



A new surgical modality for breast reconstruction in patients with breast cancer: a case report and literature review

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Background: Breast preservation can considerably improve the postoperative living quality of breast cancer patients. Through this study, we proposed a novel, safe, and effective surgical modality for breast preservation in patients with early breast cancer.

Case Description: Herein, we present a case report of a patient with early-stage breast cancer (T1cN0M0), who underwent skin-sparing nipple areola hypodermic gland resection combined with primary breast reconstruction using silicone implants. The patient was administered with general anesthesia, and the implants were inserted using an insufflation-free suspension and hook suspension under the pectoralis major muscle. The patient was followed up on postoperative days 1, 2, 7, 14, 30, 60, and 100 to check for any complications, such as upper limb edema, paresthesia, or flap necrosis. The patient experienced no complications. No obvious surgical scars or axillary surface infections were observed. The patient was satisfied with the surgical outcome, and this treatment approach reduced her treatment costs by approximately USD 2,600.

Conclusions: The new surgical procedure for breast reconstruction considerably improved the quality of life of the patient; no postoperative complications such as skin flap necrosis, paresthesia, or upper limb edema were experienced by the patient; and the treatment costs were reduced. In addition, this method effectively overcomes the concerns related to axillary space instability and limited operative space, rendering it worthy of promotion in clinical practice.

Keywords: Breast cancer; breast reconstruction; mastoscopic; suspension hook; case report

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Introduction

The breast is an important organ and a secondary sex characteristic, that plays an important role in the self-confidence of women. Although advancements in the treatment of breast cancer have considerably increased the

life expectancy of the patients, improving the postoperative quality of life of the patients has become a major concern for breast surgeons (1,2). Research has shown that breast preservation can substantially improve the postoperative quality of life for women (3,4). However, in clinical practice, some patients fear tumor recurrence after breast-conserving

surgery, resulting in considerable psychological burden. Breast-conserving surgery has its limitations and requires postoperative radiotherapy, owing to which many patients do not choose to undergo the surgery (5). Traditional modified radical mastectomy (MRM) for breast cancer significantly increases the occurrence of complications, such as upper limb edema, and sensory abnormalities, and leaves a surgical scar extending from the side of the chest to the armpit. This not only affects the appearance of the patient but also restricts the movement of the shoulder joint to a certain extent (6).

Breast endoscopic surgery reduces intraoperative bleeding, postoperative extubation time, postoperative average daily drainage volume, postoperative upper limb edema and sensory abnormalities, thereby achieving minimally invasive, functional preservation and good aesthetic outcomes, leading to high patient satisfaction (7,8). However, traditional endoscopic surgery may cause complications such as hypercapnia and subcutaneous emphysema, rendering it unsuitable for elderly patients or patients with major systemic organ diseases (9). Similarly, the high costs associated with skin-preserving nipple areola subcutaneous gland resection combined with primary breast reconstruction using silicone implants and patches limit its applicability.

Hence, we proposed the skin-preserving nipple areola subcutaneous gland resection combined with primary breast reconstruction using silicone implanted by overhanging the pectoralis major muscle by a suspension hook under lipolysis-free breast endoscopy. This new method is specially designed for patients who cannot or are unwilling to preserve the breasts due to various reasons, and aims to address the concerns related to insufficient axillary

space, unstable insufflation, expensive, and other defects associated with mastoscopic surgery. We present this case in accordance with the CARE reporting checklist (available at <https://gs.amegroups.com/article/view/10.21037/gS-23-5/rc>).

