



A Comparison of Seroma Formation with and without Quilting of Skin Flaps in Modified Radical Mastectomy

Shamas Yousaf¹, M. Qasim Butt¹, Dawood Mughal¹, Hina Shaukat¹, Faiza Khalil Raza¹, Jabbar Hussain Bali²

¹Department of General Surgery, Allama Iqbal Memorial Teaching Hospital, Sialkot, Punjab, Pakistan.

²Department of General Surgery, Khawaja Muhammad Safdar Medical College, Sialkot, Punjab, Pakistan.

ARTICLE INFO

Keywords

Seroma Formation, Quilting Technique, Skin Flaps, Modified Radical Mastectomy, Postoperative Complications.

Corresponding Author: Shamas Yousaf, Department of General Surgery, Allama Iqbal Memorial Teaching Hospital, Sialkot, Punjab, Pakistan.

Email: shamasyousaf786@gmail.com

Declaration

Authors' Contribution: All authors equally contributed to the study and approved the final manuscript.

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History

Received: 08-11-2024, Revised: 24-01-2025

Accepted: 01-03-2025, Published: 23-03-2025

ABSTRACT

Background: Seroma formation is a common complication following modified radical mastectomy (MRM), often resulting in prolonged recovery and additional interventions. Quilting of skin flaps is a technique proposed to reduce fluid accumulation and improve postoperative outcomes. **Objective:** This study aims to compare seroma formation rates and other clinical outcomes between patients undergoing MRM with and without quilting of skin flaps. **Methods:** This randomized controlled trial was conducted at the Department of Surgery, Allama Iqbal Memorial Teaching Hospital, Sialkot from August 2023 to August 2024, with 60 female patients diagnosed with stage II or III breast carcinoma undergoing MRM. The participants were randomly assigned to two groups: Group I (quilting flaps, n=30) and Group II (non-quilting flaps, n=30). **Results:** Seroma formation occurred in 13.33% of patients in Group I and 63.33% in Group II ($p<0.001$). The mean drain output was significantly lower in Group I (40 ml/day) compared to Group II (110 ml/day) ($p<0.01$). Postoperative pain, measured using the VAS, was significantly lower in Group I (mean = 3.5) compared to Group II (mean = 6.8) ($p<0.05$). Wound healing was more favorable in Group I, with 93.33% showing normal healing by day 14, compared to 73.33% in Group II ($p<0.05$). The length of hospital stay was shorter in Group I (mean = 4.1 days) compared to Group II (mean = 6.5 days) ($p<0.01$). **Conclusions:** It is concluded that quilting of mastectomy flaps significantly reduces seroma formation, postoperative drain output, pain, and promotes better wound healing, leading to a shorter hospital stay.

INTRODUCTION

Breast cancer is the most common malignancy in females accounting 30% of all the cancers and more than a million cases being reported each year worldwide. A total of 16-17% of all cancer-related deaths are caused by this disease. Being most common cancer among Pakistani women, it affects one out of every nine of them. In Pakistan, breast cancer patients usually present in advance stages so need of Modified Radical Mastectomy is more frequent (1-3). Among many post mastectomy complications, wound seroma formation is the most common and troublesome complication occurring in 40-60% of cases. Seroma is collection of serous fluid under the skin flaps and in the axillary space that can be detected either sonographically or clinically. Seroma formation has been linked with multiple factors like age, Body mass Index, diabetes, drainage system, dissection instruments and type of the surgery. Extensive surgical dissection and disruption of tissue results in

seroma formation. Excessive fluid accumulation under the skin flaps impairs their adhesion to tissue bed and causes skin flap necrosis, wound dehiscence, wound hematoma, surgical site infection, delayed recovery, impaired ipsilateral shoulder function and pain. Sometimes seroma needs repeated skin punctures and even surgical excision which can lead to local infection, patient's discomfort, multiple hospital visits, healthcare cost and even delay adjuvant therapy. (4-7)

