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Care of Patients With Deep Inferior Epigastric Perforator Reconstruction

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Recent trends reflect greater numbers of women opting for mastectomy for invasive breast cancer. Breast reconstruction, either at the time of mastectomy or later, is increasingly an option patients prefer. Although many women opt for implants, reconstruction using autologous tissue offers several advantages including tissue that feels more natural and will age naturally with the patient. The deep inferior epigastric perforator flap has emerged as an alternative to the transverse rectus abdominis myocutaneous flap and allows for preservation of the underlying abdominal muscle. As greater numbers of surgeons are able to offer this microvascular alternative, nurses will care for these postoperative patients in the intensive care unit and medical/surgical settings. This article reviews the evaluation of patients for deep inferior epigastric perforator reconstruction and the unique complexities of postoperative nursing care for these patients.

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The American Cancer Society estimates that 226,870 women were diagnosed with invasive breast cancer in 2012 (American Cancer Society, 2012; Siegel, Naishadham, & Jemal, 2012). Most women with breast cancer will have surgical procedures, often combined with other treatments such as radiation, chemotherapy, and hormone therapy. Decisions regarding breast cancer treatment are made by the patient and physician after consideration of the number, size, stage, and biological characteristics of the cancer, the patient's age, health status, preferences, and the risks and benefits associated with each treatment option. Surgical options often include a choice between breast-conserving surgery (lumpectomy) and mastectomy, with or without reconstruction. In 2010, more than 80,000 women opted for mastectomy (Jemal, Siegel, Xu, & Ward, 2010).

Increasingly, women are choosing breast reconstruction, either at the time of mastectomy or later. In 2011, there were 96,277 breast reconstruction procedures, an increase of 3% over 2010, and an increase of 22% since 2000 (American Society of Plastic Surgeons, 2012). Gene testing for breast cancer susceptibility genes (BRCA1 or BRCA2) mutations has also contributed to increasing rates and acceptance of prophylactic mastectomies, often with immediate reconstruction (Habermann et al., 2010). One of the goals of breast reconstruction is the restoration of a natural looking breast. While breast implants remain the choice for many patients, breast reconstruction using autologous tissue has become increasingly popular, creating a more natural and realistic result than reconstruction with silicone or saline-filled implants (Damen et al., 2011; Stermer, 2010).

DEEP INFERIOR EPIGASTRIC PERFORATOR FLAP

The transverse rectus abdominis myocutaneous (TRAM) flap was popularized in the United States during the 1980s for breast reconstruction after mastectomy, using the rectus abdominus muscle, lower abdominal skin, and fatty tissue. This tissue by definition is not foreign and therefore does not risk foreign-body reaction, rejection, or capsular contracture. A majority of patients who develop breast cancer are at an age when they may have developed excess skin and abdominal fat and mature ptotic breasts (Albornoz et al., 2012). Because fat tissue from the abdomen and breast have a similar density and consistency, using abdominal fat creates a breast that looks and feels natural in terms of volume and texture (Damen et al., 2011). An added benefit of the abdominal donor site is an improved abdominal contour that approximates an abdominoplasty or "tummy tuck."

Although the TRAM flap continues to be the most frequent flap procedure, the deep inferior epigastric perforator (DIEP) flap developed in the 1990s has evolved as an alternative. Microsurgical flap procedures accounted for only 5.5% of breast reconstructions in 2008 (Albornoz et al., 2012); however, their proportion of reconstruction is expected to increase because of positive outcomes, greater patient awareness of reconstructive options, and increased numbers of surgeons skilled in microvascular flap procedures (Matros et al., 2010). The *European Journal of Plastic Surgery* recently described "an international drive toward the use of DIEP flaps for breast reconstruction as the ideal tissue with minimal donor site morbidity" (Adamthwaite, Wilson, James, Searle, & Harris, 2012).

