Preliminary Results for Treatment of Early Stage Breast Cancer With Endoscopic Subcutaneous Mastectomy Combined With Endoscopic Sentinel Lymph Node Biopsy in China

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BACKGROUND AND OBJECTIVES: To evaluate efficacy and aesthetic outcome for combined endoscopic subcutaneous mastectomy (E-SM) and endoscopic sentinel lymph node biopsy (E-SLNBI) in early stage breast cancer patients.

METHODS: Combined E-SM + E-SLNBI was compared to modified radical resection in a cohort of Chinese patients (n = 49) with stages I and II breast cancer. Patient satisfaction with the aesthetic results was assessed 1 year after surgery with a 5-item-by-4-step scoring system for evaluating cosmetic outcomes.

RESULTS: All patients were alive 1 year following surgery with no locoregional recurrence or distant metastases and without any critical complications. The average length of incision was less in patients receiving E-SM + E-SLNBI (4.4 cm) as compared to radical resection (19.4 cm; P < 0.001), but time in surgery was longer (131.6 vs. 99.2 min; P = 0.024). After 1 year, nearly all E-SM + E-SLNBI patients rated satisfaction with their appearance as excellent or good (23/24; 95.8% vs. 19/25; 76.0%; P < 0.001), and exhibited less disturbance of sensory (P < 0.001) and motor function (P = 0.014) relative to modified radical resection.

CONCLUSIONS: E-SM + E-SLNBI provides significant aesthetic and functional advantages for patients with early stage breast cancer without compromising medical efficacy as assessed at 16 months postsurgery.


KEY WORDS: breast cancer; endoscopic mastectomy; reconstructive surgery

INTRODUCTION

The consideration of quality of life issues has led to the development of alternative surgeries for breast cancer patients, particularly in the case of localized disease. Nipple-sparing subcutaneous mastectomy (SM), for example, was designed to preserve the nipple–areola complex which facilitates breast reconstruction [1,2]. Selected patients with early stage breast cancer or high breast cancer risk are ideal candidates for the procedure which spares women from some of the psychological as well as physical trauma of radical resection without compromising their physical health [3–5]. However, SM still leaves behind a conspicuous scar.

One of the advances in surgical intervention overall has been the endoscopic technique, as it is less invasive and performed through smaller, more concealed incisions [6,7]. The breast cancer field has also embraced this technology which has led to improvements in aesthetic and functional outcome in selected patients. First, the methodology is now used to perform axillary lymph node dissection (endoscopic axillary lymph node dissection, EALND) which in modified radical resection can lead to debilitating complications [8,9]. Second, ALND itself has been altered with the development of sentinel lymph node biopsy (SLNB), which enables the prediction of the axillary status of breast cancer patients without unnecessary ALND [10–12]. SLNB can also be performed endoscopically (E-SLNBI) [13]. Finally, surgeons carry out SM with endoscopic techniques, which preserves the nipple–areola complex without leaving a large, unattractive scar [14]. Due to their generally small breast size (<250 ml), it is the scar and not necessarily asymmetry that is the most cosmetically disturbing aspect of the modified radical mastectomy for Chinese women. Therefore, the endoscopic technique has the potential to dramatically improve cosmetic outcome for Chinese women even without reconstruction, a procedure that is not currently covered by insurance in China.

Although breast-conserving therapy (BCT) combined with irradiation has become a standard treatment strategy for locoregional breast cancer in western countries, BCT is performed far less frequently in China [15]. For a number of personal, economic, and educational reasons, most Chinese women, even with early stage disease, refuse to accept breast conserving surgeries [16]. Therefore, modified radical resection remains the most common treatment for breast cancer patients in China despite having access to these treatment options [17]. Here, stages I and II breast cancer patients (n = 49) received either E-SM + E-SLNBI or a modified radical resection in order to compare efficacy of the two procedures on the basis of morbidity, cosmesis, and upper limb function. Technical details of the procedure are provided as well as the clinical characteristics that make patients ideal candidates for E-SM + E-SLNBI.

Conflicts of interest: The authors declare no competing interests.

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MATERIALS AND METHODS

Ethics Statement

All surgical procedures were approved by the Department of Surgery at the Beijing Friendship Hospital of the Capital Medical University (Beijing, China). Written informed consent was obtained from all patients before surgery.