Many techniques have been used in past to reduce seroma formation like external compression clothing, drains, different type of cauterization, shoulder immobilization, tetracycline, sclerotherapy but none was effective enough. However some studies noted significant effect of closing the dead space under the flaps by quilting of mastectomy flaps with underlying muscles in reducing post mastectomy seroma formation. (8) Across the globe, quilting of flaps has been the topic

of study amongst researchers to check its efficacy in reducing rate of seroma formation. A randomized controlled trial in 2021 showed the frequency of seroma formation 13.33% in quilting group as compared to 63.33% in non-quilting group. (9) In a study at PIMS hospital, Islamabad, 2/35 patients developed seroma at wound site in quilting group in comparison with 3/35 in non-quilting group, which was not statistically significant (3). In a randomized controlled study including 105 patients, there was no statistically significant difference in incidence of seroma formation ($p=0.7$), incidence of seroma aspiration ($p=0.3$) or mean post-operative pain score ($p=0.1$). However, mean operative time with quilting technique was 100.1 ± 17.4 vs 92.3 ± 17.1 minutes in conventional surgery $p(0.02)$ which was statistically significant (10). In 2020, Yuhui Wu concluded that seroma formation rate was higher in conventional closure group as compared to quilting suture group ((19.3% vs. 9.5%, $p = 0.032$), but wound hematoma and surgical site infection rate were comparable and there was longer operation time associated with quilting technique {mean (SD), 109.1 s (9.1 s)}. (11) Furthermore, in a randomized control trial for evaluating the efficacy of mastectomy flap suturing revealed the incidence of seroma was 3/30 in quilting group while 18/30 in non-quilting group ($p=0.028$) (12).

The rationale of this study is to compare seroma formation with and without quilting of mastectomy flaps. Already available data results are controversial. So, we designed this study to compare the seroma formation in modified radical mastectomy patients in our local settings to see which technique is better, so later on we can upgrade our local guidelines for management of these patients.

Objective

To compare frequency of seroma formation with quilting and without quilting of skin flaps in patients of breast cancer treated with modified radical mastectomy at Khawaja M. Safdar Medical College, Sialkot.

METHODOLOGY

This Randomized Controlled Trial was conducted at Department of Surgery, Allama Iqbal Memorial Teaching Hospital / KMSMC, Sialkot from August 2023 to August 2024. Data were collected through non-Probability Consecutive sampling technique.

Sample Size

Sample size is calculated using the literature in a previously conducted study where frequency of seroma formation in Quilting group was 13.33% and in non-quilting group 63.33% (9) by using 95% CI and 80% power of test. Sample size is 60 (30 in each group).

Inclusion Criteria

- Biopsy proven patients of breast carcinoma stage II and III who underwent MRM

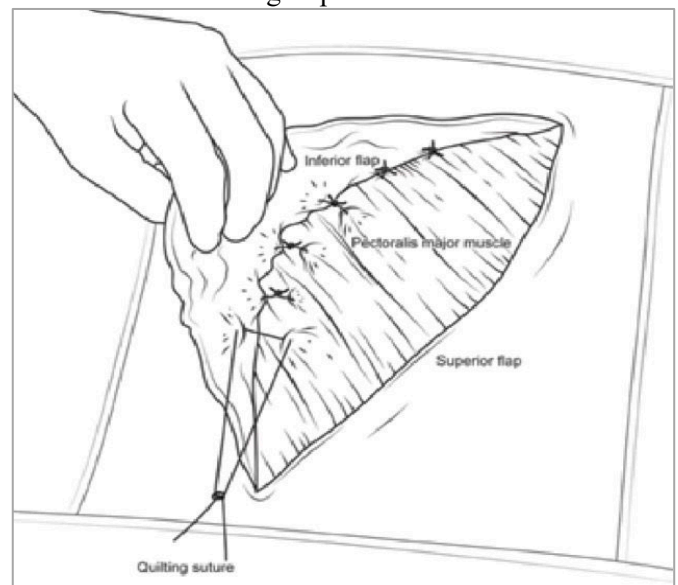
- Females between age 35- 70.
- Patients with Body Mass Index 18.5 - 29.9
- Diabetic and hypertensive patients will also be included in this study.

