

Nipple Sensation in Reduction Mammoplasty: Review Article

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Abstract

Background: Surgery today involves preserving not only tissue viability but also function in terms of sensation. The nipple serves as a sensate unit in erectile function and plays a large part in the physical intimacy of women. Nipple sensation has shown to be a valuable part of women's psychological and sexual health.

Aim: To review nipple sensation in reduction mammoplasty, with emphasis on the anatomical basis of nipple-areola complex innervation and the influence of different breast reduction techniques on sensory preservation.

Conclusion: Pedicle-based reduction mammoplasty generally provides better preservation of nipple sensation than free nipple grafting, with the medial pedicle showing particularly favorable sensory recovery. Preservation of the fourth intercostal nerve, especially its lateral cutaneous branch, may help guide surgical dissection and improve postoperative nipple-areola complex sensation.

Introduction

The nipple-areola complex (NAC) has important sensory and functional roles that contribute to postoperative satisfaction and quality of life. Consequently, preservation of nipple sensation has become an important consideration in breast surgery, particularly in reduction mammoplasty. However, despite its clinical relevance, the anatomical pattern of nipple innervation remains incompletely defined, with considerable variation and disagreement reported in the literature regarding the dominant neural supply [1].

Many advocate that nipple sensation is paramount to patient satisfaction as well. As the nipple is perhaps the most sensitive area of the breast, it serves a significant role in a woman's sexual life. Erectile function and sensation are frequently necessary for both the woman herself and her partner. Consequently, loss of these functions has a detrimental impact on procedure outcome and patient satisfaction [2].

Previous studies have demonstrated that the majority of women feel that nipple-areola sensitivity as an important part of their sexual life, and of those women who underwent breast surgery and lost nipple sensation, the majority of women were significantly bothered by the result [3].

In general, patients undergoing breast-reduction surgery demonstrate high satisfaction due to the improvement in neck, shoulder, and back pain. However, loss of sensation to the nipple results in a poorer outcome. Anatomical analysis of the innervation of the NAC possibly helps guide the surgeon in avoiding damage to the nerves of the nipple [4].

Anatomical Basis of Nipple Sensation

Other studies also demonstrated accessory innervation of the nipple to come from both anterior and lateral branches of the second through sixth intercostal nerves [2].

The nipple-areola complex is supplied by intercostal nerve branches, and preservation of these neural pathways is central to maintaining sensation during breast surgery [2].

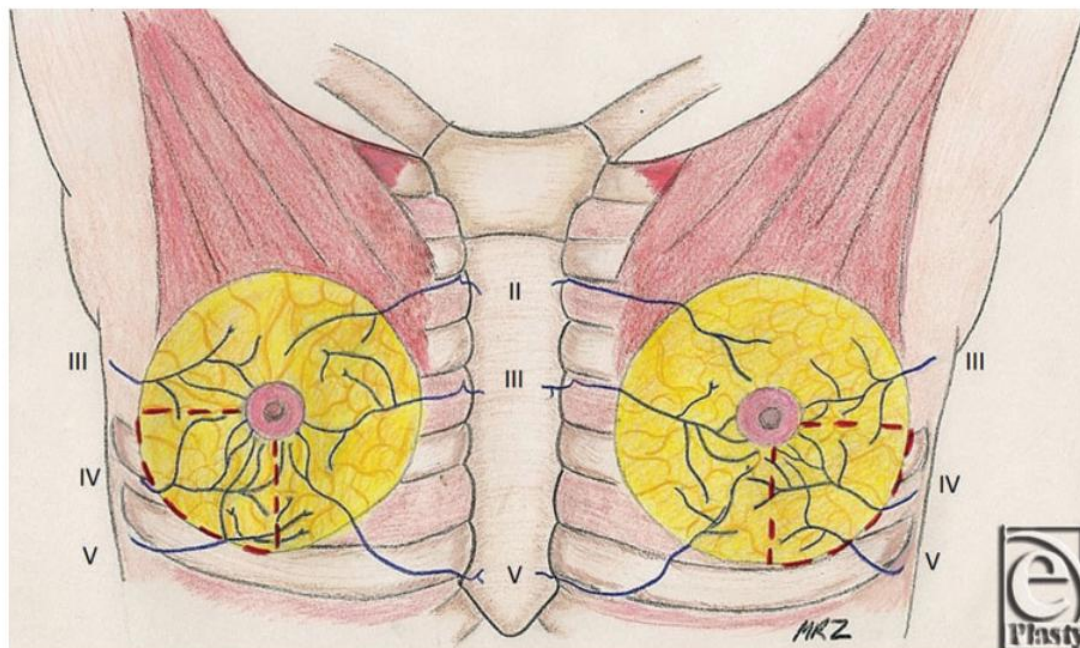


Figure 1. Anterior view of intercostal nerve innervation to the nipple. The red dashed lines demarcate the inferolateral breast quadrant to be avoided during surgical dissection so as to preserve nipple sensation [2].

