ORIGINAL RESEARCH ARTICLE

Single Drain versus Two Drain Technique Following Modified Radical Mastectomy: A Comparative Analysis of Seroma Formation, Wound Healing, and Postoperative Recovery

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Abstract: Background: Closed-suction drainage after modified radical mastectomy limits postoperative fluid accumulation, but the benefit of adding a second drain remains uncertain. The number of drains may affect wound morbidity, discomfort and postoperative recovery.**Objective:** To compare single and two-drain strategies after modified radical mastectomy with respect to seroma formation, wound healing, drain-related outcomes and early postoperative recovery.**Materials and Methods:** A prospective comparative observational framework included 40 women undergoing modified radical mastectomy at Usha Bansal Nursing Home between March 2024 and February 2026. Twenty patients were evaluated in each group. A single axillary closed-suction drain was compared with two drains positioned in the axilla and beneath the mastectomy flap. The primary endpoint was clinically detectable postoperative seroma within 30 days after surgery. Secondary endpoints included aspiration, wound complications, total drainage, drain duration, pain scores, length of stay and resumption of daily activity. Fisher's exact test and Welch's t test were used for between-group comparisons.**Results:** Seroma developed in 5/20 (25%) single-drain patients and 4/20 (20%) two-drain patients (Fisher's exact P = 1.000). Aspiration was required in 4 and 3 patients, respectively. Mean drain duration was 7.0 ± 1.3 versus 7.8 ± 1.4 days (P = 0.073). Mean 24-hour pain scores were 3.8 ± 0.9 and 4.6 ± 1.0 (P = 0.011). Rates of infection, flap necrosis, hematoma and wound dehiscence were low in both groups.**Conclusion:** The two drainage strategies showed similar short-term seroma and wound complication frequencies in this small comparison, whereas the single-drain strategy was associated with lower early pain scores. Larger, prospectively controlled studies with standardized drainage and flap-closure protocols are needed to establish comparative effectiveness.

Keywords: modified radical mastectomy; closed-suction drain; seroma; surgical-site infection; postoperative pain; wound healing; axillary dissection.

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1. INTRODUCTION

Modified radical mastectomy (MRM) entails removal of breast tissue combined with axillary lymph-node dissection and remains an important operation in selected patients with breast malignancy. Extensive dissection exposes the chest wall and axillary tissues, disrupts lymphatic channels and creates potential spaces beneath the mastectomy flaps. Seroma, defined as postoperative accumulation of serous or lymphatic fluid in these spaces, is among the most frequent causes of morbidity after mastectomy. A persistent or symptomatic collection can delay wound healing, require repeated needle aspiration and increase postoperative healthcare use [1–3].

Closed-suction drains evacuate blood and lymphatic fluid, support flap apposition, and provide a practical means of monitoring postoperative effluent. However, the choice of one

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or two drains is debated. A single drain is commonly positioned in the axilla, whereas two-drain systems add a pectoral or sub-flap drain. Although the latter arrangement may offer separate routes for evacuation from two anatomical compartments, it also adds an exit site, tubing management and potential patient discomfort [4–6].

Direct comparisons of single and double drainage have produced mixed results. Randomized trials and prospective surgical series have generally not established a consistent reduction in seroma formation with the routine use of two drains, even though some studies have identified differences in pain or time until drain removal [5–8]. Seroma development also depends on body habitus, extent of axillary dissection, surgical technique, dead-space closure and timing of drain removal [2,3,9]. These coexisting determinants complicate attribution of postoperative outcomes to drain number alone.

The present comparative study examined clinically significant seroma formation, wound healing and postoperative recovery after MRM performed using single-drain and two-drain strategies. The primary objective was to compare the proportion of patients developing seroma within the first postoperative month. Secondary objectives included evaluating aspiration requirements, drain output and duration, wound infection, flap necrosis, wound dehiscence, pain intensity, hospitalization and return to routine activities.

2. MATERIALS AND METHODS

2.1 Study design and setting

A single-centre prospective comparative observational study was conducted in the Department of General Surgery at Usha Bansal Nursing Home, Sri Muktsar Sahib, Punjab over two years, from March 2024 through February 2026. The analysis included 40 women undergoing modified radical mastectomy, with 20 patients in the single-drain group (Group A) and 20 in the two-drain group (Group B). Treatment groups were defined by the drain configuration selected during surgery; no randomization or masking was assumed.

