

Single versus Double Suction Drain After Modified Radical Mastectomy: A Prospective Comparative Study from a Tertiary Care Centre in Northern India

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DOI:

10.55489/njmr.160320261361

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Date of Submission: 22/04/2026

Date of Acceptance: 23/06/2026

Date of Publication: 01/07/2026

Funding Support:

None Declare

Conflict of Interest:

The authors have declared that no conflict of interest exists.

How to cite this article:

Singh K, Bhargava GS, Mittal S, Gill PK. Single versus Double Suction Drain After Modified Radical Mastectomy: A Prospective Comparative Study from a Tertiary Care Centre in Northern India. Natl J Med Res 2026;16(03):174-179. DOI: 10.55489/njmr.160320261361

ABSTRACT

Background: Seroma formation remains one of the most common complications following modified radical mastectomy (MRM) for breast cancer. Closed suction drainage is routinely used to reduce postoperative fluid accumulation; however, the optimal number of drains required remains a subject of debate. The objective was to compare postoperative outcomes associated with single versus double suction drainage following modified radical mastectomy.

Methods: The prospective comparative study was conducted in the Department of General Surgery at a tertiary care hospital between July 2024 and December 2025. Seventy female patients undergoing elective MRM for histopathologically confirmed breast carcinoma were enrolled and allocated into either a single-drain group (n=35) or a double-drain group (n=35). Primary outcomes included total drain output, duration of drainage, and incidence of postoperative seroma formation. Secondary outcomes included seroma volume, aspiration requirements, and postoperative complications during a four-week follow-up period.

Results: The mean total drain output was 409.43±71.88 ml in the single-drain group and 438.43 ± 69.16 ml in the double-drain group (p=0.060). The mean duration until drain removal was comparable between groups (8.31 ± 0.90 vs. 8.37 ± 0.94 days; p=0.699). Seroma formation occurred in 11.4% of patients in the single-drain group and 8.6% in the double-drain group (p=0.797). No statistically significant differences were observed in seroma volume, aspiration requirements, or other postoperative complications during follow-up.

Conclusion: Single suction drainage following modified radical mastectomy demonstrated postoperative outcomes comparable to those achieved with double suction drainage. The findings suggest that a single-drain approach may serve as a safe and effective alternative in appropriately selected patients.

Keywords: Breast Neoplasms, Modified Radical Mastectomy, Seroma, Wound Drainage, Postoperative Complications

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Publisher: Medsci Publications [www.medscipublications.com]

ISSN: 2249 4995

Official website: www.njmr.in

INTRODUCTION

Modified radical mastectomy (MRM) remains an important surgical treatment for breast cancer, which continues to be the most frequently diagnosed malignancy among women worldwide. The procedure involves complete removal of the breast tissue and nipple-areolar complex along with level I and II ipsilateral axillary lymph node dissection while preserving the pectoralis major muscle.[1] MRM evolved from the radical mastectomy originally described by Halsted in the late nineteenth century, with subsequent modifications by Patey and Dyson, [2] reducing postoperative morbidity while maintaining oncological effectiveness.

Although breast-conserving surgery has become increasingly common in the management of breast cancer, modified radical mastectomy remains an important treatment option for patients with locally advanced disease, multicentric tumors, contraindications to breast conservation, or those requiring extensive axillary clearance.[3,4]

Seroma formation remains the most common postoperative complication following MRM, with reported incidences ranging from 3% to 85%.[5,6] Seroma is defined as the accumulation of serous fluid within the dead space created after surgical dissection and is considered a multifactorial process involving lymphatic leakage, inflammatory exudation, and tissue response to surgical trauma.[6,7] Several patient- and procedure-related factors, including advanced age, obesity, hypertension, extent of axillary dissection, and nodal disease burden, have been associated with an increased risk of seroma formation. Although often self-limiting, persistent seroma may result in patient discomfort, wound complications, infection, flap necrosis, repeated aspirations, and delays in adjuvant treatment.[5-7]

