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Negative Pressure Wound Therapy for Improved Nipple Survival in Large Volume Reduction Mammoplasty

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Abstract

Background Large volume breast reductions are at increased risk of nipple ischemia and necrosis due to tenuous blood supply of long pedicles. We adapted incisional negative pressure wound therapy to augment nipple survival in such patients undergoing mammoplasty by inferior pedicle technique.

Methods Patients with nipple-to-inframammary fold distance >14 cm were informed of increased risk of requiring free nipple graft. All patients underwent inferior pedicle technique with Wise pattern skin incision. Once incisions were closed and the nipple-areolar complex was inset, the complex was assessed for vascularity. In 12 cases there was evidence of compromised arterial inflow or venous outflow. For these patients, incisional negative pressure wound therapy was applied to the bilateral nipple-areolar complexes for 5-7 days.

Results None of the 12 patients (24 breasts) in this series experienced nipple-areolar complex ischemia or necrosis. Only 2 patients experienced delayed wound healing which was successfully managed by local wound care.

Conclusions This study demonstrates the utility of negative pressure wound therapy in nipple survival for at-risk patients. We believe it augments healing by allowing improved micro-circulation.

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Keywords Negative pressure wound therapy · npwt · Breast reduction · Mammoplasty · Macromastia · Gigantomastia · Nipple ischemia · Nipple necrosis

Introduction

Breast reconstruction is a common plastic surgery operation to relieve discomfort caused by large, ptotic breasts. The goals of operation are both functional and aesthetic. In general, nipple-areolar complex blood supply is maintained by a vascularized parenchymal pedicle technique to maximize functional and aesthetic outcome [1, 2]. Large breast reductions, however, present specific concern for survival of the nipple-areolar complex (NAC). Large, ptotic breasts can result in a long pedicle, which presents a challenge because the anatomy may be more variable and the tissue must be compressed or folded in some manner when closed within the smaller skin envelope of the newly formed breast. If not anticipated or monitored, this may result in nipple ischemia or soft tissue loss when a portion of the pedicle is compromised [3, 4]. A common alternative technique is a free nipple-areolar graft (FNG) onto a more reliable vascularized recipient bed [2, 5]. This can present its own disadvantages, namely loss of nipple sensation, pilomotor function, skin coloration, and lactation [6, 7]. Converting to a non-pedicle technique can also negatively impact the eventual breast shape and volume distribution

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resulting in a breast that is boxy, flat, and with unsatisfactory projection [8, 9].

In this study, we present an alternative technique to conversion to FNG. For high-risk patients, we used negative pressure wound therapy (NPWT) to promote blood flow in the nipple-areolar complex overlying the vascular pedicle. As long as there was evidence of some blood flow at the time of closure, we hypothesized that NPWT can attenuate tissue edema and improve blood flow during the healing process. Often, need for FNG is determined by subjective assessment intraoperatively, or by arbitrary cutoffs for weight of tissue resection or pedicle lengths [10, 11]. Rather than use an arbitrary weight or breast size to determine the need for FNG, we used clinical assessment at the time of pedicle inset. For our practice, this substantially reduced the number of FNG breast reductions performed.

NPWT has seen increased use in closed surgical wound management, especially with the development of portable disposable systems. Although NPWT has been used in breast reduction surgery, the focus has been incisional healing [12, 13]. It has not been described as a modality to improve viability of at-risk NACs. In this series, 12 patients with large volume macromastia (Schnur scale > 900 g) underwent bilateral reduction mammoplasty using the Wise pattern and inferior pedicle technique. Negative pressure wound therapy was applied to bilateral NACs, and NACs were assessed for function and survival.

Materials and Methods

Study inclusion criteria were age > 18 years of age, non-smoking, no history of breast surgery, breast tissue excision > 900 gm each breast, and preoperative sternum-to-nipple measurement > 35 cm or nipple-to-inframammary fold measurement > 20 cm. All patients were marked in the upright position using Wise pattern. Minimal pedicle width was 10 cm. Informed consent included the use of NPWT in the setting of concern over NAC viability. Blood flow to the NAC attached to the inferior pedicle was assessed during inset and documented. No bleeding required conversion to FNG. During the 16-month study interval this occurred 3 times. For all other cases meeting the inclusion criteria, the NPWT was applied to the NAC after inset. After skin closure and NAC inset, multiple small stab incisions were made in the NAC, as would be done in the setting of a full thickness skin graft (Fig. 1). We used a single-use, portable pump without exudate canister (PICO, Smith and Nephew Medical Ltd., UK) (Fig. 2). Dressing was left in place for 5–7 days. Patients were informed to call if the suction was not functioning properly and asked to return to the clinic for troubleshooting. NAC perfusion, wound healing, and tactile nipple sensation were



Fig. 1 Patient 3. Scalpel used to place small, full-thickness openings in the skin of the nipple-areolar complex



Fig. 2 Patient 3. Negative pressure wound therapy secured over the nipple-areolar complex

assessed clinically by the surgeon. Standing IRB approval was in place for this cohort study.