Case presentation

A 40-year-old woman presented with a left breast mass that had been present for 10 days. She had undergone regular physical examinations, was premenopausal, and denied having any family history of genetic diseases. On June 10, 2022, the patient was admitted to the Breast and Thyroid Surgery Outpatient Department at Zibo Central Hospital, China. Her breast surface appeared normal, without any color change, depression, surgical scar, “orange peel” appearance, redness, swelling, nor ulceration. Both her nipples showed no invagination, erosion, nor deformity. Physical examination revealed a palpable mass measuring approximately 1.0×1.0 cm on the left breast at the 6 o’clock position, 0.8 cm from the edge of the nipple; it was of a tough texture, unclear borders, and smooth surface, and it moved on with applying pressure. It showed no adhesion to the skin or the pectoralis major muscle and was not painful on palpation. No discharge was produced from the nipple when squeezing the nipple and areolar complex. No enlarged lymph nodes were observed in the affected axilla or supraclavicular fossa. The contralateral breast and axilla also did not show any obvious abnormalities. Ultrasound of the breast revealed an irregularly shaped hypoechoic nodule near the left nipple at the 6 o’clock position (*Figure 1A*). The nodule measured approximately 13 mm × 11 mm and had clear borders, non-uniform internal echogenicity, and multiple calcified spots. Color Doppler flow imaging revealed internal blood flow signals in the nodule. Elastography yielded a score of 4 points. No obvious enlarged lymph nodes were detected in the bilateral armpits. Imaging of the left breast mass revealed that the mass belonged to category 4C as per the Breast Imaging Reporting and Data System (BI-RADS) classification. Magnetic resonance imaging of the breast showed symmetrical and dense bilateral mammary glands with no skin thickening nor nipple depression. A roundish mass was seen in the middle of the left lower middle mammary gland (*Figure 1B*). The mass exhibited high signal intensity on T2-weighted imaging, uneven low signal intensity on T1-weighted imaging, high signal intensity on diffusion-weighted imaging, uneven high signal

Highlight box

Key findings

- We proposed a new, safe, and effective surgical modality for breast preservation in patients with early breast cancer.

What is known and what is new?

- Breast preservation can improve the postoperative living quality of breast cancer patients.
- The new surgical modality addresses the shortcomings of traditional surgery and traditional endoscopic surgery.

What is the implication, and what should change now?

- The new surgical method could resolve the issues related to axillary space instability and limited operating space. This novel surgical modality has potential for clinical promotion.

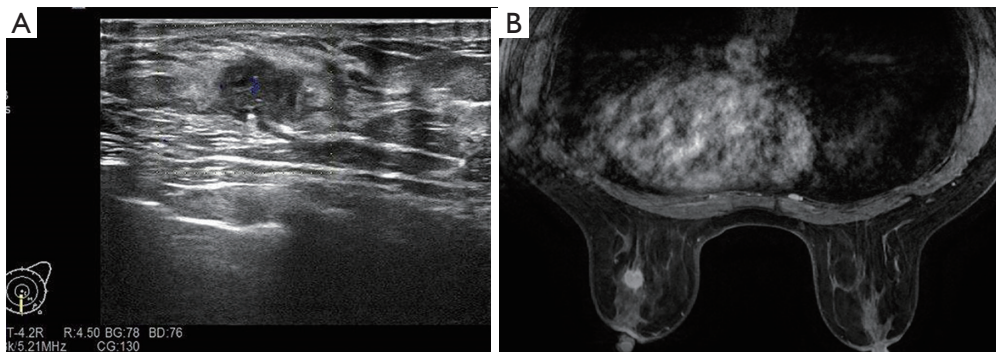


Figure 1 Patient's examination results. (A) Breast ultrasound results. (B) The patient's breast magnetic resonance images.

intensity on liver acquisition with volume acceleration, and a low apparent diffusion coefficient value (0.87–0.94). The maximum cross-sectional size of the mass was approximately 1.7 cm × 1.4 cm. On enhanced scan, the lesion appeared as a heterogeneously enhanced mass, and the time signal intensity curve of the lesion exhibited an outflow pattern. The right breast showed no obvious abnormal enhancement lesions, and the bilateral armpits showed no obvious enlarged lymph nodes. Pathological examination confirmed a diagnosis of invasive ductal carcinoma of the left breast. The patient refused to undergo breast-conserving surgery and requested breast prosthesis reconstruction following gland resection. Professor He Guijin from the second extramammary ward of Shengjing Hospital, China Medical University, was invited to guide and jointly conduct the operation. After discussing with the patient and her family, the patient was scheduled for skin-preserving nipple areola subcutaneous gland resection combined with primary breast reconstruction using silicone implants inserted by overhanging the pectoralis major muscle with the help of a suspension hook under lipolysis-free breast endoscopy. This study and the operation were approved by the ethics committee of Zibo City Central Hospital (No. 202004023). All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