2.2 Eligibility and clinical assessment

Eligible participants were adult women with biopsy-confirmed breast carcinoma undergoing elective MRM with axillary dissection. Patients requiring immediate reconstruction, bilateral simultaneous mastectomy, re-operation for an existing wound complication, or an additional major procedure affecting postoperative drainage were excluded. Baseline evaluation included age, body mass index, diabetes, hypertension, neoadjuvant systemic treatment, clinical stage and operative characteristics. The surgery type and oncological management were determined by routine clinical assessment and treating-surgeon judgment.

2.3 Operative technique and drain placement

Modified radical mastectomy consisted of breast removal with level I–II axillary clearance as clinically indicated. Skin flaps were elevated, breast tissue mobilized from the chest wall and axillary lymphovascular channels secured. Hemostasis was reviewed before wound closure. Standard closed-suction drainage was applied in both groups. Group A received a single axillary drain positioned to communicate with the dissected axillary and flap space. Group B received two drains: one within the axilla and the second beneath the mastectomy flap. Drain tubes were brought out through separate skin stab incisions and connected to negative-pressure reservoirs. Skin closure, dressing and postoperative care followed comparable perioperative practice.

2.4 Drain monitoring and postoperative care

Drain effluent was measured in millilitres every 24 hours. Total drainage was calculated as the sum of recorded daily volumes until all drains had been removed. The last drain-removal day represented the duration of drainage for patients with two drains. Drains were removed when output from the relevant drain fell below 30 mL over 24 hours on two successive days and the clinical examination showed no concerning collection. Postoperative management included analgesia, wound inspection, drain-site care and graded shoulder mobilization according to clinical tolerance. Patients were assessed during admission and at approximately postoperative days 7, 14 and 30, with earlier review for pain, leakage, swelling or signs of infection.

2.5 Outcome definitions

The primary endpoint was seroma formation within 30 postoperative days, defined as a clinically appreciable fluid collection under the mastectomy flaps or in the axilla after drain removal. Ultrasonography was reserved for equivocal collections or when clinically indicated. A symptomatic collection requiring needle evacuation was recorded separately as an aspirated seroma, along with the total number of aspiration procedures. Superficial surgical-site infection was defined clinically by purulent drainage or a wound with localized inflammation requiring treatment within 30 days. Flap-edge necrosis, hematoma and wound dehiscence were recorded as separate events. Wound healing was considered complete when the incision was closed without active separation or drainage at follow-up.

Pain intensity was scored on a 0–10 visual

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analogue scale (VAS) at 24 hours, day 3 and day 7. Length of initial hospital stay was calculated from surgery to discharge in days. Return to normal light activities was defined as the first day the patient resumed usual basic self-care and routine household activity without additional assistance. Unplanned clinic attendance and any intervention for postoperative complications were recorded through day 30.

2.6 Statistical analysis

Continuous variables were summarized as mean ± standard deviation (SD), and categorical variables as number and percentage. Independent-group continuous outcomes were compared using Welch's t test; categorical outcomes were compared using Fisher's exact test, appropriate to the small cell frequencies. Risk ratios (RRs) and approximate 95% confidence intervals (CIs) were reported for selected binary endpoints. Two-sided $P < 0.05$ was used as the nominal level of statistical significance. With only 40 participants and relatively few complication events, analyses were interpreted as exploratory, and adjusted multivariable modeling was not undertaken. The patient was the unit of analysis, with no repeated observations treated as independent individuals.

3. RESULTS

3.1 Patient characteristics

Forty patients were included, with 20 in each drain group. Baseline demographic and selected clinical characteristics are summarized in Table 1. Mean age and body mass index were comparable across the two groups. The proportions with diabetes, hypertension, stage III disease and neoadjuvant systemic treatment were similar.

Table 1. Baseline demographic and clinical characteristics

Characteristic	Single drain (n = 20)	Two drains (n = 20)	P value
Age (years)	53.5 ± 8.6	55.2 ± 9.3	0.561
Body mass index (kg/m²)	25.9 ± 3.0	26.5 ± 3.4	0.579
Diabetes mellitus	4 (20.0%)	3 (15.0%)	1.000
Hypertension	5 (25.0%)	6 (30.0%)	1.000
Neoadjuvant systemic therapy	8 (40.0%)	9 (45.0%)	1.000
Clinical stage II	12 (60.0%)	11 (55.0%)	1.000
Clinical stage III	8 (40.0%)	9 (45.0%)	1.000

Values are mean ± SD or n (%). Between-group P values are exploratory.

