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IDEAS AND INNOVATIONS

Gender-Affirming Surgery

Intercostal Nerve Transfer as a Novel Technique for Sensation Preservation in Gender-affirming Subcutaneous Mastectomy

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Summary: Chest-wall contouring surgery is an important step in the transitional journey of many transgender individuals who choose to undergo masculinization procedures. Traditional gender-affirming chest surgery does not include reinnervation of the nipple–areolar complex (NAC) or the mastectomy skin flaps and risks partial or complete denervation of these areas. Efforts to restore sensation have emerged leading to various sensory nerve transfer techniques including direct neurorrhaphy to the repositioned NAC or to underlying dermatosensory elements. Here, we describe a novel technique in which we perform a nerve transfer from the anterior lateral branch of the fourth intercostal nerve (of the breast parenchyma to be resected) to the anterior lateral branch of the third or second intercostal nerve in the mastectomy skin flap. There has been no increased risk of complications, and results so far are promising. As we continue to collect long-term outcome data, the effectiveness of NAC reinnervation using this technique will be presented in a forthcoming publication.
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INTRODUCTION

Gender-affirming subcutaneous mastectomy is increasingly common in transgender patients, yet the prevention of postoperative numbness and preservation of nipple-areolar complex (NAC) sensation are often overlooked. When addressed, both technique and outcomes remain a challenge. There is a lack of development in preserving sensation, which plays an essential role in erogenous sensation, self-esteem, and identity. Iatrogenic intercostal nerve transection from a mastectomy can lead to complications including neuromas, chronic pain, and postmastectomy pain syndrome. Postoperative changes in chest sensation, including permanent numbness and loss of nipple sensation, are well-documented in the oncological mastectomy population and in the transgender population. Lack of return of meaningful NAC sensation can result in a lack of sexual arousal, a negative impact on one's self-esteem, and an increased risk of injury due to the lack of sensation.[1,2]

Although techniques such as direct neurorrhaphy have shown promise,[3,4] our group decided to explore sensory nerve transfer between the intercostal nerves instead. Given the reliable innervation of the breast and NAC by the fourth intercostal nerve, we hypothesized that key breast sensation characteristics could be preserved by performing a sensory nerve transfer between the fourth intercostal nerve to the remaining mastectomy skin flap via the second or third intercostal nerves. The fourth intercostal nerve branches are primarily responsible for NAC sensation; however, they innervate the tissue removed during a mastectomy. The second and third intercostal nerves innervate the tissue in the remaining mastectomy skin flaps, which are thicker than those in oncological mastectomies.[5,6] By transferring the sensory input from the mastectomy flap to the fourth intercostal nerve, we aim to mimic native breast and NAC sensation. This technique may also capture a larger sensory area, thereby improving postoperative sensation.

PATIENTS AND METHODS

Between 2019 and 2023, 27 mastectomies with intercostal nerve transfer were performed by 3 surgeons

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(W.L., B.P., and B.S.), with the same primary surgeon across all patients. All patients met the World Professional Association for Transgender Health Standards of Care for chest surgery. Patients were offered double incision gender-affirming mastectomy in addition to the option for intercostal sensory nerve transfer. Data collection included demographics, postoperative sensation using Semmes-Weinstein monofilament testing, and a survey on patient-reported sensory outcomes.

Surgical Technique

Operative exposure is provided via the standard gender-affirming "double-incision" mastectomy approach. First, breast tissue is elevated from the pectoralis muscle fascia, going medial to lateral. At the lateral border of the pectoralis, dissection proceeds carefully under loupe magnification toward the midaxillary line to identify the lateral cutaneous branches of the third, fourth, and/or fifth intercostal nerves (Fig. 1).

The anterior branch of the lateral cutaneous branch of the fourth intercostal nerve is identified as it enters the breast tissue to be removed; this will serve as the donor nerve. The anterior branch is dissected along its course into the breast parenchyma to gain additional length and to allow primary neurorrhaphy, obviating the need for grafts. Dr. Mackinnon's[7] usual mantra, "donor distal, recipient proximal," applies here. In our experience, we have found that dissecting an additional 3–5 cm is sufficient to achieve primary neurorrhaphy. All nerve branches going into the breast parenchyma are isolated.

Next, the dissection proceeds cephalad to find the recipient nerve, and the anterior lateral cutaneous branch of the third intercostal nerve is identified as it enters the mastectomy skin flap. Usually, it is from the third intercostal nerve, but sometimes it can be from the second intercostal nerve. Additional length is not needed here (Fig. 1).