Patients

Procedures were performed on breast cancer patients (n = 49) between October 2013 and May 2014 at the Beijing Friendship Hospital (Table I). Inclusion criteria for patients were the following: (i) diagnosis of stages I or II ductal carcinoma; (ii) lesions of <5 cm in diameter; and (iii) clinically negative axilla. Patients were divided into two groups based on the two surgical approaches being evaluated: open field modified radical resection (group A; n = 25) and E-SM+ESLN9 (group B; n = 24). Patients were selected for group B, on the basis of additional criteria: (i) tumor (including multifocal tumors) was confined to the mammary gland as confirmed by MRI; (ii) the distance between the lesion and nipple was >2 cm; and (iii) absence of involvement of the nipple and skin as determined by physical examination and MRI. Finally, severe breast ptosis was a relative contraindication for endoscopic subcutaneous mastectomy. The cosmetic results, upper extremity function, and morbidity were compared between these two groups.

Surgical Procedures

All surgeries (n = 49) were performed by a single surgeon (X. Qu). The optic, the trocars, and the endoscopic instruments were all provided in the laparoscopy equipment kit and were reusable (Olympus Optical Co., Tokyo, Japan). Patients were placed in a supine position with the ipsilateral arm in 90° abduction, and methylene blue (1.0 ml) was injected near the tumor for the identification of sentinel lymph nodes. To prepare the breast for liposuction which was necessary to create space for the endoscopic procedures, tumescent solution (20 ml of 2% lidocaine and 1 mg adrenaline in 500 ml of 0.45% sodium chloride) was used to infiltrate the axillary fat pad (250–500 ml), the subcutaneous fat pad (1,000–1,500 ml), and the fat overlaying the pectoralis major (1,000–1,500 ml). After ~10–15 min, aspiration of adipose tissue was initiated at a pressure of 800 mbar with the liposuction cannula inserted through an incision (5 mm) in the posterior axillary line and two incisions (10–12 mm) in the anterior axillary and midclavicular lines. An adequate working space within the breast was created by insufflation with carbon dioxide gas (8 mmHg) through the first 12 mm trocar inserted in the existing incision in the anterior axillary line. The remaining 12 mm and 5 mm trocars were placed in the posterior axillary and in the midclavicular lines, respectively (Fig. 1). The 30° angled 10 mm optic was placed using one of the trocars at the anterior axillary line. The blue-stained sentinel node (Fig. 2) was located and resected using a 5-mm grasping forceps and an electrocautery. The sentinel node was removed through the 12 mm trocar, and an endoscopic retriever was used to avoid incision implantation metastasis. Fast-frozen sections of the sentinel node were evaluated intraoperatively, and axillary lymph node dissection was carried out in levels I and II for diagnoses of lymphatic metastasis.

For removal, the mammary gland was separated first from the skin by severing Cooper’s ligaments, the only remaining point of attachment following liposuction (Fig. 3), and subsequently the pectoralis major by dissecting away the fibrous connective tissue, leaving the subcutaneous glandular layer completely exposed. The incision located on the posterior axillary line was extended, and the mammary gland was removed with the second endoscopic retriever (Fig. 4). The stump of the nipple site and the dissected surfaces of the tumor (bordering skin and pectoralis major muscle) were intraoperatively submitted for frozen-section cytology.

Finally, the fluid collected during liposuction was filtered through gauze to retrieve the lymph nodes, which were also histologically examined.

Cosmetic Evaluation and Patient Satisfaction

All patients were regularly examined, and breasts were photographed from eight different views every 6 months to document physical changes. Patient satisfaction with the aesthetic results was assessed 1 year after surgery with a 5-item-by-4-step scoring system (ABNSW) for evaluating cosmetic

![Fig. 1. Position of the trocars. Carbon dioxide gas (8 mmHg) was introduced through the first 12 mm trocar inserted in the existing incision in the anterior axillary line. The remaining 12 and 5 mm trocars were placed in the posterior axillary and in the midclavicular lines, respectively. The orientation of the patient with respect to the instruments is indicated.](https://www.journalofsurgicaloncology.com/fig1.jpg)
outcomes [18]. The five items in the survey were the following: asymmetry (A), breast shape (B), nipple shape (N), condition of the skin (S), and the wound scar (W). Each item was evaluated on a 4-step scale of 0 to 3: 0, poor; 1, fair; 2, good; 3, excellent. Scores from each of the five items were totaled for each patient, and the total points were defined on the basis of a maximum score of 15: 15, excellent; 11–14, good; fair, 6–10, fair; and 0–5, poor.

