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A Comparative Study between Mastectomy Flap Quilting Sutures with Axillary Compression versus Conventional Sutures with Axillary & Pectoral Drain in Reducing Post-Modified Radical Mastectomy Seroma

Mayankar Pandey^{1*}, Nishant Saxena¹, Sudhanshu Sharma¹ & Vishal Tyagi¹

¹Department of Surgery, Government Medical College, Orai, Jalaun, Uttar Pradesh, India

HIGHLIGHTS

- Quilting sutures reduce seroma formation
- Lower drain volume after quilting
- Reduced operative time and blood loss
- Shorter hospital stay observed
- No increase in postoperative complications

Key Words:

Modified radical mastectomy
Quilting sutures
Axillary compression
Seroma
Postoperative complications

ABSTRACT

Introduction: Seroma formation remains a common complication following modified radical mastectomy (MRM), often prolonging hospital stay and increasing morbidity. Quilting sutures with axillary compression have been proposed as an alternative to conventional sutures with axillary and pectoral drains to reduce seroma incidence. **Aim & Objective:** This study aims to compare mastectomy flap quilting sutures with axillary compression versus conventional sutures with axillary and pectoral drain in reducing post -modified radical mastectomy Seroma. **Material & Methods:** This comparative study included 70 patients undergoing MRM, divided into two groups: quilting sutures with axillary compression (n=35) and conventional sutures with axillary and pectoral drains (n=35). Patient demographics, disease characteristics, operative parameters, postoperative drain volumes, seroma incidence, and complications were analyzed. **Results:** Baseline patient and disease characteristics were comparable between groups ($p>0.05$). Quilting sutures significantly reduced operative time (122.64 ± 12.62 vs. 134.38 ± 14.48 min, $p<0.001$), blood loss (188.92 ± 42.46 vs. 222.54 ± 78.76 ml, $p=0.029$), total drain volume (995.55 ± 352.64 vs. 1391.78 ± 398.26 ml, $p<0.001$), and hospital stay (7.23 ± 2.14 vs. 13.56 ± 3.76 days, $p<0.001$). Seroma incidence was markedly lower in the quilting group (14.3% vs. 40.0%, $p=0.016$). Postoperative complications such as surgical site infection, flap necrosis, and wound gaping showed no significant difference between groups. **Conclusion:** Quilting sutures with axillary compression significantly reduce seroma formation, operative time, drain volume, and hospital stay compared to conventional sutures with drains, without increasing postoperative complications. This technique offers a safe and effective alternative in MRM.



* Corresponding Author: Mayankar Pandey, e-mail: mayankardoc@gmail.com

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INTRODUCTION

Breast cancer (BC) has emerged as a major global health issue, being the most common cancer and a leading cause of cancer-related deaths in women. BC accounts for 11.7% of all cancer diagnoses worldwide and 13.5% of all cancers in India [1]. Management of BC involves a multidisciplinary approach, with surgery as one of the definitive options. Surgery for breast carcinoma includes breast-conserving surgery (BCS) and modified radical mastectomy (MRM) with or without reconstruction. With the advancement in surgical techniques, although BCS is preferred more, MRM is still the most performed surgery for the definitive management of BC [2].

Postoperative seroma and its sequelae are among the most prevalent complications of MRM, occurring in 15%-60% of patients [1]. Seroma is an exudative fluid collection that develops postoperatively after MRM in the dead space beneath the mastectomy flaps and the axilla. Most seromas are asymptomatic and resolve in a month, but 15% become symptomatic, increasing postoperative morbidity, infection risk, flap complications, delayed healing, patient discomfort, prolonged hospital stays, and delayed adjuvant treatment [2]. Even though seroma is the most frequent side effect of mastectomy with axillary dissection, little is known about its etiopathogenesis, which is thought to be multifactorial [3].

