



RESEARCH ARTICLE

DOI:

<https://doi.org/10.5281/zenodo.21009171>

Volume 1 Issue 2
July 2026

*Corresponding author

Dr. Uttam Soni

Submitted 18 June 2026

Accepted 26 June 2026

Published 01 July 2026

Citation

Dr. Uttam Soni,

Consultant,

Department of Surgery,

Sita Devi Hospital,

India

Vol 1: Iss 2, 2026.

The article was
originally submitted in
ENGLISH.

Translations into other
languages were
reviewed and validated
by the authors and the
editorial team.

Nevertheless, for the
most accurate
representation of the
subject matter, readers
are encouraged to
consult the article in its
original language.



POSTOPERATIVE COMPLICATIONS AND RECOVERY PATTERN FOLLOWING BREAST SURGERY

Adil Mohammed Suleman ¹, Janhavi Sirsat ², Uttam Soni ³, Vinod Kumar Singhal ⁴, Sandeep Joglekar ⁵, Amrithraj Thiyagarajan ⁶, Ashwani Goyal ⁷, Hemant sharma ⁸, Faris Dawood Alaswad ⁹, Vidher V V Singhal ¹⁰

¹. Specialist, General Surgery, Prime Hospital, Dubai, UAE². Register, Department of Surgery, Prime Hospital, Dubai, UAE³. Consultant, Department of Surgery, Sita Devi Hospital, India⁴. Specialist, General Surgery, Prime Hospital, Dubai, UAE⁵. Consultant, General Surgery, Prime Hospital, Dubai, UAE⁶. Specialist, General Surgery, Prime Hospital, Dubai, UAE⁷. Care Well Hospital Faridabad.⁸. MD MS FACS, FEBS, Diplomate Multi-Organ Transplant & HPB Surgery (American Society of Transplant)⁹. Specialist, General Surgery, Prime Hospital, Dubai, UAE¹⁰. Postgraduate UCL, UK

Abstract

Background: Breast surgery is commonly performed for benign and malignant breast diseases, but postoperative complications may delay recovery, prolong hospital stay, increase treatment cost, and reduce quality of life. Local evidence on combined postoperative complications and recovery patterns remains limited.

Aim of the study: This study aimed to evaluate the pattern of postoperative complications and recovery following breast surgery and to identify factors associated with postoperative morbidity among patients undergoing breast surgical procedures.

Methods: This retrospective observational study was conducted among 250 adult patients undergoing elective or emergency breast surgery for benign breast disease or breast carcinoma using a consecutive sampling technique. The study was conducted from 2023 to 2025 at a tertiary care hospital in India. Data on baseline, clinical, surgical, perioperative variables, postoperative complications, and recovery indicators were collected using a structured data sheet. Data were analyzed using SPSS version 26. A p-value <0.05 was considered statistically significant.

Results: Among 250 patients, the mean age was 48.2±12.6 years, and breast carcinoma was the commonest indication for surgery (162; 64.8%). Modified radical mastectomy was the most frequent procedure (82; 32.8%), and axillary lymph node dissection was performed in 98 (39.2%). Postoperative complications occurred in 70 (28.0%) patients, mainly sensory disturbance (13.6%), persistent pain (12.4%), shoulder stiffness (11.2%), surgical site infection (10.0%), and seroma (8.8%). Complete recovery by 6 weeks was observed in 202 (80.8%) patients. Complications were significantly associated with older age, comorbidities, extensive surgery, prolonged operation, prolonged drainage, and neoadjuvant chemotherapy.

Conclusion: Postoperative complications were common after breast surgery, particularly sensory disturbance, pain, shoulder stiffness, surgical site infection, and seroma. Most patients recovered well by 6 weeks. Older age, comorbidities, mastectomy, axillary dissection, prolonged surgery, prolonged drain duration, and neoadjuvant chemotherapy were significantly associated with complications.

Keywords: Breast surgery; Breast carcinoma; Surgical site infection; and Modified radical mastectomy.

