International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 8; Issue 05 (F); May 2019; Page No.18872-18878
DOI: http://dx.doi.org/10.24327/ijcar.2019.18878.3618

Review Article

THE VERSATILITY OF DEEP INFERIOR EPIGASTRIC ARTERY BASED RECTUS ABDOMINIS FLAP IN COVERING VARIOUS DEFECTS: A STUDY IN A TERTIARY HOSPITAL OF EASTERN INDIA

Dr.Purbarun Chakrabarti[1] and Dr. Dipankar Mukherjee[2*]

[1]Department of Surgery, Midnapore Medical College, Pashchim Midnapore
[2]Department of Plastic and Reconstructive Surgery, NRS Medical College, Kolkata

A R T I C L E I N F O

Article History:
Received 06th February, 2019
Received in revised form 14th March, 2019
Accepted 23rd April, 2019
Published online 28th May, 2019

Key words:

Transverse Rectus Abdominis Musculocutaneous (TRAM) Flap, Deep Inferior Epigastric Artery (DIEA), Free Myocutaneous Flap, Perforator Flap

A B S T R A C T

Objective: Deep inferior epigastric vascular system supplies a wide area of the anterior abdominal wall and offers a versatile variety of tissue combinations for local or free flap transfer. We conducted this study to analyse its utility.
Method: We conducted a review of all patients who underwent a reconstruction using the DIE based RAM flap between May 2017 and April 2018 in our institution. Indications for the flap, complication rates and outcomes and donor site morbidity were all observed.
Results: We conducted 12 DIEP based RAM flap procedures. Face (25%) and Perineum (25%) were the main recipient areas, followed by hip, theigh, leg, ankle and lower back (8.6%). Primary closure without prolene mesh was done for donor site management in 41.6% cases and the rest of 58.4% cases required closure with prolene mesh reinforcement. Of the 12 cases there was no cases of complete flap necrosis, five(41.6%) flaps had complete survival, four(33.3%) flaps underwent partial necrosis and in three(25%) cases there is partial loss of STSG. Among the donor sites in the twelve cases eight(66.6%) had no complications, remaining four(33.3%) cases one each had complications like wound dehiscence, discharge, ulceration and pain. There is no significant statistical association between complications and types of flap used.
Conclusions: This flap is versatile it provides cutaneous cover that can be used anywhere. It can be used as a pedicled flap for perineal, inguinal, upper thigh regions and as a free flap, resurfacing anywhere from head to foot including the sole. It is versatile in the orientation and low donor site morbidity.

INTRODUCTION

The rectus abdominis muscle (RAM) flap and its various modifications are some of the most popular flaps used in reconstructive surgery. Rectus abdominis flaps, whose blood supply is mainly provided by superior and deep inferior epigastric vessels, are suitable not only for local transfer but also as free flaps. Based on abundant anastomoses of deep inferior epigastric vessels with other vessels such as superior epigastric vessels, lower intercostal vessels, subcostal vessels, lumbar vessels, superficial epigastric vessels, and superficial and deep circumflex iliac vessels, the rectus abdominis flap may be designed as a vertical flap, transverse flap, or an oblique flap. The RAM flap was first described by Holmstron in 1979 who based the flap on its inferior pedicle, the deep inferior epigastric artery (DIEA). The rectus abdominis muscle based on its inferior pedicle provides a reliable flap for defects of the anterior pelvis and groin (Logan and Mathes, 1984)[3] . The RAM flap gained popularity with the work of Hartrampf[1], with its utilization as a pedicled flap based on its superior pedicle, the superior epigastric artery, in breast reconstructions. The perfusion of the transverse lower abdominal flap was first described by Scheflan and Dinner on the unipedicle transverse rectus abdominis musculocutaneous (TRAM) flap. These authors divided the lower abdominal ellipse into four equal parts and named them with numbers according to their clinical impression of perfusion. However, the zoning system became known after Hartrampf's paper on the TRAM flap for breast reconstruction and took his name (Hartrampf zone of perfusion).[1] After the first report of the successful transposition of avertical rectus abdominis myocutaneous flap for abdominal wall reconstruction [4], it has become accepted as workhorse flap in defect coverage of the trunk and the proximal thigh [11, 13]. With the objective of reducing the sequelae resulting from harvesting it from the abdominal wall, Koshima in 1989[6] proposed its use with complete preservation of the rectus muscle and its innervation, a flap which is now termed the deep inferior epigastric artery perforator (DIEP) flap. Currently, the DIEP is considered the gold standard in breast reconstructions in which large flaps are required. The rectus abdominis flap, based on the deep inferior epigastric artery, is a composite flap and comprises muscle, overlying fascia and skin. It is versatile and provides a large

