



Comparative outcomes in breast reconstruction: autologous techniques and long-term functionality

Thomas Norman Steele[^], Nicholas Till Haddock[^]

Department of Plastic Surgery, UT Southwestern Medical Center, Dallas, TX, USA

Correspondence to: Nicholas Till Haddock, MD. Department of Plastic Surgery, UT Southwestern Medical Center, 5323 Harry Hines Blvd, Dallas, TX 75390, USA. Email: nicholas.haddock@utsouthwestern.edu.

Comment on: Löfstrand J, Paganini A, Grimby-Ekman A, *et al.* Long-term patient-reported back and shoulder function after delayed breast reconstruction with a latissimus dorsi flap: case-control cohort study. *Br J Surg* 2024;111:znad296.

Keywords: Breast reconstruction; autologous reconstruction; latissimus dorsi flap (LD flap); quality of life (QoL); deep inferior epigastric perforator flap (DIEP flap)

Submitted May 21, 2024. Accepted for publication Aug 06, 2024. Published online Aug 22, 2024.

doi: 10.21037/gs-24-184

View this article at: <https://dx.doi.org/10.21037/gs-24-184>

Breast cancer is a prevalent condition, affecting one in eight women over their lifetime, according to the American Cancer Society (1). Approximately one-third of these women will undergo some form of mastectomy. While this procedure is crucial for treating breast cancer, it often results in a decreased sense of femininity and a reduced quality of life (QoL) for the patients (2). Breast reconstruction plays a vital role in improving the QoL, psychosocial wellbeing, sexual wellbeing, and overall confidence of these women (3). Among the various methods available, autologous reconstruction, which uses the patient's own tissue, is shown to significantly enhance QoL as measured by standardized patient-reported outcome measures such as the BREAST-Q, while also eliminating the risks associated with prosthetic implants (4).

Autologous reconstruction can be broadly classified into pedicled and free tissue transfer methods. The latissimus dorsi (LD) myocutaneous flap, first described by Iginio Tansini in 1897, has been a cornerstone of pedicled flap techniques for over a century (5). It remains a reliable option, particularly for patients who have undergone radiation therapy. However, the primary concern with the LD flap is the associated donor site morbidity due to the sacrifice of the LD muscle, which is a powerful adductor, extensor, and internal rotator of the upper extremity (6,7).

In response to these concerns, surgical techniques have evolved to include muscle-sparing approaches to reduce morbidity (8-10). Despite these advances, the traditional LD flap continues to be associated with significant functional impairments (11).

In search of a more favorable donor site for breast reconstruction, the pedicled transverse rectus abdominis myocutaneous (TRAM) flap, introduced by Hartrampf *et al.* in 1982, was a pivotal development (12). This technique, which initially involved sacrificing the entire rectus abdominis muscle, had evolved into the free TRAM flap, but due to the frequency of postoperative abdominal hernia/bulge, the field progressed to the deep inferior epigastric perforator (DIEP) flap, which preserves the rectus muscle by using only the perforating vessels from the deep inferior epigastric system. The DIEP flap, now considered the gold standard in autologous breast reconstruction, minimizes donor site morbidity while providing excellent reconstructive outcomes (13).

Prior studies analyzing the functional outcomes of patients following LD flap breast reconstruction have been inconclusive, plagued by relatively short follow-up periods, and have not controlled for potential confounding factors such as chest/axillary surgery (e.g., axillary dissection), chest wall radiation therapy, age, and adjunct therapy.

[^] ORCID: Thomas Norman Steele, 0000-0002-7502-4061; Nicholas Till Haddock, 0000-0003-4649-6147.

A 2014 systematic review included 22 studies involving 719 cases to evaluate changes in donor site functionality through various metrics like the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire, shoulder range of motion, and strength tests (14). The authors concluded that while most patients experience minimal functional impairment at the donor site, there are significant challenges during the early postoperative period. Some patients face long-term reductions in shoulder strength and functional limitations in sports and art-related activities, although daily activities remain largely unaffected. A more recent systematic review and meta-analysis from 2019 found that while there is significant impairment in shoulder flexibility and abduction in the short term (up to 3 months post-surgery), long-term effects vary, with some studies indicating persistent impairment while others show minimal long-term impact (15). Factors like age, smoking, obesity, radiotherapy, and the specific type of flap used were significant in influencing outcomes.