Results

A total of 12 patients received NPWT during bilateral reduction mammoplasty during the study interval. Table 1 highlights demographic information of the cohort. Mean age was 35, body mass index 37.6, and bilateral tissue excised 1361.3 g. The final pedicle length after dissection ranged from 15 to 24 cm (Fig. 3). Mean follow-up time

Table 1 Patient baseline demographics

Pt.	Age	BMI	Preoperative sternal notch-to-nipple distance (cm)		Preoperative nipple-to-inframammary fold (cm)		Intraoperative pedicle length (cm)		Weight resected (g)	
			R	L	R	L	R	L	R	L
1	42	42	45	43	20	20	22	21	1481	1376
2	31	29	38	40	18	19	20	20	1084	1153
3	28	44	40	43	16	17	17	19	1703	1768
4	46	33	37	37	21	21	21	22	1293	1288
5	49	42	39	37	17	17	17	15	1347	1282
6	21	50	38	39	17	18	16	16	1148	1329
7	19	38	44	42	16	15	17	16	1275	1183
8	26	37	45	45	19	19	19	20	1290	1322
9	38	40	38	39	20	21	20	20	1648	1723
10	44	31	45	44	19	17	19	18	1435	1402
11	47	30	35	37	22	22	22	21	1090	1126
12	39	35	42	41	25	25	24	23	1463	1461
Avg	35.8	37.6	40.5	40.6	19.2	19.4	19.3	19.3	1354.8	1367.8

was 6 months (Fig. 4). None of the 12 patients in this series

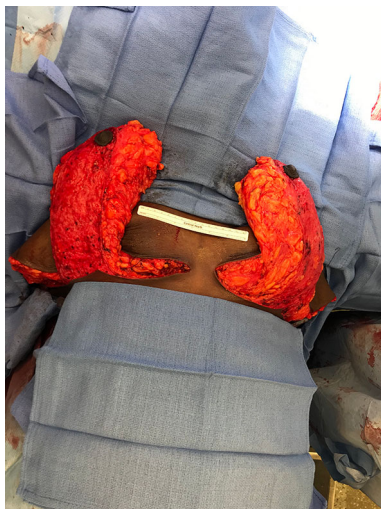


Fig. 3 Patient 11. Intraoperative image of the inferior based pedicles after dissection; right 22 cm and left 21 cm

experienced NAC ischemia or necrosis. There were no cases of soft tissue loss or fat necrosis. All patients confirmed resolution of back and shoulder pain and were satisfied with the results. No cases required further surgery or NAC tattooing. Delayed wound healing occurred in 2 patients and was successfully managed by local wound care for 6 and 8 weeks. In one case, there was leaking at the borders of the PICO dressing; this nonfunctional dressing was left in place until day 5 when it was removed without complication. Three patients experienced sensory loss



Fig. 4 Patient 3. **a** Pre-operative and **b** 6 months post-operative

compared to baseline: unilaterally in two cases and bilaterally in one.

Discussion

We have shown that negative pressure wound therapy can prevent nipple loss in large volume breast reductions. The technique is simple to implement and well-accepted by patients. There were no instances of nipple ischemia or necrosis in the 12 patients studied, nor was there evidence of pedicle healing problems. Only two patients experienced delayed wound healing which resolved in 8 weeks. Sensation was preserved in 78% of breasts that had sensation preoperatively. This compares favorably to previous reports of subjective sensation after pedicled reductions [14, 15]. Incidentally, sensation has been shown to return over time, and follow-up in the present series was 6 months [14]. We believe these findings increase the scope for use of a vascular pedicle technique in women who may not have previously been considered candidates for it.

FNG is often the safe option for large volume breast reductions. Our series suggests that a pedicled technique combined with NPWT can be safely used even when blood supply is marginal at the time of closure. Literature supports the concept that NPWT reduces edema within the tissue and augments venous outflow to improve oxygenated blood circulation [16, 17]. As long as the pedicle has some blood flow, the NPWT can be functioning as it does in cases of skin graft healing [18].

There are reports in the literature of successfully performing long pedicle breast reduction [19]. Some authors suggest that intraoperative Doppler can improve the safety of this operation [20, 21]. It is our belief that venous compromise, because it is a lower pressure system, is the bigger risk in this setting. NPWT augments venous outflow during early healing. The three patients that were converted to FNG during the study interval had severely compromised blood flow, and there is no reason to believe that NPWT could have overcome this.

The use of disposable NPWT in surgical wound healing has been established [22]. In breast surgery, recent studies have demonstrated the benefits of NPWT in mammoplasty. Galiano et al demonstrated fewer healing complications in NPWT-treated breasts versus standard care [12], and Tanaydin et al showed less complications and improved quality of scarring in NPWT sites [13]. Both of these studies focused on skin incisions and not the NAC. There is additional cost associated with this technology, but it is offset by decreased complications, healing problems, and need for further surgery often seen in high BMI patients [23].

Limitations of this studied include selection bias, small group size, and lack of control group. Although we do not believe it would be ethical to randomize patients for this type of study, we are looking at ways to more objectively study the physiology at work. Quantifying blood flow or oxygenation

before and after application of the NPWT would clarify the active nature of this intervention.

Conclusions

Our series suggests utility of NPWT for improving nipple survival in large volume reduction mammoplasty with vascularized pedicles. NPWT may improve wound outcomes by reducing edema in the healing interface. Maintaining an intact NAC can improve functional and aesthetic outcomes, and therefore may be an attractive option for surgeons performing reduction mammoplasty in this population.

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Declarations

Conflict of interest The authors declare that they have no conflicts of interest to disclose.

Ethical Approval All procedures performed were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments.

Informed Consent Informed consent was obtained from all patients in this case series.

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