******Corresponding author:* **Dr. Dipankar Mukherjee**
Department of Plastic and Reconstructive Surgery, NRS Medical College, Kolkata

volume of soft tissue and is technically straightforward to raise. Many variations based on the inferior epigastric artery, including perforator flaps, have been described. Mathes & Bostwick (1977)[4] surgically manipulated the rectus abdominis myocutaneous flap to repair defects in the anterior abdominal wall. Subsequently this flap was used in breast reconstruction (Hartrampf *et al*. 1982)[1], as a donor for free-tissue transfer(Pennington)[2] and to repair defects in the groin (Logan & Mathes, 1984; Ramasastry *et al*. 1989)[3,5]. A thorough knowledge of the anatomy of the abdominal wall can aid in harvesting different combinations of tissues, based on different sources of blood supply, while producing reliable reconstructions with minimal chances of hernia formation and aesthetically displeasing results at the donor site.

MATERIALS AND METHODS

Study Area- Department of Plastic Surgery, Medical College and Hospital, Kolkata.

Study Population- Patients attending at Plastic Surgery OPD/ ER and admitted to Plastic Surgery Department of MCH and referred cases from other specialities of General Surgery, Oncosurgery and ENT. Informed consent of the patients were taken in all cases.

Inclusion Criteria: All patients requiring deep inferior epigastric artery based rectus abdominis muscle flap and its various modifications for covering defects, attending to Plastic Surgery Department, Medical College, Kolkata.

Exclusion Criteria: Those patients having peripheral vascular diseases, uncontrolled diabetes, gross obesity and older than 70 years of age, and patients with history of lower abdominal surgery and irradiation will be excluded.

Study Period- May 2017 to April 2018.

Sample Size - Total number of patients with soft tissue defects during the study period - 12 cases.

Sample Design- Study population were chosen from all the patients attending plastic surgery out-patient department with the diagnosis of requiring soft tissue reconstruction using RAM flap. History taking and clinical examinations were carried out to confirm the diagnosis clinically and to get ascertain the applicability of inclusion and exclusion criteria in the patient before allocating the patient in the study population. Patients of the study population were investigated optimally and pre anesthetics fitness were judged. The whole of the surgical procedure including advantages and disadvantages of this reconstructive procedure were explained to the patients.

Study Design- Descriptive (observational) type of study, institution based prospective study.

Study Tools

a. Patients' informed consent.
b. Proforma for relevant history and clinical examination of the primary defect for which the procedure of reconstruction was performed.
c. Doppler ultrasound probe (hand-held) was used to locate the perforators, markers, tapes to design the flap pre and intra operatively, microsurgical instruments and loupes for magnification during dissection.
d. Predetermined proforma for tabulation of data.

Technique of Flap Harvest

Template of the defect taken with the help of lint-piece and planned in reversed to mark the donor site within the previously marked area. The RAM flap is harvested as suitable as a pure muscle flap, or a myocuteneous flap. In the DIEP flap dissection, the perforator vessel is dissected from the rectus muscle fibres through a longitudinal direction split. This dissection extends up to the lateral margin of the RAM. After the medial and lateral aspect of the anterior rectus sheath is completely exposed, the anterior fascia is incised on its medial and lateral aspect to expose the underlying rectus muscle. The lateral aspect is easily determined by the location of the largest perforator previously identified.

