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# Purse-String Suture: A Simple Novel Technique to Shorten Mastectomy Scar and Optimize Chest Wall Radiotherapy in Large Breasts- A Case Report

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## Keywords
Purse-String Suture, Mastectomy Scar, Breast cancer, Post-mastectomy radiation, Dog ear deformity.

## Introduction
Patients with large, ptotic breasts often pose a challenge in achieving a smooth, flat chest wall contour after mastectomy. Excess skin at the lateral edges of a mastectomy incision can form undesirable "dog-ear" deformities, which are not only cosmetically displeasing but can also interfere with clothing or prosthesis fit and cause physical discomfort. (Figure 1) Such contour irregularities can negatively impact body image and quality of life. Another concern with large breasts is the residual lateral chest wall skin fold that becomes more prominent after mastectomy, especially in overweight patients, due to the loss of the pulling effect of the large, heavy breast (Figure 2). Traditionally, surgeons have attempted to manage redundant skin in large-breasted patients by excising the dog-ear skin at the lateral edges of the wound, using techniques such as L-shaped excision, fish-tail excision, or Y-plasty closure, as nicely demonstrated in a published article by Swaim [1]. All of those techniques result in extending the mastectomy incision and elongating the final scar (Figure 3). Additionally, those techniques may result in closure under tension to flatten the lateral chest wall contour, especially with the extended "Y" closure, predisposing to healing complications such as wound dehiscence or edge necrosis. Although the overall incidence of mastectomy wound complications without reconstruction is relatively low 1–4%, any healing delay can postpone adjuvant therapy and adversely affect cosmetic and functional outcomes. Therefore, there is a genuine need for improved closure techniques in this setting [2,3].

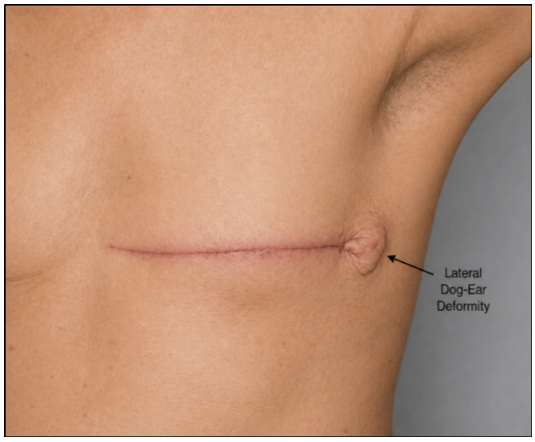


**Figure1:** Left post-mastectomy scar with lateral dog-ear deformity.

**Figure 2:** Right post-mastectomy residual skin fold in overweight patients.


**Figure 3:** Left mastectomy scar extending to the posterior axillary line after excision of lateral dog-ear.

Beyond cosmetics, the length and location of the mastectomy scar have important implications for radiation therapy planning. Radiation oncologists typically include the entire mastectomy scar in the treatment field to cover any potential microscopic disease along the surgical site, and reduce recurrence rate, which is the highest at the surgical scar [4]. The Radiation Therapy Oncology Group (RTOG) Breast Cancer Atlas provides contouring guidelines for PMRT, specifying that the chest wall clinical target volume (CTV) should encompass the chest wall musculature and the full extent of the scar plus a margin [5,6]. A long incision that extends far laterally toward the axilla or back (Figure 3) will therefore mandate a larger radiation field. This widening of the irradiated field may increase exposure of healthy tissues (skin, lung, heart) and potentially raise the risk of radiation-associated toxicity or long-term adverse events. Many studies have demonstrated that women with very large breasts often experience higher rates of acute skin reactions during radiation, owing to greater irradiated surface area and dose inhomogeneity [7,8]. Hence, minimizing scar length and avoiding unnecessary lateral dog-ears is desirable not only for cosmesis but also to optimize radiation therapy coverage and spare normal tissues [9].

Given the limitations of traditional dog-ear excision techniques and the dual cosmetic and oncologic importance of a tidy closure, attention has turned to novel methods to improve outcomes in large-breasted mastectomy patients. The National Comprehensive Cancer Network (NCCN) recently introduced the concept of "aesthetic flat closure," emphasizing careful surgical planning to remove excess skin and produce a smooth chest wall contour when a patient chooses to forgo reconstruction [10]. In this context, the novel purse-string suture (PSS) technique, described in this paper, offers a simple yet effective solution to shorten mastectomy incisions in patients with large, ptotic breasts, aiming to improve cosmetic flat closure and facilitate a favorable radiation therapy planning.