To minimize postoperative fluid accumulation and facilitate adherence of skin flaps, closed suction drainage has become standard practice following MRM.[5] Traditionally, surgeons have employed two drains, one positioned in the axillary cavity and another beneath the mastectomy flap. However, the optimal drainage strategy remains controversial. Several studies have suggested that a single-drain approach may provide outcomes comparable to those of double-drain placement while potentially improving patient comfort, reducing drain-related morbidity, and decreasing healthcare costs.[8] In addition, adjunctive techniques such as mastectomy flap quilting have been shown to significantly reduce postoperative seroma formation and may influence drain requirements following modified radical mastectomy.[9]

Despite previous studies comparing single and double drainage systems, results remain inconsistent, and evidence from rural Indian healthcare settings remains limited. Given the socioeconomic challenges faced by many patients in resource-constrained environments, identifying a safe and effective drainage strategy with minimal patient burden has important clinical implications.

Therefore, the aim of the present study was to compare the clinical outcomes of single versus double suction drainage following modified radical mastectomy. Primary outcomes included total drain output, duration of drainage, and incidence of postoperative seroma formation. Secondary outcomes included seroma volume, frequency of aspiration, and postoperative complications during a four-week follow-up period.

MATERIALS AND METHODS

Study Design and Setting: This prospective comparative study was conducted in the Department of General Surgery at Sri Guru Ram Das Institute of Medical Sciences and Research (SGRDIMS), Amritsar, Punjab, India, over an 18-month period from July 2024 to December 2025. Evaluated clinical outcomes associated with two routinely practiced postoperative drainage strategies following modified radical mastectomy (MRM) for breast carcinoma.

Ethical Approval: The study protocol was reviewed and approved by the Institutional Ethics Committee (Approval No. SGRD/IEC/2024-298) and the Institutional Research Committee of Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar. Written informed consent was obtained from all participants prior to enrolment. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. All eligible patients presenting during the predefined study period and fulfilling the inclusion criteria were consecutively enrolled using a convenience sampling approach.

Study Population and Participant Selection: Female patients aged 18 years or older with histopathologically confirmed early-stage carcinoma breast planned for elective modified radical mastectomy were considered eligible for inclusion.

Inclusion Criteria: Female patients aged 18 years or older with histopathologically confirmed early breast carcinoma who were scheduled to undergo elective modified radical mastectomy and were willing to provide written informed consent were included in the study.

Exclusion Criteria: Patients with locally advanced breast carcinoma requiring additional surgical procedures, downstaged breast carcinoma following neoadjuvant therapy, metastatic breast carcinoma, male breast cancer, or known coagulation disorders or bleeding diathesis were excluded from the study.

Patients with advanced, metastatic, or down-staged disease were excluded because these conditions may influence the extent of surgery, postoperative drainage characteristics, wound healing, and complication rates. Patients with coagulation disorders were excluded due to their increased risk of postoperative bleeding and hematoma formation, which may confound assessment of seroma formation.

Participant Allocation: A total of 70 eligible patients were enrolled in the study. Participants were allocated

alternately according to the order of enrolment. Patients with odd serial numbers were assigned to the Single Drain Group (n=35), while those with even serial numbers were assigned to the Double Drain Group (n=35).

Group A (Single-Drain Group): Patients assigned odd serial numbers received a single closed suction drain placed in the axillary region.

Group B (Double-Drain Group): Patients assigned even serial numbers received two closed suction drains, one placed in the axillary region and the other beneath the mastectomy skin flaps.

Surgical Procedure and Data Collection: Following written informed consent, all patients underwent standard modified radical mastectomy performed according to institutional surgical protocols. Demographic information, and perioperative details were recorded using a structured proforma.

Postoperatively, drain output was measured and docu

mented daily until drain removal. Drains were removed when the drainage volume was ≤ 30 ml over a 24-hour period for two consecutive days, consistent with commonly accepted surgical practice.[6,10]

Outcome Measures: The primary outcome measures included the total postoperative drain output (mL), postoperative day of drain removal, and the incidence of postoperative seroma formation. The secondary outcome measures included the volume of seroma aspirated (mL), the number of seroma aspirations required, and the occurrence of postoperative wound-related complications.

