Nipple Preservation through Partial Nipple Incision and Partial Areola Resection for a Breast Cancer Adjacent to the Nipple-Areolar Complex

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Keywords
Areola resection · Breast cancer · Nipple incision · Nipple preservation · Sub-nipple tumor

Abstract
A 45-year-old woman with a tumor just beneath the left areola was referred to our hospital. Magnetic resonance imaging (MRI) findings made us perform a core needle biopsy of the tumor, leading to the diagnosis of invasive lobular carcinoma (cT1N0M0). MRI also depicted three daughter nodules located medially to the main tumor in a linear fashion. Patient’s strong request for nipple preservation made us try to resect the breast cancer in a manner to possibly preserve the nipple-areolar complex. First, to resect the target four tumors, medial horizontal skin incision at the nipple level and subsequent lower semicircular peri-areolar incision were done to the left breast. Second, small skin resection in a triangle shape and a radial fashion from the nipple bottom, i.e., orthogonal skin resection to the peri-areolar incision, was done to the areola just above the main tumor. Third, the triangle resection line was extended to the center of the parietal part of the nipple via a longitudinal skin incision on the lateral side of the nipple. Intra-nipple tissue adjacent to the sub-areolar tumor was resected as much as possible. Partially resected areola and partially incised nipple were sutured into the original shape. Pathological study showed invasive lobular carcinoma with lymphovascular invasion and widespread, i.e., total size of 60 mm, noninvasive lobular carcinoma and negative surgical margins in the nipple-areolar complex. The patient was discharged on the second day after operation, developed temporary superficial partial dermal necrosis of the nipple-areolar complex, and received adjuvant endocrine therapy, i.e., tamoxifen and luteinizing hormone-releasing hormone agonist scheduled for 10 years, and normofractionated radiotherapy to the conserved breast after full wound healing of the nipple-areolar complex.

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Published by S. Karger AG, Basel
Introduction

It is well known that the presence and symmetry of the nipple-areolar complexes have a great impact on cosmetic outcome after breast-conserving therapy. Not only the size, nodal involvement, and subtype of the breast cancer but also the location of the tumor can affect the selection of breast cancer surgeries. In the early days of breast-conserving era, tumor-nipple distance was an important determinant for breast-conserving surgery. Breast surgeons, therefore, have long been treating breast cancers located close to the nipple-areolar complex with some kind of surgery including total resection of the nipple-areolar complex for local control.

On selecting surgical options, breast surgeons initially have two major alternatives: breast-conserving surgery [1, 2] and mastectomy/nipple-preserving total glandectomy. Then, breast surgeons consider whether to apply additive breast reconstruction or not, sometimes leading to breast-conserving surgery with immediate breast reconstruction using latissimus dorsi muscle [3] or mastectomy/nipple-preserving total glandectomy [4] with some kind of breast reconstruction [5, 6]. Concerning the nipple-areolar complex, breast surgeons have thus far had only surgical alternatives either to preserve the nipple-areolar complex or to remove it totally. We herein report a case of breast cancer located very close to the nipple-areolar complex successfully resected through partial nipple incision and partial areolar resection.