Influence of Reduction Mammoplasty Technique on Nipple Sensation

Inferior Pedicle

The inferior pedicle technique preserves the NAC via a stalk that stems from the inferior pole breast tissue. Vascular supply of this pedicle includes the lateral thoracic artery and intercostal artery perforators. Preservation of the blood supply allows for the safe relocation of the NAC higher on the breast mound while reducing the overall breast volume [5].

The inferior pedicle technique is reliable for achieving large volume reductions while maintaining sensation to the NAC. It also ensures a robust blood supply to the NAC, reducing the risk of ischemia and necrosis. This technique is highly versatile and can be adapted to various breast sizes and shapes [6].

Superomedial Pedicle

The superomedial pedicle (SMP) technique preserves the blood supply and innervation to the NAC from the upper and medial portions of the breast. The neurovascular supply originates from the internal mammary system. This approach allows for the repositioning of the NAC to a higher location using a rotational method [5].

Similar to the inferior pedicle, those with good skin elasticity tend to have better esthetic outcomes, as their skin can support the weight of the pedicle and can accommodate the stretching and reshaping more effectively. With the SMP, the NAC has a robust vascular supply from the internal mammary artery perforator and nipple loss is rare [7].

One disadvantage of this technique is that to achieve adequate pedicle rotation to NAC reseating, it is necessary to detach the distal pedicle from the underlying tissue. This sometimes requires a generous amount of undermining of the pedicle, particularly in large breasts with long pedicles. Given this degree of mobilization, blood supply to the distal aspect of the pedicle can become compromised which would affect viability of the NAC [8].

Superior Pedicle

The superior pedicle technique preserves the blood supply and innervation to the NAC from the upper portion of the breast. The internal mammary perforators and neurovascular bundle are from the second intercostal space and are the main suppliers of this pedicle. This approach allows the NAC to be repositioned higher on the breast mound while reducing the overall breast volume [5].

The superior pedicle technique offers several advantages. The superior pedicle technique is particularly beneficial for patients with moderate breast size and significant ptosis where the bulk of the excess parenchyma is below the NAC. This technique allows for significant reduction and lifting of the breast. The superior pedicle method often results in a well-defined upper pole. This technique is relatively versatile and can be used in smaller and medium sized reductions. The resultant scars from a superior pedicle approach can be less extensive because the skin excision options are not limited to the conventional wise pattern and can also include vertical and periareolar patterns [9].

Major disadvantages to the superior pedicle technique include limited use in large reductions and a high risk of sensory loss at the NAC. The superior pedicle is not ideal for larger resection, particularly in patients with excess upper pole tissue, as it can be difficult to inset the pedicle.

Medial Pedicle

Medial pedicle breast reduction preserves blood supply and innervation to the NAC from the medial portion of the breast. Preservation of tissue extending from the medial breast to the NAC creates a pedicle with a retained blood and nervous supply to the NAC via internal mammary perforators and medial intercostal nerves, respectively [5].

The medial pedicle technique offers several advantages. This technique lifts and reshapes the breast more in comparison to the SMP technique due to elimination of the superior pedicle attachment and thus, a wider arc of rotation is available to the pedicle. Additionally, this method proves to have a high rate of sensation preservation and viability of the NAC while allowing for significant parenchymal excisions. The rate of pseudoptosis is lower compared to the inferior pedicle technique [10].

Furthermore, this technique is particularly beneficial for patients with pronounced medial fullness or those who desire to have greater projection of the medial aspect of the breast post-operatively. Disadvantages include limited overall breast projection and suboptimal breast shape. Additionally, this technique is limited in ability to remove large volumes of breast tissue unless dog ears are created to accommodate excess removal [11].

Central Mound

The central mound technique maintains blood supply and innervation to the NAC through the central portion of the breast. This approach elevates the NAC while reducing overall breast volume [5].