Statistical Analysis

Statistical analysis was performed with SPSS, version 19.0, released 2010 (IBM corp., Armonk, NY). *P*-values < 0.05 were considered significant. Comparisons between groups were performed with the independent samples *t*-test, and the χ² test (or Fisher’s exact test when applicable) was used for comparison of categorical data.

RESULTS

Statistical analysis of the clinical data from each group demonstrated that the clinical characteristics of the patient groups were similar (Table I). No statistically significant differences in age, tumor size, incidence of premenopause, body mass index (BMI), TNM stage, or histology were observed (*P*-values > 0.05).

To highlight important technical aspects of the two approaches that might influence patient outcome, the perioperative data of the two groups were compared (Table II). As expected, time in surgery was increased for the endoscopic procedure: 99.2 min (group A) versus 131.6 min (group B; *P* = 0.024). The average length of incision however was significantly less: 19.4 cm (group A) versus 4.4 cm (group B; *P* < 0.001; Fig. 5). Importantly, the sentinel node was successfully identified in 100% of the cases in group B. The mean number of stained nodes detected was 3.7 (range, 1–6). In only three cases, sentinel node biopsy was followed by complete endoscopic axillary clearing in levels I and II due to sentinel lymph node metastasis. There were no significant differences between the two groups for drainage duration (*P* = 0.858) or drainage volumes (*P* = 0.950).

![Fig. 2. Methylene blue stained sentinel lymph node. Methylene blue was injected near the lesion in order to identify sentinel lymph nodes. The 30° angled 10 mm optic was placed using a trocar located at the anterior axillary line. The blue-stained sentinel node was identified and resected using a 5-mm grasping forceps and an electrocantery. The sentinel node was removed through the 12 mm trocar, and an endoscopic retriever was used to avoid incision implantation metastasis. Histological diagnosis was performed on intraoperative frozen section.](image)

![Fig. 3. Attachment of skin and mammary gland only by Cooper’s ligaments after liposuction. Image of breast following liposuction showing the remaining attachment of skin and mammary gland through Cooper’s ligaments. The arrow highlights Cooper’s ligaments.](image)

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<th>TABLE II. Comparison of Perioperative Results Based on Surgical Procedure</th>
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<td><strong>Conventional group</strong> A (n = 25)</td>
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| E-SM+E-SLNBI, endoscopic subcutaneous mastectomy + endoscopic sentinel lymph node biopsy. Data are presented as the mean ± SD. *P* < 0.05 was considered significant. The independent samples *t*-test and Fisher’s exact test were used to evaluate whether differences between the groups were statistically significant.

![Fig. 4. Mammary gland following removal with E-SM+E-SLNBI. The incision located on the posterior axillary line was extended, and the mammary gland was removed from a patient with a diagnosis of stage I breast cancer with the second endoscopic retriever.](image)
significantly was used to evaluate whether differences between the groups reached statistical significance. Extremity function was based on a scale of 1–10, where a score of 1 = poor function and a score of 10 = excellent function. The independent samples t-test was used to evaluate whether differences between the groups reached statistical significance.

No adverse effects of E-SM+E-SLNB on medical outcome were observed during follow-up. The median follow-up period was 16.1 months (range, 14.2–19.1 months). All patients in the study were living, with no evidence of locoregional recurrence or distant metastases, and several patients in group B (n = 6) had undergone one-stage breast reconstruction. All remaining patients (n = 43) chose not to undergo reconstructive surgery. Although no patient had experienced any critical complications, two patients in group B (8.3%) had developed nipple areola necrosis.

Overall, the general physical status of patients tended to be improved in group B at follow-up. First, although patients did not experience statistically significant differences in pain at the surgical site (P = 0.260), those who had undergone endoscopic surgery experienced less upper arm pain (P < 0.001), and had better range of motion of the shoulder (P = 0.015) as well as function of the upper extremities (P = 0.014; Table III). Second, nearly all patients who had undergone endoscopic procedures rated their satisfaction with their physical appearance at 12 months as excellent or good (23/24; 95.8%) with only a single patient scoring a fair rating (1/24; 4.2%; Table II and Fig. 6A and B). Although most patients in group A (19/25; 76.0%) also viewed their physical appearance following surgery as excellent or good, a greater portion (6/25; 24%) viewed their physical appearance as only fair or poor (Table II). Although patients in both groups generally rated their appearance as excellent or good (37/49), most of the lower scoring patients had undergone a modified radical resection (6/7; 85.7%). These differences were statistically significant (P < 0.001) indicating that endoscopic surgery might improve cosmetic results without adversely effecting medical outcome for a specific subset of breast cancer patients. Finally, while the majority of patients in group B (n = 18) did not choose to undergo reconstructive surgery, these patients interestingly still rated their satisfaction with E-SM+E-SLNB as excellent or good (17/18; 94%), similar to the patients who received reconstruction (6/6; 100%).

