (DIEP); perioperative nursing

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Introduction

Breast cancer is the most common cancer among women, and the absolute lifetime risk for breast cancer is up to 10%. About one-third of patients diagnosed with breast cancer have undergone a variety of breast resection procedures (1).

Meanwhile, the number of patients undergoing prophylactic mastectomy is also increasing (2). With the increasing survival rate of breast cancer patients and the emphasis on quality of life (QOL), breast reconstruction surgery has become an active choice for many breast cancer patients

due to psychological problems (such as family concerns and sexual problems) that may be left behind in patients undergoing mastectomy. This procedure plays an important role in women's recovery from breast cancer (3-5). However, challenges (e.g., proper breast appearance, biomechanical balance of the breast, recovery of breast fullness, and formation of symmetric scar) persist for surgeons and nurses during a breast reconstruction surgery. The treatment of breast cancer requires a team-based work environment. In addition to perioperative physical care for patients undergoing mastectomy, nurses also need to be skillful in communicating with patients and their families and ensuring patient-centered personalized care. Breast reconstruction with a deep inferior epigastric perforator (DIEP) flap has become a mainstream autologous breast reconstruction method after breast tumor resection (6). However, few literature has described its peri-operative nursing. In our hospital, immediate breast reconstruction with a DIEP flap was performed after breast tumor resection in 29 patients from June 2015 to December 2017. The nursing cooperation workflow throughout the surgery is described as follows.

Methods

General information

A total of 29 patients who were treated at the Breast Cancer Prevention and Treatment Center of Sun Yat-sen Memorial Hospital, Sun Yat-sen University, from June 2015 to December 2017 were enrolled in this study. All the patients were females aged 24–60 years (median: 43 years). Preoperative biopsy or intraoperative frozen-section pathology confirmed the unilateral breast cancer, with 18 cases on the left and 11 on the right, among which 16 were located in upper outer quadrant, 4 in lower inner quadrant, and 9 in lower outer quadrant. According to the American Joint Committee on Cancer (AJCC) TNM classification system, the disease in our series was in stage I in 19 patients and stage II in 10 patients. All the patients had a strong desire for breast preservation. The surgical protocol was radical mastectomy in 9 cases and modified radical mastectomy in 20 cases. Postoperative pathological diagnoses included invasive ductal carcinoma (n=23), invasive lobular carcinoma (n=4), and combined lobular and ductal carcinoma (n=2). All patients had no history of abdominal surgery. Distant metastases were excluded before surgery.

Surgical methods

Chest handling

The operation was basically the same as radical mastectomy or modified radical mastectomy, although the nipple-areola complex was preserved as much as possible when the entire breast tissue was removed. Incisions with different shapes (e.g., crescent-shaped, shuttle-shaped, etc.) were selected according to tumor locations. In a specific incision, the subcutaneous tissue was separated till the inframammary fold, and the fat thickness of the flap was evenly maintained at 0.5–1.0 cm to ensure the blood flow of the flap. Multiple specimens were collected from the tumor surface skin, the resection margin, and the basal tissue of nipple-areolar complex for frozen-section pathology to ensure that no cancerous tissue or infiltrate remained. The thoracic and dorsal veins were exposed as recipient blood vessels. After the ipsilateral breast was completely removed and the lymph nodes were dissected, the wound was rinsed with distilled water before stopping bleeding. Titanium clips were applied at the upper, lower, inner, and outer sides of the residual capacity of surgical field to guide postoperative radiotherapy. Wet gauze was applied to protect the chest wound.

Abdominal handling

The skin and subcutaneous tissue were cut open along the pre-designed line till the sarcolemmal surface. The flap was lifted inwards from the surfaces of abdominal external oblique muscle and rectus abdominis muscle. After the peripheral vascular fibers of the perforator vessels were bluntly separated, the small vascular branches were ligated till the inferior epigastric vessels. The rectus abdominis was not transected, and the nerve integrity of the rectus abdominis fibers and the entered muscles was maintained. The inferior epigastric vessels were dissected till the inguinal ligament and the vessels were sutured and the DIEP flap was isolated. The trunks of inferior epigastric artery and vein were separately isolated as vascular pedicles. The operating bed was adjusted so that the patient was in a semi-sitting position. The upper and lower cut edges of the abdominal wound were fixed in the best position for reconstructing the umbilicus with a towel clamp. The drainage tube was placed before the umbilical cord was sutured.

DIEP flap breast reconstruction

The DIEP flap was transplanted into the recipient area in

thoracic region. The scope of flap epidermis removal was determined according to the conditions of the recipient area. After the breast was re-shaped and the wound was covered, the inferior epigastric artery and vein were anastomosed end-to-end with the thoracodorsal artery and vein, respectively. The chest wound was sutured after the flap had good blood supply. The donor area in the abdomen was closed, during which tension-free suturing was performed on the sheath of rectus abdominis. Dissection beneath the upper edge of the incision at the donor area was performed till the xiphoid and costal margins to reduce tension on incision closures. Finally, the abdominal incision was sutured layer by layer.