Exclusion Criteria

- Inoperable malignancy (Inflammatory carcinoma breast/where flap could not be raised)
- Recurrent breast cancer.
- Patients who do not give consent.
- Patients with a past history of any bleeding diathesis, coagulation disorder or multiple comorbidities

Data Collection

Once the study synopsis was approved, data collection began at Allama Iqbal Memorial Teaching Hospital, Sialkot. A total of 60 patients who met the inclusion criteria were recruited for the study. Each patient provided written informed consent after being fully informed about the study's objectives. Participants were randomly assigned to two groups using the sealed envelope method. Group I, the experimental group, consisted of 30 patients who underwent quilting of the mastectomy flaps. Group II, the control group, also consisted of 30 patients, but no quilting was performed in this group. The same surgical team performed all the surgeries, with the researcher acting as the primary assistant. In Group I, the mastectomy flaps were sutured to the underlying muscles and fascia using interrupted 2-0 vicryl sutures, and one drain was placed in the wound. In Group II, two drains (axillary and chest) were placed, but no quilting was done. Post-operative care, including pain management and prophylactic antibiotics, was standardized for both groups.



Follow-up

The follow-up process was conducted to monitor the healing process and detect any complications. The first follow-up took place on the 7th post-operative day,

where wound seroma formation was assessed, and the drain was removed if possible. A second follow-up was conducted on the 14th post-operative day to assess wound healing, remove sutures, and check for seroma formation. The researcher conducted all follow-up visits, and a consultant surgeon assessed the cases. The assessor was blinded to the surgical procedure to prevent bias. All relevant study data were recorded on a pre-designed performa to ensure consistency in data collection.

Data Analysis

Data analysis was performed using SPSS v26 software. Descriptive statistics were used to calculate means and standard deviations for quantitative variables. The normality of the data was tested using the Shapiro-Wilk test, and if the data were not normally distributed, median values and interquartile ranges (IQR) were calculated. Frequency and percentages were calculated for qualitative variables. To compare clinical outcomes between the two groups, Chi-square tests or t-tests were used, depending on the type of data. A p-value of ≤ 0.05 was considered statistically significant. A p-value ≤ 0.05 considered significant.

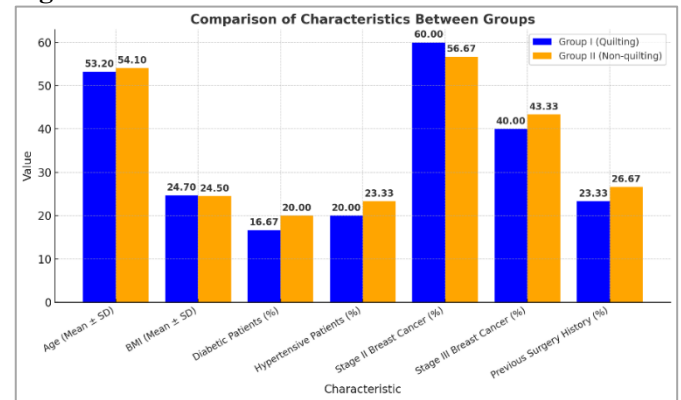
RESULTS

A total of 60 patients were added in the study. The mean age was 53.2 ± 7.6 years in Group I (Quilting) and 54.1 ± 6.8 years in Group II (Non-quilting), with no significant difference ($p = 0.67$). The Body Mass Index (BMI) was also similar between the two groups (24.7 ± 3.1 vs. 24.5 ± 3.2 , $p = 0.78$). The distribution of diabetic and hypertensive patients, as well as the stages of breast cancer (Stage II: 60% vs. 56.67%, Stage III: 40% vs. 43.33%), did not differ significantly (p-values ranging from 0.72 to 0.87). Additionally, the history of previous surgeries was comparable between the groups (23.33% vs. 26.67%, $p = 0.81$).