However, the medial aspect is calculated in order to preserve the maximum extension of the fascia to perform an adequate and tension-free abdominal wall closure. Normally, the medial incision is situated 1.5–3 cm from the medial aspect of the rectus muscle. The muscle can then be starting from these perforators, thereby sparing an amount of fascia that will simplify closure of the abdominal wall. The rectus muscle is undermined from its posterior sheath by blunt dissection in this loose areolar tissue plane. At the tendon's intersection, the muscle adheres to the anterior aponeurosis, so dissection becomes more difficult. Once the muscle is isolated, it is sectioned, carefully isolating and ligating the DIEA. Usually, when performing a pedicled rectus muscle or myocutaneous flap based on the superior epigastric vessels and there is no plan to supercharge the deep inferior epigastric vessels, the DIEA is located at the lateral edge of rectus sheath and divided. When additional blood flow is required or needed and the surgeon plans to augment blood inflow or venous outflow through supercharging either the artery or the vein, the DIEA and DIEV can be dissected to the level of the inguinal ligament and divided. This approach permits an increase of 3–6 cm in pedicle length and the DIE vessels can serve as an optional source of flap vascularization if an additional anastomosis is performed between the divided DIE vessels and the recipient site. From this point on, the flap is elevated and any remaining adhesions are cut. A tunnel in the subcutaneous plane is utilized to transfer the flap to the thorax. At the beginning of flap dissection, the umbilicus is circumscribed as a circle. Usually, the skin is incised down to the rectus abdominis muscle fascia in order to perform complete isolation of the umbilicus. After donor site closure and inferior traction of the superior abdominal flap, the new point of the umbilicus is calculated. For this purpose, a vertical incision passing through this point and equal in length to that of the original umbilicus is performed. The skin is incised and small ellipses of fullthickness skin and fat of the superior abdominal flap are resected on either side of the vertical line to recreate the gap in which to inset the horizontal dimension of the umbilicus. After hemostasis, the umbilicus is exteriorized and the 6-o'clock position of its stalk is plicated inferiorly with non-absorbable sutures on the rectus fascia and the edges of the navel are sutured to the skin with 5-0 nylon sutures.

Muscle Flap

If only a muscle flap is to be dissected, it can be performed by a median, paramedian or even a low transverse incision with the abdominal flap undermined to expose the muscle. The muscle is dissected according to the previous description.

Free Flap

The muscle is divided superiorly and inferiorly. As free flaps utilize the deep inferior epigastric artery as the main pedicle, the superior epigastric pedicle is ligated proximally. The DIEA is dissected to the level of the inguinal ligament. The two venae comitantes will become one vein near the external iliac vein.

Perforator flap

The main difference when dissecting perforator flaps is the intramuscular dissection of the perforator pedicles. When they are identified, the anterior rectus margin is opened vertically. The pedicles are dissected to their depth, ligating the muscle branches that originate from the main pedicle. If more than one perforator pedicle is needed, the small muscle segment between the pedicles should be sectioned. Injury to the nerves of the muscles that cross transversely should be avoided. Dissection continues to the deep inferior epigastric artery and the pedicle is ligated as soon as sufficient length is achieved. The donor site closure is performed as standard technique.

Closure of Donor Site

closure is usually accomplished with interrupted figure-of-eight non-absorbable sutures reinforced with a running suture. An onlay mesh is utilized when a complete secure closure cannot be accomplished. Usually, the mesh reinforcement is indicated after the bipedicled TRAM flap. For this purpose, five regions located near the bony sites are dissected and marked: the pubic symphysis inferiorly, the anterior superior iliac spines laterally, and the lower costal cartilages superiorly. Two longitudinal incisions are made 3–5 cm apart on the anterior sheath of the rectus muscle above the umbilicus. This strip of fascia is left on the muscle, which is completely detached and lifted with the lower abdominal flap after transection at the level of the arcuate line. The anterior fascial defect is then approximated by a running non-absorbable suture. In a monopedicled TRAM flap, the opposite anterior rectus fascia is plicated vertically to the size of the contralateral defect to reposition the umbilicus. A mesh is applied over most of the abdominal wall and fixed under tension with interrupted on-absorbable sutures to the five bony sites. After the mesh is anchored in place, it is approximated circumferentially to the external oblique fascia with running sutures. The umbilicus is fixed in the conventional manner and the donor area is closed in layers. Suction drainage is employed routinely.

Post-Operative Care

Post-operative flap monitoring was done by periodical clinical assessment every 2 hours for the first 48 hours and then 6 hourly for next 3 days with preparation for possible secondary intervention as required. Post-operative prophylactic anticoagulant therapy was administered during the period of immobilization, if indicated. When the lower abdominal skin is included with the flap, as with breast reconstructions, positioning the patient in a semi-fowler position reduces skin tension on the donor area. Excessive efforts, chiefly those that increase abdominal pressure such as lifting or carrying weight, should be avoided for at least 1 month. Drains are kept in place for about 3 days and hospitalization is about 5 postoperative days.