Surgical procedure

After administering general anesthesia, the patient was

placed in the supine position with the affected upper limb abducted. An iodophor-impregnated sterile drape was then applied to the surgical site, after which the patient was subcutaneously administered methylthioninium chloride at multiple points in the areola. The fixed suspension surgical instruments were fixed and installed using methods described in our previous study (9). Three subcutaneous steel needles were inserted through the skin at the top of the armpit to suspend the skin. A 10-mm trocar was then placed through an anterior axillary line incision at the lower border of the breast subcutaneously. The trocar was then removed, and the tissue was separated using a vascular clamp. The axilla was explored using a 10-mm trocar under endoscopic visualization. Subsequently, 5-mm and 10-mm trocars were subcutaneously inserted in the inframammary fold. After successful punctures were achieved, separation forceps and grasping forceps were inserted in the trocars. The subcutaneous tissues were freed to enter the axilla, and the branches of blood vessels were broken with an electric hook, while avoiding the lymphatic vessels visible under the microscope. The blue-stained axillary lymph nodes and adipose tissue visible under the microscope were cleared (*Figure 2A*) and sent for intraoperative frozen section. The test results indicated that no metastasis in the three sentinel lymph nodes. Three hypodermic steel needles were then cross-fixed to the surface skin of the gland (*Figure 2B*). A vascular clamp was used to separate the skin and the gland, facilitating the isolation of the breast gland under the endoscope. The intraoperative photographs are shown in *Figure 3A, 3B*. After all the glands were freed, a 5-cm arc-shaped incision was made along the inframammary fold to remove the freed glands in an intact manner. The lower third of the pectoralis major muscle was dissected, and the upper two-thirds were sutured to the skin and fixed to a

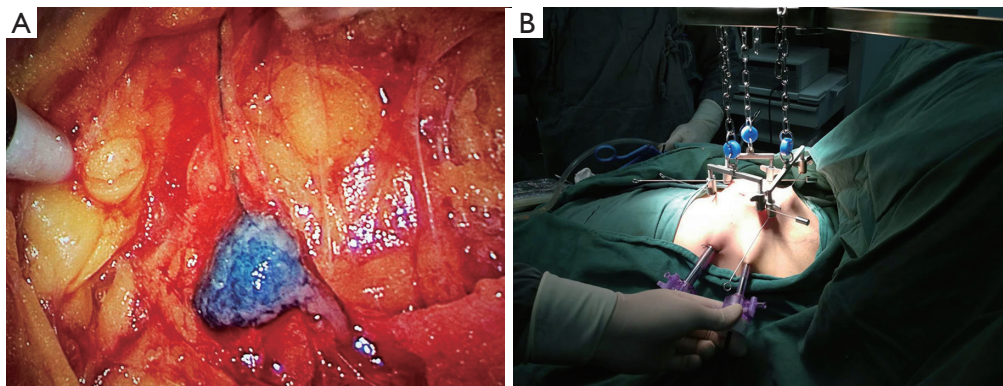


Figure 2 Stained lymph nodes and suspension retractor. (A) Blue-stained lymph nodes under endoscopy. (B) Suspension retractor to suspend breast skin for gland excision.