Definition of Seroma: Seroma was defined as a clinically detectable postoperative fluid collection occurring at the operative site after drain removal and confirmed by ultrasonographic examination when clinically suspected. Fluid collections requiring aspiration were recorded and quantified.

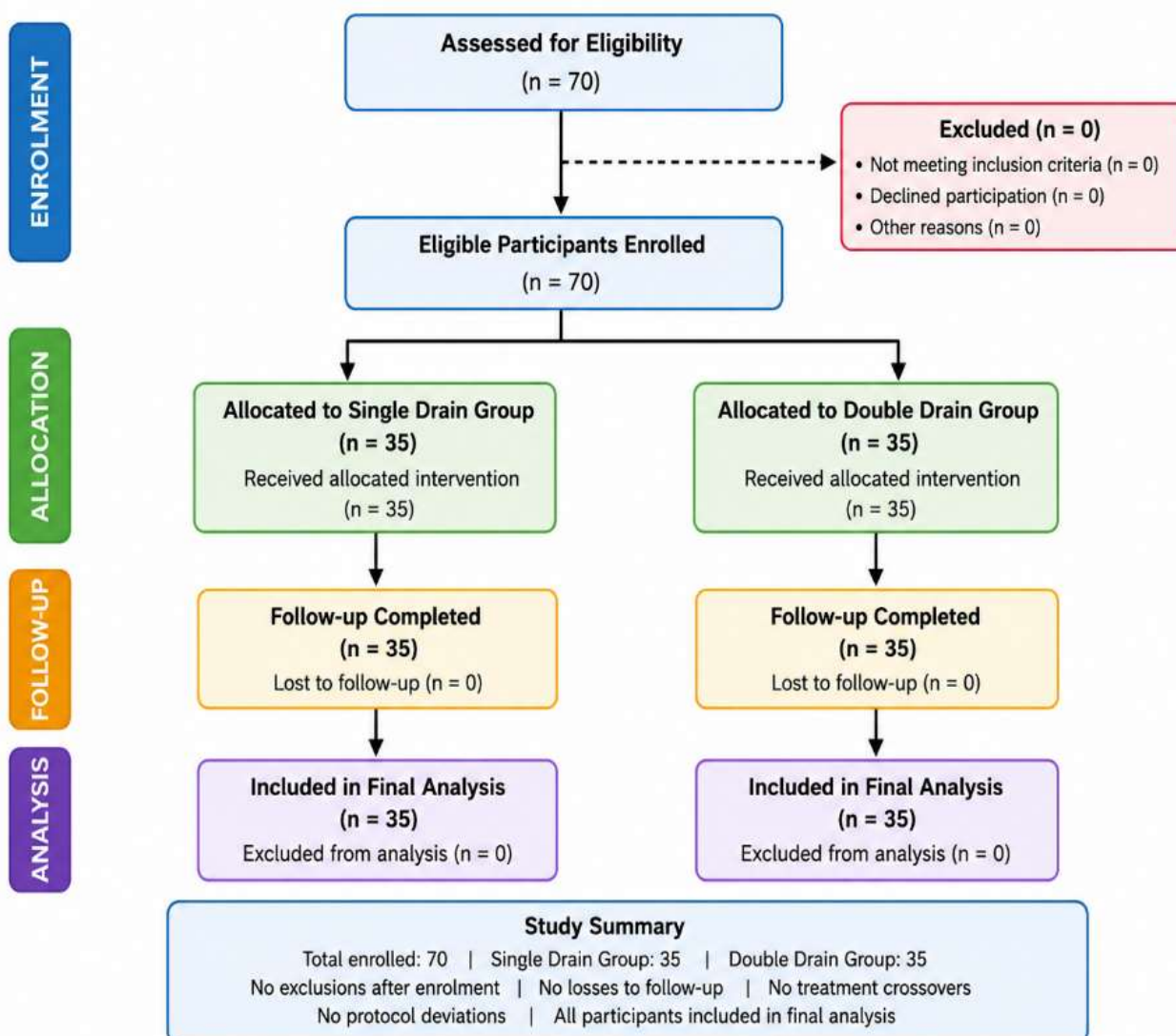


Figure 1: Participant flow diagram illustrating enrolment, allocation, follow-up, and final analysis of patients undergoing modified radical mastectomy with single- or double-suction drainage. All enrolled participants completed follow-up and were included in the final analysis.

