

DISCUSSION

In general, small breast cancers are good candidates for breast-conserving therapy. Various factors, however, can affect cosmetic outcome among patients with breast cancer indicated for breast conservation. The larger the tumor size, the worse the cosmetic outcome after partial mastectomy. In addition, not only the size of the tumor but also the size of the breast has a great impact on cosmetic outcome. Breast-conserving therapy, therefore, is indicated for breast cancer 3cm or smaller in Japanese patients [4] and for that up to 5cm in American patients [5].

Besides lymphatic permeation and hematogenous spread, breast cancer can widely spread in the breast in a stromal invasion fashion and/or a ductal spread fashion. Even small breast cancers, therefore, have been treated not with breast-conserving therapy but with total mastectomy due to the possible cancer, especially non-invasive ductal cancer, spread mainly toward the nipple-areolar complex. Improvement of spatial resolution of the magnetic resonance imaging (MRI) has made us more accurately evaluate the stromal invasion to the nipple-areolar complex preoperatively than the era without MRI evaluation on one hand [6]. No image modalities including MRI can detect small amount of non-invasive ductal spread to the nipple on the other hand. Unexpected positive margins on frozen section, therefore, sometimes force us to treat the patients not with nipple preservation but with nipple resection, or even with total mastectomy [7]. In this case, we could not precisely evaluate the cancer spread in the breast preoperatively due both to the presence of pacemaker and her renal impairment. We, therefore, intended to resect the possible intra-ductal spread, even if present, between the main tumor and the nipple.

Many surgeons undoubtedly believe that ischemia of the nipple due to full mammary gland resection could easily cause nipple necrosis. Breast surgeons unfamiliar with nipple base resection hence often resect the nipple base in such a manner to leave certain amount of mammary gland under the nipple. Rusby [8] however, reported that one-third of the blood supply to the nipple was from the mammary gland and the other two-thirds were from the skin. These findings highly suggest safer nipple preservation, even if the mammary gland is completely removed, as long as the blood flow in the nipple skin is maintained.

It is well known that non-invasive ductal cancers spread more widely in the breast than small invasive ductal cancers, leading to less application rate of breast conservation to stage 0 ductal cancers than to stage 1 ductal cancers. This phenomenon is further amplified by the idea that even slight involvement of non-invasive ductal cancer just around the nipple should not be the candidates for nipple preservation. On the other hand, non-invasive ductal cancer does not invade the nipple skin except for the parietal part of the nipple. These facts strongly encourage breast surgeons to resect non-invasive ductal component spreading almost to the nipple or

even slightly into the nipple with some surgical intervention, i.e., nipple incision or partial nipple resection, to the nipple-areolar complex. Our nipple base resection techniques, however, can provide another alternative, i.e., feasible resection of ductal spreading for the nipple direction without direct surgical intervention to the nipple-areolar complex, for patients with breast cancer located very close to the nipple-areolar complex.

The main points of our nipple base resection technique are as follows. First, certain amount of sub-areolar fat tissue should be preserved to prevent inhibition of venous return from the nipple, i.e., nipple congestion. In order to ensure the safety of preserving the subcutaneous fat around the nipple-areolar complex, it is important for breast surgeons to select the patients suitable for nipple and subcutaneous fat preservation. Therefore, breast cancers with massive lymphatic permeation should be contra-indicated for our surgical procedures and be treated not with primary surgery but with primary chemotherapy followed by some surgery using our nipple base resection techniques, when observed marked response to the primary chemotherapy [9]. Second, breast surgeons should detach the sub-nipple mammary gland from surrounding fat tissue with the curved Mosquito forceps. Because the horizontal cross-section of the sub-nipple mammary gland is oval shape, this blunt dissection procedures are easier with the curved forceps than with the straight forceps. Then, appropriate counter-traction for nipple base enables surgeons to also resect some part of the intra-nipple mammary gland. In addition, our operative techniques safely and uniformly enable breast surgeons to prevent skin damage on sub-nipple mammary gland resection by passing one blade of the scissors into the dissected space just beneath the sub-nipple mammary gland and moving the blades toward the nipple base with the blades being kept open.

