The Breast 22 (2013) 667–672

Contents lists available at SciVerse ScienceDirect

The Breast

journal homepage: www.elsevier.com/brst

Original article

Breast reconstruction with the denervated latissimus dorsi musculocutaneous flap

Pawel Szychta [a,b,*], Mark Butterworth [a], Mike Dixon [c], Dhananjay Kulkarni [c], Ken Stewart [a], Cameron Raine [a]

[a] Plastic and Reconstructive Surgery Department, St John's University Hospital, Howden Road West, Livingston, West Lothian, EH54 6PP, United Kingdom
[b] Department of Oncological Surgery and Breast Diseases, Polish Mother's Memorial Hospital-Research Institute, Lodz, Poland
[c] Breast Surgery Department, Western General Hospital, Edinburgh, United Kingdom

ARTICLE INFO

Article history:
Received 7 July 2012
Received in revised form
8 November 2012
Accepted 6 January 2013

Keywords:
Breast reconstruction
Latissimus dorsi
Denervation
Innervation
Muscle atrophy
Volume loss
Flap

ABSTRACT

Objective: To analyze clinical implications of the thoracodorsal nerve division in the latissimus dorsi musculocutaneous flap breast reconstruction.
Patients and methods: Prospective cohort study was conducted on 29 patients. Breast reconstruction with latissimus dorsi musculocutaneous flap was performed unilaterally in 20 patients or bilaterally in 9 women (38 breasts). Thoracodorsal nerve was divided during reconstruction of 20 breasts (group 1) and was preserved for 18 breasts (group 2). Height, width, projection, area of the covering skin and volume of the reconstructed and healthy breasts were measured on the 3D images of the anterior chest wall, taken 6 weeks and 6 months postoperatively with the Di3D 3D camera. Data regarding tissue consistency, painfulness and animation of the reconstructed breast, symmetry of both breasts and overall satisfaction after the surgery were collected at 6 months.
Results: The reconstructed and healthy breasts decreased in volume in group 1 (-45.85 cm^3 $\pm$ 48.41 cm^3, $p = 0.0004$; -29.13 cm^3 $\pm$ 14.98 cm^3, $p = 0.0009$) and in group 2 (-31.5 cm^3 $\pm$ 25.35 cm^3, $p = 0.0001$; -15.4 cm^3 $\pm$ 21.96 cm^3, $p = 0.0537$). There were no differences in decrease in volume between groups 1 and 2 ($p > 0.05$).
Respondents in group 1 in comparison to group 2 showed similar satisfaction of the tissue consistency of the reconstructed breast ($p > 0.05$) and the level of symmetry between both breasts ($p > 0.05$), gave lower scores for painfulness ($p < 0.0001$), animation ($p < 0.0001$) and higher scores for the overall satisfaction about the reconstructed breast ($p = 0.0001$).
Conclusion: We suggest that division of the thoracodorsal nerve during latissimus dorsi musculocutaneous flap breast reconstruction is a useful undertaking to minimize unnatural animation of the reconstructed breast.

Introduction

At present, modern techniques for breast reconstruction aim to recreate a symmetric breast with good esthetic shape and contours.[1] It is well recognized that the incorporation of a patient's own tissues in breast reconstruction gives more favorable esthetic outcomes in the majority of patients when compared to implant-only techniques.[2] The latissimus dorsi musculocutaneous flap is an excellent source of well vascularized autologous tissue for use in breast reconstruction with a complication rate of around 9%, including seroma formation, infection, partial flap necrosis and liponecrotic pseudocysts.[3] Favorable aspects of the surgical technique include a high rate of good esthetic results with symmetrical, natural looking breasts, relatively short procedure and prompt recovery in comparison to the use of free flaps.[4] The technique is appropriate for a wide group of patients including very thin women, those unwilling to use the abdominal tissue, patients at high risk for free abdominal flaps with obesity, diabetes, hypertension or tobacco smokers.[5,6] It can act as a salvage procedure for those with partial flap necrosis after free abdominal flap breast reconstruction or in cases of cancer recurrence after conservative surgery.[7] Early descriptions of the technique limited the volume available to recreate an adequate breast mound.[8] This issue was overcome by introducing the extended latissimus dorsi musculocutaneous flap technique.[4] The

* Corresponding author. Tel.: +44 79 05 33 88 84.
E-mail address: szychta@yahoo.pl (P. Szychta).

0960-9776/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.breast.2013.01.001

drawbacks of this surgical technique are weakening of the shoulder, a donor site scar on the back and animation of the reconstructed breast.[9]

The above mentioned last adverse effect – unwanted animation of the reconstructed breast – could potentially be avoided by cutting the thoracodorsal nerve during the surgery; however there would be a theoretical risk of atrophy of the denervated muscle which could lead to a decrease of the reconstructed breast volume. The thoracodorsal nerve is a branch of the posterior cord of the brachial plexus, and is made up of fibers from the posterior divisions of all three trunks of the brachial plexus. It follows the course of the subscapular artery, along the posterior wall of the axilla to the latissimus dorsi muscle, in which it may be traced as far as the lower border of the muscle. It carries motor fibers and supplies latissimus dorsi on its deep surface. The skin on the latissimus dorsi muscle is supplied mainly by dorsal primary divisions from the sixth to twelfth thoracic nerves.[10] There is still no definite standard concerning the surgical management of the thoracodorsal nerve. Presently, many surgeons leave the thoracodorsal nerve intact during breast reconstruction which can give rise to unwanted movement.

