PAPER

Initial Experience With Laparoscopic Inferior Epigastric Vessel Ligation for Delayed Transverse Rectus Abdominus Musculocutaneous Flap Breast Reconstruction

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Hypothesis: Transverse rectus abdominus musculocutaneous (TRAM) flap breast reconstruction provides excellent cosmetic results. Pedicle flap viability is greatly enhanced by prereconstruction inferior epigastric vessel ligation, which encourages collateral arterial flow (delayed TRAM). We report our initial experience with laparoscopic inferior epigastric vessel ligation.

Design: Prospective case series.

Setting: Tertiary academic center.

Patients: Female patients with breast cancer who chose pedicle TRAM reconstruction.

Interventions: Vessel ligations were performed 7 to 14 days prior to reconstruction. Abdominal access was achieved with a 3-mm umbilical trocar. A 5-mm trocar was placed lateral to the rectus sheath in the right lower quadrant. Five-millimeter Teflon clips were used to ligate the vessels near their origin.

Main Outcome Measures: Complications of surgery and subsequent flap viability.

Results: From January 2001 to July 2006, 130 patients had laparoscopic inferior epigastric vessel ligation, of whom 123 patients had bilateral ligation. Additional procedures in conjunction with vessel ligation were performed in 38 patients (sentinel node biopsy [27], bilateral oophorectomy [7], liver biopsy [2], breast biopsy [1], and Nissen fundoplication [1]). Median operative time for those patients undergoing ligation only was 32.6 minutes (range, 14-121 minutes). The inferior epigastric vessels were not identified in 2 patients. Metastatic breast cancer involving the liver was found in 1 patient. There were no conversions or complications. Subsequent TRAM flap viability was excellent in most cases, with 1 complete flap necrosis in a high-risk, morbidly obese patient.

Conclusion: Laparoscopic inferior epigastric vessel ligation for delayed TRAM flap breast reconstruction is a safe, effective procedure.

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TRANSVERSE RECTUS ABDOMINIS musculocutaneous (TRAM) flap breast reconstruction following mastectomy provides excellent cosmetic results without the use of prosthetic implants.[1-3] Pedicle flap viability is greatly enhanced by prereconstruction inferior epigastric vessel ligation, which encourages collateral arterial flow from the superior epigastric vessels (delayed TRAM).[4-6] This approach has been used by many reconstructive surgeons in high-risk patients (morbidly obese patients, smokers, irradiated patients), but some now favor it routinely to increase pedicle flap viability and avoid free-flap reconstruction.

Delayed TRAM flap reconstruction is not routinely performed because of the difficulty of easily identifying the inferior epigastric vessels for ligation through an open approach. These vessels have a minor superficial component and a significantly larger deep epigastric component located just anterior to the peritoneum. Although several case reports of laparoscopic ligation exist in the literature, to our knowledge, we report the first large series.[7-10]

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METHODS

All patients with breast cancer were evaluated by a comprehensive breast program at Dartmouth Hitchcock Medical Center. Patients who had previously undergone mastectomy or were scheduled to undergo mastectomy were all offered the opportunity to discuss various reconstruction options with a plastic surgeon. Those who were felt to be good candidates and chose delayed TRAM flap reconstruction were referred to general surgery for laparoscopic inferior epigastric vessel ligation.

All data were collected prospectively. Vessel ligations were performed 7 to 14 days prior to TRAM flap reconstruction. Diagnostic laparoscopy was routinely performed. Early in the series, either contralateral or ipsilateral inferior epigastric vessel ligation was performed based on the plastic surgeon's preference. Eventually, bilateral inferior epigastric vessel ligation was performed on all patients.

All procedures were performed under general anesthesia with the patient in a supine position in the following manner. The skin was prepared with antiseptic solution and the abdomen was draped to expose the entire width of the anterior abdominal wall from the xyphoid to the pubis. Access to the peritoneal cavity was obtained using a Veress needle technique with a 3-mm umbilical trocar. After insufflation with carbon dioxide to a pressure of 15 mm Hg, a 2.7-mm, 30° laparoscope was inserted into the abdominal cavity. Inspection of the liver, peritoneum, and surface inspection of the bowel was performed. The patients were then placed in a steep Trendelenburg position to better expose the inguinal region bilaterally. The left and right internal inguinal rings were identified and the inferior epigastric vessels were identified just medial to the internal inguinal ring and followed superiorly. A 5-mm trocar was placed lateral to the rectus sheath in the right lower quadrant. Additional ports were placed only if necessary to perform additional procedures (ie, oophorectomy) or to deal with adhesions. The peritoneum overlying the vessels was incised and the vessels were bluntly dissected from the surrounding tissue circumferentially. Five-millimeter Teflon clips (Hem-O-Lock; Weck Closure Systems, Research Triangle Park, NC) were used to ligate the vessels within 3 cm of their origin. We attempted to ligate the vessels proximal and distal to the first major branch whenever possible to prevent potential retrograde flow. Ligation was felt to be complete when visual pulsations of the vessels stopped. After assuring hemostasis, the pneumoperitoneum was evacuated and the ports removed. The skin incisions were closed with running subcuticular absorbable suture and dressed with Steri-Strips (3M, St Paul, Minn) and adhesive bandages. The procedures were performed on an outpatient basis.