3.2 Operative and drainage outcomes

Operative duration was 106.0 ± 13.1 versus 111.0 ± 15.0 minutes in Groups A and B, respectively. Mean total drain output was 414.2 ± 83.6 mL in the single-drain group and 450.0 ± 79.0 mL in the two-drain group ($P = 0.172$). Drain removal occurred after 7.0 ± 1.3 and 7.8 ± 1.4 days, respectively ($P = 0.073$). The two-drain group showed a numerically longer drain duration and a greater total drainage volume (Table 2).

Table 2. Operative characteristics, drain use and early recovery

Outcome	Single drain (n = 20)	Two drains (n = 20)	P value
Operative time (minutes)	106.0 ± 13.1	111.0 ± 15.0	0.269
Estimated blood loss (mL)	139.9 ± 31.1	148.9 ± 29.0	0.352
Total drain output (mL)	414.2 ± 83.6	450.0 ± 79.0	0.172
Drain retention (days)	7.0 ± 1.3	7.8 ± 1.4	0.073
Hospital stay (days)	3.1 ± 0.8	3.5 ± 0.9	0.150
Return to light activity (days)	13.1 ± 2.6	14.5 ± 2.8	0.115

Values are mean ± SD; comparisons are unadjusted Welch tests. Drain retention represents time until the last drain was removed.

3.3 Seroma and wound complications

Seroma was observed in 5 patients (25.0%) in Group A and 4 (20.0%) in Group B (RR 1.25 (0.39–3.99); $P = 1.000$). The absolute seroma risk difference was +5.0 percentage points. Symptomatic fluid accumulation requiring aspiration occurred in 4 and 3 patients, respectively. Infection, flap-edge necrosis, hematoma and wound dehiscence were uncommon. No statistically compelling between-group difference in these individual complications was detected (Table 3).

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Table 3. Seroma and postoperative complications within 30 days

Outcome	Single drain (n = 20)	Two drains (n = 20)	P value
Seroma within 30 days	5 (25.0%)	4 (20.0%)	1.000
Seroma requiring aspiration	4 (20.0%)	3 (15.0%)	1.000
Surgical-site infection	2 (10.0%)	2 (10.0%)	1.000
Flap-edge necrosis	1 (5.0%)	1 (5.0%)	1.000
Wound dehiscence	1 (5.0%)	2 (10.0%)	1.000
Hematoma	1 (5.0%)	0 (0.0%)	1.000
Unplanned clinic visit	6 (30.0%)	5 (25.0%)	1.000

Values are n (%); exact two-sided Fisher P values. More than one complication may have occurred in a single patient.

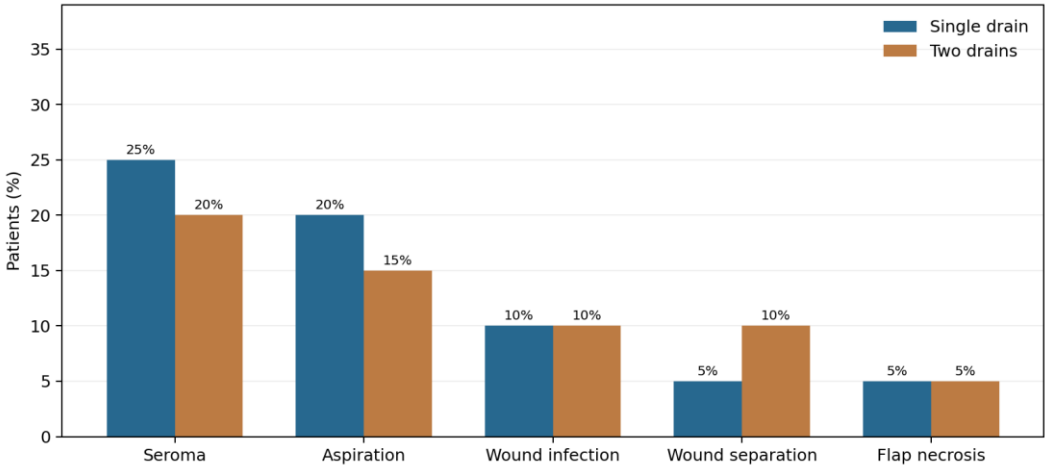

Figure 1. Frequency of seroma and selected postoperative wound complications during 30-day follow-up. Rates are percentages within each 20-patient group.