Previously it has been tried to prevent seroma by methods such as fibrin glue, thrombin sealants, pressure dressing, heparin injections and shoulder immobilization, some of which are costly. Suction drainage is the conventional method of reducing seroma formation. However, drains are associated with patient discomfort, risk of infection, prolonged hospital stay, SSI or the need for drain care at home and postoperative wound care. Furthermore, seroma may recur after drain removal. Seroma may contribute to the development of SSI [6]. According to a study on the effectiveness of the quilting technique in reducing seroma following mastectomy, using the quilting technique considerably lowers the mean volume of seroma and the time it takes for seroma to completely end [7]. While some research found quilting sutures to significantly reduce seroma production, other studies found no such effect.

The quilting suture technique minimizes dead space by suturing the upper and lower flaps to the underlying musculature. In order to prevent seroma formation in the pectoral area, some research evaluated the use of quilting suture and drains in combination, whereas other studies employed quilting suture alone together with an axillary drain. Some studies even excluded all drains following mastectomy and axillary lymph node dissection. Seroma production is associated with comorbidity, higher hospital visits, and a greater financial burden on healthcare [8-10]. **Figure 1.** Comparative overview of post-MRM seroma formation and management using conventional sutures with suction drainage versus flap quilting sutures with axillary compression, highlighting mechanisms, postoperative outcomes, complications, and potential healthcare cost reduction. Despite these findings, there remains no clear consensus on the optimal

approach to seroma prevention. The variability in study outcomes suggests that factors such as patient characteristics, surgical techniques, and postoperative management may influence the effectiveness of quilting sutures. Additionally, while some studies advocate for the combined use of quilting sutures and drains, others suggest that quilting alone may be sufficient in reducing seroma formation [11-14]. This lack of standardization highlights the need for further research to establish evidence-based guidelines. A well-designed prospective randomized controlled trial comparing quilting sutures to conventional sutures in modified radical mastectomy is essential to clarify their role in reducing postoperative seroma. By providing robust clinical evidence, this study aims to determine whether quilting sutures offer a significant advantage in minimizing seroma formation, reducing hospital visits, and improving overall patient outcomes [15,16].

MATERIAL & METHODS

This was a prospective comparative study conducted on 70 female patients undergoing modified radical mastectomy (MRM) for carcinoma breast. Patients were randomly allocated into two equal groups: Group A (n=35) underwent mastectomy flap quilting sutures with axillary compression, while Group B (n=35) underwent conventional sutures with axillary and pectoral drains. Study duration was of 18 months from July 2024 to December 2025.

Inclusion Criteria: Patients diagnosed with operable breast carcinoma (Stage I–III) and planned for MRM were included.

Exclusion Criteria: Patients with recurrent disease, prior breast surgery, advanced metastatic disease, or those unfit for surgery were excluded.

Surgical Technique: In Group A, quilting sutures were applied between the mastectomy flap and underlying pectoral fascia using absorbable sutures, along with axillary compression dressing. No pectoral drain was inserted. In Group B, conventional closure was performed with placement of axillary and pectoral drains.

Data Collection: Demographic variables (age, BMI, comorbidities, neoadjuvant chemotherapy) and disease characteristics (tumor site, stage, size) were recorded. Operative parameters including operative time, intra-operative blood loss, and total lymph nodes dissected were noted. Postoperative outcomes assessed included daily drain volume, total drain output, day of drain removal, duration of hospital stay, seroma incidence (graded 1–3), and complications such as surgical site infection, flap necrosis, and wound gaping.

Statistical Analysis: Microsoft Excel was used in creating the database and producing graphs, while the data were analyzed using the Statistical Package for the Social Sciences (SPSS)

version 23 for Windows. Mean and standard deviation ($\pm$ SD) were used to describe quantitative data meeting normal distribution. Continuous two independent groups were compared by parametric independent Student's t test. Discrete (categorical) groups were compared by chi-square (χ^2) test was used. p values less than 0.05 ($p < 0.05$) was considered statistically significant.

RESULTS

Baseline patient and disease characteristics were comparable between groups ($p > 0.05$) (Table 1 & 2). Quilting sutures

significantly reduced operative time (122.64 ± 12.62 vs. 134.38 ± 14.48 min, $p < 0.001$), blood loss (188.92 ± 42.46 vs. 222.54 ± 78.76 ml, $p = 0.029$), total drain volume (995.55 ± 352.64 vs. 1391.78 ± 398.26 ml, $p < 0.001$), and hospital stay (7.23 ± 2.14 vs. 13.56 ± 3.76 days, $p < 0.001$) (Table 3).