## Case Presentation

A 67-year-old postmenopausal woman with a known history of hypertension presented to the breast surgery clinic with a right breast mass that had been present for approximately two years. No other breast symptom. Her past history was insignificant for family history or other high-risk factors.

On physical examination, the patient had C-cup breast size with Grade 3 ptosis. A firm, palpable retroareolar mass was identified in the right breast, measuring approximately 7× 6 cm and extending from the 8 o'clock to the 10 o'clock position. Examination of the right axilla revealed a hard, palpable lymph node. The left breast and axilla were clinically unremarkable.

Mammography demonstrated heterogeneously dense breast tissue, which could obscure small lesions. The right breast revealed multiple microlobulated, high-density masses within the lower outer quadrant, spanning up to 7.7 cm in the anteroposterior dimension and 1.3 cm in the medial-lateral dimension. These findings were highly suggestive of multicentric malignancy. Additionally, a circumscribed mass with central calcifications measuring 3.0 cm was noted in the upper inner quadrant, classified as indeterminate. The left breast showed no suspicious abnormalities, and no enlarged lymph nodes were visualized in either axilla.

Ultrasound of the right breast confirmed the presence of multiple irregular hypoechoic masses corresponding to the mammographic abnormalities. The largest lesion, located between the 7 o'clock and 8 o'clock positions, measured 2.0×1.0 cm, with an overall extent of 7.7 cm. A right axillary lymph node measuring 3.9 cm was consistent with metastatic involvement. In the left breast, two sub-centimeter oval hypoechoic lesions were identified, likely representing benign cysts. No suspicious lymphadenopathy was noted in the left axilla.

A core biopsy of the right breast mass confirmed the diagnosis of invasive ductal carcinoma, Grade 2, with the following immunohistochemical profile: Estrogen receptor (ER): Negative, Progesterone receptor (PR): Negative, HER2-neu: Negative, Ki-67 proliferation index of 50%. Biopsy of the right axillary lymph node confirmed metastatic involvement.

Metastatic workup in the form of computed tomography scan of the chest, abdomen, and pelvis, and a bone scan revealed no evidence of distal metastasis.

## Management

The case was discussed at the breast multidisciplinary tumor board (BMDT) meeting as Right breast multicentric triple negative cancer, cT2N1M0. Based on the BMDT recommendations, the patient received neoadjuvant chemotherapy (NACT), followed by right mastectomy and sentinel lymph node biopsy using a dual-tracer technique.

### Surgical Technique

The mastectomy was performed through a transverse elliptical incision, and the excised breast tissue weighed 681 grams. The

PSS technique was used for skin closure of the mastectomy incision to manage the large skin envelope, reduce the lateral dog-ear, and optimize wound healing. This method involved placing a continuous circular purse-string-like absorbable suture in the deep dermal layer along both the superior and inferior skin flap edges of the lateral one-third of the incision. The suturing starts at the lateral 1/3 point of the inferior skin flap and continues until it reaches the lateral 1/3 point of the superior skin flap (Figure 4a). As the suture is tied, the redundant skin of the lateral incision is gathered and puckered (Figure 4b), pulling the lateral wound angle towards the center of the wound and minimizing the final scar length. Multiple interrupted sutures using a multifilament absorbable thread are placed between the purse-string loops to secure wound edges and evenly distribute tension, reducing the risk of ischemia and enhancing healing outcomes. The remaining medial part of the incision is closed with interrupted deep dermal sutures. The skin is then closed with a monofilament absorbable subcuticular suture (Figure 4c), yielding a smooth contour and facilitating an aesthetically favorable result while optimizing conditions for subsequent adjuvant radiotherapy.

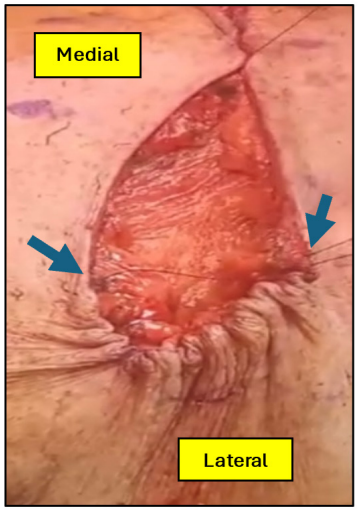


**Figure 4a:** Purse-string suture applied to the deep dermis starting and ending at the lateral 1/3 points (arrows) of the inferior and superior mastectomy flaps.