Introduction:

Breast surgery is among the most frequently performed surgical procedures in general and oncological practice. It includes operations for benign breast diseases, diagnostic excision, breast-conserving surgery, mastectomy, axillary staging, axillary lymph node dissection, and reconstructive procedures. Although advances in anesthesia, surgical technique, antimicrobial prophylaxis, drainage practice, and perioperative care have improved surgical safety, postoperative morbidity remains clinically important. Complications such as surgical site infection, seroma, hematoma, wound dehiscence, flap necrosis, lymphedema, shoulder stiffness, sensory disturbance, persistent pain, delayed wound healing, readmission, and reoperation may prolong hospital stay, increase treatment cost, delay adjuvant therapy, and reduce patient satisfaction and quality of life [1-5].

The relevance of breast surgery is closely linked to the global and regional burden of breast disease, particularly breast cancer. Breast cancer is one of the most commonly diagnosed cancers worldwide, with an estimated 2.3 million new female cases and about 670,000 deaths reported in 2022, and the burden is projected to rise further by 2040 and 2050, especially in transitioning countries [6-8]. Asia contributes substantially to this burden because of its large population, aging, lifestyle changes, delayed diagnosis, and unequal access to screening and treatment [9]. In India, breast cancer is a major public health problem and the leading cancer among women. GLOBOCAN 2022 data reported about 192,020 new cases and 98,337 deaths in India, highlighting the need for early detection, timely referral, and comprehensive care [11]. Indian studies also show regional and molecular variation, supporting the need for India-specific evidence to guide treatment, follow-up, and rehabilitation [10,12].

The clinical outcome of breast surgery should not be assessed only by operative success or removal of disease. Early postoperative complications can directly affect recovery, while functional outcomes, such as pain control, arm movement, ambulation, wound healing, return to daily activities, and complete recovery, determine the patient's broader postoperative experience. Surgical site infection remains a notable problem after breast operations, despite breast surgery often being categorized as a clean surgery. Recent studies and systematic reviews have identified patient-related and procedure-related factors, including obesity, diabetes, smoking, prolonged operative time, mastectomy, axillary dissection, drain use, and inadequate prophylaxis, as important contributors to postoperative infection risk [1-3]. Persistent pain after mastectomy or breast-conserving surgery is another under-recognized morbidity, reported in a considerable proportion of patients and associated with nerve injury, axillary surgery, radiotherapy, chemotherapy, psychological factors, and extensive surgical dissection [4]. Similarly, lymphedema and shoulder dysfunction can impair daily activity and long-term quality of life [5].

Despite increasing breast surgery, postoperative recovery is not consistently documented in many low- and middle-income settings. Existing studies mainly focus on specific complications, survival, or reconstruction, while limited evidence evaluates complications and recovery indicators together in routine practice. In India, routine-practice data remain limited on the combined burden of wound complications, postoperative pain, shoulder limitation, drain duration, hospital stay, return to activity, and patient satisfaction following breast surgery. This gap is important because Indian patients often present across diverse clinical settings, ranging from tertiary cancer centers to regional hospitals, where postoperative follow-up, physiotherapy access, and rehabilitation support may vary considerably. This affects risk assessment, counseling, discharge planning, follow-up, rehabilitation referral, and quality improvement. Structured postoperative support can improve shoulder function, activity, and quality of life [13]. Therefore, the study aimed to evaluate the pattern of postoperative complications and recovery following breast surgery and to identify factors associated with postoperative morbidity among patients undergoing breast surgical procedures.

Methods

This hospital-based retrospective observational study was conducted among patients undergoing breast surgery at a tertiary care hospital in India. A total of 250 patients were included by consecutive sampling after fulfilling the selection criteria, during three years from, 2023 to 2025. Adult patients aged 18 years or above who underwent elective or emergency breast surgery for benign breast disease or breast carcinoma were included. Patients with incomplete clinical records, previous major chest wall surgery, severe systemic illness precluding postoperative follow-up, and those lost to follow-up were excluded.

Data were collected using a pre-designed structured data collection sheet. Baseline variables included age, sex, residence, body mass index, smoking history, diabetes mellitus, hypertension, anemia, previous breast surgery, family history of breast cancer, and history of neoadjuvant chemotherapy. Surgical and perioperative variables included the indication for surgery, surgical side, type of breast surgery, axillary procedure, type of anesthesia, operative duration, drain placement, drain duration, blood transfusion requirement, and length of hospital stay.