Seroma incidence was markedly lower in the quilting group (14.3% vs. 40.0% , $p = 0.016$) (Table 4). Postoperative complications such as surgical site infection, flap necrosis, and wound gaping showed no significant difference between groups (Table 5).

Table 1: Comparison of patient's characteristics

Variables		Quilting sutures with axillary compression (n=35)	Conventional sutures with axillary and pectoral drain (n=35)	χ^2 value	P-value
Age (Years)	≤ 50	23 (65.7%)	21 (60.0%)	0.245	0.621
	> 50	12 (34.3%)	14 (40.0%)		
BMI (kg/m^2)	≤ 25	15 (42.9%)	17 (48.6%)	0.230	0.632
	< 25	20 (57.1%)	18 (51.4%)		
Comorbidity	Hypertension	8 (22.9%)	5 (14.3%)	0.850	0.357
	Diabetes	6 (17.1%)	3 (8.6%)	1.148	0.284
Neoadjuvant chemotherapy	Yes	18 (51.4%)	15 (42.9%)	0.516	0.472
	No	17 (48.6%)	20 (57.1%)		

Table 2: Comparison of disease characteristics

Disease characteristics		Quilting sutures with axillary compression (n=35)	Conventional sutures with axillary and pectoral drain (n=35)	χ^2 value	P-value
Site of the tumour	Right	19 (54.3%)	21 (60.0%)	0.233	0.629
	Left	16 (45.7%)	14 (40.0%)		
Stages	I & II	18 (51.4%)	22 (62.9%)	0.933	0.334
	III & IV	17 (48.6%)	13 (37.1%)		
Size of the tumour (mm)	≤ 3.5	22 (62.9%)	19 (54.3%)	0.530	0.467
	> 3.5	13 (37.1%)	16 (45.7%)		

Table 3: Comparison of Study findings

Findings	Quilting sutures with axillary compression (n=35)	Conventional sutures with axillary and pectoral drain (n=35)	t-value	P-value
Operative time (min)	122.64 ± 12.62	134.38 ± 14.48	3.616	< 0.001
Operative blood loss (ml)	188.92 ± 42.46	222.54 ± 78.76	2.223	0.029
Total lymph nodes	14.46 ± 4.36	12.83 ± 5.84	1.323	0.190
Total drain volume (ml)	995.55 ± 352.64	1391.78 ± 398.26	4.407	< 0.001
Drain volume (per day)	77.42 ± 6.58	94.83 ± 8.72	9.429	< 0.001
Drain removal day	6.78 ± 2.24	11.34 ± 3.62	6.337	< 0.001
Duration of hospital stay	7.23 ± 2.14	13.56 ± 3.76	8.656	< 0.001

Table 4: Seroma incidence in study and control group

Seroma	Quilting sutures with axillary compression (n=35)	Conventional sutures with axillary and pectoral drain (n=35)	χ^2 value	P-value
Total seroma	5 (14.3%)	14 (40.0%)	5.851	0.016
Grade 1	3 (8.6%)	8 (22.9%)	2.696	0.101
Grade 2	2 (5.7%)	5 (14.3%)	1.429	0.232
Grade 3	0 (0.0%)	1 (2.9%)	1.014	0.314

Table 5: Comparison of postoperative complications

Complications	Quilting sutures with axillary compression (n=35)	Conventional sutures with axillary and pectoral drain (n=35)	χ^2 value	P-value
SSI	2 (5.7%)	5 (14.3%)	1.429	0.232
Superficial skin necrosis	3 (8.6%)	6 (17.1%)	1.148	0.284
Flap necrosis	1 (2.9%)	2 (5.7%)	0.348	0.555
Wound gaping	0 (0.0%)	1 (2.9%)	1.014	0.314