Follow-up Protocol: All patients were followed for four weeks following surgery. Clinical evaluation was performed at four-day intervals. Patients were assessed for seroma formation, wound complications, and other postoperative adverse events. Suspected seromas were confirmed by ultrasonography and managed by aseptic aspiration. Repeat aspirations were performed when clinically indicated until complete resolution. Blinding of surgeons and patients was not feasible because of the visible differences in drain placement. Outcome assessment and data analysis were also not blinded. Patients and members of the public were not involved in the design, conduct, reporting, or dissemination planning.

Statistical Analysis: Data were entered into Microsoft Excel for data management and cleaning. Statistical analyses were performed using SPSS software version 26 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean \pm standard deviation, whereas categorical variables were presented as frequencies and percentages. Between-group comparisons were performed using the Independent Samples t-test for continuous variables and Fisher's Exact Test for categorical variables. A two-sided p-value <0.05 was considered statistically significant. Given the relatively small sample size and limited number of outcome events, multivariable regression analysis was not performed. Therefore, potential confounding factors could not be adjusted statistically and this limitation has been acknowledged.

RESULTS

A total of 70 eligible patients were enrolled and allocated equally into the Single Drain Group (n=35) and the Double Drain Group (n=35). All participants received the assigned intervention, completed the scheduled follow-up, and were included in the final analysis. No losses to follow-up or protocol deviations were recorded. No losses to follow-up, protocol deviations, treatment crossovers, or unplanned interventions were recorded during the study period (Figure 1).

Baseline demographic characteristics were comparable between the two groups (Table 1). The mean age was 50.86 ± 9.63 years in the single-drain group and 49.46 ± 10.11 years in the double-drain group ($p=0.530$). Similarly, mean body mass index (BMI) did not differ significantly between groups (34.30 ± 8.03 kg/m² vs. 33.30 ± 8.15 kg/m², $p = 0.606$).

Table 2 compares postoperative drain-related outcomes between the single-drain and double-drain groups. The mean total drain output was lower in the single-drain

group (409.43 ± 71.88 mL) than in the double-drain group (438.43 ± 69.16 mL); however, the difference did not reach statistical significance ($p = 0.060$). Similarly, the mean day of drain removal was comparable between groups (8.31 ± 0.90 vs. 8.37 ± 0.94 days, $p = 0.699$), indicating no significant difference in drain duration.

Table 3 shows that seroma formation was infrequent in both groups, occurring in 11.4% of patients in the single-drain group and 8.6% in the double-drain group, with no significant difference ($p=0.797$). The number of aspirations required was also comparable between groups ($p=0.898$), indicating similar postoperative seroma-related outcomes.

Table 4 demonstrates comparable postoperative seroma volumes between the two groups. Although mean week 1 USG-detected seroma and aspiration volumes were lower in the single-drain group, the differences were not statistically significant ($p >0.05$). Week 2 seroma and aspiration volumes were recorded in only one patient from each group, limiting meaningful comparison.

Table 1: Demographic Characteristics of Study Cohort

Variable	Single Drain Group (n=35)	Double Drain Group (n=35)	p-value
BMI (kg/m ²), Mean \pm SD	34.30 \pm 8.03	33.30 \pm 8.15	0.606
Age (years), Mean \pm SD	50.86 \pm 9.63	49.46 \pm 10.11	0.530
30-40 Years (%)	6 (17.14%)	5 (14.29%)	
41-50 Years (%)	10 (28.57%)	16 (45.71%)	
51-60 Years (%)	11 (31.42%)	7 (20.00%)	
>60 Years (%)	8 (22.85%)	7 (20.00%)	

Values expressed as Mean \pm SD. Comparison performed using independent samples t-test. SD = Standard Deviation.