Postoperative complications were assessed during hospital stay and follow-up visits. The main complications recorded were surgical site infection, seroma, hematoma, wound dehiscence, flap or skin necrosis, lymphedema, shoulder stiffness, persistent postoperative pain, sensory disturbance, readmission, and reoperation. Recovery patterns were evaluated by time to ambulation, duration of analgesic use, time to drain removal, wound healing within 2 weeks, return to daily activity within 4 weeks, and complete recovery by 6 weeks.

Data were checked, coded, and analyzed using SPSS version 26. Quantitative variables were expressed as mean $\pm$ standard deviation, and qualitative variables as frequency and percentage. Chi-square test was used to compare categorical variables. A p-value <0.05 was considered statistically significant. Ethical approval was obtained from the institutional review board, and informed written consent was taken from each participant.

Results

Among 250 patients, the mean age was 48.2 ± 12.6 years, with the highest proportion in the 50-59 years age group (70; 28.0%), followed by the 40-49 years age group (65; 26.0%). Most patients were female (247; 98.8%). Rural residence was slightly more common, 132 (52.8%). Regarding BMI, 102 (40.8%) patients were overweight, and 52 (20.8%) were obese. Hypertension was present in 62 (24.8%) patients, diabetes mellitus in 48 (19.2%), anemia in 43 (17.2%), and 54 (21.6%) patients received neoadjuvant chemotherapy.

Variable	Category	n (%)
Age group (years)	<30	28 (11.2)
	30-39	45 (18.0)
	40-49	65 (26.0)
	50-59	70 (28.0)
	≥ 60	42 (16.8)
	Mean $\pm$ SD	48.2 ± 12.6
Sex	Female	247 (98.8)
	Male	3 (1.2)
Residence	Rural	132 (52.8)
	Urban	118 (47.2)
BMI category	Normal weight	96 (38.4)
	Overweight	102 (40.8)
	Obese	52 (20.8)
Diabetes mellitus	Yes	48 (19.2)
Hypertension	Yes	62 (24.8)
Anemia	Yes	43 (17.2)
Smoking history	Yes	18 (7.2)
Neoadjuvant chemotherapy	Yes	54 (21.6)

Table 1. Baseline Sociodemographic and Clinical Characteristics of the Study Patients (n = 250)

Breast carcinoma was the commonest indication for surgery, observed in 162 (64.8%) patients, while 88 (35.2%) underwent surgery for benign breast disease. Right-sided surgery was slightly more frequent, 128 (51.2%). Modified radical mastectomy was the most common procedure, 82 (32.8%), followed by lumpectomy or excision biopsy, 65 (26.0%). Axillary lymph node dissection was performed in 98 (39.2%) patients. The mean duration of surgery was 92.4 ± 31.8 minutes, drain placement was required in 168 (67.2%) patients, and the mean hospital stay was 4.3 ± 2.1 days.

Variable	Category / Measurement	n (%) / Mean $\pm$ SD
Indication for surgery	Benign breast disease	88 (35.2)
	Breast carcinoma	162 (64.8)
Side of surgery	Right	128 (51.2)
	Left	116 (46.4)
	Bilateral	6 (2.4)
Type of surgery	Lumpectomy / Excision biopsy	65 (26.0)
	Wide local excision / Breast-conserving surgery	48 (19.2)
	Simple mastectomy	35 (14.0)
	Modified radical mastectomy	82 (32.8)
	Mastectomy with reconstruction	20 (8.0)
Axillary procedure	No axillary procedure	109 (43.6)
	Sentinel lymph node biopsy	43 (17.2)
	Axillary lymph node dissection	98 (39.2)
Duration of surgery	Minutes	92.4 ± 31.8
Surgery duration >90 min	Yes	118 (47.2)
Drain placed	Yes	168 (67.2)
Drain duration	Days	6.2 ± 2.8
Drain duration >7 days	Yes	67 (26.8)
Hospital stays	Days	4.3 ± 2.1

Table 2. Surgical and Perioperative Characteristics of the Study Patients (n = 250)

Postoperative complications were observed in 70 (28.0%) patients. The most common complications were sensory disturbance or numbness (34; 13.6%), persistent postoperative pain (31; 12.4%), shoulder stiffness (28; 11.2%), surgical site infection (25; 10.0%), and seroma formation (22; 8.8%). Less frequent complications included wound dehiscence (10; 4.0%), hematoma (8; 3.2%), and flap or skin necrosis (7; 2.8%). Reoperation was required in 6 (2.4%) patients, while readmission occurred in 9 (3.6%).

