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Nipple Delay Improves Nipple-Areolar Complex Viability in High-Risk NSM Patients

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Introduction

Nipple-sparing mastectomy (NSM) is increasingly utilized in breast cancer surgery due to its superior cosmetic outcomes and patient satisfaction. However, ischemic complications, particularly necrosis of the nipple-areolar complex (NAC), remain a significant concern, with reported incidence ranging from 6% to 30%. Several patient- and surgery-related factors such as large breast volume, periareolar incisions, prior breast surgery, radiation exposure, and smoking have been identified as contributors to NAC necrosis.
Nipple delay (ND) is a surgical technique performed approximately 1–2 weeks prior to NSM, designed to improve NAC perfusion and reduce ischemic complications in patients considered high risk. To our knowledge, this is the first report from Japan to assess the impact of ND in a cohort of Japanese patients undergoing NSM with immediate autologous reconstruction.

ND Procedure (Figure 1,2)

・Incisions were made either periareolarly or at the lateral breast or inframammary fold (IMF).
・Skin flap was elevated from the breast gland in a circular area with a radius of more than 5 cm (diameter >10 cm) centered on the NAC.
・Hydrodissection was used for the undermining procedure.
・A small cone-shaped portion of the gland directly beneath the nipple was excised and submitted for permanent histopathological examination.
・An absorbable hemostatic agent was placed in the subcutaneous space.
・No drain was used.

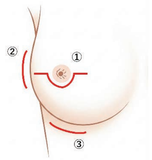


Figure 1 ND incision pattern
① periareolar, ② Lateral, ③ IMF



Figure 2 extent of dissection

Patients

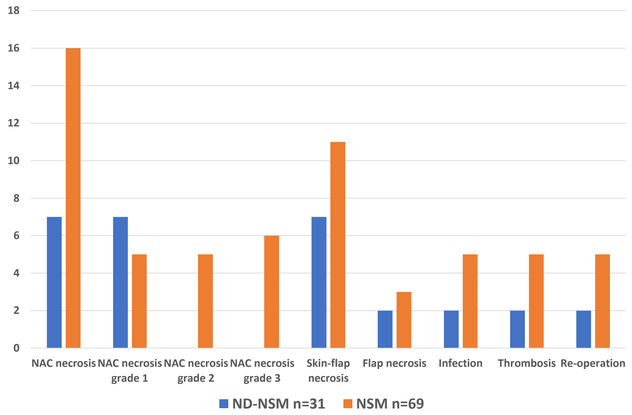
Study period: January 2020 to March 2025
Comparison of two cohorts:
ND-NSM group (n=31)
NSM-only group (n=69)

	ND-NSM n=31	NSM n=69	p value
Age	49.8	51.3	0.4654
BMI	22.5	22.6	0.901
Smoking	8	22	0.5396
Diabetes	1	4	0.5853
Hypertension	5	13	0.7441
Exogenous steroid use	0	2	0.3383
Neoadjuvant therapy	6	21	0.2484
Prior breast surgery	1	2	0.9293
History of Breast radiation	1	2	0.9293
Axillary surgery SLNB ALND	 1 30	 4 65	0.5853
Reconstruction type DIEP PMT GAP	 28 0 3	 56 6 7	0.2329
Incision type periareolar lateral IMF	 25 5 1	 23 42 4	<0.0001
Operation time (min)	559.9	510.8	0.0655
Blood loss (ml)	312.5	234.5	0.0249
Specimen weight (g)	350.7	275.1	0.0237

DIEP: Deep Inferior Epigastric Perforator flap
PMT: Posterior Medial Thigh Perforator flap
sGAP: superior gluteal artery perforator flap

Results

The overall incidence of NAC necrosis did not differ significantly between groups (22.6% in ND-NSM vs. 23.2% in NSM-only). However, when stratified by necrosis grade, the ND-NSM group demonstrated a significantly lower rate of grade ≥2 necrosis (p = 0.0276).
Importantly, no cases of grade ≥2 necrosis were observed in the ND group.
Other complications such as skin necrosis, infection, thrombosis, and flap-related events were similar between groups.



Discussion

Key Findings
ND is feasible and protective in Japanese NSM patients
Despite higher-risk features in the ND-NSM group, severe NAC necrosis (grade ≥2) was significantly reduced
No cases of grade ≥2 necrosis observed in the ND group
Other complications remained comparable between groups.

The literature reports several risk factors for NAC necrosis, including the location of the skin incision, smoking status, obesity (BMI ≥ 25 kg/m²), and large breasts (glandular weight ≥ 750 g).
An analysis of the relationships between the minor complications observed in this study and these risk factors revealed that of the 6 patients with partial NAC necrosis, 3 (50%) had major risk factors, such as obesity or a history of smoking. Furthermore, in all 6 of these cases, a periareolar incision was used. Similarly, of the 7 patients with skin incision margin necrosis, 3 (43%) had risk factors such as obesity or smoking. While this suggests a tendency for complications to occur in patients at high risk of impaired blood flow, it also indicates that even in such high-risk cases, the intervention of the ND procedure limited the degree of necrosis to a partial and conservatively manageable level.

Conclusions

Despite higher-risk features, the ND-NSM group showed a markedly reduced severity of NAC necrosis. Our findings suggest that the nipple delay procedure may allow patients with traditionally high-risk characteristics to safely undergo NSM with complication rates comparable to lower-risk patients.
This is the first study from Japan to evaluate the clinical utility of ND, and our results indicate that this approach is both feasible and beneficial in the Japanese population. ND should be considered a valuable adjunct to NSM in patients at elevated risk for ischemic complications, particularly when immediate autologous reconstruction is planned.

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