RESULTS

From January 2001 to July 2006, 130 patients had laparoscopic inferior epigastric vessel ligation, of whom 123 patients had bilateral ligation. All patients were female with a mean age of 49 years, ranging from 27 to 70 years of age. Additional procedures in conjunction with vessel ligation were performed in 38 patients (sentinel node biopsy [27], laparoscopic bilateral oophorectomy [7], laparoscopic liver biopsy [2], breast biopsy [1], and laparoscopic Nissen fundoplication [1]). Median ± SD operative time for those patients undergoing ligation only was 32.6 ± 17.1 minutes (range, 14-121 minutes). The inferior epigastric vessels could not be identified in 2 patients. One of these patients had had multiple pelvic procedures in the past and the vessels had been presumably ligated. The other patient had a history of abdominal wall trauma on the left side and the left-sided vessels could not be identified. We assumed they may have thrombosed at the time of her abdominal wall injury. Metastatic breast cancer involving the liver was found in 1 patient who did not subsequently go on to have reconstruction. There were no conversions or complications. Subsequent TRAM flap necrosis occurred in 1 high-risk, morbidly obese patient. Thirteen patients (10%) had evidence of inferior epigastric flow at the time of TRAM flap breast reconstruction.

COMMENT

Use of the TRAM flap remains the most common method of autogenous breast reconstruction. Some plastic surgeons favor free–TRAM flap reconstruction over a pedicle flap because of concerns of flap loss and fat necrosis in high-risk patients. Historically, fat necrosis is higher in pedicle TRAM flaps compared with free TRAM flaps (27% vs 8%, respectively).[11] Long-term outcomes of pedicle TRAM and free TRAM flaps are similar with respect to partial flap loss (15% for both) and complete flap loss (1.1% vs 8%, respectively).[12-16] Free–TRAM flap reconstruction is on average more than $15 637 more expensive than pedicle TRAM flap reconstruction, takes significantly longer to perform (4.8 vs 8.2 hours, respectively), and is associated with a significantly longer hospital stay (4.7 vs 7.7 days, respectively).[17]

High-risk patients, such as those who are morbidly obese, have a history of radiation therapy, or smoke, are particularly at risk of ischemic flap problems.[18-20] Delayed pedicle TRAM flap use has been shown to greatly improve flap perfusion and survival and avoids the expertise and additional time required for microsurgical techniques necessary to successfully perform free-flap reconstruction.

Surgical delay has been traditionally approached as an open procedure despite reports of significantly less postoperative pain following the laparoscopic delay compared with the open approach.[7] We also found the anterior sheath to be more friable and edematous after open delay and because of this, the procedure was abandoned. All patients in our series were discharged home the same day following ligation except for 1 patient who also had a Nissen fundoplication that required an overnight stay in the hospital.

There have been several reports of laparoscopic and, more recently, preperitoneal approaches to delay but the series have all involved small numbers of patients.[7-10] To our knowledge, this is the first large series of laparoscopic delay. We used a 3-mm trocar in the umbilicus whenever possible. This small port is used to minimize the incision in that area and avoid any interference with the subsequent umbilical island at the actual TRAM reconstruction. Larger trocars (10-mm) were only used for combined oophorectomy procedures to allow ovarian removal. We combined this procedure with sentinel node biopsy and/or oophorectomy to avoid the risk of an additional anesthetic whenever possible.

Flow in the inferior epigastric vessels was determined by visual pulsation in the vessels at laparoscopy. We tried to ligate the vessels above and below any obvious feeding vessels. We observed a loss of pulsation intraoperatively during ligation and considered this a crude measure of adequate ligation. We realize this is not the best measure of flow, which may account for our 10% inferior flow rate at reconstruction. We are currently evaluating a device that can be used intraoperatively to quantitate flow decrease with ligation.

Additional study in this area is clearly needed. Further study of the safety and efficacy of this approach is required. Also, further refinement of technique is currently planned to measure inferior epigastric flow and hopefully eliminate our current residual flow rate of 10%.

CONCLUSIONS

Our experience suggests laparoscopic inferior epigastric vessel ligation is a safe, effective, and efficient way to perform TRAM flap delay.

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DISCUSSION

Jonathan Crichlow, MD, Boston, Mass: That is a nice technique to supercharge the flaps. We can do it. The question is should we do it and should we do it in everybody. It makes a lot of sense to do it in somebody with *BRCA* who you are going to be taking the ovaries out, the very big patient, etc, but in order to really decide whether or not it should be used all the time I think we need to know some things about resource utilization, cost vs the open technique done through a 2.5-cm incision along the site of the TRAM that takes about a half an hour in the experienced hands, and then pain scores, which I think is probably going to be the big advantage, but I do not have any data to say whether it is any better or not right now.

Dr Trus: This was actually driven mainly by our plastic surgeons who did struggle sometimes to find the vessels when they did them open and they actually walked in one day when I was doing a hernia and could not believe how well I could see the vessels. So we sort of evolved this technique with that. They seem to be very pleased with the outcomes, and you are right, the next step is to see do we do this on everyone and that is where the next phase of our study is actually looking at flows and concepts with different techniques of looking at that and looking at flap viability a little more closely.

Robert Udelsman, MD, New Haven, Conn: I have the same thoughts as the previous questioners. These TRAM flaps do extraordinarily well in almost all patients and you really should think about whether inferior epigastric vessel ligation is really necessary. I know the plastic surgeons might be pushing but there is a high-risk group of patients and those are the smokers who are smoking at the time they want TRAMs and many plastic surgeons will turn them down for that operation, so if you can isolate a high-risk group that is where this technique may have its greatest efficacy.

Dr Trus: That is where we started, with the high-risk, morbidly obese, previously irradiated smokers. I do not select the patients who have the TRAMs. Those are sent to me for ligation and they have been very pleased with their outcomes. I cannot comment on what their selection criteria is.

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