An advantage of DIEP reconstruction over TRAM flap is preservation of the underlying abdominal muscle. This is accomplished by separating blood vessels supplying the skin and fat of the DIEP flap from muscle using microsurgical techniques. Once transferred to the chest, tiny blood vessels of the DIEP flap are connected to blood vessels at the mastectomy site using an operating room microscope. After blood vessels of the flap are connected, the skin and fat of the DIEP flap are shaped into a new breast. Whenever possible, efforts are made to restore sensation by reattaching nerves (neurotization); although postoperative breast sensation is variable, innervation is often attempted by attaching a sensory nerve in the DIEP flap to a sensory nerve at the mastectomy site (Shridharani et al., 2010).

It has been said that mastectomy treats the disease and reconstruction heals the mind (Braddock, Kercher, Edney, & Clark, 2010). While treating the disease is the first priority, planning a mastectomy is often less distressing when the surgery involves immediate reconstruction.

EVALUATING PATIENTS FOR DIEP RECONSTRUCTION

When considering breast reconstruction, a consult with a plastic surgeon is the first step. Following a medical history and physical examination, pros and cons of various reconstructive options can be considered. Among factors in determining whether a patient is an appropriate candidate for DIEP are the patient's preference for breast size and the quantity and quality of abdominal skin and fat. Patients with low body fat may not be adequate autologous donors. Scars from prior abdominal surgery need to be evaluated, but a low abdominal incision from a cesarean section will not exclude a patient from DIEP reconstruction. With technical advances, microvascular reconstruction is being offered to patients with more complexities, such as obese patients, older patients, and those with previous scars (Massey et al., 2009). A midline scar, however, is often a contraindication as the rate of complications is significantly higher when tissue across a midline scar is included in a DIEP flap (Henry, Chang, Misra, Huang, & Cheng, 2011).

An additional consideration is whether a bilateral or unilateral reconstruction is planned. Although implant reconstruction is more frequent following bilateral mastectomy, autologous tissue is also a choice for unilateral reconstruction, in part because it often achieves better symmetry with the remaining breast. Timing is also a factor, with autologous tissues more likely to be used in delayed rather than immediate reconstructive procedures (Albornoz et al., 2012).

Patients who have had chest wall radiation are generally advised to wait 4–6 months after completing radiation before DIEP surgery. Although radiation does not hinder the overall success of reconstruction, there are technical implications for surgeons working on a previously irradiated area (Fosnot et al., 2011; Spear, Ducic, Low, & Cuoco, 2005). Some surgeons continue to recommend a TRAM flap for smokers, as smokers are at significantly higher risk for mastectomy skin flap necrosis, abdominal flap necrosis, and abdominal hernia than are nonsmokers. Smoking-related complications can be significantly reduced when the patient stops smoking at least 4 weeks before surgery and commits to abstaining from smoking and avoiding second-hand smoke for at least 4 weeks postoperation to optimize vascular perfusion (Chang, 2012). Other patient history factors such as diabetes,

autoimmune diseases, or a history of clotting issues require careful consideration.

In addition to the medical history and physical examination, an assessment of the epigastric perforators is performed via CT scan as part of the preoperative evaluation (Rosson et al., 2011). The anatomy of the anterior abdominal wall is highly variable, so identification of the number, caliber, and location of the perforators is critical for surgical planning to reduce operating time (Schaverien, Ludman, Neil-Dwyer, & McCulley, 2011). The design of the flap is marked preoperatively with the patient standing. The inframammary folds are marked, and the abdominal flap is marked at or above the umbilicus with the lower marking just above the pubis following the natural skin fold. The design of the flap is tapered to the anterior superior iliac spine to minimize the development of a "dog ear" at the donor site closure (Chang, 2012).