Postoperative Complication	n (%)
Any postoperative complication	70 (28.0)
Surgical site infection	25 (10.0)
Seroma formation	22 (8.8)
Hematoma	8 (3.2)
Wound dehiscence	10 (4.0)
Flap / skin necrosis	7 (2.8)
Lymphedema	12 (4.8)
Shoulder stiffness	28 (11.2)
Persistent postoperative pain	31 (12.4)
Sensory disturbance / Numbness	34 (13.6)
Reoperation required	6 (2.4)
Readmission	9 (3.6)

Table 3. Pattern of Postoperative Complications (n = 250)

The mean time to ambulation was 18.5 ± 7.4 hours, and the mean duration of injectable analgesic use was 2.6 ± 1.1 days. Drain removal was done at a mean of 6.2 ± 2.8 days. Wound healing within 2 weeks was achieved in 205 (82.0%) patients, and 194 (77.6%) returned to normal daily activity within 4 weeks. Complete recovery by 6 weeks was observed in 202 (80.8%) patients, while 213 (85.2%) patients were satisfied with their recovery.

Recovery Parameter	n (%) / Mean $\pm$ SD
Time to ambulation (hours)	18.5 ± 7.4
Duration of injectable analgesic use (days)	2.6 ± 1.1
Drain removal time (days)	6.2 ± 2.8
Wound healing within 2 weeks	205 (82.0)
Return to normal daily activity within 4 weeks	194 (77.6)
Persistent pain at 1 month	31 (12.4)
Shoulder movement limitation at 1 month	28 (11.2)
Complete recovery by 6 weeks	202 (80.8)
Patient satisfaction with recovery	213 (85.2)

Table 4. Recovery Pattern Following Breast Surgery (n = 250)

Postoperative complications were significantly more common among patients aged ≥ 50 years (43; 61.4%) than among those without complications (69; 38.3%), $p < 0.001$. Diabetes mellitus, obesity, anemia, smoking history, breast carcinoma, modified radical mastectomy, axillary lymph node dissection, surgery duration > 90 minutes, drain duration > 7 days, and neoadjuvant chemotherapy were also significantly associated with postoperative complications. The strongest associated factors were modified radical mastectomy, axillary lymph node dissection, prolonged surgery, and prolonged drain duration, all with $p < 0.001$.

Variable	Complication Present (n = 70)	Complication Absent (n = 180)	p-value
Age ≥ 50 years	43 (61.4)	69 (38.3)	< 0.001
Diabetes mellitus	22 (31.4)	26 (14.4)	0.003
Obesity	24 (34.3)	28 (15.6)	0.001
Anemia	19 (27.1)	24 (13.3)	0.01
Smoking history	10 (14.3)	8 (4.4)	0.009
Breast carcinoma	56 (80.0)	106 (58.9)	0.002
Modified radical mastectomy	38 (54.3)	44 (24.4)	< 0.001
Axillary lymph node dissection	42 (60.0)	56 (31.1)	< 0.001
Surgery duration > 90 minutes	48 (68.6)	70 (38.9)	< 0.001
Drain duration > 7 days	34 (48.6)	33 (18.3)	< 0.001
Neoadjuvant chemotherapy	24 (34.3)	30 (16.7)	0.003

Table 5. Factors Associated with Postoperative Complications

Discussion

The present study evaluated postoperative complications and recovery patterns among 250 patients undergoing breast surgery. The mean age was 48.2 ± 12.6 years, most patients were female, and breast carcinoma was the commonest indication for surgery (64.8%). Modified radical mastectomy was performed in 32.8%, axillary lymph node dissection in 39.2%, and drain placement in 67.2%. Overall, postoperative complications occurred in 70 patients (28.0%). This rate is comparable with reports from developing settings, where overall wound or early postoperative morbidity ranged from 25.0% to 30.0% [14,15], but higher than large registry-based studies that counted only major complications requiring readmission or reoperation, such as the 3.2% major complication rate reported by de Boniface et al. [16]. This difference is expected because the present study included both major and minor complications, including sensory disturbance, pain, shoulder stiffness, and seroma.