The aim of the study was to analyze the clinical implications of thoracodorsal nerve division during latissimus dorsi musculocutaneous flap breast reconstruction.

Patients and methods

The prospective cohort study was conducted from September 2010 until September 2011 following approval of the South East Scotland Research Ethics Committee 10-S1101-33. For the study we included 29 patients, who had breast reconstruction in the Department of Plastic and Reconstructive Surgery in St John's Hospital in Livingston or in the Department of Breast Surgery in the Western General Hospital in Edinburgh, Great Britain. Breast reconstruction with latissimus dorsi musculocutaneous flap was performed unilaterally in 20 patients or bilaterally in 9 women (38 breasts). In all patients the extended latissimus dorsi flap technique was used.[11] In 31 cases implants were added to increase volume of the reconstructed breasts. The thoracodorsal nerve was divided for 14 patients in reconstruction of 20 breasts done by one surgeon (group 1) and it was preserved for 15 patients in reconstruction of 18 breasts performed by three surgeons (group 2) (Figs. 1 and 2).

Patients had 3D scans taken of the anterior chest wall 6 weeks and 6 months after the surgery with the Di3D 3D camera. Use of 3D imaging has been previously extensively validated for assessment of the breast shape and size.[12,13] Height, width, projection, area of the covering skin and volume of the reconstructed and healthy breasts were measured from the 3D scans. Subsequently, the difference in parameters between the reconstructed and healthy breasts 6 weeks and 6 months after the surgery was calculated for: height, width, projection, area and volume. The degree of asymmetry for area and volume of both breasts used the equation: $a = (l - r)/(l + r)^*100$ and the results were presented as percentage (from 0% – no asymmetry to ±100% – total asymmetry).

A survey of five questions was conducted at 6 months after the surgery to investigate: (a) tissue consistency of the reconstructed breast in relation to the normal breast tissue, (b) painfulness, (c) animation of the reconstructed breast, (d) symmetry of both breasts and (e) overall satisfaction level after the surgery. The answers were scored from 1 (very weak) to 5 (very good).

The significance of differences between the variables was assessed with statistical tests. The Kolmogorov–Smirnov test was used to evaluate the normality of the groups. Differences between independent parametric variables were assessed with *t*-test for independent samples. Differences between dependent parametric variables, such as comparing values of parameters in the same group between 6 weeks and 6 months after surgery were checked with *t*-test for dependent samples. Correlations were assessed with Pearson's test. Probabilities of less than 0.05 were accepted as significant.

Surgical technique

During the preoperative consultation an intact thoracodorsal nerve is indicated if the patient can adduct the arms against resistance, using the functional innervated latissimus dorsi muscle. Preoperative markings are undertaken with the patient standing making note of the projected breast 'footprint'. On the back the markings include the borders of the muscle, including: medial line and posterior axillary line, iliac crest and the tip of the scapula. We favor a transverse skin ellipse leaving a scar in the bra line however, the skin paddle can be in any of the 3 popular locations, i.e. upper transverse, vertical and lower transverse.[7,14]

The surgical technique for extended latissimus dorsi flap harvest is well described.[15–18] Under general anesthesia the patient is placed

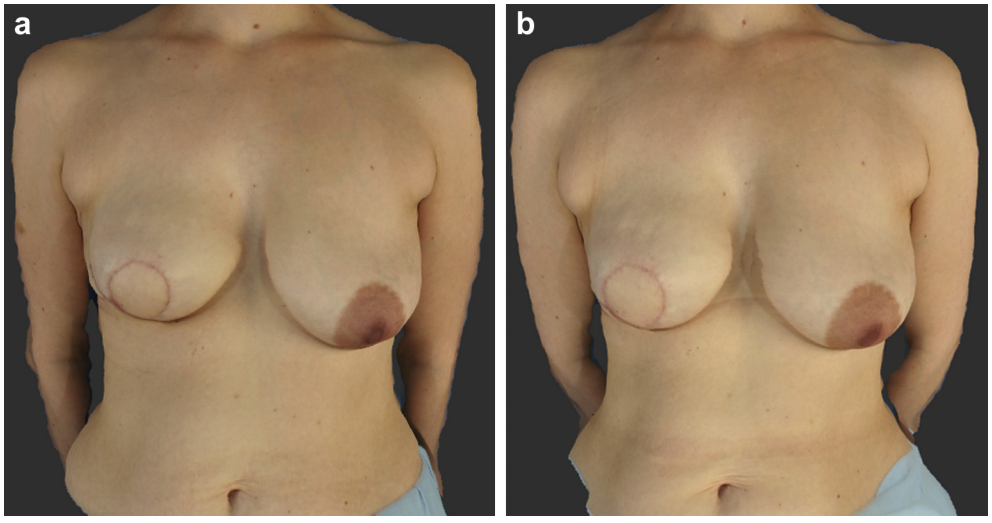

Fig. 1. 3D scan of patient after breast reconstruction with the denervated latissimus dorsi musculocutaneous flap; (a) state after 6 weeks, (b) state after 6 months.