Table 1
Demographic and Baseline Characteristics of Participants

Characteristic	Group I (Quilting)	Group II (Non-quilting)	p-value
Age (Mean \pm SD)	53.2 \pm 7.6	54.1 \pm 6.8	0.67
Body Mass Index (BMI) (Mean \pm SD)	24.7 \pm 3.1	24.5 \pm 3.2	0.78
Diabetic Patients (%)	5/30 (16.67%)	6/30 (20%)	0.72
Hypertensive Patients (%)	6/30 (20%)	7/30 (23.33%)	0.80
Stage II Breast Cancer (%)	18/30 (60%)	17/30 (56.67%)	0.82
Stage III Breast Cancer (%)	12/30 (40%)	13/30 (43.33%)	0.87
Previous Surgery History (%)	7/30 (23.33%)	8/30 (26.67%)	0.81

Figure 1

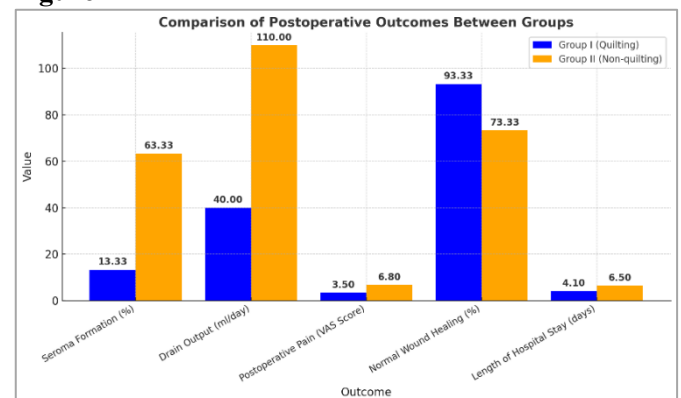


In Group I (Quilting), seroma formation occurred in 13.33% of patients, compared to 63.33% in Group II (Non-quilting), indicating a substantial reduction in seroma formation with quilting. The average drain output was also significantly lower in Group I (40 ml/day) compared to Group II (110 ml/day). Postoperative pain, measured using the VAS score, was significantly lower in Group I (mean score = 3.5) compared to Group II (mean score = 6.8). Regarding wound healing, 93.33% of patients in Group I experienced normal healing by the 14th postoperative day, compared to 73.33% in Group II.

Table 2
Comparison of Seroma Formation and Clinical Outcomes between Quilting and Non-quilting Groups

Outcome	Group I (Quilting)	Group II (Non-quilting)
Seroma Formation	13.33% (4/30)	63.33% (19/30)
Drain Output (ml/day)	40 (20-60)	110 (70-150)
Postoperative Pain (VAS Score)	3.5 \pm 1.09	6.8 \pm 0.98
Normal Wound Healing	93.33% (28/30)	73.33% (22/30)
Length of Hospital Stay (days)	4.1	6.5
Postoperative Complications	No significant complications	4 wound infections

Figure 2



The mean drain output in Group I was significantly lower at 40 ml/day, compared to 110 ml/day in Group II. Postoperative pain, measured using the VAS score, was also considerably reduced in Group I, with a mean score

of 3.5, compared to 6.8 in Group II. Wound healing was notably better in Group I, with 93.33% of patients showing normal healing by the 14th postoperative day, compared to 73.33% in Group II. The mean length of hospital stay was shorter in Group I (4.1 days) compared to Group II (6.5 days). Finally, seroma formation occurred in only 13.33% of patients in Group I, compared to 63.33% in Group II, indicating that quilting significantly reduced the incidence of seroma.

Table 3
Postoperative Clinical Outcomes in Quilting and Non-quilting Groups

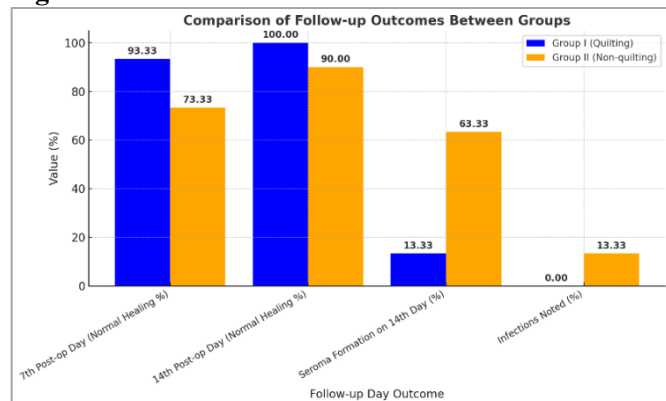
Outcome	Group I (Quilting)	Group II (Non-quilting)
Mean Drain Output (ml/day)	40	110
Mean Postoperative Pain (VAS)	3.5	6.8
% Normal Wound Healing	93.33%	73.33%
Mean Length of Stay (days)	4.1	6.5
Incidence of Seroma (%)	13.33%	63.33%