Results

The surgeries were smooth in all 29 patients. The operative time was 3–5 hours, and the average intra-operative blood loss was 100–300 mL. In 27 patients, the flaps survived after surgery and primary healing was achieved at the wounds. The remaining two cases presented with venous vascular crisis within 24 h after the surgery, and the flaps survived after active rescue. The patients were followed up for 4 months to 3 years. Neither complication such as local tumor recurrence, incision infection, flap necrosis, or upper limb lymphedema in the surgical area nor complication such as abdominal wall bulging, abdominal wall hernia, or fat liquefaction of incision in the donor area was reported. The shape of the reconstructed breasts was natural and satisfactory.

Discussion

Preoperative assessment of abdominal flap to be isolated

Patients are interviewed one day before surgery to learn their coagulation status, history of smoking, and history of abdominal surgery. It has been reported that (7,8) the incidences of breast skin necrosis, abdominal skin necrosis, and abdominal wall hernia remarkably increase in smokers (7,8). Therefore, patients should be advised to quit smoking completely. In addition, the patients' general health status and local vascularity in the abdominal wall should be thoroughly investigated. For patients with hypertension, diabetes, and/or obesity, blood pressure, blood glucose, and body weight should be well controlled to prevent postoperative thrombosis and wound dehiscence (9,10). It is also important to check: Is the abdominal wall thin

and weak? Is there any abdominal wall hernia? Is there a sufficient number of abdominal tissues to ensure the primary healing of the donor area? The patient is asked to take a flexion position, and the tension between the upper and lower abdominal incisions is estimated. Patients who have undergone previous abdominal surgery may have injured inferior epigastric vessels, perforator vessels, and/or microvascular network. For these patients, ultrasound, CT angiography (CTA), or MR angiography (MRA) is performed pre-operatively to evaluate blood vessels in the donor area, so as to ensure blood supply to the flaps.

Preparation of instruments and items

The instruments and items used in the surgery include radical mastectomy instrument kit, flap-harvesting instrument kit, vascular anastomosis instrument, pulling hook with a cold light source, titanium clip and titanium clamp for marking tumor bed, two electric knives with a straw, two sets of aspirator, marker pen, measuring rule, prolene sutures (0/8 or 0/9), methylene blue, heparin and saline, warm (40–42 °C) sterile distilled water, microscope, Doppler ultrasound machine, etc.

Strict implementation of cancer-free technique

The surgical incision is large and the operation is complex. It involves two disciplines: tumor resection and plastic repair. The concepts of “cancer-free technique” and “aseptic technique” are equally important during the surgery. It is recommended that the thoracic surgery (i.e., mastectomy) and abdominal surgery (i.e., DIEP flap harvesting) are performed by two different groups of surgeons and nurses. Materials and dressing devices used in the thoracic and abdominal surgeries should be placed strictly apart from each other and cannot be confused. If there is only one group of surgical personnel, the resection site should be thoroughly rinsed with sterile distilled water after the mammary tumor is removed and then protected with a distilled water-moistened gauze. After all instruments are removed, all the medical staff should change their gowns and sterile gloves. A new set of flap-harvesting instruments are used in the abdominal surgery. After the operator removes the tumor, the nurse should immediately hand over a bending plate to catch the tumor. The specimen should be carefully protected. Dressings and instruments that have touched the specimen cannot be reused.

Cooperation during the design and harvesting of DIEP flaps

A reasonable flap design before surgery can guarantee the blood supply of the flap and achieve better bilateral breast symmetry. The base width and height of the breast are measured with a measuring tape, and the size of the abdominal flap is decided according to the breast volume and the factors affecting postoperative flap survival. The patient is asked to take a standing position. The navel is marked first, followed by the marking of the ipsilateral inframammary fold line, which is typically 1 to 2 cm higher than the contralateral inframammary fold line, so as to offset the downward movement of the line caused by the pulling and suturing of the abdominal incision during the operation. The abdominal flap is designed as spindle-shaped or ellipse, with the upper boundary at the level of the umbilicus and the lower boundary depending on the degree of skin relaxation. To reconstruct the breast volume as much as possible and to ensure that the donor area can be closed smoothly, both ends of the flap reaches the anterior axillary lines. In our series, according to the weights of the excised breast lumps and the estimated volume, the flap sizes ranged from 11 cm × 26 cm to 14 cm × 35 cm. After the skin flap is harvested, it is in a status of ischemia shortly. The scrub nurse should protect the flap carefully and irrigate it with heparin saline to avoid thrombosis; then, the flap is wrapped with a saline-moistened gauze for further use. The circulating nurse set the room temperature at 22–24 °C, paying attention to keeping the patient warm and preventing vasoconstriction caused by hypothermia. During the suturing of the donor site incision, 0/2 absorbable sutures or retention sutures are used for tension-free fascial suturing to prevent postoperative abdominal bulging or abdominal wall hernias (11).