Recipient site: In lower extremity reconstructions, the patient must keep the reconstructed limb elevated for 1 week and, after this period, is encouraged to maintain the elevation. In breast reconstructions, the use of a surgical brassiere is recommended for about 1 month.

Donor site: In breast or facial reconstructions, the patient is encouraged to ambulate on the first postoperative day. Abdominal binders are recommended for 1 month. In lower extremity reconstructions, the patient can ambulate for short distances after 7 days. Post-operative follow-up for flap survival, early and late wound complications of both the flap and the donor site and their aesthetic outcome were noted. The average time of follow-up was 6 months.

RESULTS

Mean age was 49.33 years with a standard deviation of 11.11 years (Range – 28-68 years). There were 66.6% males and 33.3% females. Comorbidities were present in 66.6% cases. Multiple etiopathogenesis of soft tissue defects with Post-tumour resection being maximum (66.6%) followed by trauma(25%) and post infective pathology(8.3%). Face (25%) and Perineum (25%) being the main recipient areas of soft tissue defects followed by hip, thigh, leg, ankle and lower back (8.6%) each. Size of flap The mean flap size in our study was15.5x9.5cm.

In our study pedicled flap as done in 58.3% cases and free flap coverage were done in 41.7% cases.

- VRAM flap were done in 33.3% cases of which 25% were VRAM myocutaneous and 8.6% was VRAM muscle flap only.
- In 16.6% cases the pedicled flap consisted of both vertical and transverse component and in 8.6% cases a BERAM flap was used.
- Among the cases where free flap coverage were done, 25% cases used free myocutaneous flap, 8.6% cases used DIEP flap and 8.6% cases used free muscle flap only.
- On pre-operative Doppler (hand held) perforators were located in DIEP flaps.

Donor site Management- Primary closure without prolene mesh was done for donor site management in 41.6% cases and the rest of 58.4% cases required closure with prolene mesh reinforcement. The average operative time in our study was 4.3 hours.

Flap Survival- Complete Flap survival on post-operative monitoring and follow up was observed in 41.6% cases with 33.3% cases reported partial necrosis and in 25% cases partial loss of grafted skin has occurred in our study. In the partially necrosed flap, necrosis was present peripherally probably due to encroachment outside the vascular territory or angiosome. No case of complete flap necrosis was reported.

Complications- In our study of 12 cases there was no cases of complete flap necrosis, five(41.6%) flaps had complete survival, four(33.3%) flaps underwent partial necrosis and in three(25%) cases there is partial loss of STSG.

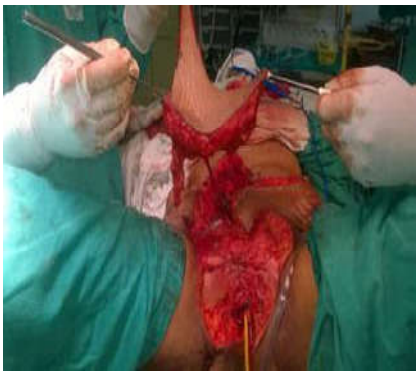
There is no significant statistical association between complications with comorbidities (p-value obtained by Pearson's chi-square test > 0.05).

Donor site Complications- Among the donor sites in the twelve cases eight (66.6%) had no complications. Of the remaining four (33.3%) cases one each had complications like wound dehiscence, discharge, ulceration and pain.

There is no significant statistical association between complications and types of flap used (p-value obtained by Pearson's chi-square test > 0.05).

Defect after excision

Flap marking



Flap harvesting

After flap insetting

Post operative

DISCUSSION

The design and size of the flap vary greatly depending onthe surgical technique utilized and the characteristics of the donor and recipient areas .It is preferable to include periumbilical perforators in the design of the skin paddle whenever possible. These perforators are larger and provide better supply to the skin of the abdominal wall. However, in some cases, in order to preserve a majority of periumbilical perforators, a supraumbilical incision should be used as the superior margin of the flap. Closure of the donor site in that situation may not allow for the inferior incision to be placed immediately above the pubic hairline. In those situations, the inferior incision is placed higher in the abdomen, in a visible location. The other alternative is to place the superior incision than the umbilicus and sacrifice some of the periumbilical perforators, allowing for a more aesthetically pleasing incision line. The most commonly employed design of the skin portion of the flap is the transverse lower abdominal skin flap, similar to the skin resection of an abdominoplasty. The superior margin of the skin island is usually 2 cm above the umbilicus(in order to include the periumbilical perforators) and the inferior margin is above the pubic hairline. When the lower abdominal skin is harvested as a myocutaneous flap based on blood supply traversing the rectus muscle with inclusion of the muscle in the flap, this is called a transverse rectus abdominis myocutaneous (TRAM) flap. This design permits dissection of a thick flap, since it is a region that usually accumulates some excess fat, and it confers a pleasing aesthetic result to the donor area. Variations in flap design depend on the type of flap dissection utilized.