On the 7th post-operative day, 93.33% of patients in Group I exhibited normal wound healing, compared to 73.33% in Group II. By the 14th post-operative day, 100% of patients in Group I showed normal healing, whereas 90% of patients in Group II had normal healing. In terms of seroma formation, only 13.33% of patients in Group I developed seromas by the 14th day, compared to 63.33% in Group II, showing a substantial reduction in seroma formation with quilting.

Table 4
Follow-up Assessment of Wound Healing and Seroma Formation

Follow-up Day	Group I (Quilting)	Group II (Non-quilting)
7th Post-operative Day	28/30 normal healing (93.33%)	22/30 normal healing (73.33%)
14th Post-operative Day	30/30 normal healing (100%)	27/30 normal healing (90%)
Seroma Formation on 14th Day	4 (13.33%)	19 (63.33%)
Infections Noted	0	4 (13.33%)

Figure 3



The mean VAS pain score was considerably lower in Group I (Quilting), with an average score of 3.5 ± 1.23, compared to 6.8 ± 1.54 in Group II (Non-quilting). Additionally, 86.67% of patients in Group I reported

mild pain (VAS < 4), while only 40% in Group II experienced mild pain. Furthermore, none of the patients in Group I experienced severe pain (VAS ≥ 7), whereas 20% of patients in Group II reported severe pain.

Table 5
Postoperative Pain and Analgesic Use

Parameter	Group I (Quilting)	Group II (Non-quilting)
Mean VAS Pain Score	3.5±1.23	6.8±1.54
Percentage with Mild Pain (VAS < 4)	26/30 (86.67%)	12/30 (40%)
Percentage with Severe Pain (VAS ≥ 7)	0	6/30 (20%)

DISCUSSION

This study aimed to evaluate the impact of quilting of skin flaps on seroma formation and other clinical outcomes following modified radical mastectomy (MRM). Our study revealed that quilting mastectomy flap procedures decreased patients' need for seroma formation as well as reduced drain output volume and postoperative pain levels compared to patients without quilting intervention. The surgical practice of quilting after breast surgery produced improved wound healing outcomes together with shorter durations of hospital stay for patients (13,14). Proficient clinical data showed that patients who received flap quilting methods had substantially decreased seroma formation. Following mastectomy surgery seromas commonly develop as a known complication which subsequently requires extended hospitalization, adds to postoperative morbidity and necessitates additional treatments through aspiration or surgical drainage (15). The patient population receiving quilting intersected technique experienced seroma formation in 13.33% of subjects while non-quilting patients developed seromas in 63.33% of cases. The reduction of seroma volumes occurs due to quilting methods that limit fluid accumulation spaces in tissue. The medical research indicates that quilting results in better seroma prevention following mastectomy procedures. The quilting technique shows particular benefits for patients who display big or floppy skin tissue after surgery or those whose cancer stage or obesity increases their risk of seroma formation (16).

Drain output serves as an essential indicator of postoperative recovery so the two groups revealed significant results regarding this factor. Patients in the quilting group experienced much lower drain output measured by mean 40ml/day versus the non-quilting group measured by mean 110 ml/day (17). The amount of postoperative fluid accumulation remains lower in patients because skin flap fluid migration spaces are eliminated through quilting procedures. Shorter drain placement duration during quilting procedures is likely to have led to quicker patient recovery together with reduced hospitalization duration. Patients who received

quilting treatment experienced less postoperative pain as they recorded mean VAS scores at 3.5 compared to those without quilting who had higher pain levels (18). Post-operative pain tends to decrease when surgeons perform quilting procedures because skin flap tension decreases thus minimizing fluid build-up that causes discomfort. The research findings confirm previous studies that link postoperative breast surgery pain reduction with quilting procedures. Our research showed that patients who received quilting achieved better tissue recovery when contrasted with the patients who did not undergo quilting (19). The quilting technique led to better wound healing results since 93.33% of patients recovered normally within fourteen days compared with only 73.33% in the control group without quilting. Better tissue stability produced by quilting enables the skin flaps to incorporate better with surrounding tissues and reduces the risks of infection and postoperative wound healing delays. The increased wound infections rates in the non-quilting group proves that wound quilting offers beneficial outcomes for wound treatment. Multiple factors need consideration when analyzing the study results despite their encouraging nature (20). The research included 60 participants as enough sample to