Finally, the donor nerve (fourth intercostal) is transected as distally as possible, and the recipient nerve (third intercostal) is transected proximally as it enters the skin flap. Primary neurorrhaphy is performed under loupe or microscope magnification using an 8-0 or 9-0 nylon suture (Figs. 2, 3). The neurorrhaphy site is then protected using a commercially available nerve wrap held in place with detensioning sutures proximally and distally. Following the nerve transfer, the mastectomy is then completed in the usual fashion. This nerve transfer method does not affect the mastectomy design or aesthetic outcomes.

Takeaways

Question: Identify a novel way to enhance the preservation of sensation in transgender mastectomy patients.

Findings: We developed a nerve transfer to help preserve sensation in patients after gender-affirming mastectomies. Specifically, we transferred the anterior lateral branch of the fourth intercostal nerve to the third or second intercostal nerve in the mastectomy skin flap.

Meaning: The sensory transfer from the fourth to the third intercostal nerve is a novel technique to restore chest sensation in gender-affirming mastectomy; this technique is safe, does not require additional or extended incisions, and has no effect on aesthetic outcomes.

RESULTS

Twenty-seven patients underwent top surgery with intercostal nerve transfers during the study period. Demographic data are summarized in Table 1 and surgical outcomes in Table 2. Early postoperatively, sensory transfer patients had more numbness than controls but developed a larger area of nipple-like sensation upon sensory return. (**See figure, Supplemental Digital Content 1**, which displays a patient-reported diagram for nipple-like sensation in sensory transfer [left upper] and control [right upper]; patient-reported diagram for early postoperative sensation in sensory transfer [left lower]

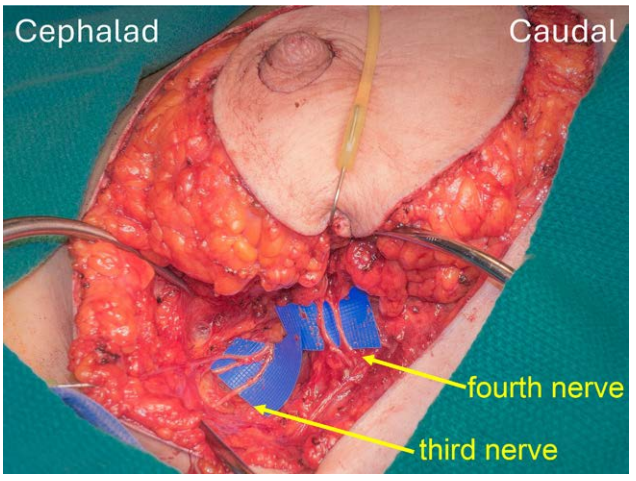

Fig. 1. The fourth intercostal lateral cutaneous nerve branches are seen entering the breast specimen. The third intercostal branches are seen entering the mastectomy skin flap.

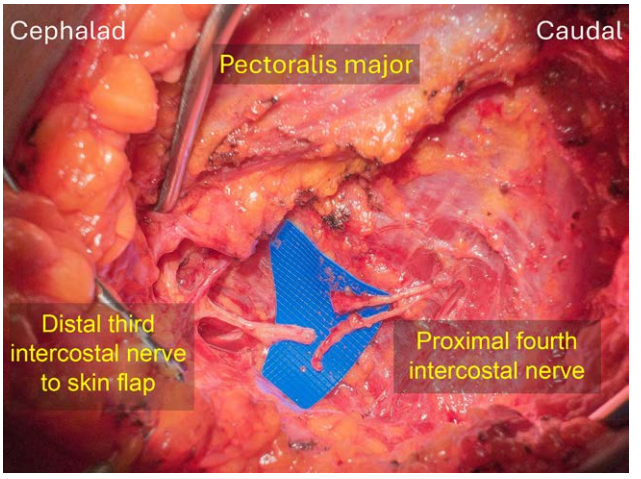

Fig. 2. The proximal third and distal fourth lateral intercostal nerve branches are divided and oriented for tension-free repair.