Table 2: Postoperative Drain Characteristics

Variable	Single Drain Group (n=35)	Double Drain Group (n=35)	p-value
Total Drain Output (ml)	409.43 \pm 71.88	438.43 \pm 69.16	0.060
Drain Removal Day	8.31 \pm 0.90	8.37 \pm 0.94	0.699

Values are in Mean \pm SD; Test used: Independent t-test.

Table 3: Postoperative Seroma Formation

Outcome	Single Drain Group (n=35)	Double Drain Group (n=35)	p-value
Seroma formation			
Seroma Present	4 (11.4%)	3 (8.6%)	0.797
Seroma Absent	31 (88.6%)	32 (91.4%)	-
Aspirations Required			
0	31 (88.6%)	32 (91.4%)	0.898
1	3 (8.6%)	2 (5.7%)	-
2	1 (2.8%)	1 (2.8%)	-

Statistical test: Fisher's exact test Note: No statistically significant difference in seroma incidence or management between groups.

Table 4: Longitudinal Follow-up of Seroma Volume and Aspiration

Variable	Single Drain Group	Double Drain Group	p-value
Week 1 USG Seroma Volume (ml), Mean \pm SD	47.50 \pm 23.63	66.67 \pm 11.55	0.259
Week 1 Aspiration Volume (ml), Mean \pm SD	33.75 \pm 20.57	46.67 \pm 5.77	0.348
Week 2 USG Seroma Volume (ml)	40.00 (single patient)	50.00 (single patient)	-
Week 2 Aspiration Volume (ml)	30.00 (single patient)	40.00 (single patient)	-

USG=Ultrasonography, SD=Standard Deviation. Statistical test: Independent t-test

DISCUSSION

Modified radical mastectomy (MRM) remains one of the most commonly performed surgical procedures for breast cancer worldwide. Despite improvements in surgical technique, seroma formation continues to be the most frequent postoperative complication, with reported incidences ranging from 3% to 85% depending on the definition used, patient characteristics, and drainage protocols employed. Agrawal A et al.[5] described seroma as a multifactorial process resulting from lymphatic disruption, inflammatory exudation, and the creation of dead space following breast and axillary dissection, emphasizing its persistent clinical significance after MRM.

The present prospective comparative study evaluated whether the placement of a second suction drain confers additional benefit following MRM. The findings demonstrated no statistically significant differences between single- and double-drain groups regarding total drainage volume, duration of drainage, postoperative seroma formation, ultrasonographic fluid collections, or aspiration requirements during follow-up. These results suggest that a single closed suction drain is comparable to a double-drain system in maintaining postoperative fluid control.

Our findings are consistent with those reported by Bhagchandani M et al. [9] who observed no significant reduction in seroma formation or drain output with the use of two drains compared with a single drain following MRM. Similarly, Stoyanov GS et al.[11] reported equivalent postoperative outcomes between the two drainage strategies and concluded that routine placement of an additional drain did not improve clinical results. Khan S et al. [12] also demonstrated comparable rates of seroma formation and drain removal between single- and double-drain groups, supporting the growing body of evidence that increased drainage does not necessarily translate into improved postoperative outcomes.

Although postoperative fluid may accumulate within both the axillary cavity and the mastectomy flap bed, these postoperative spaces communicate following surgical dissection, allowing effective evacuation by a properly positioned closed suction drain. Postoperative seroma formation is primarily related to lymphatic leakage, inflammatory exudation, and persistence of dead space.[13] Most postoperative fluid originates from transacted lymphatic channels within the axilla, which represents the principal source of lymphatic leakage. Consequently, a properly positioned suction drain can effectively evacuate fluid from both regions through a single drainage pathway. Agrawal A et al. [5] emphasized that the persistence of dead space and lymphatic disruption, rather than the number of drains, are the primary determinants of seroma formation. This may explain why insertion of an additional drain fails to produce measurable reductions in fluid accumulation.