Surgical site infection was observed in 25 patients (10.0%). This finding closely matches the 9.3% SSI rate reported by Adwall et al. in a prospective study of 707 breast cancer procedures and the 10.4% rate reported by Chin et al. after non-reconstructive breast cancer surgery [2,14]. It also falls within the 10.2% to 30.0% range reported in many breast cancer surgery publications, although it is higher than the 2.4% cumulative SSI incidence reported in a recent Saudi bicentric study [17,18]. By contrast, Bawoke et al. reported SSI in 14.9% after modified radical mastectomy in a low-income country [15]. These variations may reflect differences in case mix, cancer stage, reconstruction status, surveillance methods, antibiotic policy, drainage practices, and hospital infection control standards.

Seroma formation was observed in 22 patients (8.8%), lower than the 17.2% reported by Bawoke et al., the 15.0% reported in a Pakistani modified radical mastectomy series, and the 23.0% reported by Nazir et al. after modified radical mastectomy [15,19,20]. However, it was higher than the 5.3% seroma rate reported by Rizvi et al. in Pakistan [21]. The relatively moderate seroma rate in the present study may be related to mixed inclusion of lumpectomy, breast-conserving surgery, simple mastectomy, modified radical mastectomy, and reconstruction, rather than mastectomy-only cases. Hematoma was observed in 3.2%, identical to that reported by Rizvi et al. [21], while flap or skin necrosis was 2.8%, lower than the 4.3% reported by Rizvi et al. and much lower than some reports from late-presenting disease settings [21,22].

Persistent postoperative pain was present in 12.4%, and sensory disturbance or numbness in 13.6%. These findings are clinically important, although lower than post-mastectomy pain syndrome estimates of 25.0% to 60.0% reported in reviews [4,23]. The lower rate in the present study may be due to shorter follow-up and the inclusion of less extensive procedures. Shoulder stiffness was present in 11.2% and lymphedema in 4.8%. These values are lower than the estimated chronic lymphedema incidence of about 21.4% after breast cancer treatment and the 19.9% incidence reported after axillary lymph node dissection [5]. A short follow-up period may explain this difference, as lymphedema and shoulder impairment can develop months after surgery.

The present study identified age ≥ 50 years, diabetes mellitus, obesity, anemia, smoking, breast carcinoma, modified radical mastectomy, axillary lymph node dissection, operative duration >90 minutes, drain duration >7 days, and neoadjuvant chemotherapy as significant factors associated with complications. These findings align with studies showing higher risk among patients with diabetes, anemia, prolonged drainage, neoadjuvant chemotherapy, mastectomy, and axillary surgery [18,24,25]. The association with axillary lymph node dissection is also biologically plausible, as extensive axillary dissection increases lymphatic disruption, seroma formation, lymphedema, sensory symptoms, and shoulder morbidity [5,26].

Recovery outcomes were generally favorable. Wound healing within 2 weeks was achieved in 82.0%, return to daily activity within 4 weeks in 77.6%, complete recovery by 6 weeks in 80.8%, and satisfaction in 85.2%. The mean drain removal time was 6.2 ± 2.8 days, close to the 4.8-day mean drain indwelling time reported by Uslukaya et al., although prolonged drainage remained a risk factor in the present study [27]. Recent trials and reviews show that early structured exercise, prehabilitation, and combined functional and psychological interventions improve shoulder strength, range of motion, activity, fatigue, and quality of life after breast cancer surgery [28-30]. Therefore, the findings support routine preoperative risk assessment, optimization of anemia, glycemic control, and smoking cessation; careful selection of axillary procedures; standardized drain protocols; early wound surveillance; and timely referral for physiotherapy and rehabilitation.

Limitations of the study: This was a single-center hospital-based study with a relatively small sample size, so the findings may not be generalizable to the wider population. The follow-up period was short, which may have underestimated late complications such as lymphedema, chronic pain, shoulder dysfunction, and long-term quality of life outcomes.

Conclusion

This study concluded that postoperative complications following breast surgery were relatively common, with sensory disturbance, persistent pain, shoulder stiffness, surgical site infection, and seroma being the main complications. Most patients achieved satisfactory recovery, with good wound healing, return to daily activity, and complete recovery by 6 weeks. Several factors, including older age, diabetes mellitus, obesity, anemia, smoking, breast carcinoma, modified radical mastectomy, axillary dissection, prolonged surgery, prolonged drain duration, and neoadjuvant chemotherapy, were significantly associated with complications. Proper risk assessment, optimized perioperative care, and rehabilitation may improve outcomes.