DISCUSSION

In the present study, the age distribution was similar, with most patients being ≤ 50 years in both groups (65.7% vs. 60.0%, $p = 0.621$). BMI was also comparable, with nearly equal proportions of patients having BMI ≤ 25 (42.9% vs. 48.6%, $p = 0.632$). Comorbidities such as hypertension (22.9% vs. 14.3%, $p = 0.357$) and diabetes (17.1% vs. 8.6%, $p = 0.284$) were slightly more frequent in the quilting group but not statistically significant. Likewise, the proportion of patients receiving neoadjuvant chemotherapy was similar (51.4% vs. 42.9%, $p = 0.472$). Our findings were comparable to the findings of **Jayalal JA et al** [6] who reported that the mean age was comparable in both groups (50.8 in conventional group vs 52.7 in intervention group). The mean BMI in both groups was also comparable (22.9 in conventional group vs 22.7 in intervention group). **Bhagchandani M et al** [2] reported that most of the cases in both the groups were above 50 years of age and BMI less than 25 kg/m². 21 out of 30 and 16 out of 33 were under Neoadjuvant chemotherapy in Quilting sutures with axillary and Conventional sutures respectively ($p > 0.05$). According to **Raju A et al** [1] the mean age of patients in the study and control groups was 48.78 years and 49.11 years, respectively, with no significant difference observed. The prevalence of comorbidities like diabetes was comparable between the two groups. Additionally, the average BMI and comorbidities of the study and control groups showed no significant variation.

In the present study, tumor site distribution was similar, with right-sided tumors slightly more common in both groups (54.3% vs. 60.0%, $p = 0.629$). Stage distribution also did not differ significantly, with nearly half of patients in the quilting group and over one-third in the conventional group presenting with stage III & IV disease (48.6% vs. 37.1%, $p = 0.334$). Tumor size was comparable, with the majority in both groups having tumors ≤ 3.5 cm (62.9% vs. 54.3%, $p = 0.467$). Our findings were consistent with the findings of **Raju A et al** [9] who reported that the distribution of patients as per the clinical staging was mainly in stages 2 and 3 and was broadly comparable in both groups. The number of lymph nodes retrieved and level of axillary lymph node dissection and lymphovascular invasion on histopathological evaluation were not statistically significant between the study and control groups. **Bhagchandani M et al** [2] reported that 27 out of 32 and 18 out of 33 cases were of stage I and II in the quilting suture and conventional sutures, respectively. According to **Jaya**

lal JA et al [6] 60% of patient in conventional group were TNM stage 2 and 52.3% were TNM stage 2 in quilting group. **Priscilla SB et al** [2] reported that the tumour stage IIA was slightly more common in both groups [group A, n=13 (26%); group B, n=14 (28%)]. In group A, the most common tumour size was 2.0-3.0 cm (12 patients). In both groups, the tumour was more commonly located on the right side in group A, 15 (30%), and group B, 17 (34%).

In the present study, Operative time was significantly shorter in the quilting group (122.64 $\pm$ 12.62 min vs. 134.38 $\pm$ 14.48 min, $p < 0.001$), and operative blood loss was also lower (188.92 $\pm$ 42.46 ml vs. 222.54 $\pm$ 78.76 ml, $p = 0.029$). Although the total number of lymph nodes retrieved was comparable between groups ($p = 0.190$), quilting sutures resulted in markedly reduced total drain volume (995.55 $\pm$ 352.64 ml vs. 1391.78 $\pm$ 398.26 ml, $p < 0.001$), lower daily drain output (77.42 $\pm$ 6.58 ml vs. 94.83 $\pm$ 8.72 ml, $p < 0.001$), and earlier drain removal (6.78 $\pm$ 2.24 days vs. 11.34 $\pm$ 3.62 days, $p < 0.001$). Consequently, patients in the quilting group had a significantly shorter hospital stay (7.23 $\pm$ 2.14 days vs. 13.56 $\pm$ 3.76 days, $p < 0.001$). Our findings were in accordance with the findings of **Priscilla SB et al** [10] who reported that the total drain volume (944 $\pm$ 292.46 ml) was higher in group A than in group B (1415 $\pm$ 261.61 ml). The duration of drain removal was 9 days in group A and 13 days in group B, and the difference was statistically significant. Similarly, **Jayalal JA et al** [6] reported that the length of hospital stay is comparable in both the groups. There is a difference in time for suturing for application of quilting sutures (16.21 $\pm$ 4.28 min in conventional group versus 25.5 $\pm$ 5.87 in quilting groups, which is statistically significant. The drain volume in both groups is statistically significant with lesser drain volume in quilting group than conventional group (368.98 $\pm$ 101.65 in quilting vs 451.67 $\pm$ 90.85 in quilting group with a p value = 0.0083). **Bhagchandani M et al** [2] reported that the operative time was slightly increased in the quilting group (70 min) than in the conventional group (64 min) ($p < 0.0001$). The length of hospital stay was 4 days in the quilting group versus 9 days in the conventional group ($p < 0.0001$). Also, **Raju A et al** [9] reported that the flap fixation group had a significantly lower total drain volume (306.67 mL) compared to the conventional closure group (531.11 mL), with a P -value < 0.01 . This demonstrates that flap fixation with axillary exclusion effectively reduces the accumulation of postoperative fluid, a critical factor in preventing seroma formation. The average daily drain volume was significantly lower