To address a paucity of long-term outcomes, Löfstrand *et al.* conducted a single-institution retrospective observational case-control cohort study to evaluate patient-reported outcomes of back and shoulder function following delayed breast reconstruction using the LD flap compared to the DIEP flap (16). The study involved 135 patients who underwent LD flap reconstruction and 118 control patients who received DIEP flap reconstruction, with a mean follow-up period of 7 years. The study involved participants who completed two validated questionnaires: the BREAST-Q reconstruction LD domains and the Western Ontario Shoulder Osteoarthritis Index (WOOS). The findings revealed that patients reconstructed with LD flaps reported significantly less satisfaction with back and shoulder function than those reconstructed with DIEP flaps. Commonly reported symptoms in the LD group included tightness when stretching the affected arm, a pulling sensation in the back, weakness in the arm, and difficulty carrying heavy objects. Key predictors of poor back and shoulder function included axillary surgery, axillary radiotherapy, and older age at the time of reconstruction.

This study contributes to the growing body of scientific literature indicating that the LD flap for breast reconstruction is associated with long-term functional impairment, as defined by established patient-reported outcome measures. Although the DASH score is commonly utilized in similar studies to assess the morbidity of the LD flap, this outcome measure evaluates the entirety of the upper extremity, thus including some irrelevant sections.

In contrast, the BREAST-Q LD and the WOOS were employed by the researchers to assess the function of the shoulder and back more specifically. As mentioned in the cited article, the results of this study align closely with those from two previous studies that used the BREAST-Q LD, but it is noted that there were no preceding studies utilizing the WOOS for assessing function post-LD flap breast reconstruction, thereby limiting direct comparisons.

With the increasing prevalence and standardization of microsurgical training amongst reconstructive surgeons, the LD flap has been relegated to a reliable salvage option in many centers, including our own. While there are many patients who may not be candidates for abdominally based free tissue transfer, either due to prior surgery or to a paucity of abdominal tissue, there are an increasing number of alternative options for microvascular autologous breast reconstruction, namely the profunda artery perforator (PAP) flap (17), the lumbar artery perforator (LAP) flap (18), or the superior gluteal artery perforator (SGAP) flap (19). In the thin patient, the use of multiple free flaps in a stacked or conjoined fashion has been demonstrated as safe and effective by our institution and others (20). In the rare case of a failed DIEP flap breast reconstruction, many surgeons now turn to a second free flap given the improved donor site aesthetics and low functional morbidity when compared to an LD flap (21-24).

Microsurgical breast reconstruction is not without its drawbacks. The primary drawback remains the high level of training and skill required to perform the technical aspects of perforator dissection and microvascular anastomosis involved in free tissue transfer. Operative time is another consideration, with many centers reporting an average operative time of 8–10 hours for bilateral DIEP flap breast reconstruction. But this is becoming less of a concern, as the focus of efficiency in the operating theater has reduced the average operative time to less than 4 hours at our own institution (25). Significant scar burden remains a downside when compared to less-invasive methods such as fat grafting or implant-based reconstruction, but these may not be safe or effective in the irradiated patient (26,27).

In summary, the study by Löfstrand *et al.* (16) provides valuable insights into the long-term functional outcomes of LD flap breast reconstruction. It highlights the need for careful patient selection, thorough preoperative counseling, and meticulous postoperative monitoring to ensure the best possible outcomes. As the field continues to evolve, it is crucial to balance the benefits of autologous reconstruction with the potential risks, tailoring surgical approaches to

meet the individual needs of each patient. By understanding the long-term impacts and continuously refining surgical techniques, we can improve the QoL for breast cancer survivors undergoing reconstruction.

Acknowledgments

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the editorial office, *Gland Surgery*. The article has undergone external peer review.

Peer Review File: Available at <https://gs.amegroups.com/article/view/10.21037/gS-24-184/prf>

Conflicts of Interest: Both authors have completed the ICMJE uniform disclosure form (available at <https://gs.amegroups.com/article/view/10.21037/gS-24-184/coif>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Cite this article as: Steele TN, Haddock NT. Comparative outcomes in breast reconstruction: autologous techniques and long-term functionality. *Gland Surg* 2024;13(8):1349-1352. doi: 10.21037/gs-24-184