Recommendations

Patients should receive proper preoperative risk assessment and optimization of modifiable factors such as diabetes, obesity, anemia, and smoking. Standard infection prevention, careful surgical technique, appropriate drain management, and early detection of complications should be ensured. Postoperative counseling, wound and drain care education, arm exercises, timely follow-up, and early physiotherapy are recommended to improve recovery, reduce pain and shoulder stiffness, and support early return to daily activity.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee.

References

1. Ashok A, Chaudhary AK, Shanker P, Singh CS, Rana Y, SHANKER P, SINGH CS, Arti A. Analysis of seroma formation, flap necrosis, and postoperative pain following modified radical mastectomy in patients with breast cancer: a prospective study. *Cureus*. 2025 Oct 18;17(10).
2. Chin K, Wärnberg F, Kovacs A, Olofsson Bagge R. Impact of surgical care bundle on surgical site infection after non-reconstructive breast cancer surgery: a single-centre retrospective comparative cohort study. *Cancers*. 2023 Feb 1;15(3):919.
3. Liu Y, Yang Z, Wang D, Zhang H. Risk Factors for Surgical Site Infection in Patients Undergoing Breast Surgery: A Systematic Review and Meta-Analysis. *Clinical and Experimental Obstetrics & Gynecology*. 2025 May 28;52(6):37161.
4. Tan PY, Anand SP, Chan DX. Post-mastectomy pain syndrome: a timely review of its predisposing factors and current approaches to treatment. *Proceedings of Singapore Healthcare*. 2022 Dec;31:20101058211006419.
5. Gillespie TC, Sayegh HE, Brunelle CL, Daniell KM, Taghian AG. Breast cancer-related lymphedema: risk factors, precautionary measures, and treatments. *Gland surgery*. 2018 Aug;7(4):379.
6. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, Jemal A. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: a cancer journal for clinicians*. 2024 May;74(3):229-63.
7. Arnold M, Morgan E, Rumgay H, Mafra A, Singh D, Laversanne M, Vignat J, Gralow JR, Cardoso F, Siesling S, Soerjomataram I. Current and future burden of breast cancer: Global statistics for 2020 and 2040. *The breast*. 2022 Dec 1;66:15-23.
8. Freihat O, Sipos D, Kovacs A. Global burden and projections of breast cancer incidence and mortality to 2050: a comprehensive analysis of GLOBOCAN data. *Frontiers in Public Health*. 2025 Oct 30;13:1622954.
9. Fu M, Peng Z, Wu M, Lv D, Li Y, Lyu S. Current and future burden of breast cancer in Asia: A GLOBOCAN data analysis for 2022 and 2050. *The Breast*. 2025 Feb 1;79:103835.
10. Sathishkumar K, Chaturvedi M, Das P, Stephen S, Mathur P. Cancer incidence estimates for 2022 & projection for 2025: result from National Cancer Registry Programme, India. *Indian journal of medical research*. 2022 Oct 1;156(4&5):598-607.
11. Karmakar S. Comprehensive Overview of Breast Cancer in India. *JCO Global Oncology*. 2025 Sep;11.
12. Somal PK, Sancheti S, Sharma A, Sali AP, Chaudhary D, Goel A, Dora TK, Brar R, Gulia A, Divatia J. A clinicopathological analysis of molecular subtypes of breast cancer using immunohistochemical surrogates: A 6-year institutional experience from a tertiary cancer center in north India. *South Asian journal of cancer*. 2023 Apr;12(02):104-11.
13. Das SA, Sureshkumar S, Vijayakumar C, Kate V, Srinivasan K. Effect of exercise on shoulder function and morbidity following mastectomy with axillary dissection in patients with breast cancer: a prospective randomized clinical study. *Int Surg J*. 2018 Sep 25;5(10):3217-25.
14. Adwall L, Hultin H, Mani M, Norlén O. Prospective evaluation of complications and associated risk factors in breast cancer surgery. *Journal of Oncology*. 2022;2022(1):6601066.
15. Bawoke G, Kejela S, Alemayehu A, Bogale GT. Experience with modified radical mastectomy in a low-income country: a multi-center prospective observational study. *BMC surgery*. 2021 Oct 20;21(1):371.
16. de Boniface J, Szulkin R, Johansson AL. Major surgical postoperative complications and survival in breast cancer: Swedish population-based register study in 57 152 women. *British Journal of Surgery*. 2022 Oct 1;109(10):977-83.

