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REVIEW

Comparing the donor-site morbidity using DIEP, SIEA or MS-TRAM flaps for breast reconstructive surgery: A meta-analysis

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Summary *Background:* Countless studies have compared the use of autologous tissue for breast reconstruction; however, rates of donor-site morbidity differ greatly. This study examined the donor-site morbidity of superficial inferior epigastric artery (SIEA), deep inferior epigastric perforator (DIEP) and muscle-sparing transverse rectus abdominis myocutaneous (MS-TRAM) flaps when used for unilateral breast reconstruction.
Methods: Searches in PubMed and Medline as well as three manual search strategies for English-language articles published from 1 January 1995 to 1 January 2011 resulted in 2154 publications. Four levels of screening identified five studies suitable for the meta-analysis. StatsDirect software was used to perform the Mantel–Haenszel fixed-effect model.
Results: Only one study reported rates of donor-site morbidity for SIEA flaps. It was therefore impossible to perform any analysis regarding SIEA flaps. Five studies reported rates for both DIEP and MS-TRAM flaps and were used to estimate pooled relative risk (RR) and confidence intervals (CIs) of bulging. There was a 20% reduced risk of bulging when DIEP flaps were used compared to MS-TRAM flaps (RR 0.80, 95% CI 0.48–1.35). Subgroup analysis demonstrated that the risk of bulging in DIEP flap patients was one-third of MS-TRAM flap patients (RR 0.29; 95% CI 0.06–1.36), when rates were reported by clinical examinations. However, when rates were reported by surveys there was no difference in bulge formation between DIEP and MS-TRAM flap patients (RR 1.04; 95% CI 0.59–1.79). The adjusted RR of hernia in DIEP flap patients was approximately one-half of MS-TRAM flap patients (RR 0.43; 95% CI 0.07–2.63).

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Conclusion: This analysis demonstrated a clear trend towards a favourable outcome when DIEP flaps were used compared to MS-TRAM flaps.

Background

In 1979, Holmström[1] was the first to describe the use of autologous tissue harvested from the lower abdomen in breast reconstruction. Three years later, in 1982, Hartrampf et al.[2] popularised the 'transverse abdominal island flap', later to be known as the 'transverse rectus abdominis myocutaneous (TRAM) flap'. Abdominal tissue has proven to be a reliable source of soft tissue due to a rich supply of volume and good-quality tissue, while creating an inconspicuous scar. The TRAM flap has for many years been the gold standard in breast reconstruction, but the donor-site morbidity remains a major concern as the rectus muscle is harvested. Techniques have been developed to minimise the trauma to the fascia and muscle, while still providing adequate blood supply. The muscle-sparing (MS) TRAM flaps (MS-0, MS-1 and MS-2) were developed to minimise the resection of the rectus muscle. In 1989, the deep inferior epigastric perforator (DIEP) flap, also known as MS-3, was described by Koshima and Soeda[3] and subsequently popularised by both Allen[4] and Blondeel.[5] The superficial inferior epigastric artery (SIEA) flap has gained popularity as it completely spares the rectus muscle and fascia and thereby, at least theoretically, minimises the donor-site morbidity. The impact of different types of flaps on the abdominal wall has been a topic for much discussion.[6–14] The theoretical advantage of the DIEP and SIEA flap compared with the MS-TRAM flaps seems obvious. The MS-TRAM flap is still a widely used procedure as it is technically easier than a DIEP flap. The current literature often yields opposing conclusions regarding the impact of the flaps on the donor-site.[10–14] A meta-analysis is therefore performed in order to shed some light on the results and quality of studies that have been published so far.

Method

This study was performed following the guidelines outlined by the Meta-analysis of Observational Studies in Epidemiology (MOOSE) group.[15]

The aim of the study was to compare the donor-site morbidities of SIEA, DIEP and MS-TRAM flaps when used for breast reconstruction. Several different methods have been used to investigate the impact of the SIEA, DIEP and MS-TRAM flaps on the donor site. One method is objective reporting of bulges and hernias, and another is surveys on the impact on daily-life activities and finally muscle-strength measurement with a dynamometer. It is not possible to compare the three different methods without compromising the homogeneity of the studies, patients and methods. As a consequence, this study exclusively investigated donor-site morbidity defined as hernias or abdominal bulging. When bilateral reconstructions are performed, it is not uncommon to use two different types of flaps.[16–18] Knowing which of the two methods is at fault is difficult under these circumstances. It was therefore chosen to exclusively investigate the impact of flaps used in unilateral reconstructions. Only studies with a minimum of two cohorts of patients, comparing SIEA and DIEP flaps, SIEA and MS-TRAM flaps, DIEP and MS-TRAM flaps or all three types of flaps, were included in the analysis.

Search strategy

The following search terms were used in PubMed and Medline databases:

'DIEP', 'SIEA', 'TRAM', 'deep inferior epigastric perforator', 'transverse rectus abdominis musculocutaneous' and 'superficial inferior epigastric artery'.

This search yielded 2154 hits. Three manual search strategies were used to try to retrieve additional studies. First, studies that were published after the cut-off date were identified via PubMed. Second, a search for related citations was performed as well as a specific search for studies by authors who are internationally acknowledged on the subject of perforator flaps. Publications from major plastic surgery journals, not initially identified by the database searches, were also reviewed. Third, plastic surgeons worldwide, with a history of publishing articles on the subject, were contacted via e-mail in order to obtain studies that have not been published yet. Unfortunately, these efforts did not result in any additional studies.

The search was limited to include only studies on flaps performed on women, and only studies published between 1 January 1995 and 1 January 2011. Animal studies, abstracts only, literature reviews, single-case reports, letters, comments and publications in languages other than English, were excluded. This reduced the results to 685 studies, of which 434 were not directly related to SIEA, DIEP or MS-TRAM flaps. They were therefore excluded.

Abstracts were retrieved for the remaining 226 studies. Of these, 176 studies were discarded because they did not include data on donor-site morbidity. Full-text articles were reviewed for the remaining 50 studies. Studies with less than 10 patients were excluded. When different publications were using the same cohort of patients, the study with the largest population of patients was chosen. Studies containing only one leg of interest (SIEA, DIEP or MS-TRAM flaps) were excluded, as well as studies focussing on TRAM flaps that were not muscle sparing. Studies that did not separate data from the different types of perforator flaps, combined data from unilateral and bilateral procedures or in other ways had incomparable data (i.e., raw data mashed with estimates) were excluded. A total of five