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Original Research Article

Incidence and Risk Factors for Seroma Formation Following Modified Radical Mastectomy: A Retrospective Observational Study

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Abstract:

Background: The most common postoperative complication after modified radical mastectomy (MRM) is seroma development. It contributes to patient discomfort, repeated aspirations, wound complications, and delayed adjuvant therapy.

Objective: To evaluate the incidence and risk factors associated with seroma formation following MRM.

Methods: A retrospective analysis of 100 patients undergoing MRM at two tertiary centers between January and December was conducted. Demographic, clinical, operative, and postoperative data were extracted from hospital records. Seroma was defined as a clinically or radiologically detected fluid collection requiring aspiration. Statistical analyses included univariate testing and logistic regression.

Results: Seroma developed in 28 patients (28%). Independent risk factors included age ≥60 years (OR 2.6, 95% CI 1.1–6.2), BMI ≥30 kg/m² (OR 2.9, 95% CI 1.2–7.1), drain duration >5 days (OR 3.8, 95% CI 1.4–9.7), and axillary clearance >15 lymph nodes (OR 2.2, 95% CI 1.0–5.1). Diabetes mellitus showed a non-significant association. Quilting sutures reduced incidence, though not significantly.

Conclusion: Seroma occurred in nearly one-third of patients undergoing MRM. Older age, obesity, prolonged drainage, and extensive axillary dissection were major risk factors. Adoption of standardized drain protocols and quilting sutures may reduce seroma incidence.

Keywords: Seroma, Modified Radical Mastectomy, Breast Cancer, Postoperative Complications, Risk Factors.

Introduction

In India, breast cancer is a serious public health issue and continues to be the most prevalent cancer among women worldwide. Advances in screening, awareness, and treatment have improved outcomes, yet a large number of women continue to present at advanced stages of the disease. While breast-conserving surgery is increasingly adopted in well-resourced health systems, modified radical mastectomy (MRM) remain one of the most commonly performed operations in developing regions. This is largely due to delayed presentation, economic constraints, and the limited availability of radiotherapy, which is an essential component of breast conservation therapy. Although MRM provides excellent oncological clearance, it is frequently associated with postoperative complications. The most common among these is seroma formation, a troublesome problem that can prolong recovery, cause patient distress, and increase the burden on already stretched healthcare services.

The buildup of transparent serous fluid in the surgical cavity beneath the skin flaps or in the axilla after mastectomy and lymph node dissection is known as a seroma. Despite being well recognized, the exact mechanism remains poorly understood. Several explanations have been proposed: interruption of lymphatic channels, inflammatory fluid exudation from surgical trauma, and constant shearing between skin flaps and the chest wall. While seroma is not life-threatening, it is a source of discomfort, requires repeated aspirations, and may predispose to infection or flap necrosis. Multiple patient-related factors appear to influence risk, including increasing age, higher BMI, and the presence of comorbidities such as diabetes. Surgical factors also play a role, such as the extent of axillary

dissection, method of hemostasis, and the use of quilting sutures to reduce dead space. In addition, postoperative care practices, especially the use and duration of suction drains, significantly affect outcomes.

Numerous preventive strategies have been explored to lower the seroma incidence. These include external compression dressings, the use of tissue sealants, and modifications in drain management. Among these, flap fixation using quilting sutures has shown considerable promise, as it eliminates dead space and minimizes tissue shear. Drain placement is another widely practiced method, but the optimal timing of removal remains controversial. Some surgeons prefer early removal once the drainage volume falls below a certain threshold, while others advocate keeping drains longer to reduce the risk of fluid accumulation. Despite decades of research and multiple clinical trials, no universal consensus has been reached. The persistence of seroma as a common complication reflects the multifactorial nature of its development and the limitations of existing preventive measures.

The continuing problem of seroma after MRM highlights the need for better understanding of its risk factors in different clinical settings. In India, where MRM remains the dominant surgical approach for breast cancer, there is a particular need to evaluate local patient populations and surgical practices. Identifying individuals at higher risk allows surgeons to adapt techniques, adopt preventive measures such as quilting sutures, and provide closer postoperative monitoring. Furthermore, documenting the true incidence of seroma in regional centers provides valuable evidence that can guide institutional protocols and training. This retrospective study was therefore conducted across two tertiary hospitals to determine the incidence of seroma following MRM and to analyze the patient- and surgery-related factors associated with its development. By focusing on practical, real-world data, the findings aim to contribute to improving surgical outcomes and reducing the morbidity associated with breast cancer treatment.