***Free Myocutaneous flap Based on the DIEA*:** When this type of reconstruction is employed, its vascularisation is abundant and reliable, permitting use of the entire inferior abdominal skin.

Perforator Flap Based on the Deep Inferior Epigastric Artery: Despite its sufficient arterial supply, venous congestion is occasionally noted on the opposite side of the DIEA. Therefore, the fusiform design is the most recommended perforator flap centered on the side of the pedicle or consideration is given to including the contralateral superficial inferior epigastric vein with the flap.

Other Reconstructions

In other types of reconstructions, the flap design will depend on the defect to be repaired. Flaps with vertical or oblique skin islands can be utilized or even separate distinct skin islands, based on perforator pedicles. If the design is oblique, it is possible to utilize the skin portion above the rib cage that has the advantage of being thinner and consequently more suitable for modelling the flap. This flap is designed transversely over the anterior portion of the lower costal margin laterally all the way to the level of the midaxillary line. On the other hand, if volume is necessary, a major or minor portion of the rectus muscle can be included in the flap, always bearing in mind the fact that about 20–30% of the muscle volume is usually lost due to denervation of the muscle. If the planned flap is purely muscular, it can be dissected through a paramedian incision placed longitudinally and cantered over the rectus muscle with a lateral extension in the caudal portion that aids in exposure of the DIEA, or alternatively, via a low transverse incision, followed by undermining of anabdominal flap and dissection of the muscle flap below it. The placement of the skin island may differ slightly if a pedicled flap is to have an extended reach; otherwise, the principles are similar and the designs described can be used for both pedicled and free flaps.

Kikuchi N *et al*[12] studied the abdominal perforator flaps based on a cutaneous branch of the deep inferior epigastric artery(DIEP flaps). To allow easier preparation and elevation of a DIEP flap pedicle, they proposed that the arterial perforator should: 1) be more than 1.0 mm large; 2) run a straight intramuscular course, parallel to the rectus abdominis fibers, with no large muscular branches; and 3) have only a short portion running immediately under the anterior rectus abdominis sheath. They classified the course and ramification pattern of the deep inferior epigastric artery into six patterns, depending on whether the anastomosis was sited in the medial or lateral branch and the level at which the branches originated.

Munhoz AM *et al* [11] studied the Importance of lateral row perforator vessels in deep inferior epigastric perforator flap harvesting. Thirty DIEP flaps from 15 fresh cadavers were used. The number, location, and intramuscular course of the perforator vessels were determined. In addition, an initial clinical study was performed in 31 patients using 35 DIEP flaps in breast reconstruction. The number, location, and the intramuscular course of the perforators were assessed. The majority of the lateral row perforators presented a rectilinear intramuscular course, which was shorter than that of the medial row perforators. This anatomical characteristic favours dissection with reduced operative time and vascular lesion morbidity, resulting in an important anatomical parameter for DIEP flap harvesting.

Zhang J *et al*[9] studied the reconstruction of leg and ankle defects by using free rectus abdominis muscle flaps with intermediate split thickness skin graft . From May 1998 to December 2002, 11 cases of defects on legs (2 cases) and on ankles (9 cases) were repaired by use of unilateral free rectus abdominis flap with skin graft. The soft tissue defects were accompanied by osteomyelitis or the exposure of bone or tendon. The disease course was 1 month to 10 years. The defect size ranged 3 cm x 4 cm to 8 cm x 14 cm. The area of rectus abdominis muscle flaps was 4 cm x 6 cm to 8 cm x 15 cm. All patients were followed up 6 months to 4 years after operation. All rectus abdominis flaps survived with good appearances and functions. The primary healing was achieved in 8 cases, intermediate split thickness skin graft necrosed in 3 cases and wound healed after re-graft.