POSTOPERATIVE CARE FOLLOWING DIEP RECONSTRUCTION

The length of surgery is typically 6–8 hr for a unilateral DIEP and 10–12 hr for a bilateral DIEP, involving both the breast surgeon's team and a plastics team with microvascular expertise. Patients often remain in the post anesthesia/recovery room for several hours of careful monitoring of the circulatory status to the flaps, and their initial care may be in the intensive care unit or other specialized care unit due to the intensity of postoperative monitoring.

To optimize vascular circulation, patients are usually kept in an environment with the temperature higher than 75° for the first 48 hr. If a heated room is not available, warm blankets may be used (Stermer, 2010). The blood supply of microvascular free flaps is critical in the first postoperative days; timely recognition of a complication is essential for survival of the flap (Rahmanina-Schwarz, Rothenberger, Amr, Jamit, & Schaller, 2011; Tindholdt, Saidian, Pripp, & Tonseth, 2011). Postoperative complications of greatest concern include total flap necrosis, partial flap necrosis, fat necrosis, and venous congestion. Total flap loss is defined as complete necrosis of the skin and fat and is usually caused by compromised circulation at the anastomosis. Partial flap necrosis is defined as loss of a portion or segment of the cutaneous and fat components because of insufficient circulation distal to the anastomosis. A retrospective review of flap failures from 1999 to 2008 by Rao, Parikr, Goldstein, and Nahabedian (2010) revealed that flap failure is more common in bilateral than unilateral reconstructions, with the rate of flap failure estimated to be between 2% and 3.5%. In 2007, Hofer, Damen, Mreau, Rakhorst and Roche (2007) published a similar retrospective review of DIEP reconstructions done between 2002 and 2006, revealing a total flap failure rate of 1% but noting the need for microsurgical revision in 4%. Similarly, in 2010, Fabre, Vandevoort, and Vranchx (2010) published a retrospective analysis in which DIEP had a lower flap failure rate (0.86%) than other flap techniques.

In the initial postoperative period, circulatory assessment of the flaps is done every 15 min to confirm perfusion status. This monitoring involves noninvasive tissue perfusion and oximetry assessment, most often with either Doppler or ViOptix Tissue Oximeter (ViOptix Inc., Fremont, CA), which can detect decreased blood flow and tissue oxygenation changes before flap color changes occur (Keller, 2007). Any decrease in blood flow could lead to loss of a free flap, devastating to both the patient and the surgeon, so it is essential that the surgeon is notified immediately with any signs of decreased perfusion (Stermer, 2010). In a 2007 review of flap viability, Keller cited 4 studies revealing salvage rates for anastomotic thrombosis at over 50%, and directly related to the amount of time elapsed from compromised circulation to the correction, highlighting the paramount importance of tissue oximetry assessment during the postoperative period. After the first 2 postoperative hours, the frequency of Doppler monitoring continues on an hourly basis for the first 24 to 72 hr, at the discretion of the surgical team. In addition to data from oximetry, the breast flap should be assessed for color, warmth, and capillary refill, and the incision should be assessed for drainage and wound edge approximation. Darkened discoloration of the flap may indicate venous outflow obstruction. Palor or mottling may indicate decreased arterial blood flow. Petechiae may reflect poor venous return, while bruising is probably normal (Dell, 2011). Supplemental oxygen at levels of 2–6 L via nasal cannula is usually recommended from the day of surgery until 48 hr postoperation, with frequent monitoring of oxygen saturation levels.

Initially postoperative DIEP patients should take nothing by mouth until the most immediate concern for the need to return to the operating room has past and tissue oximetry is stable. Maintaining adequate intravenous hydration is important, especially since insensible losses may be increased in the heated room.

Strict bed rest is maintained during the postanesthesia period, with the head of the bed elevated 45° and the knees flexed at 45°. This positioning allows for optimal circulation to the flap and is often referred to as the "beach chair position." If patients complain of back discomfort, they can be gently turned to the side with a pillow for back support. On the first postoperative day, the patient

should be gently assisted out of bed to a chair with legs elevated. A Foley catheter will remain until the patient is ambulating to the bathroom, usually on the second postoperative day.