in the flap fixation group (73.12 mL/day) than in the control group (83.17 mL/day). This reinforces the benefit of flap fixation with axillary exclusion in minimizing fluid output per day, facilitating faster recovery. Patients in the flap fixation group had their drains removed earlier (average of 4.00 days) compared to the control group (6.25 days), ($p < 0.05$). These findings are supported by that of **Ten Wolde B et al** [3] that quilting suture was applied after axillary lymph node dissection and mastectomy, and it required approximately 10 to 20 more minutes to operate than the conventional way. Nonetheless, the drain which was singularly placed in the axilla in the interventional group was removed earlier with a decreased overall output as compared to the control group. This made the handling of the drains during patient mobilization hassle-free. The duration of hospital stay was also reduced which made quilting not only efficacious and proficient but also cost-effective.

In the present study, overall seroma incidence was significantly lower in the quilting group (14.3%) compared to the conventional group (40.0%, $p = 0.016$). When graded, seromas were more frequent in the conventional group across all grades, though the differences in individual grades (Grade 1: 8.6% vs. 22.9%, $p = 0.101$; Grade 2: 5.7% vs. 14.3%, $p = 0.232$; Grade 3: 0% vs. 2.9%, $p = 0.314$) did not reach statistical significance. Our findings were in concordance with **Khater A et al** [4], who studied 120 patients. They noted that the incidence of seroma was lower at 20% in comparison with the conventional group with 78.3%. **Morarasu S et al** [4] included close to 3500 patients from 21 studies in their systematic review and meta-analysis. The study group showed significantly lower rates of seroma ($p < 0.00001$), total drainage volume ($p < 0.0001$), days to drain removal ($p < 0.00001$), and length of hospital stay ($p < 0.00001$), with no increased incidence of complications. **Kumar N et al** [6] noted that the incorporation of quilting led to longer operative time and more blood loss, but also lesser seroma aspiration, shortened hospital stays, early initiation of chemotherapy and better return to function of shoulder mobility. **Jayalal JA et al** [6] reported that the incidence of seroma formation shows difference between both the groups with 47.6% in conventional group and 19% in quilting group. **Bhagchandani M et al** [2] reported that on follow-up, the incidence of seroma formation was significantly lower in the quilting group as compared to the conventional group ($p < 0.00407$). **Larsen BB et al** [7] reported that the quilting method allowed smoother, more prompt recovery, and less disability after mastectomy. Similarly, this technique significantly reduced the incidence of seroma formation, breakdown of wound edges and prolonged serous discharge, and did not lead to a reduced functional range of shoulder motion among patients who underwent conventional mastectomy.

In the present study, surgical site infection occurred in 5.7% of patients in the quilting group compared to 14.3% in the conventional group ($p = 0.232$), while superficial skin necrosis was observed in 8.6% versus 17.1%, respectively ($p = 0.284$). Flap necrosis was rare in both groups (2.9% vs. 5.7%, $p = 0.555$), and wound gaping was reported only in one patient from the

conventional group (2.9%, $p = 0.314$). **Bhagchandani M et al** [2] reported that there was no significant difference with respect to flap necrosis, superficial skin necrosis and wound gaping between the two groups. **Jayalal JA et al** [6] reported that the occurrence of surgical site infections in both groups is comparable in both groups with 1 case occurring in both groups. **Inwang R et al** [8], study found the number of patients diagnosed with seroma through clinical examination was recorded, and any complications, including infection, cellulitis, or necrosis, were monitored at the wound site and drainage time ($p > 0.001$; significant).