Our surgical techniques allow many breast surgeons, including inexperienced young surgeons, to safely and easily excise the intraductal breast cancer spread toward the nipple-areolar complex without major nipple complication. This report mainly mentioned our surgical techniques how to safely preserve the nipple-areolar complex for a breast cancer located close to the nipple with limited post-operative follow-up. Not only preoperative nipple complication but also long-term local control of our surgical techniques should be evaluated in the near future.

In conclusion, our nipple base resection techniques can offer feasible nipple base resection for breast cancer located close to the nipple-areolar complex. We are convinced that the acquisition of our surgical techniques will greatly contribute to the increase in the number of patients who will benefit from nipple preservation.

STATEMENT OF ETHICS

The study was approved by the Kishiwada Tokushukai Hospital Ethics Committee (IRB #Case 20-06). Written

informed consent was obtained from the patient for the publication of this case report and any accompanying images.

CONFLICT OF INTEREST STATE

The authors have no conflicts of interest to declare.

FUNDING SOURCES

No funding was received for this research.

AUTHOR CONTRIBUTIONS

Naoko Abe contributed to the design of the report. Shoji Oura drafted the manuscript.

Shinichiro Makimoto revised the manuscript. All authors have read and approved the final version of the manuscript.

DATA AVAILABILITY STATEMENT

All data generated during this study are included in this article. Further inquiries can be directed to the corresponding author.

REFERENCES

1. Halse WS (1894) I. The Results of Operations for the Cure of Cancer of the Breast Performed at the Johns Hopkins Hospital from June, 1889, to January, 1894. *Ann Surg* 20(5): 497-555.
2. Veronesi U, Cascinelli N, Mariani L, Greco M, Saccozzi R, et al. (2002) Twenty-year follow-up of a randomized study comparing breast-conserving surgery with radical mastectomy for early breast cancer. *N Engl J Med* 347(16): 1227-1232.
3. Fisher B, Anderson S, Bryant J, Margolese RG, Deutsch M, et al. (2002) Twenty-year follow-up of a randomized trial comparing total mastectomy, lumpectomy, and lumpectomy plus irradiation for the treatment of invasive breast cancer. *N Engl J Med* 347(16): 1233-1241.
4. Saji S, Hiraoka M, Tokuda Y, Fukui N, Ikeda T (2012) Trends in local therapy application for early breast cancer patients in the Japanese Breast Cancer Society Breast Cancer Registry during 2004-2009. *Breast Cancer* 19(1): 1-3.
5. Poggi MM, Danforth DN, Sciuto LC, Smith SL, Steinberg SM, et al. (2003) Eighteen-year results in the treatment of early breast carcinoma with mastectomy versus breast conservation therapy: The National Cancer Institute Randomized Trial. *Cancer* 98(4): 697-702.
6. Kinkel K, Helbich TH, Esserman LJ, Barclay J, Schwerin EH, et al. (2000) Dynamic high-spatial-resolution MR imaging of suspicious breast lesions: diagnostic criteria and interobserver variability. *Am J Roentgenol* 175(1): 35-43.
7. Peters NH, van Esser S, van den Bosch MA, Storm RK, Plaisier PW, et al. (2011) Preoperative MRI and surgical management in patients with nonpalpable breast cancer: The MONET - randomized controlled trial. *Eur J Cancer* 47(6): 879-886.
8. Rusby JE, Brachtel EF, Taghian AG, Michaelson JS, Koerner FC, et al. (2007) Microscopic anatomy within the nipple: Implications for nipple sparing mastectomy. *Am J Surg* 194(4): 433-437.
9. Newman LA (2017) Decision Making in the Surgical Management of Invasive Breast Cancer-Part 2: Expanded Applications for Breast-Conserving Surgery. *Oncology (Williston Park)* 31(5): 415-420.