DISCUSSION

The evolution of treatment for breast cancer is based in part on consideration of the patient’s quality of life following surgery. Surprisingly, one of the challenges in introducing advanced techniques in China has been reluctance of the patients themselves to undergo procedures other than traditional/modiﬁed radical resection. Our approach to address patient concerns was to introduce nipple sparing SM and SLNB, which have been widely successful for selected patients around the world [19], to a cohort of early stage breast cancer patients in China. In our study, SM and SLNB were furthermore performed with the endoscopic technique [20,21], and the combined strategy was found to be safe with no adverse effects on outcome at a follow-up time of 16 months in our cohort. In addition, E-SM+E-SLNB patients reported improved satisfaction with the cosmetic outcome over patients treated with modiﬁed radical mastectomy.

As with any novel surgical approach, it was critical to establish ﬁrst that E-SM+E-SLNB demonstrated a level of efficacy that was at least equivalent to traditional modiﬁed radical resection. First, we were able to complete the procedure for all patients (24/24) selected for group B, with no major complications. One minor complication, nipple areola necrosis, occurred in two cases early in the study, and was thought to be due to the injection of methylene blue into the nipple–areola complex. Once we no longer injected methylene blue around the tumor, which in group B patients was located more closely to the area, no further incidents of nipple areola necrosis occurred. Second, despite the more conservative surgical approach, patients in group B, as in group A,
suffered no locoregional recurrence or distant metastases as reported during the follow-up period of 16 months.

Overall, E-SM+E-SLNB is less physically traumatizing. There is less blood loss and skin injury, for example, and all of the manipulations can generally be performed through more discretely placed smaller incisions than in traditional subcutaneous mastectomy. One of the fundamental advantages of our strategy, E-SLNB combined with intraoperative pathological diagnosis, prevented most patients (21/24; 87.5%) from undergoing unnecessary ALND. As a result, E-SM+E-SLNB patients experienced increased upper extremity function and reported greater satisfaction with the aesthetic outcome (Tables II and III). For these reasons in particular, further investigation of E-SM+E-SLNB as a viable surgical alternative might lead to improved quality of life for a subset of breast cancer patients in China.

Quality of life also depends on our ability as physicians and surgeons to develop strategies that are well-suited for our particular patient population. The endoscopic technique is widely available across the country, so that E-SM+E-SLNB becomes a feasible option for many patients who fit the criteria. E-SM+E-SLNB also enables us to overcome economic concerns of our patients while addressing dignity/quality of life issues. Because most Chinese patients are thin, with a breast volume of <250 ml, symmetry following E-SM+E-SLNB is fairly good (Fig. 6A and B). Thus, E-SM+E-SLNB becomes an option that may not require breast reconstruction, a procedure which is not currently covered by medical insurance in China.

One potential disadvantage is that E-SM+E-SLNB procedures generally lasted almost 40 min longer than modified radical mastectomies. The additional time in surgery though is largely due to liposuction. Although procedures took more time, unnecessary ALND was avoided. A second concern with E-SM+E-SLNB is the possibility of disrupting the tumor or disseminating tumor cells during liposuction. We have addressed this issue by only considering patients over 250 ml, symmetry following E-SM+E-SLNB. Thus the cancer can be removed with extraction of the mammary gland while maintaining the skin and the nipple for cosmetic purposes. Finally, although we have demonstrated feasibility of the procedure, medical outcome must be more rigorously evaluated with extended follow-up of >16 months.

CONCLUSIONS

In summary, the combination of E-SM+E-SLNB presents a promising surgical alternative to BCT or modified radical resection in China. Our results demonstrated that E-SM+E-SLNB could lead to improvement in some of the inherent physical consequences of surgery, such as less conspicuous scarring and increased upper extremity function, without compromising medical outcome. However, as these are preliminary results for E-SM+E-SLNB in our hands, a randomized comparison clinical trial is currently underway at our institution to more robustly evaluate the medical and cosmetic outcomes of this novel approach for the treatment of breast cancer in a larger cohort of Chinese patients with extended follow-up.

REFERENCES

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