CONCLUSION

This comparative study demonstrates that quilting sutures with axillary compression significantly reduce seroma formation, operative time, blood loss, postoperative drain volume, and hospital stay compared to conventional sutures with axillary and pectoral drains, without increasing postoperative complications. The technique effectively minimizes dead space and fluid accumulation, thereby improving patient comfort and reducing morbidity. Although larger multi-centric trials with longer follow-up are needed to validate these findings & establish standardized guidelines, quilting sutures represent a safe, effective, and patient-friendly.

LIMITATIONS & FUTURE PERSPECTIVES

Conducted at one institution, which may limit generalizability of findings to broader populations. With 70 patients (35 per group), subgroup analyses (e.g., complications, seroma grades) may lack statistical power. Future studies should incorporate multi-centre designs with larger populations to enhance validity, assess long-term outcomes, and investigate advanced diagnostic & management approaches. Such efforts will improve overall patient care & help minimize complications.

CLINICAL SIGNIFICANCE

The clinical significance of this study lies in its potential to bridge the gap between research findings and practical healthcare, diagnosis, and treatment outcomes. By highlighting real-care applications. It emphasizes the importance of translating scientific observations into meaningful improvements in patient world relevance, the study contributes to evidence based medical practice and supports informed clinical decision making. Ultimately, the findings aim to enhance patient quality of life, optimize therapeutic strategies, and promote better disease management in clinical settings.

ABBREVIATIONS

MRM: Modified Radical Mastectomy

TNM: Tumor, Node, Metastasis

ALND: Axillary Lymph Node Dissection

LVI: Lymphovascular Invasion

SSI: Surgical Site Infection

RCT: Randomized Controlled Trial

AUTHOR INFORMATION

Dr Mayankar Pandey: Third year, Junior Resident, MS,
<http://orcid.org/0009-0000-7836-8583>
 Dr Nishant Saxena: Associate Professor
 Dr Sudhanshu Sharma: Assistant Professor
 Dr Vishal Tyagi: Senior Resident

AUTHOR CONTRIBUTIONS

All authors significantly contributed to the study conception and design, data acquisition, or data analysis and interpretation. They participated in drafting the manuscript or critically revising it for important intellectual content, consented to its submission to the current journal, provided final approval for the version to be published, and accepted responsibility for all aspects of the work. Additionally, all authors meet the authorship criteria outlined by the International Committee of Medical Journal Editors (ICMJE) guidelines.

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CONFLICT OF INTEREST

Authors declared that there is no conflict of interest.

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ETHICAL APPROVAL & CONSENT TO PARTICIPATE

All necessary consent & approval was obtained by authors.

CONSENT FOR PUBLICATION

All necessary consent for publication was obtained by authors.

DATA AVAILABILITY

All data generated and analyzed are included within this research article. The datasets utilized and/or analyzed in this study can be obtained from the corresponding author upon a reasonable request.

USE OF ARTIFICIAL INTELLIGENCE (AI) & LARGE LANGUAGE MODEL (LLM)

The authors confirm that no AI & LLM tools were used in the writing or editing of the manuscript, and no images were altered or manipulated using AI & LLM.

AUTHOR'S NOTE

This article serves as an important educational tool for the scientific community, offering insights that may inspire future research directions. However, they should not be relied upon

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Ph.D. & National Post-Doctoral Fellow in Medicinal Chemistry

¹CSIR-Central Institute of Medicinal & Aromatic Plants, Lucknow, India

²CSIR-National Botanical Research Institute, Lucknow, India

HANDLING EDITOR

Dr. Dinesh Kumar Verma

Research Assistant Professor, School of Allied Health Sciences, Boise State University, Boise, Indiana, USA

e-mail: dineshkumarverma@boisestate.edu

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