Materials and Methods

Study design and setting: A retrospective observational study was carried out at Mata Gujri Medical College in Kishanganj, Bihar, and the Department of General Surgery at Sri Guru Ramdas Institute of Medical Sciences and Research in Amritsar, Punjab. The study period was January to December (1 year).

Study Population: A total of 100 consecutive female patients with breast carcinoma who underwent MRM with axillary dissection were included.

Inclusion criteria:

- Female patients ≥18 years undergoing MRM with axillary clearance.

Exclusion criteria:

- Previous breast/axillary surgery
- Immediate breast reconstruction
- Pre-existing wound infection
- Incomplete clinical records

Data Collection: Medical records were searched for patient information, including demographics (age, BMI, comorbidities), oncological factors (tumor stage, neoadjuvant chemotherapy), operative details (number of nodes removed, duration of surgery, use of quilting sutures), and postoperative outcomes (drain duration, seroma formation).

Definition of Seroma: Clinically or ultrasonographically detected subcutaneous or axillary fluid collection requiring aspiration within 30 days postoperatively.

Statistical Analysis: The Chi-square/Fisher's exact test was used to evaluate categorical variables, and the Student's t-test or Mann-Whitney U test, as appropriate, was used to analyze continuous variables. Variables with $p<0.15$ on univariate analysis were included in multivariable logistic regression. A p-value <0.05 was considered statistically significant.

Results

Patient Characteristics: A total of 100 patients were included in the study. The mean age was 54 ± 11 years; 32% were aged ≥60 years. Twenty-six patients (26%) were obese (BMI ≥30 kg/m²). Diabetes mellitus and hypertension were present in 22% and 30% of patients respectively. Neoadjuvant chemotherapy was administered to 35% of patients.

Incidence of Seroma: Seroma developed in 28 patients (28%). The majority were detected within the first postoperative week, with a median time to presentation of 7 days (IQR 5–10). Most cases required two aspirations (median 2; IQR 1–3).

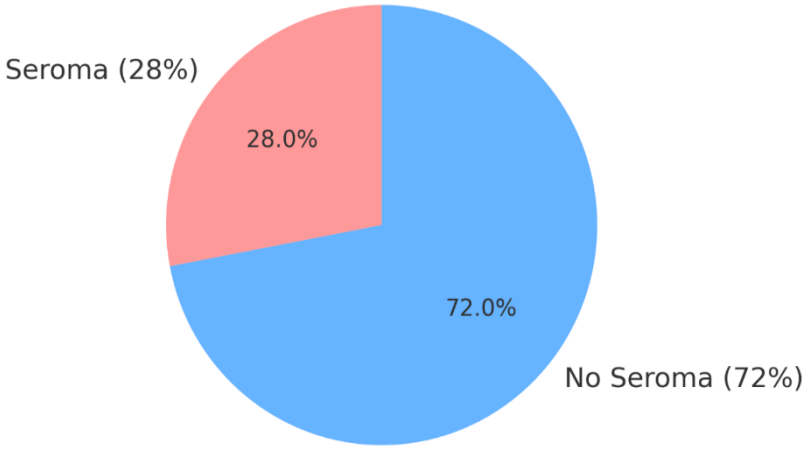

Figure 1: Shows the overall incidence of seroma formation in the cohort.

Risk factor analysis: On univariate analysis, age ≥60 years, BMI ≥30 kg/m², prolonged drain duration (>5 days), and retrieval of >15 lymph nodes were significantly associated with seroma formation. Diabetes mellitus showed a trend towards significance, while quilting sutures were associated with a protective effect.

Table 1 summarizes the univariate associations of different clinical and operative factors with seroma formation.

