Retromammary breast-conserving surgery and volume displacement with diced acellular dermal matrix for operable breast cancer

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Abstract

Summary Background Data: Previous study proved diced acellular dermal matrix(dADM) was effective to fill the defect in the breast after breast-conserving surgery(BCS), however, some patients showed non-infectious erythema on the skin over the cavity filled with dADM. We take into consideration of embryological characteristics of breast to minimize this complication by changing approach route through retromammary plane, while maintaining its proven advantage.

Methods: After institutional review board approval, we prospectively recruited 530 breast cancer patients requiring BCS from August 2019 to June 2022. Incision was made along the periphery of breast mound including axilla or inframammary fold, where the minimum distance was expected from the incision to the index tumor. After breast cancer removal, cavity was filled with dADM. After surgery, all patients received adjuvant local irradiation treatment, systemic chemotherapy, targeted agent or endocrine treatment according to the recommendations of international treatment guidelines according to the type of molecular subtype. All enrolled patients were followed up at 6 months after completion of both chemotherapy and external radiation treatment and up to 3 years from the date of surgery, including systemic evaluation to assess the occurrence of any complications, including non-infectious erythema, and oncologic outcome related to locoregional recurrence or systemic metastasis.

Results: Of 530 patients enrolled, only 5 patients showed non-infectious erythema. Locoregional recurrence and systemic metastasis rates were also not statistically different from previous results not included in this study.

Conclusions: Retromammary BCS and volume displacement with dADM for operable breast cancer is effective for reducing non-infectious erythema post-operatively, even after repetitive episodes of neutropenia during systemic chemotherapy, and is easy to preserve preoperative breast mound volume and shape. Although further clinical studies are needed in a larger number of patients, we believe that this surgical method could be another oncoplastic BCS that can overcome the limitations of conventional BCS.

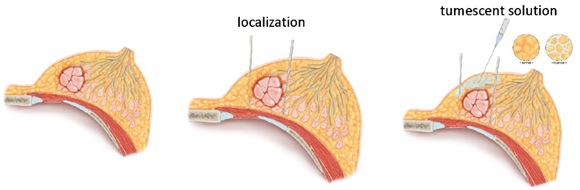
Introduction

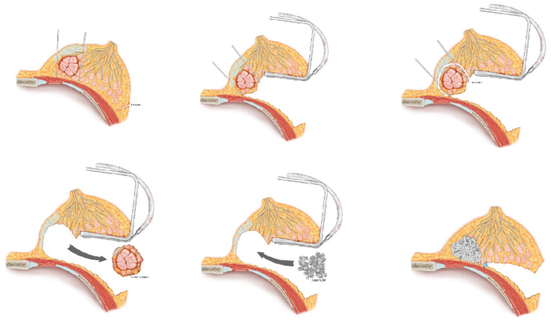
Decades after the initiation of BCS for breast cancer, goal of breast cancer treatment had been moving towards early detection and preserving volume and shape of ipsilateral breast as much as possible, which culminates into the latest concept of oncoplastic breast cancer surgery (OPS). Therefore, once the clinicopathologically complete removal of resectable breast cancer is guaranteed, main goal of OPS should be attaining to have cosmetically acceptable shape and volume of ipsilateral breast, while minimizing or preventing breast deformity after postoperative complication such as intramammary fat necrosis close to index tumor bed, with or without chemotherapy. We already proved clinical efficacy of dADM as filling material in the cavity after BCS in the previous clinical trial (KCT0003886). In this prospective clinical trial, we tried to evaluate the effect of retromammary approach during BCS to significantly minimize postoperative intramammary fat necrosis, even after numerous episodes of grade III or IV neutropenia by chemotherapy.

Methods and Materials

The study protocol was reviewed and approved by the institutional review board of the Catholic University of Korea (VC19OESI0079). Then, this clinical trial was registered as KCT0004500 on the site of Clinical Research Information Service of Korea that has been participated as one of the primary registries in WHO International Clinical Trials Registry Platform, before starting patient accrual. From August 2019 to June 2022, 530 breast cancer patients aged more than 18 years but less than 80 years old were prospectively recruited for this study after getting written informed consent.

Figure 1. Sequential graphic illustrations for the retromammary breast-conserving surgery.





Results

In conventional BCS, non-infectious erythema occurred in 4 out of 117 patients (0.034%) undergoing volume replacement using dADM, whereas erythema was observed in only 5 out of 530 patients (0.0094%) using the retromammary approach, representing a 73% reduction. These results demonstrate the safety and feasibility of the retromammary approach, which, excluding erythema, shows no other postoperative complications compared to conventional BCS without dADM. Furthermore, when applying a follow-up period of 36 months or longer to all 530 patients, no difference was confirmed compared to the standard survival period for Korean breast cancer published in 2024. The diced ADM used in this study may exhibit a phenomenon where it feels hard after adjuvant external irradiation in cases of small breast size or thin subcutaneous fat. However, this issue is considered a technical limitation that can be resolved through material development. Reports on ipsilateral breast recurrence should be confirmed after all subjects have completed the 5-year follow-up period.

Chart 1. Overall survival of this trial and Korea.

Stage	Retromammary	Korea (%)
0	99.4	98.3
I	97.1	96.6
II	92.2	91.8
III	75.9	75.8
IV		34.0

Discussion

Even though a few advantages can be given for patients, present OPS should have to accompany functional deficit on the donor site and/or long and easily identifiable non-cosmetic incisions both on donor and recipient sites. In addition, it is somewhat hard to get symmetry with contralateral healthy breast, and the body image – volume and shape of breast mound - after these reconstructions may not be naturally acceptable, considering her age. These hurdles can be easily confronted in women with smaller breasts, especially who are not willing to augment bilateral breasts. Therefore, the best ideal way of reconstruction after BCS should be maintaining natural breast contour including volume while not compromising oncologic outcome, and preferably leaving as less and esthetically hard-to-identifiable incisions. Acellular dermal matrix (ADM) is a specific kind of biomaterial comprised of allogenic dermal component and lacking epidermal component, but its extracellular matrix contains type I collagen, elastin, laminin and site-specific glycosaminoglycans. After a while, we started to use diced ADM (dADM) instead, because particulate ADM use was far more convenient to fill the cavity than tailoring, and its flexibility and adjustability to the shape of cavity as well as original breast mound was an impetus behind this clinical trial. The advantage of retromammary approach with dADM is no need of compromising natural breast contour while fully applying oncologic principles of BCS with ample safety margins in all directions within far less operative time as well as much less serious postoperative complications.

Conclusions

Compared to previous one, retromammary approach enables far less postoperative complications. Retromammary approach for BCS followed by dADM filling has shown promising results of far less complication of fat necrosis and skin problems near to incision, therefore it will help to maintain its shape and volume of diseased breast as it was before BCS without sacrificing donor sites anatomically and functionally after breast cancer removal. No other newly found complication related to this procedure was found even on completion of postoperative adjuvant systemic chemotherapy, during which many complications related to hematologic toxicities from the agents may provoke wound problems to be managed medically or even surgically. The ongoing pilot study (KCT0008401) will also utilize the retromammary approach, enabling robotic breast-conserving surgery in all quadrants for all patients using only a single transaxillary incision.

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