**Figure 4b:** Tying the PSS results in the gathering of excessive skin (potential dog-ear) at the lateral end.

**Figure 4c:** Final scar result showing lateral skin puckering that resolves in a few weeks.


**Figure 5:** Before and after pictures showing the shortening of the mastectomy scar and shifting the lateral angle from the posterior (PAL) to the anterior axillary line (AAL).

## Discussion

The purse-string suture technique can be interpreted as an oncoplastic adjunct to minimize scar length while maintaining a flat chest contour. In practice, the surgeon places a continuous circular suture, often in the deep dermis layer, around the peripheral one-third to half of the open wound or the area of anticipated dog-ear, then tightens it to draw the skin edges together and toward the center of the wound.

This maneuver effectively gathers the excess skin, converting a broad, flat defect into a smaller aperture for final closure. As a result, the lateral or medial mastectomy incisions can be shortened significantly without cutting away large wedges of skin [3]. Such purse-string closures are a well-recognized technique in dermatologic and reconstructive surgery to reduce wound surface area and achieve partial or complete closure with minimal scarring. In the context of a mastectomy, applying a purse-string at the end of the incision takes advantage of this principle; it shrinks the redundant tissue into the wound, preventing a protuberant dog-ear and avoiding an extensive lateral/medial scar. Importantly, the tension of closure is distributed evenly around the circular suture, rather than concentrated at a single area as in a Y-plasty, reducing the risk of focal ischemia [9]. The PSS technique is straightforward and can be performed with standard absorbable

suture material at the time of wound closure, requiring no additional specialized equipment or skills. This simplicity makes it an attractive, reproducible option for surgeons in both breast and general surgery [11]

A key benefit of the purse-string approach is minimizing the final scar length by shifting the lateral scar angle from the peripheral wound edge towards the center of the wound; in the demonstrated case, the lateral scar angle was shifted after the PSS closure from the posterior axillary line to the anterior axillary line (Figure 5), which has downstream advantages for radiation therapy. Long mastectomy scars necessitate broader radiation fields; conversely, a shorter scar allows the radiation oncologist to confine the treatment area more closely to the chest wall and immediate scar vicinity. The RTOG Breast Cancer Atlas defines the anatomical boundaries for breast contouring during post-mastectomy radiation therapy (PMRT) as follows: medially at the sternal-rib junction, laterally at the mid-axillary line, with exclusion of the latissimus dorsi muscle [12] (Figure 7).

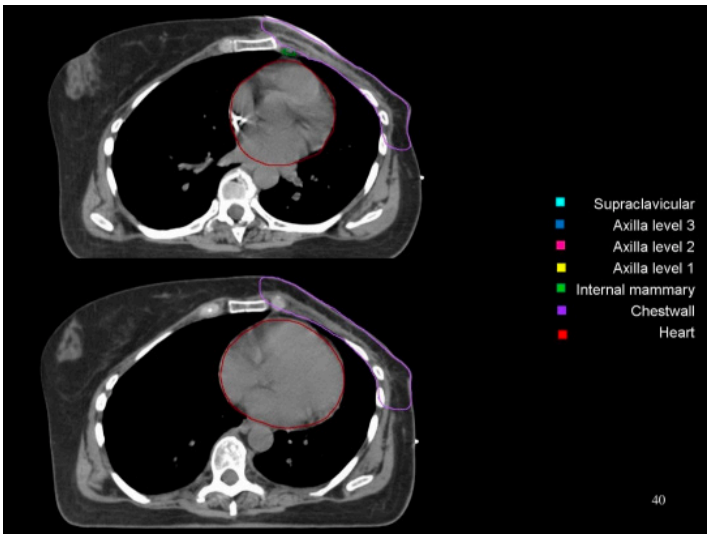


**Figure 7:** CT simulation showing chest wall contouring (in purple) for radiation therapy including the mastectomy scar.