Tansatit T *et al*[13] studied the Neurovascular anatomy of the deep inferior epigastric perforator flap for breast reconstruction to find out the most suitable perforator and cutaneous nerve for strategic design of the deep inferior epigastric perforator (DIEP) flap. The characteristics of the pedicles, perforators, intercostal nerves and the relationship between nerves and vessels in DIEP flaps were studied in 31 formalin-preserved cadavers. Four hundred and five perforator vessels were divided into three vertical rows. These perforators were mostly contained in the medial row (45.4%), the average size of the perforators in the lateral row was the largest (1.0+/- 0.3 mm). The largest perforators (1.4+/- 0.3 mm) were mostly located within 1 cm horizontally from the umbilicus. Lateral row perforators, usually rectilinear course (82.7%), traveled with nerves from the beginning. Whereas, the perforators in the medial row usually coursed obliquely (86.4%) and were not related to nerves initially, they joined before piercing the rectus sheath. Their findings indicate that it would be more beneficial to use the lateral row perforators.

Schaverien MV *et al*[14] studied the comparison of outcomes and donor-site morbidity in unilateral free TRAM versus DIEP flap breast reconstruction. The aim of this study was to evaluate postoperative outcomes and long-term subjective functional deficit in patients following unilateral free TRAM compared with DIEP flap breast reconstruction. Sixty consecutive patients who underwent unilateral autologous breast reconstruction were included in the study, 30 of whom had undergone a DIEP flap, and 30 a free TRAM flap. They found no significant difference in postoperative outcomes or in the subjective ability to perform activities of daily living, including work, domestic activities, sports and hobbies, between patients who underwent TRAM flap breast reconstruction and those who underwent a DIEP flap, and no significant difference between the groups for scores on the physical functioning, role-physical, or bodily pain scales of the SF-36.

Takeishi M *et al*[15] studied the Muscle sparing-2 transverse rectus abdominis musculocutaneous flap for breast reconstruction: a comparison with deep inferior epigastric perforator flap. Breast reconstruction using free transverse rectus abdominis musculocutaneous (TRAM) flap can be divided into 4 muscle-sparing (MS) types: conventional TRAM flap containing full width muscle as MS-0, while deep inferior epigastric perforator (DIEP) flap containing absolutely no muscle as MS-3. They include only the muscle portion between the medial row and lateral row perforator vessels in TRAM flap, which is designated as MS-2. Between October 1999 and April 2006, the same surgeon performed 82 breast

constructions using MS-2 free TRAM flaps in 79 patients. All the flaps survived. Postoperative complications included partial fat necrosis in 8 cases, all corresponding to zone IV or zone II. Bulging of donor site occurred in 5 patients, 4 of whom were obese and 1 had bilateral flap harvest. Compared with our own reconstructions using DIEP flap (30 cases), there were no significant differences in operative time and blood loss between the two techniques. In conclusion, MS-2 free TRAM flap is a useful technique for breast construction considering the easy surgical techniques, length of the vascular pedicle that can be harvested, and the degree of freedom of the flap.

Shukla HS *et al*[8] studied the clinical application of inferior pedicle based rectus abdominis myocutaneous flap for repair of perineal defects after radical surgery for cancer. This review attempts to summarize the anatomic-technical aspects of inferiorly based RAMF and its applications.

Wan DC etal[17] studied the inclusion of mesh in donor-site repair of free TRAM and muscle-sparing free TRAM flaps yields rates of abdominal complications comparable to those of DIEP flap reconstruction. A retrospective review of all free flap breast reconstructions at the University of California, Los Angeles Medical Center from 2002 to 2007 was performed. Abdominal bulge and hernia were noted for patients undergoing free TRAM and muscle-sparing free TRAM flap reconstructions and were compared with those observed following DIEP flap reconstructions. Their conclusion was that Incorporating mesh into rectus fascia repair in free and muscle-sparing free TRAM flap cases significantly reduces the rate of postoperative abdominal complications to levels equivalent to those for DIEP flap reconstructions.