Sequential compression devices and compression stockings are usually recommended to reduce the risk of deep vein thrombosis and pulmonary embolism until patients are ambulating several times a day. In addition, subcutaneous low dose or low-molecular-weight heparin is often prescribed during hospitalization, and it is important to avoid abdominal injection. Most patients will also be prescribed aspirin as an anticoagulant postoperatively for 30 days. As patients increase out-of-bed mobility, they are encouraged to continue ambulation as a baseline level of exercise to maximize circulation.

Following breast reconstruction, patients will have several Jackson-Pratt (JP) drains in place, usually at least one on each side of the abdominal site and one on each side of the chest wall. Depending on the size of the patient and preference of the surgeon, the patient may have multiple drains on each side, and in the case of bilateral surgery, patients may have six or more JP drains. It is essential that the drains be labeled and output be monitored recorded. As soon as the drains are practical during the postoperative period, the patient should become familiar with the position and care of the drains. All patients will be discharged with JP drains and expected to care for them at home. Early teaching will assist patients transitioning to self-care. Depending on drain placement, which may be in the lateral chest, caregivers should also become familiar with drain care to assist the patient.

Milking or stripping the JP tubing is essential to maintaining proper suction and to prevent clots or obstructions from forming in the tubing. This manipulation may briefly be uncomfortable for patients, in which case it is advisable to schedule pain medication within the hour before milking and emptying drains. In addition, patients with multiple drains may have difficulty securing and handling all the drains. Tape tabs attached to drains will make it easier to pin them to garments. For patients who express concern regarding visitors seeing the drains, especially children who might be disturbed by the site of blood, small socks can be used to cover the JP bulbs making them less obvious. A cloth barrier over the drains will also eliminate the uncomfortable sensation of plastic rubbing on the skin.

Pain management is essential to recovery, and most patients will require narcotic analgesic for pain management, often via a patient-controlled analgesia pump during the initial postoperative course. As patients transition to oral pain management, it is important to maintain consistent dosing as activity is increased. Abdominal, chest area, and back pain related to surgical wounds and drains can interfere with adequate lung expansion, so maintaining adequate pain control and promoting pulmonary hygiene are important to preventing atelectasis, bronchiectasis, and pneumonia. The use of an inspirative spironmeter or triflo to promote effective breathing and instruction in abdominal splinting will assist patients as they adjust to their incisions. With the use of narcotics, patients should also be receiving stool softeners and teaching to prevent narcotic-induced constipation.

Following DIEP reconstruction, patients may be advised to avoid caffeine and chocolate for 30 days, as both can impact vasoconstriction. If a caffeine restriction is ordered, decaffeinated coffee and tea should also be avoided as both contain measurable amounts of caffeine. Tea labeled "caffeine free" provides an option. In addition, smoking and exposure to second-hand smoke must be avoided as nicotine is a potent vasoconstrictor and can decrease blood flow to the flap.

For the first several weeks after DIEP surgery, tightness and pain at the abdominal incision can make it difficult to stand up straight. Although patients are advised to lean slightly forward when they first get out of bed, consistently bending forward with protective posturing—head tilted forward, shoulders hunched, and elbows bent—can become a difficult habit to break. Pain, drains, and discomfort from surgery can cause patients to limit the range of motion in the trunk and shoulders. As mobility resumes, it is important to encourage patients to keep their heads up and shoulders back as much as possible.

Although the DIEP does not disrupt the rectus muscles in the abdomen to the extent that the TRAM flap does, the transverse abdominis muscle—a broad, deep muscle that encircles the abdomen and back like a girdle—does become more relied upon. This core muscle is involved in movement essential to daily tasks such as standing, walking, bending, lifting, twisting, and reaching. For patients who demonstrate difficulty regaining independent mobility, a physical therapy referral may be beneficial.