Extending the mastectomy scar beyond these anatomical boundaries results in a wider field of radiation exposure and potentially higher toxicity. Although no published series has yet to quantify dosimetric differences with or without purse-string closure in PMRT, it is reasonable to extrapolate that reducing the lateral extent of the scar will spare some normal tissue from irradiation. Even a modest reduction in chest wall circumference can be meaningful. A more compact radiation field can reduce incidental dose to organs at risk, for example, decreasing lung volume in the field, and may lower the risk of radiation pneumonitis, rib fracture, or chronic lymphedema. Likewise, a smaller irradiated skin area might translate to less acute dermatitis and a smaller region at risk for fibrosis [13,14]. Large breast size is known to correlate with increased acute skin toxicity during breast/chest wall radiation, so any measure that effectively reduces the treated area or allows more uniform dose distribution could mitigate these side effects [8]. Thus, by minimizing scar length and area, the purse-string suture not only improves the aesthetic outcome but also has the potential to optimize the radiation therapy plan and reduce treatment-related toxicity.

Cosmetic outcomes and patient satisfaction stand to improve with the purse-string closure as well. Traditional flat closures in patients with very large or ptotic breasts can leave visible scars that extend into the lateral chest or underarm, sometimes visible in clothing or causing asymmetry. In contrast, a purse-string closure results in a more localized scar that is often flatter and easier to conceal. Initially, the purse-string may create a puckered, purse-like wrinkle in the skin, but this effect typically diminishes over time as the skin redrapes. Reports in the breast surgery literature have demonstrated that the skin pleating from purse-string sutures flattens within a few weeks to a month, resulting in a smooth scar [15,16]. The resulting scar is generally shorter and, in many cases, can lie along or within the inframammary fold area, which is cosmetically advantageous. Karacı et al. described a “chain” purse-string suture to shorten vertical incisions in reduction mammaplasty, and the majority of patients in their series were satisfied with the shorter scar and overall breast shape at 1-year follow-up [17]. Notably, none of those patients developed postoperative pseudoptosis, indicating that the gathered closure maintained its form without stretching out. The Lassus vertical mammoplasty was modified by Lejour to accommodate larger-sized breasts by introducing three adjustments, including a purse-string closure at the lower end of the scar to gather excess skin and avoid scar prolongation [18]. Her series of 138 consecutive patients (227 breasts) showed sustainable aesthetic results and excellent long-term patient satisfaction. Improved cosmesis with a flatter contour can have significant psychosocial benefits. Women who achieve an optimal flat closure report greater comfort with their bodies and less difficulty in resuming daily activities without reconstruction. Additionally, eliminating bulging dog-ears facilitates the wearing of an external breast prosthesis or a bra, as there are no excess skin flaps pinched by undergarments. Overall, by producing a shorter, flatter, and more symmetric scar, the purse-string suture technique aligns with the goals of aesthetic flat closure and may translate into higher patient satisfaction and quality of life.

Another advantage of the purse-string technique is its favorable profile for reproducibility and cost-effectiveness. This method leverages a basic surgical skill – suturing and does not require additional operative time beyond what a careful multi-layered closure would take. It uses standard suture materials and can often replace a more time-consuming dog ear excision and reclosure procedure. Because it is a tension-reducing maneuver, PSS may also contribute to a healthier wound. By distributing tension, it could lower the risk of edge ischemia and necrosis compared to traditional excisional closure under high lateral tension. Reducing wound complications is not only beneficial for the patient’s recovery but also yields downstream cost benefits: fewer clinic visits and less need for revision surgery or wound care. Perhaps most critically, avoiding major wound complications ensures that adjuvant treatments, such as chemotherapy or radiation, can start

on schedule without delay. In the era of multidisciplinary breast cancer care, surgical techniques that facilitate timely postoperative therapy are highly valuable. The PSS technique is easily taught and can be standardized, suggesting strong potential for widespread adoption. In terms of oncologic safety, a purse-string closure does not interfere with tumor resection margins or pathology assessment. Thus, from a health systems perspective, the purse-string suture is a low-cost, high-impact intervention: it harnesses a simple technique to potentially improve cosmetic outcomes and reduce radiation field size, thereby benefiting both the patient's quality of life and the delivery of adjuvant therapy.

## Conclusion

In summary, the purse-string suture (PSS) closure represents a valuable addition to the breast surgeon for managing large or ptotic breasts undergoing mastectomy. This simple and reproducible cost-effective technique can enhance cosmetic results, while also optimizing post-mastectomy radiation therapy and eventually improving patients' quality of life. While prospective studies and patient-reported outcome assessments will be valuable for further quantifying the benefits of PSS, current data and clinical experience strongly support its broader adoption.

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