Table 1: Univariate analysis of risk factors for seroma formation

Variable	Seroma (%)	No Seroma (%)	p-value
Age ≥60 years (n=32)	50	20	0.008
BMI ≥30 kg/m² (n=26)	46	21	0.004
Diabetes mellitus (n=22)	41	24	0.06
Drain >5 days (n=55)	40	12	<0.001
>15 nodes removed (n=40)	40	20	0.01
Quilting sutures (n=40)	20	33	0.09

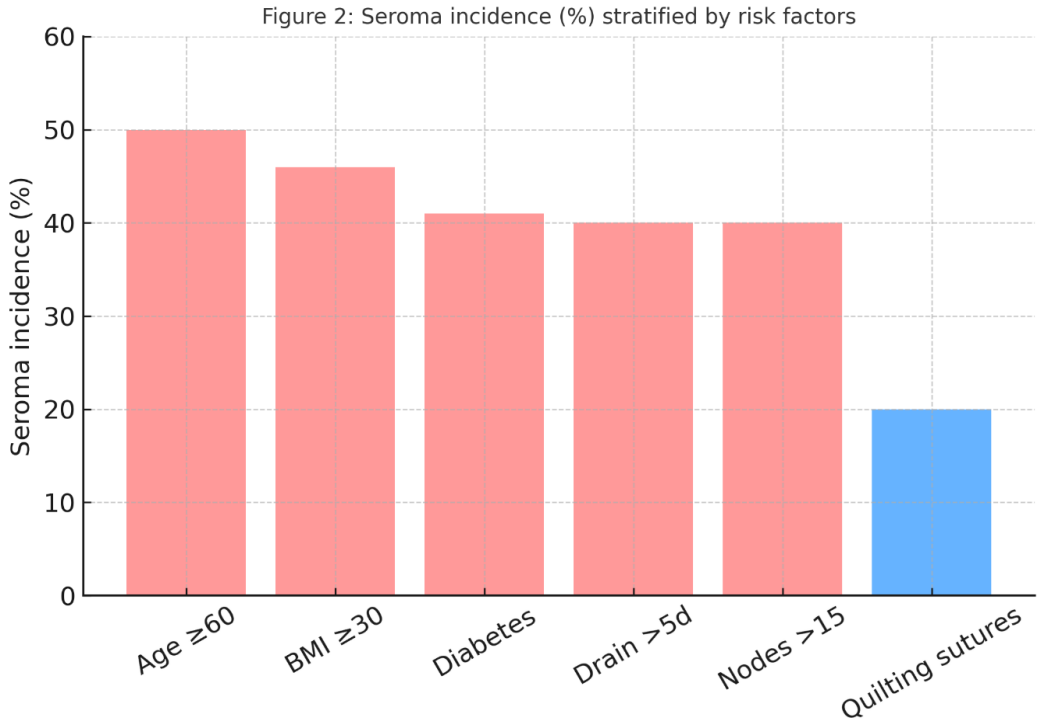

Figure 2: Illustrates the proportion of patients developing seroma across key risk factors.

Multivariable logistic regression: On regression analysis, four variables remained independent predictors of seroma formation:

Table 2: Multivariable logistic regression for predictors of seroma

Predictor	Adjusted OR	95% CI	p-value
Age ≥60 years	2.6	1.1–6.2	0.03
BMI ≥30 kg/m²	2.9	1.2–7.1	0.01
Drain >5 days	3.8	1.4–9.7	0.008
>15 nodes removed	2.2	1.0–5.1	0.049
Diabetes mellitus	1.8	0.8–4.3	0.15
Quilting sutures	0.6	0.3–1.2	0.14

Discussion

In this retrospective review, we evaluated 100 patients who underwent modified radical mastectomy at two tertiary hospitals over a one-year period. The study demonstrated that seroma continues to be the most frequent postoperative complication, occurring in nearly one-third of patients. While not life-threatening, the presence of seroma adds to patient discomfort, prolongs recovery, and often necessitates repeated aspirations. The key findings were that older age, higher body mass index, prolonged drain placement, and extensive axillary clearance significantly increased the risk of seroma. Diabetes was associated with a higher proportion of cases but did not reach statistical significance, whereas quilting sutures showed a trend toward protection. These results provide an important snapshot of risk factors relevant to everyday surgical practice.