- M, Desai S, Mahmoud E. Surgical Site Infection After Breast Surgery—A Bicentric Retrospective Case–Control Study in Saudi Arabia. *Clinics and Practice*. 2025 Dec 8;15(12):231.
18. Hu Y, Mao Z, Xu Y. RETRACTED: Comprehensive analysis of risk factors for postoperative wound infection following radical mastectomy in breast cancer patients. *International Wound Journal*. 2024 Apr;21(4):e14848.
 19. Nedooshan JJ, Rahmatabadi MH, Kargar S, Lotfi MH. Evaluation of complications of short-term and long-term drainage following mastectomy with removal of axillary lymph nodes: A randomized clinical trial. *Asian Pacific journal of cancer prevention: APJCP*. 2022 Aug;23(8):2873.
 20. Naqvi SK, Nazir A, Amir A, Waris H, Irshad B, Ibrahim M, Hamza M, Khan I, Ihtesham A, Rehman A. The incidence of early postoperative complications following modified radical mastectomy in breast cancer patients. *Cureus*. 2024 Dec 17;16(12):e75886.
 21. Rizvi FH, Khan MK, Almas T, Ullah M, Shafi A, Murad MF, Ali A, Nadeem F. Early postoperative outcomes of breast cancer surgery in a developing country. *Cureus*. 2020 Aug 22;12(8):e9941.
 22. Traore B, Diarra AM, Keita M. Complications of breast cancer surgery at Conakry oncological surgery unit. *The Pan African Medical Journal*. 2020 Dec 8;37(327).
 23. Gong Y, Tan Q, Qin Q, Wei C. Prevalence of postmastectomy pain syndrome and associated risk factors: A large single-institution cohort study. *Medicine*. 2020 May 15;99(20):e19834.
 24. Hara Y, Otsubo R, Shinohara S, Morita M, Kuba S, Matsumoto M, Yamanouchi K, Yano H, Eguchi S, Nagayasu T. Lymphedema after axillary lymph node dissection in breast cancer: prevalence and risk factors—a single-center retrospective study. *Lymphatic Research and Biology*. 2022 Dec 1;20(6):600-6.
 25. Palubicka A, Jaworski R, Wekwejt M, Swieczko-Zurek B, Pikula M, Jaskiewicz J, Zielinski J. Surgical site infection after breast surgery: a retrospective analysis of 5-year postoperative data from a single center in Poland. *Medicina*. 2019 Aug 21;55(9):512.
 26. Byeon J, Kang E, Jung JJ, Cheun JH, Seo KS, Kim HK, Lee HB, Han W, Moon HG. Risk of lymphedema after sentinel node biopsy in patients with breast cancer. *Journal of Breast Cancer*. 2024 Oct 24;27(5):323.
 27. Uslukaya Ö, Türkoğlu A, Gümüş M, Bozdağ Z, Yılmaz A, Gümüş H, Kaya Ş, Gül M. Factors that affect drain indwelling time after breast cancer surgery. *The journal of breast health*. 2016 Jul 1;12(3):102.
 28. Min J, Kim JY, Ryu J, Park S, Courneya KS, Ligibel J, Kim SI, Jeon JY. Early implementation of exercise to facilitate recovery after breast cancer surgery: a randomized clinical trial. *JAMA surgery*. 2024 Aug;159(8):872-80.
 29. Xu Q, Liu C, Jia S, Wang P, Liu Q, Ding F, Ren Y, Ma X, Zhu J. Effect of physical exercise on postoperative shoulder mobility and upper limb function in patients with breast cancer: a systematic review and meta-analysis. *Gland Surgery*. 2024 Aug 31;13(8):1494-510.
 30. Casanovas-Álvarez A, Estanyol B, Ciendones M, Padròs J, Cuartero J, Barnadas A, García-Valdecasas B, González-Colom R, Sebío-García R, Masià J. Effectiveness of an exercise and educational-based prehabilitation program in patients with breast cancer receiving neoadjuvant chemotherapy (PREOptimize) on functional outcomes: a randomized controlled trial. *Physical Therapy*. 2024 Dec;104(12):pzae151.