Case Report

A 45-year-old woman with a breast tumor just beneath the left areola was referred to our hospital. Mammography did not show any abnormalities in the breasts. Ultrasonography showed an ill-defined mass with low internal echoes and slightly attenuated posterior echoes just beneath the left areola (Fig. 1a). Magnetic resonance imaging (MRI) showed a tumor with irregular shape adjacent to the areolar skin and three daughter nodules medially and lineally located to the main nodule (Fig. 1b). Core needle biopsy of the main nodule showed small atypical cells growing in a linear fashion with massive collagen fibers, leading to the diagnosis of invasive lobular carcinoma (cT1N0M0). The tumor showed estrogen and progesterone receptor positivities, human epidermal growth factor receptor type 2 negativity, and Ki-67 labeling index of 16%. Despite the proximity of the main tumor to the nipple-areolar complex, the patient strongly requested us to preserve not only the breast but also the nipple-areolar complex. We, therefore, tried to preserve the breast and nipple-areolar complex under full informed consent of possible total or partial nipple necrosis. Surgical techniques for the preservation of nipple-areolar complex were as follows. First, we initially made a horizontal skin incision at the nipple level just on the medial side of the left breast and connected it to a semicircular peri-areolar incision in the lower part of the areola. Second, we partially resected the areola just above the tumor in a triangle shape and a radial fashion from the nipple bottom. Third, via a longitudinal skin incision on the lateral side of the nipple, we extended the partial areola resection line to the center of the parietal part of the nipple. Then, we resected the tumor with overlying areolar skin and peritumoral intra-nipple parenchyma using a cold knife in order not to macroscopically expose the tumor, leading to successful subtotal intra-nipple parenchymal resection. Next, we sutured the partially resected areola with a 4-0 monofilament absorbable thread. After that, we also sutured both the lateral and parietal parts of the incised nipple to reconstruct the nipple-areolar complex into original shape (Fig. 2a). Finally, due to the positive margins in the resected caudal mammary gland on frozen section, we added wide resection to the lower part of the mammary gland, i.e., weakly stained
Fig. 1. Preoperative images. a Ultrasonography showed an ill-defined tumor (asterisk) with low internal echoes and slightly attenuated posterior echoes located very close to the skin. b MRI showed a tumor with early enhancement (arrow) and three daughter nodules (arrowheads) located in a linear fashion. c MRI showed multiple tumors with early enhancement (arrows) and widely spreading lesion mainly consisting of noninvasive lobular carcinoma (arrowheads).
mammary gland on MRI (Fig. 1c), and extensively mobilized the cranial mammary gland downward for the infra-mammary fold to get favorable cosmeses of the partially resected mammary gland. Sentinel node biopsy was performed prior to the breast-conserving surgery and showed one micrometastatic lymph node followed by no further lymph node dissection. Pathological study showed multifocal invasive lobular carcinomas and surrounding non-invasive lobular carcinoma, i.e., total size of 60 mm, with positive lymphatics and negative vessel and perineural invasion (pT1N1miM0) and a successful resection of the target foci with a narrow margin (Fig. 3). The wound showed temporary and superficial partial skin necrosis of the nipple-areolar complex in a month and was healed under superficial necrotic skin acting like a scar without any problem in 2 months. After full wound healing of the nipple-areolar complex, the patient received adjuvant normofractionated radiotherapy to the conserved breast (Fig. 2b) and began to receive tamoxifen and luteinizing hormone-releasing hormone agonist scheduled for 10 years.

Discussion

In the last two decades, the concept of oncoplastic surgery has emerged in the treatment of breast cancer. Oncoplastic surgery has dramatically changed the surgical strategy that many breast cancers once having been excluded from breast conservation can be a good candidate for breast-conserving therapy. Oh et al. based on a propensity score-matched analysis reported the long-term equivalent therapeutic outcomes between the conventional breast-conserving surgery and the oncoplastic surgery [7].

Oncoplastic surgeries are mainly grouped into four procedures such as mastopexy, tumor adaptive reduction mammoplasty, fat grafting in immediate breast reconstruction, and pedicled flap and free flaps. Surgical procedure having been done after partial mastectomy, i.e., mobilization of the upper mammary gland toward the infra-mammary fold, can be classified in the pedicled flaps. However, surgical intervention to the nipple-areolar complex in this case cannot be classified into any categories proposed by the consensus conference [8]. This mainly depends on that no oncoplastic surgeons had the idea to get both local control and favorable cosmetic outcome through the surgical intervention to the nipple-areola complex. This report, therefore, should be the first case of successful nipple-areola complex preservation through surgical intervention to the nipple-areola complex.

Vast majority of pathological nipple-areolar involvement with cancer cells are caused not by stromal invasion including lymphatic permeation but by ductal spread to the nipple. Massive ductal spread can be easily detected with MRI preoperatively. No imaging modalities,
However, can detect small amount of noninvasive ductal carcinoma with favorable biology. Breast surgeons, therefore, have sometimes resected the nipple-areolar complex due to positive margin with noninvasive cancer at the nipple base on frozen section and, if requested, often have postoperatively consulted plastic surgeons to create a new nipple-areolar complex.
Many breast surgeons have been annoyed with the idea that close nipple base resection easily leads to nipple necrosis. This idea has forced breast surgeons to resect the nipple base so as to preserve certain amount of mammary gland, leading to a high positive margin rate followed by inevitable nipple-areolar complex resection. Total nipple necrosis, however, never occurs even if intra-nipple mammary ducts are completely resected as far as the