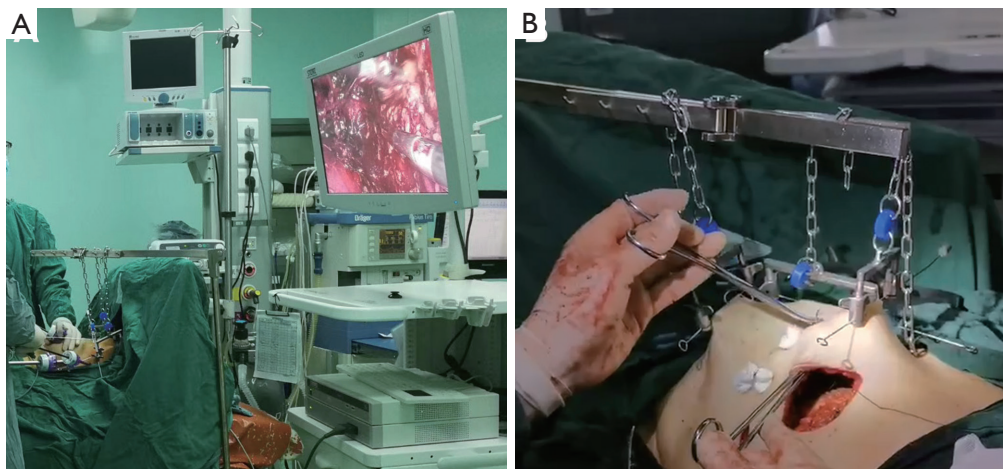


Figure 3 Intraoperative photographs. (A) Intraoperative endoscopic surveillance. (B) Intraoperative photograph with the arc-shaped incision.

cotton ball. The skin was suspended using a suspension device, and the upper two-thirds of the pectoralis major muscle was freed from the pectoralis minor muscle gap under endoscopic visualization. Subsequently, a 330 mL prosthesis (Johnson & Johnson) was placed between the pectoralis major and minor muscles along the inferior crease incision, with the lower edge of the prosthesis exposed between the skin and the lower third of the pectoralis major muscle. The axillary drainage tube was inserted through the 10-mm trocar incision, and a subcutaneous drainage tube was placed along the junction of the mid-axillary line. The incision was then closed layer by layer using absorbable sutures.

Data and complication statistics

The intraoperative bleeding volume and operation time were measured by the nurses in the operating room, whereas, the average daily drainage volume and extubation time of the patient were measured by the nurses in the ward. The patient was followed up on postoperative days 1, 2, 7, 14, 30, 60, and 100 to check for any complications such as upper limb edema, paresthesia, or flap necrosis.

Results

The operation time was approximately 180 minutes, with



Figure 4 Postoperative image shows symmetrical breasts, with the incision hidden.

an intraoperative blood loss of approximately 80 mL. The weight of the mastectomy specimen was 210 g. No complications, such as upper limb edema, paresthesia, nor flap necrosis, were noted at follow-up. The patient's axillary drainage tube was removed on postoperative day 4, with an average daily drainage volume of 26.33 mL. Subcutaneous extubation required 10 days, with an average drainage volume of 43.50 mL. The postoperative cosmetic result was ideal (*Figure 4*), and the surgical outcome was satisfactory. A total of RMB 19,000 of the breast soft tissue augmentation patches (pfm medical) was saved for the patient.

Discussion

The main complications after MRM with skin, nipple, and areola-preserving resection for breast cancer include nipple and flap necrosis, upper limb edema, and sensory abnormalities (10,11), which can seriously affect patients' postoperative quality of life. Conventional modified radical surgery for breast cancer involves the isolation of various skin flaps. However, the excessive use of an electric knife during the operation can cause local skin burns, and excessive contraction or necrosis of the subcutaneous capillaries, affecting the postoperative blood supply to the flap (12). Inappropriate preoperative incision design and excessive intraoperative suture tension can also cause ischemia and necrosis of the local skin flap, substantially prolonging the postoperative healing time of the patients (9). Axillary effusion or infection may cause lymphatic reflux obstruction, and fibrotic scar formed by over-clearance may hinder the establishment of collateral circulation, consequently causing lymphedema of the upper limbs and seriously affecting patients' quality of life (13). Preservation

of the intercostobrachial nerve can considerably reduce the occurrence of postoperative paresthesia (14). In routine surgical practice, axillary lymph nodes are often disconnected from the intercostobrachial nerves owing to excessive clearing or improper operation, resulting in abnormal sensations such as postoperative upper limb pain, numbness, soreness, and acid reflux (15). The excessive dissociation of skin flaps, mammary glands, and axillary fatty lymphoid tissue in conventional radical surgery for breast cancer increases the traumatic area, postoperative bleeding volume and the average daily drainage flow, thereby extending the extubation time.