3.4 Wound healing and clinical recovery

Incisional healing was documented by postoperative day 14 in 17 single-drain patients and 16 two-drain patients. By day 30, 19 patients in each group had achieved complete wound closure. Mean hospital stay was 3.1 ± 0.8 versus 3.5 ± 0.9 days, and mean time to return to light activity was 13.1 ± 2.6 versus 14.5 ± 2.8 days. These observations suggested no marked difference in overall short-term wound recovery.

Table 4. Incision healing at scheduled follow-up

Assessment	Single drain (n = 20)	Two drains (n = 20)	P value
Healed incision by day 14	17 (85.0%)	16 (80.0%)	1.000
Healed incision by day 30	19 (95.0%)	19 (95.0%)	1.000

Values are n (%) and refer to complete incision closure at each examination.

3.5 Postoperative pain

Pain scores declined between the first postoperative day and day 7 in both groups. At 24 hours, mean VAS was 3.8 ± 0.9 in the single-drain group and 4.6 ± 1.0 in the two-drain group (P = 0.011). By postoperative day 7, mean VAS had decreased to 1.5 ± 0.6 and 1.8 ± 0.7, respectively (P = 0.160). The early pain difference was smaller at later measurements (Table 5, Figure 2).

Table 5. Pain intensity during postoperative follow-up

Assessment	Single drain (n = 20)	Two drains (n = 20)	P value
24 hours	3.8 ± 0.9	4.6 ± 1.0	0.011
Postoperative day 3	2.6 ± 0.8	3.2 ± 0.9	0.027
Postoperative day 7	1.5 ± 0.6	1.8 ± 0.7	0.160

Pain score is a 0–10 visual analogue scale; values are mean ± SD. Cross-sectional P values are exploratory and do not model within-patient repeated measurements.

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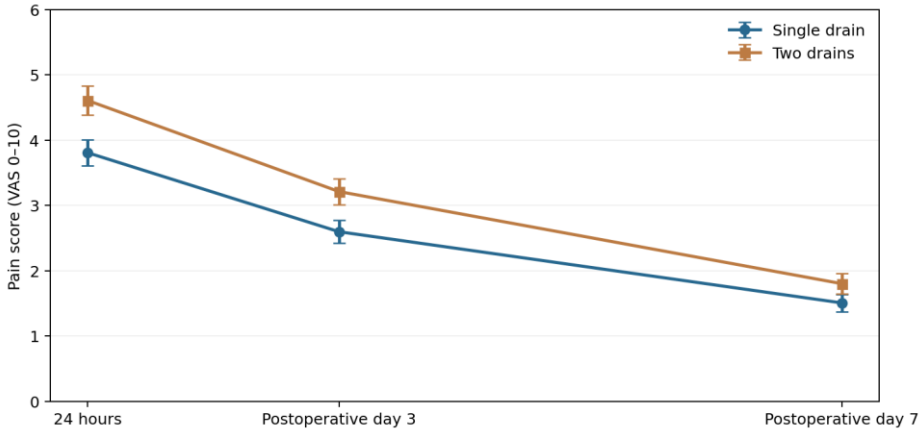

Figure 2. Mean pain scores (± standard error of the mean) at 24 hours, postoperative day 3 and day 7 by drain group.

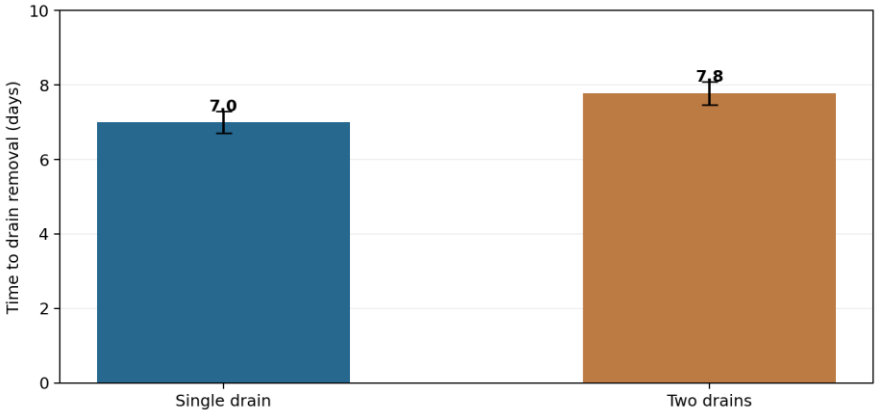

Figure 3. Mean duration until final drain removal by postoperative drainage strategy. Error bars indicate standard error of the mean.