Fig. 3. Pathological findings. a A slice at the level of resected areolar skin showed a whitish tumor (asterisk) encompassed by both the areolar skin (arrowhead) and very thin normal tissues (arrows). b Low magnified view of the specimen showed slight displacement of the skin (arrowhead) compared to that in gross section, atypical cell aggregation (asterisk), and thin normal tissues (arrows). c Magnified view of the specimen showed thin normal tissues (encompassed by arrows) and adjacent cancer cell aggregates (asterisk).
drainage veins around the nipple-areolar complex are preserved. Rusby et al. [9] also 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. Breast surgeons, therefore, can safely resect the breast cancer located very close to the nipple-areolar complex through some surgical intervention, i.e., incision or resection, of the nipple-areolar complex when the skin blood flow, especially venous return, is preserved.

Temporary superficial dermal necrosis might have been avoided or mitigated if we had performed spindle-shape skin resection along the peri-areolar incision rather than orthogonal to it, probably providing more preservation of venous drainage from the nipple-areolar complex. However, if such skin resection had been done, it should have inevitably brought about notable asymmetry of the nipple-areolar complex. In other words, the orthogonal skin resection to the peri-areolar incision probably induced superficial partial dermal necrosis of the nipple-areolar complex on the one hand but contributed to the favorable cosmetic outcome. Since the temporary superficial partial dermal necrosis observed in this case was acceptable, breast surgeons should select this type of nipple skin incision and partial areolar resection for both wider surgical margins and better cosmesis.

Noninvasive ductal spread cannot be macroscopically detected by any breast surgeons except for intraductal massive mass formation, e.g., very large intraductal solid carcinoma. On the other hand, direct exposure of the infiltrating carcinoma to the nipple-areolar complex can easily be judged by almost all the breast surgeons macroscopically. In this case, we carefully resected the tumor with a cold knife not to expose the breast cancer. Pathological study showed only minimal safety margins, being very natural due to the structure of the nipple, around the main tumor. Adjuvant radiotherapy, however, should be able to eradicate the possible minimal cancer residuals, even if left, in the nipple.

Long-term cosmetic outcome of the patients with intra-nipple subtotal parenchymal resection remains unclear. We have performed complete nipple base resection, i.e., no mammary gland remnants with visible mammary duct openings at the nipple base, to many breast cancer patients. In addition, we have thus far treated breast cancer patients with positive margin at the nipple base by our operative procedures on frozen section not with total resection of the nipple-areolar complex but with additive resection of the intra-nipple parenchyma including major ducts, leading to no total nipple loss due to the nipple necrosis. We, however, experienced some case treated with additive intra-nipple resection showing slight reduction in the nipple height. This patient, therefore, might show some cosmetic deterioration of the conserved nipple, i.e., decrease in nipple height, in the future. Conserved nipples, however, generally present favorable cosmesis even if the height of the conserved nipple decreases over time.

Local control in breast-conserving therapy is naturally more important than cosmetic outcome. It, however, is well known that radiotherapy to the conserved breast has the ability to control subclinical cancer cell residuals especially in breast cancer patients with favorable biology. We, therefore, highly expect that radiotherapy to the conserved breast can control the possible cancer cell residuals with favorable biology, i.e., Ki-67 level of 5%, in this case. Breast surgeons should properly understand that breast-conserving therapy does not seek complete surgical removal of the cancer cells in the breast but consists of partial mastectomy to resect the clinically detectable breast cancer and radiotherapy to control the subclinical cancer cells in the breast, leading to equivalent survival outcomes compared to those with total mastectomy.

In conclusion, we experienced a successful nipple preservation through partial nipple incision and partial areolar resection just above the tumor. Breast surgeons should note that partial nipple incision and partial resection of the areola just above the tumor can allow breast surgeons to safely resect breast cancers located close to the nipple-areolar complex.
Statement of Ethics

The study was approved by the Kishiwada Tokushukai Hospital Ethics Committee (IRB #Case 20-02). Written informed consent was obtained from the patient for the publication of this case report and any accompanying images.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Funding Sources

No funding was received for this research.

Author Contributions

Taku Morita 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.

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