Relevant literature has shown that endoscopy-guided axillary lymph node dissection is associated with faster recovery and lower incidence of complications compared with conventional axillary lymph node dissection, and can significantly improve the patients' quality of life (16,17). Minimal access breast surgery involving endoscopic and robotic approaches has been a popular choice among patients. Patients who undergo minimal access breast surgery usually experience less trauma, and achieve good cosmetic outcomes, along with optimal functional preservation and high levels of satisfaction compared with those who undergo standard nipple-sparing mastectomy (18). Compared with MRM for breast cancer, patients with breast cancer who undergo macroscopic gland resection and axillary lymph node dissection have less intraoperative bleeding, faster postoperative recovery, and shorter extubation time. Endoscopy-guided gland resection and axillary lymph node dissection could minimize damage to blood vessels through careful operation under the magnifying effect of the endoscope, significantly reducing intraoperative and postoperative bleeding volume, shortening the time to decannulation, and reducing the patient's length of hospital stay. In addition, the use of a breast endoscope allows more free space between the pectoral major and minor muscles, addressing the concern of insufficient hemostasis owing to limited exposure in the traditional surgical field.

Traditional endoscopic surgery has two shortcomings that need to be considered. The first shortcoming is the requirement of lipolysis before the operation. Accidental leakage of the lipolytic solution into the blood vessels or damages to the axillary, glandular flap vessels, axillary lymphatic vessels, and other tissues owing to violent lipolysis, could increase the risk of cardiac disease and the incidence of flap necrosis. This could lead to increased intraoperative and postoperative bleeding, contamination

of the surgical field, and prolonged extubation and hospitalization times (19). The second shortcoming is the narrow and unstable operating space caused by traditional gas insufflation, and the applicability of this surgical method to limited population. The establishment of sufficient armpit and subcutaneous operation space during macroscopic axillary lymph node dissection and subcutaneous gland resection is an important aspect of breast macroscopic surgery. However, the narrow axilla space is often established by inflation methods, rendering it relatively unstable. In addition, the surgical field of vision is often narrowed owing to gas leakage, small blood vessel bleeding, and the fog generated by electric hook hemostasis. This can cause blurring of the lens, seriously affecting the procedure and prolonging the operation time. Moreover, excessive infusion of CO₂ could adversely affect patients' physiological functions and cause visceral thermal damage, especially in those with prior medical conditions, increasing the risk of certain complications such as subcutaneous emphysema, gas embolism, hypercapnia, venous reflux block, shoulder pain, nausea, and vomiting.

Our previous study confirmed that mastoscopic MRM with skin and nipple areola preservation under air cavity-free suspension hook and stage I silicone prosthesis implantation was associated with better surgical outcomes, higher patient satisfaction, improved quality of life, and lower complication rates compared with MRM (9). Herein, to address the shortcomings of traditional breast endoscopy, we propose a lipolysis-free suspension breast endoscopy method for axillary lymph node dissection. In this method, instead of a pneumoperitoneum, a mechanical device is used to lift the skin on the surface of the armpit to create the space required for lymph node dissection through a breast endoscope. The suspension-type surgical instrument does not occupy any axillary space and only uses sterilized subcutaneous steel needle to suspend the chest wall skin and axilla from the skin surface. This method is simple to install and operate, provides reliable fixation, leaves almost no post-surgical scar, and does not carry a risk of gas insufflation complications. The suspended surgical instruments can help to establish a safe, stable, and sufficient operating space in the armpit for breast endoscopic surgery. The establishment of axillary space enables a clearer and broader vision of the axilla under the microscope, overcoming the difficulty of narrow axillary space in breast endoscopic surgery. This approach also addresses concerns related to the instability of the operation space created by the gas insufflation and the consequent