Roth FS *et al*[16] studied the transverse dual-perforator fascia-sparing free TRAM flap and its technique description. It has been well documented that incorporating both the lateral and medial perforators provides maximal perfusion to all zones of the lower abdominal transverse skin flap. However, dissection and harvest of both sets of perforators requires disruption and/or sacrifice of abdominal wall tissues. The technique presented here was designed to use both the lateral and medial row perforators, and to minimize abdominal wall disruption. Deep inferior epigastric artery medial and lateral row perforators are selected for their diameter, proximity, and transverse orientation to each other. A transverse ellipse of fascia is incised to incorporate both perforators. The fascial incision is then extended inferiorly in a T configuration to allow for adequate exposure and harvest of the vascular pedicle and/or rectus abdominis, and primary closure. Limiting perforator selection to one row of inferior epigastric arteries diminishes perfusion to the abdominal flap. Furthermore, perforator and inferior epigastric artery dissection often results in fascial defects that are not amenable to primary closure. However, maximal abdominal flap perfusion and minimal donor-site morbidity can be achieved with the transverse dual-perforator fascia-sparing free transverse rectus abdominis myocutaneous flap technique and can be performed in most patients.

Bognár G *et al*[10] studied the Perineal soft-tissue reconstruction with vertical rectus abdominis myocutan (VRAM) flap following extended abdomino-perineal resection for cancer A review of the relevant literature was carried out on perineal soft-tissue reconstruction with rectus abdominis myocutan (VRAM) flap following extended abdomino-perineal rectal resection for cancer. The more commonly used neoadjuvant chemo- and radiotherapy as well as extended surgical radicality resulted in increased perioperative risks. Therefore combined procedures between the colorectal and plastic surgical teams are inevitable. This case report illustrates the above trend.

Devulapalli C *et al*[7] studied Review and Meta-Analysis of Primary versus Flap Closure of Perineal Defects following Oncologic Resection. After data extraction from included studies, meta-analysis was performed to compare outcome parameters defining surgical-site complications of flap and primary closure. There was no statistically significant difference between primary and flap closure for minor perineal wound complications, abdominal hernias, length of stay, or reoperation rate. The authors' results have validated the use of myocutaneous flaps for reducing perineal morbidity following abdominoperineal resection or pelvic exenteration.

Macadam SA *et al*[18] studied the Quality of Life and Patient-Reported Outcomes in Breast Cancer Survivors: A Multicenter Comparison of Four Abdominally Based Autologous Reconstruction Methods. Patients from five North American centers were eligible if they underwent reconstruction by means of the deep inferior epigastric artery perforator (DIEP) flap, muscle-sparing free transverse abdominis myocutaneous (TRAM) flap, free TRAM flap, or the pedicled TRAM flap. The results of this study show that the DIEP flap was associated with the highest abdominal well-being and the lowest abdominal morbidity compared with the pedicled TRAM flap, but did not differ from muscle-sparing free TRAM and free TRAM flaps.

CONCLUSION

This flap is versatile in its indications as it provides cutaneous cover that can be used anywhere. It can be used as a pedicled flap for perineal, inguinal,upperthigh regions. As a free flap, its use includes intraoral and cutaneous resurfacing anywhere from head to foot including the sole. It is versatile in the orientation of skin paddle: A vertical, oblique or transverse skin paddle can be taken with primary closure in all directions. It provides an excellent tissue match for head and neck and extremity reconstruction. Also, it provides durable skin. The intramuscular dissection in case of DIEP flaps based on musculocutaneous perforators is a great challenge especially in case of beginners. There is in fact a steep learning curve. However this flap is indeed versatile in designing of the skin flap based on perforator localization without the fear of encroaching into a different anatomical area or significantly affecting any landmark.

Conflict of Interest: There are no conflicts of interest.