The total postoperative drainage volume in our study was numerically lower in the single-drain group, alt-

hough the difference did not reach statistical significance. Similar findings have been reported by Bhagchandani M et al. [9] and Stoyanov et al. [11] both of whom demonstrated that the addition of a second drain did not significantly alter cumulative drainage output. Furthermore, drain removal times were comparable between groups, indicating that a second drain does not accelerate postoperative recovery or shorten the drainage period. Dalberg K et al.[8] likewise reported no clinically meaningful differences in drainage duration when comparing different drainage strategies after breast surgery.

Seroma formation remains the principal concern when fewer drains are used. In the present study, clinically detected seroma and ultrasonographically measured fluid collections were comparable between groups. These findings corroborate those of Dalberg K et al.[8]; Bhagchandani M et al.[9] and Stoyanov GS et al.[11] who similarly found no significant reduction in seroma incidence with the use of multiple drains. Moreover, aspiration requirements during follow-up were low and resolved during subsequent visits in both groups, indicating satisfactory healing regardless of drain number.

Although patient comfort and treatment costs were not directly evaluated in the present study, previous investigations have suggested potential advantages of single-drain protocols. Roy S et al.[10] reported improved patient acceptance and reduced drain-related discomfort with a single-drain approach, indicating that reducing the number of drains may enhance postoperative comfort and simplify postoperative care. Similarly, Saratzis A et al.[14] demonstrated that the use of multiple drains following mastectomy was associated with greater patient discomfort and prolonged postoperative hospital stay, supporting efforts to simplify postoperative drainage whenever clinically appropriate. The findings of the present study are consistent with the growing body of evidence indicating that routine placement of an additional drain does not confer significant advantages in reducing postoperative drainage volume or seroma formation.

LIMITATIONS

Several limitations should be acknowledged. First, the relatively small sample size may have limited the ability to detect small differences between treatment groups. Second, patient allocation was performed using a systematic odd-even sequence rather than true randomization, introducing the possibility of selection bias. Third, allocation concealment and blinding were not feasible, potentially increasing the risk of observer bias. Fourth, this was a single-centre study, which may limit the generalizability of the findings to other populations and healthcare settings. Fifth, follow-up was restricted to four weeks and therefore may not capture late postoperative complications. Important variables such as tumour stage, nodal burden, patient-reported pain scores, quality-of-life measures, and cost-related outcomes were not assessed.

CLINICAL IMPLICATIONS AND FUTURE DIRECTIONS

The findings of this study suggest that routine placement of a second suction drain after MRM may not provide additional clinical benefit in terms of drainage efficacy or seroma prevention. Future multicentre studies with larger sample sizes, true randomization, longer follow-up, and incorporation of patient-reported outcome measures and cost-effectiveness analyses are required to establish the optimal postoperative drainage strategy.

CONCLUSION

In this prospective comparative study, a single closed suction drain demonstrated outcomes comparable to those of a double-drain system following modified radical mastectomy. No significant differences were observed in drainage volume, drain duration, seroma formation, ultrasonographic fluid collection, or aspiration requirements. These findings support the use of a single-drain approach as an effective alternative to double-drain placement following MRM. Further adequately powered multicentre studies are warranted to confirm these results.

Acknowledgment: The authors wish to convey their heartfelt appreciation to the leadership and administration of the Sri Guru Ram Das Institute of Medical Sciences and Research (SGRDIMSRS). Their support and the provision of essential institutional facilities were fundamental to the successful completion of this research.

Individual Author's Contribution: **KS** contributed to the study conception and design, data collection, data analysis and interpretation, manuscript preparation. **GSB** and **SM** contributed to the study conception and design, participated in data collection, critically reviewed the study. **PKG** contributed to the study conception, data analysis and manuscript preparation.

Availability of data: The data that support the findings of this study are available from the corresponding author on reasonable request.

Declaration of non-use of generative AI Tools: This article was prepared without the use of generative AI tools for content creation, analysis, or data generation. All findings and interpretations are based solely on the authors' independent work and expertise.