limitations of traditional air cavity surgery, avoiding CO₂-induced complications such as subcutaneous emphysema, and hypercapnia. The main disadvantage of suspension macroscopic surgery is that it relies on external lifting of the suspension rod and the steel needle gripper to create space. During surgery, the angle between the suspension rod and the steel needle gripper needs to be adjusted to achieve space balance. However, these adjustments do not affect the overall operation or the surgical outcomes. It is recommended to use at least three steel needle grippers for fixation. Moreover, the lipolysis-free method minimizes damage to blood vessels and lymphatic vessels, reducing the incidence of skin flap necrosis in the nipple or areola.

With advances in plastic surgery technology, the improvement economic capacity of patients, and the more detailed understanding of breast cancer, the focus of breast cancer treatment has gradually shifted from simply increasing survival rates to improving patients' quality of life. Immediate postoperative breast reconstruction has become an important aspect of localized surgery for breast cancer. An increasing number of patients who are unable to preserve their breasts or those who are psychologically stressed about preserving their glands prefer silicone prostheses combined with patch breast reconstruction. Studies have demonstrated that breast preservation can improve patients' satisfaction and quality of life after surgery (20,21). However, the high costs associated with breast implants and supplemental patches often limit their use. Besides, during traditional surgery that involves dissection of the pectoralis major and minor muscles, inadequate visualization of the surgical field, often restricts the mobility between these muscles, accompanied by uncontrollable bleeding due to improper operation along the external edge of the sternum, which increases the risk of postoperative bleeding, and infection. To address the financial constraints of patients and the concerns related to inadequate exposure of the interstitial field between the pectoralis major and minor muscles and incomplete hemostasis, our department proposed a novel surgical method that involves detaching the lower third of the pectoralis major muscle together with skin sutures, suspending the skin and the pectoralis major muscle using suspension hooks, and subsequently using an endoscope to free the interstitial space between the pectoralis major muscles. After dissection, a silicone prosthesis is placed, with its upper two-thirds placed behind the pectoralis major muscle and the lower one-third on the surface of the muscle. This surgical method eliminates the need for joint patch implantation, consequently saving

about USD 2,600 in patch costs for patients and reducing their economic burden. This procedure results in a natural and beautiful breast appearance, with a texture similar to that of the normal breast. This considerably improves patients' postoperative quality of life, while also addressing the concerns related to the limited mobility between the pectoralis major and minor muscles and incomplete hemostasis faced in traditional surgery. However, further research is warranted regarding the incidence of complications such as scar contracture, and prosthesis rupture due to radiotherapy after prosthesis placement using this surgical method. This method not only preserves the patients' breasts, ensures a good postoperative appearance, and improves the postoperative quality of life, but also resolves the concerns related to unstable axillary space, narrow operating space, and limited applicability for certain patient populations. Moreover, it reduces the financial burden on patients.

Conclusions

In summary, nipple spair mactectomy combined with primary breast reconstruction using silicone implanted above the pectoralis major muscle using a suspension hook under lipolysis-free breast endoscopy, seems to be a safe and effective approach for patients with early-stage breast cancer. This procedure has several advantages, such as economic benefits for patients, preservation of breast appearance, and improved quality of life. Moreover, it addresses the shortcomings of traditional surgery and traditional endoscopic surgery. Furthermore, this novel surgical method could resolve the issues related to axillary space instability and limited operating space, indicating its potential for clinical promotion.

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Footnote

Reporting Checklist: The authors have completed the CARE reporting checklist. Available at <https://gs.amegroups.com/article/view/10.21037/gS-23-5/rc>

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <https://gs.amegroups.com/article/view/10.21037/gS-23-5/coif>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study and the operation were approved by the ethics committee of Zibo City Central Hospital (No. 202004023). All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

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