analyze seroma development yet insufficient to fully represent MRM patients across the full spectrum. Studies with bigger patient numbers across multiple centers containing patient groups from different demographic backgrounds should verify these outcomes for broad result application. A longer follow-up period beyond 14 days is required to properly analyze how quilting affects late complications such as chronic seromas and lymphatic dysfunction.

CONCLUSION

It is concluded that quilting of mastectomy skin flaps significantly reduces the incidence of seroma formation, postoperative drain output, and pain, while improving wound healing and shortening the length of hospital stay in patients undergoing modified radical mastectomy. These findings suggest that quilting is an effective and beneficial technique that can be incorporated into routine breast cancer surgeries to enhance recovery and minimize complications. Given the positive impact on both clinical outcomes and patient recovery, quilting may be considered as a standard practice for reducing seroma formation in breast cancer surgeries.

REFERENCES

1. Chaudhary, A., & Gautam, S. (2020). A prospective study of factors affecting seroma formation after modified radical mastectomy in patients of carcinoma of breast. *International Surgery Journal*, 7(9), 2919. <https://doi.org/10.18203/2349-2902.isj20203768>
2. NAZ, R., & GONDAL, K. M. Quilting Technique to Prevent Seroma Formation following Mastectomy for Breast Cancer: A Cross-sectional Study.
3. Najeeb, E., Rashid, R., & Zaffar, S. (2019). Effect of flap fixation technique in modified radical mastectomy on incidence of postoperative Seroma formation. *Journal of the College of Physicians and Surgeons Pakistan*, 29(5), 410-413. <https://doi.org/10.29271/jcpsp.2019.05.410>
4. Ouldamer, L., Caille, A., Giraudeau, B., & Body, G. (2015). Quilting suture of mastectomy dead space compared with conventional closure with drain. *Annals of Surgical Oncology*, 22(13), 4233-4240. <https://doi.org/10.1245/s10434-015-4511-6>
5. Khater, A., Elnahas, W., Roshdy, S., Farouk, O., Senbel, A., Fathi, A., Hamed, E., Abdelkhalek, M., & Ghazy, H. (2015). Evaluation of the quilting technique for reduction of Postmastectomy Seroma: A randomized controlled study. *International Journal of Breast Cancer*, 2015, 1-6. <https://doi.org/10.1155/2015/287398>
6. Ouldamer, L., Bonastre, J., Brunet-Houdard, S., Body, G., Giraudeau, B., & Caille, A. (2016). Dead space closure with quilting suture versus conventional closure with drainage for the prevention of seroma after mastectomy for breast cancer (QUISERMAS): Protocol for a multicentre randomised controlled trial. *BMJ Open*, 6(4), e009903. <https://doi.org/10.1136/bmjopen-2015-009903>
7. Soliman, E. A. H., Shelfa, W. I. M. E., Eltih, O. A. E. A. M., & Ashour, H. R. G. (2022). Incidence of Seroma Formation after using Flap Fixation Technique in Modified Radical Mastectomy. *European Journal of Molecular and Clinical Medicine*, 9(1), 877+. <https://link.gale.com/apps/doc/A698245943/AONE?u=anon~31cfe0d2&sid=googleScholar&xid=3a665159>
8. Yilmaz, S., Aykota, M., Baran, T., Sabir, N., & Erdem, E. (2021). Randomised controlled study of seroma rates after mastectomy with and without quilting the skin flap to pectoralis