4. DISCUSSION

The comparison of one versus two drains following modified radical mastectomy addresses a practical question in postoperative breast surgery: whether a second drainage catheter provides measurable protection from seroma or wound complications that justifies additional tubing and postoperative management. In this sample, the frequency of clinically detectable seroma was similar in both groups, with slightly more events in the single-drain group, but the small number of outcomes and wide uncertainty prevent a conclusion of equivalence. Wound complications and incision healing also showed no convincing separation. The single-drain group reported lower early postoperative pain and numerically shorter drainage and recovery intervals.

Khan and colleagues reported a randomized comparison of 196 patients and found no statistically significant difference in postoperative seroma occurrence, while the single-drain group experienced less postoperative discomfort [5]. Roy and colleagues also evaluated single versus double drainage after breast surgery and found that total drainage outcomes and seroma incidence were broadly comparable, with earlier drain removal in the single-drain arm [6]. A more recent prospective study from northern India similarly reported no clear difference in seroma, aspiration requirement or other early complications [7]. These findings provide useful context for interpreting an apparent absence of large differences in the present comparison, although results may vary with operative technique and drain protocols.

The biological mechanism of seroma formation is multifactorial. Dissection-related lymphatic leakage and inflammatory exudation contribute to fluid accumulation; tissue dead space, body habitus, use of electrocautery and movement of the overlying skin flaps may modify risk [1–3]. Drain number is only one component of fluid management. The threshold for drain removal, suction pressure, axillary clearance, flap closure technique and postoperative activity can all influence cumulative output and subsequent collection. Because routine clinical choices differ across patients, the effect of adding a second drain is difficult to isolate without standardization or randomized allocation.

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The choice of a single drain may simplify postoperative care. Less tubing may reduce interference with clothing, sleep, mobilisation and patient self-management. However, the number of exit sites does not necessarily predict collection formation, and single-drain designs must still allow fluid evacuation from the relevant dead spaces. In the present comparison, a lower early VAS score in the single-drain group was observed, though analgesic dosing and individual pain tolerance remain potential contributors. Similarly, modest differences in drain duration or hospital stay should not be overinterpreted without considering perioperative discharge protocols and home drain care.

Wound-related endpoints merit independent evaluation because seroma alone does not capture all postoperative burden. Infection, wound separation, hematoma and flap-edge necrosis have different causal pathways and may coexist with seroma. Published work on flap fixation and dead-space obliteration suggests that closure technique can influence seroma formation beyond the number of suction drains used [8,9]. This emphasizes the importance of documenting additional measures such as quilting sutures, electrocautery use and degree of axillary dissection in future research. The Cochrane review of axillary wound drainage supports a role for drainage compared with no drainage in some settings, but it does not establish that two drains are superior to one [4].

A recently published systematic review synthesizing randomized comparisons of single and double drainage did not identify a statistically significant difference in seroma incidence or several wound outcomes, but rated much of the evidence as low certainty and emphasized imprecision [10]. Consequently, findings from a 40-patient observational comparison should be interpreted conservatively. The observed small absolute event differences are compatible with either benefit or harm of the additional drain, and this sample is insufficient for definitive assessment of uncommon complications.

The principal strengths of the analytical approach are the assessment of a clinically relevant primary endpoint and reporting of patient-centered outcomes, including pain, wound healing and return to routine activity, alongside drain metrics. Limitations include the small study size, potential treatment-selection bias, single-centre setting, lack of adjustment for surgical and disease-related confounders, and follow-up restricted to 30 days. Late collections, prolonged wound problems and delays to adjuvant oncology therapy may not be captured. Larger multicentre studies should predefine seroma severity, standardize drain-removal and flap-closure methods, measure analgesic use and patient satisfaction, and report adjusted treatment effects with sufficient precision.

5. CONCLUSION

Single and two-drain approaches after modified radical mastectomy showed broadly similar short-term seroma and wound complication rates in this small comparative sample. A single drain was associated with lower pain scores during early postoperative recovery, without an apparent increase in major wound morbidity. Because the differences in seroma frequency were imprecisely estimated, these findings do not establish equivalence between techniques. Drain selection should account for operative anatomy, wound management and patient circumstances while more robust comparative evidence is developed.

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