The central mound method results in the most natural breast shape with a well-defined upper pole and a gentle slope toward the lower pole. This technique provides a balanced projection throughout the breast and preserved sensation of the NAC, even in cases of severe breast hypertrophy due to the central blood and nervous supply from the chest wall. Other advantages include the multiple sources of vascularity and possibility for extensive resection circumferentially. However, the most notable disadvantage of the central mound technique includes difficulty achieving symmetry, particularly in patients with pre-existing asymmetry along either horizontal or vertical axes [12].

Free Nipple Graft

The FNG technique offers several advantages. One of the main benefits is the ability to achieve significant reduction in breast size that would not be possible with traditional pedicle techniques. This method is particularly useful for patients with extremely large or pendulous breasts, where the blood supply to the NAC might be compromised if left attached during the procedure because it would be impossible to maintain the recommended length to width ratio of 3:1 while still achieving a generous reduction. By using the FNG

technique, the risk of NAC necrosis is eliminated. Additionally, this technique allows for more flexibility in positioning the areola, resulting in better esthetic outcomes [13].

However, the FNG technique also has some notable disadvantages such as the loss of sensation and function to the nipple, as the nerves are severed during the removal for grafting. This results in permanent numbness and dysfunction of the nipple and areola. Additionally, the ability to breastfeed is lost. Further, there is always a risk of skin graft failure [5].

Recovery of Nipple Sensation

Hall-Findlay [14] found that 85% of patients with a medial pedicle recovered normal to near-normal sensation whereas the superior pedicles were only 67 per cent and the lateral pedicles 76 per cent (Table 1). These were assessed by pre- and postoperative patient-reported questionnaires using a Likert scale.

Table 1. Recovery of nipple sensation after superiorly based breast reductions [14].

Pedicle	Breasts (n)	% return
Superior	58	67%
Lateral	147	76%
Medial	1206	85%

Note: Patients were asked during the markings to remember their nipple sensation and then given a questionnaire at each postoperative visit where they were asked to compare their preoperative sensation to their postoperative sensation using a Likert scale.

Surgical Considerations for Sensory Preservation

Anatomical analysis of the innervation of the NAC possibly helps guide the surgeon in avoiding damage to the nerves of the nipple [4].

The inferior pedicle technique is reliable for achieving large volume reductions while maintaining sensation to the NAC [6]. The superomedial pedicle preserves blood supply and innervation to the NAC from the upper and medial portions of the breast [5]. The medial pedicle has a high rate of sensation preservation and viability of the NAC while allowing for significant parenchymal excisions [10]. In contrast, free nipple grafting results in loss of sensation and function to the nipple because the nerves are severed during removal for grafting [5].

Conclusion

Preservation of nipple–areola complex sensation should be considered an important functional objective of reduction mammoplasty in addition to achieving satisfactory breast shape, volume reduction, and nipple viability. The available evidence indicates that postoperative sensory outcomes are influenced by pedicle selection and, more importantly, by preservation of the principal neural pathways supplying the nipple–areola complex.

Among the techniques reviewed, pedicle-based reduction mammoplasty generally provides substantially better preservation of nipple sensation than free nipple grafting, in which transection of the native neural connections commonly results in permanent sensory loss. Available comparative data suggest particularly favorable sensory recovery with the medial pedicle, with reported recovery of normal or near-normal nipple sensation in approximately 85% of patients, compared with 76% with lateral and 67% with superior pedicles. Inferior and septum-based pedicles also appear to provide favorable sensory outcomes because they can preserve important deep and inferolateral neural pathways. Therefore, although the available literature does not establish a single universally superior technique for every patient, medial, inferior, and nerve-preserving septum-based approaches appear preferable when preservation of nipple sensation is a major surgical priority.

From an anatomical perspective, the fourth intercostal nerve represents the most important target for sensory preservation. In particular, the lateral cutaneous branch of the fourth intercostal nerve provides a dominant contribution to nipple–areola complex sensation, while the anterior cutaneous branches of the third to fifth

intercostal nerves provide additional sensory input. Consequently, careful preservation of tissue along the inferolateral and central deep breast, avoidance of unnecessary disruption of the lateral pectoral fascial region and horizontal septum, and maintenance of adequate parenchymal continuity with the nipple–areola complex may reduce the risk of neural injury. Incorporating these anatomical principles into pedicle design and surgical dissection may help optimize postoperative nipple sensation while maintaining the aesthetic and vascular objectives of reduction mammoplasty.

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