- muscle. *Nigerian Journal of Clinical Practice*, 24(12), 1779-1784. https://doi.org/10.4103/njcp.njcp_16_2_1
9. Aziz, M. (2021). Randomized controlled trial of modified radical mastectomy with and without quilting technique and its effect on Seroma formation. *Journal of Surgery & Anesthesia Research*, 1-4. [https://doi.org/10.47363/jsar/2021\(2\)122](https://doi.org/10.47363/jsar/2021(2)122)
 10. Yilmaz, S., Aykota, M., Baran, T., Sabir, N., & Erdem, E. (2021). Randomised controlled study of seroma rates after mastectomy with and without quilting the skin flap to pectoralis muscle. *Nigerian Journal of Clinical Practice*, 24(12), 1779-1784. https://doi.org/10.4103/njcp.njcp_16_2_1
 11. Wu, Y., Wang, S., Hai, J., Mao, J., Dong, X., & Xiao, Z. (2020). Quilting suture is better than conventional suture with drain in preventing seroma formation at pectoral area after mastectomy. *BMC Surgery*, 20(1). <https://doi.org/10.1186/s12893-020-00725-8>
 12. Reddy, A. V., & Mallikarjunappa, S. S. (2017). A randomized controlled trial evaluating the efficacy of mastectomy flap quilting sutures in reducing post modified radical mastectomy seroma formation. *International Surgery Journal*, 4(2), 714. <https://doi.org/10.18203/2349-2902.isj20170219>
 13. Chen D, Li Z, Song J, Zheng X, Yu A. Systematic review and meta-analysis of the use of quilting to prevent seroma formation after axillary lymphadenectomy. *Int J Clin Exp Med*. 2016;9(2):760-72.
 14. Bhagchandani, M., Shukla, V., Maurya, R. K., Chaudhary, A., & Kumar, K. (2023). A comparative study between mastectomy flap quilting sutures with axillary drain versus conventional sutures with axillary and pectoral drain in reducing post-modified radical mastectomy Seroma formation. *Indian Journal of Surgery*, 85(6), 1384-1389. <https://doi.org/10.1007/s12262-023-03756-6>
 15. Wu, Y., Wang, S., Hai, J., Mao, J., Dong, X., & Xiao, Z. (2020). Quilting suture is better than conventional suture with drain in preventing seroma formation at pectoral area after mastectomy. *BMC Surgery*, 20(1). <https://doi.org/10.1186/s12893-020-00725-8>
 16. De Rooij, L., Van Kuijk, S. M., Granzier, R. W., Hintzen, K. F., Heymans, C., Theunissen, L. L., Von Meyenfeldt, E. M., Van Essen, J. A., Van Haaren, E. R., Janssen, A., Vissers, Y. L., Beets, G. L., & Van Bastelaar, J. (2020). Reducing Seroma formation and its sequelae after mastectomy by closure of the dead space: A multi-center, double-blind randomized controlled trial (SAM-trial). *Annals of Surgical Oncology*, 28(5), 2599-2608. <https://doi.org/10.1245/s10434-020-09225-8>
 17. Van Bastelaar, J., Theunissen, L. L., Snoeijs, M. G., Beets, G. L., & Vissers, Y. L. (2017). Flap fixation using tissue glue or sutures appears to reduce Seroma aspiration after mastectomy for breast cancer. *Clinical Breast Cancer*, 17(4), 316-321. <https://doi.org/10.1016/j.clbc.2017.01.005>
 18. Meena, S. P., Bishnoi, S., Badkur, M., Lodha, M., Vishnoi, J. R., & Sharma, N. (2024). A quilting sutures technique for flap closure in patients undergoing modified radical mastectomy for the prevention of seroma: A single-center, randomized controlled trial. *Journal of Education and Health Promotion*, 13(1). https://doi.org/10.4103/jehp.jehp_47_24
 19. Yilmaz, S., Aykota, M., Baran, T., Sabir, N., & Erdem, E. (2021). Randomised controlled study of seroma rates after mastectomy with and without quilting the skin flap to pectoralis muscle. *Nigerian Journal of Clinical Practice*, 24(12), 1779-1784. https://doi.org/10.4103/njcp.njcp_16_2_1
 20. Najeeb, E., Rashid, R., & Zaffar, S. (2019). Effect of flap fixation technique in modified radical mastectomy on incidence of postoperative Seroma formation. *Journal of the College of Physicians and Surgeons Pakistan*, 29(5), 410-413. <https://doi.org/10.29271/jcpsp.2019.05.410>