PREPARING FOR DISCHARGE

For patients going home with JP drains, a referral for home care nursing is recommended. It is important for patients to keep a written log of JP drain output. Drains usually remain in place for 1–2 weeks and are removed at the discretion of the surgeon when output diminishes below a targeted level, usually less than 30 ml per 24 hr (Stermer, 2010).

Patients should be advised not to lift anything weighing greater than 5 pounds, not to raise their arms above their head or begin stretching exercises until cleared to do so by their surgeons. Most patients are advised not to resume abdominal exercises until 8 weeks. The tight closure of the abdomen may be associated with an ongoing "tight feeling" for several months. Patients require 6 weeks to 2 months to regain their energy level and resume normal activities (Stermer, 2010).

Most patients will not be able to wear bras until JP drains are removed, and then at the discretion of the surgeon they may transition to a sports bra and later to a supportive bra that does not have underwire. It is important to remind patients that it may take up to 8 weeks for bruising and swelling to the new breast tissue to resolve. The level of sensation that returns to the breast is highly individualized, occurring over several months. Studies show that breast sensation is variable and may return gradually; innervated flaps have a greater magnitude of recovery at an earlier stage compared with noninnervated flaps, but overall sensation to DIEP flaps is better than TRAM flaps (Shridharani et al., 2010).

COMPLICATIONS AND FOLLOW-UP

Because of the extensive surgery involved with DIEP, there are a variety of complications that can occur, although major complications are uncommon (Chun, Sinha, Turko, Lipsitz, & Pribaz, 2010). When concern for the viability of flap survival is detected early, reoperation may be necessary to save the flap and is successful more than 50% of the time (Keller, 2007). Additional complications may include areas of wound dehiscence, hematoma, and donor site seroma. Recent studies evaluating skin flap necrosis and wound healing delays revealed perioperative smoking history to be a contributing factor in approximately 40% of cases (Patel, Hill, Gatti, & Nahabedian, 2012). Where topical treatments were needed, moisturizing gels, wet-to-dry dressings, and antibiotic ointment were most often used. Later complications include abdominal wall bulge and fat necrosis (Venkat, Lee, Rad, Manahan, & Rosson, 2012). In addition to teaching regarding JP drain care, assessment of surgical incisions by home care nurses can assist patients to identify abnormalities in postoperative healing and recovery.

Patients usually have a follow-up appointment with the plastic surgeon 7–10 days after surgery for removal of drains. It is important for patients to understand that the reconstructive pathway may involve additional surgery related to nipple reconstruction or revision and the possible need for contour refinements or scar revision (Scott-Conner, 2010). Equally important, emotional support after breast reconstruction is essential. Knowledgeable and compassionate nursing care can be an important component in recovery, with the expectation that women will have varied reactions to their physically reconstructed breast and evolving emotions regarding their sexuality and breast cancer (Dell, 2011).

Advantages to Immediate Reconstruction

Financial. It costs less to have the mastectomy and reconstruction in the same surgery than to have two separate surgeries.

Emotional/Psychological. Immediate reconstruction eliminates two sources of distress-–a second surgery later, and the experience of waking from the first surgery with no breast.

Personal. Some women who would be candidates for lumpectomy with radiation therapy choose instead to have mastectomy with immediate reconstruction in order to avoid radiation.

Cosmetic. In some cases, immediate reconstruction provides a better cosmetic result. (Braddock et al., 2010)

Advantages of DIEP Reconstruction

Natural look and feel of breast tissue
Reconstructed breasts that will age and change naturally with the body
Recontoured abdomen, similar to a tummy tuck
Preservation of the abdominal muscle
Less chance of abdominal wall hernia formation
Possible return of some sensation, often more than TRAM flap

Disadvantages of DIEP Reconstruction

Fewer surgeons skilled in this procedure
Longer anesthesia and surgery
More costly due to highly technical aspects

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