Source of Support: Nil

List of Abbreviations

TRAM Flap - Transverse Rectus Abdominis Musculocutaneous Flap,

DIEA- Deep Inferior Epigastric Artery,

VRAM Flap- Vertical Rectus Abdominis Musculocutaneous Flap

DIEP- Deep Inferior Epigastric Artery Perforator

References

1. Hartrampf CR, Scheflan M, Black PW. Breast reconstruction with a transverse abdominal island flap. Plast Reconstr Surg. 1982;69: 216–225.
2. Pennington DG, Pellly AD. The rectus abdominis myocutaneous free flap. Br J Plast Surg 1980;33:277-82.
3. Logan SE, Mathes SJ. The use of a rectus abdominis myocutaneous flap to reconstruct a groin defect Br J Plast Surg. 1984 Jul;37(3):351-3
4. Mathes S, Bostwick J 3rd. A rectus abdominis myocutaneous flap to reconstruct abdominal wall defects. Br J Plast Surg 1977; 30: 282–283.
5. Ramasastry SS , Liang MD , Hurwitz DJ . Surgical management of difficult wounds of the groin.Surgery, Gynecology & Obstetrics [01 Nov 1989, 169(5):418-422
6. Koshima I1, Soeda S. Inferior epigastric artery skin flaps without rectus abdominis muscleBr J Plast Surg. 1989 Nov;42(6):645-8
7. Devulapalli C1, Jia Wei AT, DiBiagio JR, Baez ML, Baltodano PA, Seal SM, Sacks JM, Cooney CM, Rosson GD. Primary versus Flap Closure of Perineal Defects following Oncologic Resection: A Systematic Review and Meta-Analysis. Plast Reconstr Surg. 2016 May;137(5):1602-13.
8. Shukla HS1, Tewari M. An evolution of clinical application of inferior pedicle based rectus abdominis myocutaneous flap for repair of perineal defects after radical surgery for cancer. J Surg Oncol. 2010 Sep 1;102(3):287-94.
9. Zhang J1, Chen X, Pan S. [Reconstruction of leg and ankle defects by using free rectus abdominis muscle flaps with intermediate split thickness skin graft]. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi. 2004 May;18(3):192-4.
10. Bognár G1, Novák A, István G, Lóderer Z, Ledniczky G, Ondrejka P. [Perineal soft-tissue reconstruction with vertical rectus abdominis myocutan (VRAM) flap following extended abdomino-perineal resection for cancer].Magy Seb. 2012 Oct;65(5):388-95.
11. Munhoz AM1, Ishida LH, Sturtz GP, Cunha MS, Montag E, Saito FL, Gemperli R, Ferreira MC Importance of lateral row perforator vessels in deep inferior epigastric perforator flap harvestingPlast Reconstr Surg. 2004 Feb;113(2):517-24.
12. Kikuchi N1, Murakami G, Kashiwa H, Homma K, Sato TJ, Ogino T. Morphometrical study of the arterial perforators of the deep inferior epigastric perforator flap.Surg Radiol Anat. 2001;23(6):375-81.
13. Tansatit T1, Chokrungvaranont P, Sanguansit P, Wanidchaphloi S. Neurovascular anatomy of the deep inferior epigastric perforator flap for breast reconstruction.J Med Assoc Thai. 2006 Oct;89(10):1630-40.
14. Schaverien MV1, Perks AG, McCulley SJ. Comparison of outcomes and donor-site morbidity in unilateral free TRAM versus DIEP flap breast reconstructionJ Plast Reconstr Aesthet Surg. 2007;60(11):1219-24.
15. Takeishi M1, Fujimoto M, Ishida K, Makino Y. Muscle sparing-2 transverse rectus abdominis musculocutaneous flap for breast reconstruction: a comparison with deep inferior epigastric perforator flap. Microsurgery. 2008;28(8):650-5.
16. Roth FS1, Troy JS, Schusterman MA. Transverse dual-perforator fascia-sparing free TRAM flap: technique description. Plast Reconstr Surg. 2011 Nov;128(5):1039-42.
17. Wan DC1, Tseng CY, Anderson-Dam J, Dalio AL, Crisera CA, Festekjian JH Inclusion of mesh in donor-site repair of free TRAM and muscle-sparing free TRAM flaps yields rates of abdominal complications comparable to those of DIEP flap reconstruction. Plast Reconstr Surg. 2010 Aug;126(2):367-74.
18. Macadam SA1, Zhong T, Weichman K, Papsdorf M, Lennox PA, Hazen A, Matros E, Disa J, Mehrara B, Pusic AL. Quality of Life and Patient-Reported Outcomes in Breast Cancer Survivors: A Multicenter Comparison of Four Abdominally Based Autologous Reconstruction Methods. Plast Reconstr Surg. 2016 Mar;137(3):758-71.

How to cite this article:

Dr.Purbarun Chakrabarti and Dr. Dipankar Mukherjee (2019) 'The Versatility of Deep Inferior Epigastric Artery Based Rectus Abdominis Flap In Covering Various Defects: A Study in a Tertiary Hospital of Eastern India', *International Journal of Current Advanced Research,* 08(05), pp. 18872-18878. DOI: http://dx.doi.org/10.24327/ijcar.2019.18878.3618

****