REFERENCES

- Puckett Y, Menon G, Goethals A, Rose J. Mastectomy. 2026 Jan 31. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026. PMID: 30855800.
- Patey DH, Dyson WH. The prognosis of carcinoma of the breast in relation to the type of operation performed. *Br J Cancer*. 1948;2(1):7-13. DOI: <https://doi.org/10.1038/bjc.1948.2> PMID:18863724 PMCID:PMC2007539
- Magnoni F, Alessandrini S, Alberti L, Polizzi A, Rotili A, Veronesi P, et al. Breast Cancer Surgery: New Issues. *Curr Oncol*. 2021;28(5):4053-4066. DOI: <https://doi.org/10.3390/curroncol28050344> PMID:34677262 PMCID:PMC8534635
- Gradishar WJ, Moran MS, Abraham J, Abramson V, Aft R, Agnese D, et al. Breast Cancer, Version 3.2024, NCCN Clinical Practice Guidelines in Oncology. *J Natl Compr Canc Netw*. 2024;22(5):331-357. DOI: <https://doi.org/10.6004/jnccn.2024.0035> PMID:39019058
- Agrawal A, Ayantunde AA, Cheung KL. Concepts of seroma formation and prevention in breast cancer surgery. *ANZ J Surg*. 2006;76(12):1088-1095. DOI: <https://doi.org/10.1111/j.1445-2197.2006.03949.x> PMID:17199696
- Srivastava V, Basu S, Shukla VK. Seroma formation after breast cancer surgery: what we have learned in the last two decades. *J Breast Cancer*. 2012;15(4):373-380. DOI: <https://doi.org/10.4048/jbc.2012.15.4.373> PMID:23346164 PMCID:PMC3542843
- Kuroi K, Shimozuma K, Taguchi T, Imai H, Yamashiro H, Ohsumi S, Saito S. Evidence-based risk factors for seroma formation in breast surgery. *Jpn J Clin Oncol*. 2006;36(4):197-206. DOI: <https://doi.org/10.1093/jjco/hyl019> PMID:16684859
- Dalberg K, Johansson H, Signomkloa T, Rutqvist LE, Bergkvist L, Frisell J, et al. A randomised study of axillary drainage and pectoral fascia preservation after mastectomy for breast cancer. *Eur J Surg Oncol*. 2004;30(6):602-609. DOI: <https://doi.org/10.1016/j.ejso.2004.03.020> PMID:15256232
- Bhagchandani M, Shukla V, Maurya RK, Chaudhary A, Kumar K. 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 J Surg*. 2023;1-6. DOI: <https://doi.org/10.1007/s12262-023-03756-6> PMID:37361396 PMCID:PMC10078008
- Roy S, Gupta SS, Singh U, Anand R, Bhat G, Sooraj R, et al. Prospective Study to Evaluate Efficacy of Single Versus Double Drains in Breast Cancer Patients Undergoing Surgery. *Indian J Surg Oncol*. 2024;15(2):437-445. DOI: <https://doi.org/10.1007/s13193-024-01923-z> PMID:38741623 PMCID:PMC11088602
- Stoyanov GS, Tsocheva D, Marinova K, Dobrev E, Nenkov R. Drainage after Modified Radical Mastectomy - A Methodological Mini-Review. *Cureus*. 2017;9(7):e1454. DOI: <https://doi.org/10.7759/cureus.1454>
- Khan S, Khan M, Wasim A. Single vs. double drain in modified radical mastectomy: A randomized controlled trial. *Turk J Surg*. 2023;39(2):145-152. DOI: <https://doi.org/10.47717/turkjsurg.2023.5666> PMID:38026913 PMCID:PMC10681105
- Kazzam ME, Ng P. Postoperative Seroma Management. 2023. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026. PMID: 36256748.
- Saratzis A, Soumian S, Willetts R, Rastall S, Stonelake PS. Use of multiple drains after mastectomy is associated with more patient discomfort and longer postoperative stay. *Clin Breast Cancer*. 2009;9(4):243-246. DOI: <https://doi.org/10.3816/CBC.2009.n.041> PMID:19933080