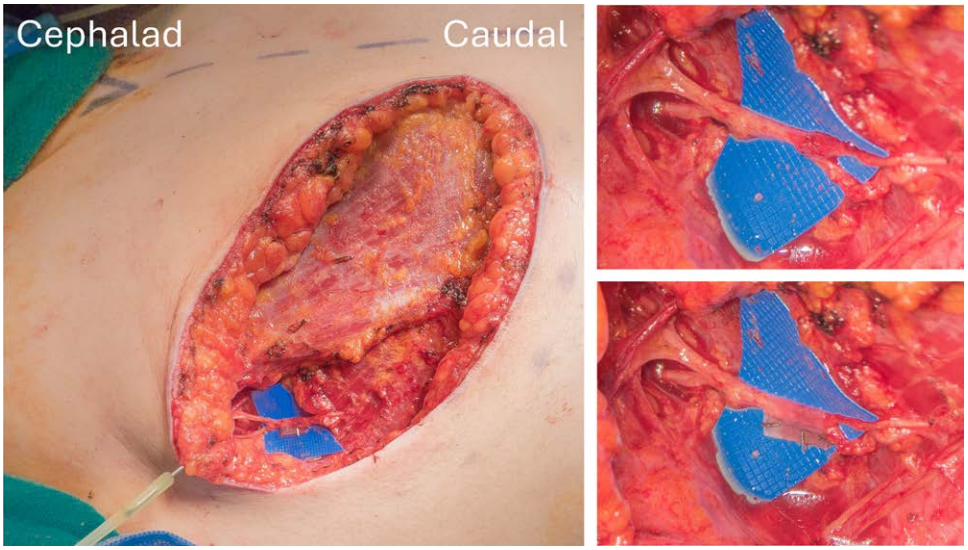

Fig. 3. The third intercostal nerve provides afferent input to the fourth intercostal nerve. Top right, the nerve repair before nerve wrap placement. Bottom right, a nerve wrap is used to protect the coaptation and take tension off the repair.

Table 1. Demographic Data

Mean age (y)	28 (SD = 12)
Mean BMI (kg/m^2)	29 (SD = 7)
Mean breast ptosis grade (the Regnault classification)	2.0
Mean specimen weight (total of both sides, g)	1868 (SD = 1276)
Mean follow-up time (mo)	6.12 (SD = 10)

BMI, body mass index.

Table 2. Surgical Outcomes

No. patients with complaints of postoperative numbness	8/27 (30%)
Number with neuroma symptoms	0
Postoperative nipple sensation	14/27 (52%)
Median Semmes-Weinstein sensation testing (g)	0.46 (SD = 31.3)

and control [right lower], **http://links.lww.com/PRSGO/D882**.)

DISCUSSION

As gender-affirming mastectomy is evolving, the focus has started to shift toward achieving nonaesthetic outcomes, including sensory preservation. Prior studies suggest neurorrhaphy of the fourth intercostal nerve directly into the dermis, to a free nipple graft,[3] or to underlying dermatosensory elements. Here, we present a novel and feasible nerve transfer technique between intercostal nerves that restores NAC and erogenous breast sensation within the remaining mastectomy skin flaps.

This sensory nerve transfer technique utilizes native cutaneous sensory branching patterns to innervate a larger anatomic area. This eliminates the risk of postoperative numbness in a dermatomal distribution commonly seen when performing direct neurotization of the nipple graft. A significant advantage of this technique is the ability to achieve tension-free nerve transfer without grafts. These early results suggest increased sensitivity compared with controls; however, data collection is ongoing. The mean follow-up time for our study population was approximately 6 months, which is early in terms of sensory nerve regeneration. With longer follow-up time, we anticipate even better sensory outcomes and a decreased rate of postoperative numbness.

Drawbacks include the lack of precise mapping of chest-wall sensory input, potentially affecting the correlation of erogenous zones with nipple grafts. This is illustrated in Supplemental Digital Content 1, where nipple-like sensation was restored to the mastectomy skin flaps and not specially at the location of the free nipple grafts (**Supplemental Digital Content 1**, **http://links.lww.com/PRSGO/D882**). However, erogenous zones do vary among individuals,[8,9] and specific geographic mapping may not be as relevant if erogenous sensation can be preserved.

Future directions include the potential to restore sensation in oncological mastectomies. The current forefront of procedures focuses on preserving sensation, in some cases by preserving the superficial anterior branch of the intercostal nerve when oncologically possible. In cases where the fourth intercostal branch cannot be spared, options such as nerve grafting or performing a sensory nerve transfer of the third intercostal to the fourth intercostal nerve.

Further outcome studies with longer patient follow-ups are needed to provide further insight as to how patients recover long term. Our current sample size is small, making it difficult to draw any conclusions. Additionally, postoperative sensation was not routinely measured in patients undergoing traditional gender-affirming mastectomy (without sensory preservation). A prospective or

randomized study is needed to determine if sensory outcomes are significant. Other than longer operative time, there has been no increase in adverse outcomes. Our data collection is ongoing, and future research will include a dedicated sensory questionnaire specific to gender-affirming patients, as well as an objective way to measure erogenous sensation.

In conclusion, sensory transfer from the fourth to the third intercostal nerve is a novel technique to restore chest sensation in gender-affirming mastectomy. The technique is safe, does not require additional or extended incisions, and has no effect on aesthetic outcomes. Further study is necessary to better quantify outcomes; however, currently, our outcomes are promising, suggesting this is a viable proof of concept.

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DISCLOSURES

Drs. Lin and Safa are consultants for Axogen. The other authors have no financial interest to declare in relation to the content of this article.

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