Cooperation during DIEP flap breast reconstruction

DIEP flap breast reconstruction involves important and delicate tissues such as blood vessels and nerves. The scrub nurse must have solid knowledge of the anatomy of the peripheral nerves and blood vessels in the donor area and the blood vessels in the recipient area. During the end-to-end anastomosis of the deep inferior epigastric vessels with the intramammary vessels, the nurse should promptly provide 0/8 or 0/9 prolene sutures and vascular anastomosis devices. Any collision with the operator's hands should be avoided and all the operations should be gentle. The microscopic instruments are extremely sophisticated, and

any slight malocclusion will affect their intraoperative use. Therefore, the scrub nurse must manage and protect the microscopic instruments carefully and handle them with care. The integrity of the instruments should be checked in advance to avoid any delay during the surgery. Prolonged anastomosis time can cause endocardial injury and thrombosis, leading to surgical failure (12). Upon the completion of the anastomosis, the pulsation of the perforator, the color of the surface skin of the flap, and the filling time of the capillaries should be checked. If necessary, a Doppler ultrasound probe can be used on the table to observe the reperfusion in the recipient area and determine the re-establishment of circulation to the flap. Topical 2% lidocaine spray is applied to prevent vasoconstriction. The incision is protected with warm saline-moistened gauze at any time.

Adjustment of intraoperative surgical position

Typically, the patient position needs to be adjusted during the surgery to check the immediate effectiveness of breast reconstruction and to facilitate the tension-reduced suturing of abdominal wound. Therefore, an electric multi-functional operating bed is recommended. The circulating nurse should make corresponding preparations before surgery. She should check the functions of the operating bed, properly position the patient, closely observe each step of the operation, and adjust the patient's position according to the surgical requirements. During a modified radical mastectomy for breast cancer, the patient is placed in a supine position with the upper extremity of the affected side abducted by 90°. The ipsilateral shoulder is raised with a soft pillow to fully expose the armpit. The sacrococcygeal part is placed in the foldable position of the electric operating bed. Soft cushions are placed under the knee joints. During breast reconstruction, the operating bed is adjusted to place the patient in a semi-supine position so that good symmetry with the healthy breast can be obtained. During the suturing of the abdominal wound after the flap is harvested, the operating bed should be adjusted to 45° flexion in both hips to relieve abdominal tension and facilitate suturing. Body position should be adjusted in a cautious manner. It is advisable to press the electric button slowly and cooperate with the anesthesiologist closely, so as to prevent any accident. During the operation, a compression cushion can be applied to protect the skin of the sacrococcygeal region and thus prevent pressure ulcers.

Observation of flap vascular crisis after operation

The surgery is performed by transplanting patients' an intact autologous tissue to remodel the ipsilateral breast. The flap necrosis caused by vascular crisis is one of the most serious postoperative complications, mainly due to technical problems during microvascular anastomosis (13). The incidence of venous crisis is higher than that of arterial crisis. The peak time for venous crisis is 24 to 72 hours after surgery, and arterial crisis generally occurs earlier. After a surgery, the specialist nurses should closely monitor the blood flow of the flap, including skin color, temperature, capillary filling time, and swelling and bleeding around the flap. If the flap is dark purple in color and becomes swollen within 72 hours after surgery, a venous crisis can be considered, which may be caused by mechanical obstruction mechanisms such as anastomotic thrombosis, vascular pedicle angulation, and mechanical compression. If the skin flap is pale in color, shows no capillary filling, and reveals no vascular pulsation on Doppler ultrasound, an arterial crisis can be considered, which may be due to embolism caused by the destruction and tearing of the endovascular membrane during arterial anastomosis. If the temperature of the flap is 2 °C lower than that of the corresponding healthy side, the flap has poor blood supply and therefore is difficult to survive. In the event of the above-mentioned crisis, the doctor shall be notified in a timely manner for appropriate treatment.

While breast cancer patients may not have obvious manifestations of the disease after a surgery, they do continue to have certain problems such as physical problems (pain and fatigue) and mental problems (fear of relapse and inability to cope with the disease) that often require long-term education, awareness-raising, and psychological support. Breast reconstruction offers the breast cancer patients a positive incentive and can improve their QOL. Immediate breast reconstruction with a DIEP flap after breast tumor removal has been widely accepted (14) since it can provide good breast appearance, good symmetry, and satisfactory control of complications (15).

Since DIEP flap breast reconstruction is a newly introduced technique, there is no standardized procedure for surgical nursing cooperation. To better cooperate with the operation, we should strengthen the management on perioperative nursing. Before the surgery, the nurses should carefully assess the patient's disease condition, communicate well with the operator, fully understand and be familiar with the surgical procedure and its special requirements, and

formulate the surgical cooperation plan. During the surgery, the nurses should pay close attention to the surgical process; they should actively cooperate with the operator according to the skills and habits of operator and be ready to assist for every next step, so as to effectively shorten the operative time. Notably, cancer-free technique should be strictly implemented by the nurses during the operation, along with their supervision of the operator's implementation of the cancer-free technique, so as effectively avoid local recurrence after surgery. After the operation, complications associated with vascular crisis of the free flap grafts should be closely monitored and actively treated. To sum up, symptomatic perioperative care plays a pivotal role in the success of the surgery.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: This study was approved by the Medical Ethics Committee of Sun Yat-sen University (approval No.: SYSEC-KY-KS-2018-048).

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