The incidence rate observed in this series is consistent with what has been documented in many national and international reports. Despite decades of investigation, seroma remains a persistent problem after mastectomy, with figures rarely dropping below 15% in most clinical settings. The 28% rate found here suggests that current measures, although helpful, are insufficient to eliminate the complication. The persistence of seroma across various populations and techniques underscores its complex and multifactorial nature. Our findings reinforce the view that seroma should be regarded not as a minor nuisance but as a significant clinical challenge that affects postoperative quality of life, delays adjuvant therapy, and places a continuing burden on surgical services.

Age was a strong predictor of outcome in this study. Patients aged 60 years and above experienced more than twice the risk of seroma formation compared with younger women. Reduced skin elasticity, slower healing, and diminished lymphatic function in older individuals likely account for this association. Obesity was another important determinant, with obese women nearly three times as likely to develop seroma. Thicker flaps, a larger dead space, and compromised lymphatic clearance in these patients create an ideal setting for fluid accumulation. Recognition of these factors is crucial for surgical planning. Elderly and obese patients should be counseled about their increased risk and may benefit from preventive strategies such as flap quilting and closer follow-up after surgery.

Diabetes mellitus has long been suspected to predispose patients to postoperative wound problems. In our series, diabetic patients showed higher rates of seroma, although this association did not reach statistical significance. The absence of significance may reflect the relatively small number of diabetic patients rather than a lack of biological effect. Poor glycemic control impairs tissue repair and compromises microvascular circulation, both of which can delay adherence of flaps to the chest wall. Although our findings cannot confirm diabetes as an independent predictor, the clinical logic suggests that careful perioperative optimization of blood glucose remains important. Larger cohorts will be needed to clarify the exact contribution of diabetes to seroma risk.

Two intraoperative and postoperative factors had the greatest impact on seroma formation: the number of nodes removed and the duration of drain placement. Patients who had more than fifteen nodes dissected were significantly more likely to develop seroma, reflecting the greater disruption of lymphatic channels with more extensive clearance. While axillary dissection remains essential for accurate staging and disease control in many patients, particularly in resource-limited settings, surgeons must weigh its oncological benefits against the potential for morbidity. Sentinel node biopsy and less aggressive clearance may help reduce seroma where feasible. Drain management was another crucial factor. Seroma was markedly more common in patients whose drains remained in situ for more than five days. Although drains are used to evacuate fluid, prolonged placement may simply identify patients prone to seroma rather than prevent it. These findings support the need for standardized drain protocols, with removal based on defined output criteria rather than arbitrary duration.

Quilting sutures were associated with a lower incidence of seroma in our study, though the difference was not statistically significant. The principle behind quilting is straightforward: by fixing skin flaps to the underlying muscle, potential dead space is reduced and flap movement minimized. Several randomized studies have shown quilting to significantly reduce seroma, outpatient aspirations, and infections. Our results, though not conclusive, are consistent with this trend. The lack of significance may reflect selective use of quilting or sample size limitations. Wider adoption of quilting, particularly in patients at high risk such as the obese and elderly, could help reduce morbidity. While concerns about operative time and cosmetic outcomes are often cited, the potential benefits in lowering complications and improving recovery outweigh these drawbacks in most cases.

The practical message from this study is clear: seroma remains common after mastectomy, but certain risk factors allow surgeons to anticipate which patients are most vulnerable. Older women, those with higher body mass index, and those requiring extensive axillary clearance or prolonged drainage should be identified preoperatively for targeted preventive strategies. The strengths of this study include its multicenter design and inclusion of consecutive cases, providing a realistic reflection of practice in tertiary centers. However, limitations must also be acknowledged. Being retrospective, the study relied on available records, and certain factors such as flap thickness or exact methods of cautery could not be assessed. The relatively small cohort may have limited statistical power, especially for variables such as diabetes or quilting. Finally, findings from two hospitals may not capture practice variations across the country. Future research should focus on larger prospective studies, preferably multicentric, with standardized definitions of seroma and uniform protocols for drain management and flap fixation.

Conclusion

Seroma formation occurred in nearly one-third of patients undergoing MRM. Older age, obesity, prolonged drain duration, and extensive axillary clearance were independent risk factors. Preventive strategies such as standardized drain management protocols and the routine use of quilting sutures may reduce the incidence of seroma and improve postoperative outcomes.

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