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STUDY OF RISK FACTORS OF LYMPHEDEMA FOLLOWING SURGERY OF CARCINOMA BREAST

General Surgery

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ABSTRACT

Background: Breast cancer-related lymphedema (BCRL) is a significant complication following breast cancer surgery, often leading to physical, functional, and psychological challenges. This study evaluates the risk factors associated with lymphedema in patients undergoing breast cancer surgery to inform preventive and management strategies. **Objectives:** To identify and analyze modifiable and non-modifiable risk factors contributing to lymphedema development in breast cancer patients undergoing surgical treatment. **Methods:** A prospective observational study was conducted on 51 participants undergoing surgery for carcinoma breast at Dr. Susheela Tiwari Government Hospital, Haldwani. Patients were followed for six months postoperatively. Lymphedema was diagnosed based on a ≥5% volume difference between the affected and unaffected arms. Data on demographic, clinical, and treatment-related factors were collected and analyzed using SPSS software. **Results:** Lymphedema was observed in 29.4% of participants. Significant associations were identified for modifiable risk factors such as BMI ≥30 ($p<0.001$), axillary lymph node dissection ($p=0.028$), sentinel lymph node biopsy ($p=0.028$), and cellulitis ($p<0.001$). Non-modifiable factors like age ≥50 ($p=0.091$) and advanced breast cancer stage ($p=0.264$) showed trends but were not statistically significant. Among treatment modalities, 60.8% of participants underwent radiotherapy, and 51.0% received chemotherapy, though neither showed a significant association with lymphedema development. **Conclusion:** The study highlights the importance of addressing modifiable risk factors such as high BMI and cellulitis in reducing the incidence of BCRL. Early risk assessment and tailored interventions can significantly improve patient outcomes and quality of life.

KEYWORDS

Breast cancer-related lymphedema, Risk factors, Axillary lymph node dissection, Sentinel lymph node biopsy, Body mass index.

INTRODUCTION

Breast cancer remains the most frequently diagnosed cancer among women worldwide, accounting for an estimated 2.3 million new cases annually, as per GLOBOCAN 2020. [1,2] It is also a leading cause of cancer-related deaths, particularly in developing nations, where survival rates for localized and regional breast cancer are significantly lower than in developed countries. [3,4] Advances in breast cancer treatment have introduced various modalities, including breast-conserving surgery (BCS), mastectomy, sentinel lymph node biopsy (SLNB), axillary lymph node dissection (ALND), chemotherapy, radiotherapy, endocrine therapy, and biological therapy. [5,6] However, these treatments come with their own set of challenges, one of the most significant being breast cancer-related lymphedema (BCRL). [7]

BCRL arises due to lymphatic system disruption following breast cancer surgery or radiotherapy, leading to protein-rich lymph fluid accumulation in the interstitial spaces. [8] This condition manifests as swelling in the breast, trunk, or upper extremities on the treated side. [9] It can further progress to adipose deposition, fibrosis, and chronic arm edema, impairing limb function and significantly diminishing the patient's quality of life. Symptoms such as pain, arm heaviness, and tightness are often accompanied by psychological distress, including anxiety and depression. [10] Alarmingly, BCRL affects approximately 21.4% of breast cancer patients, with ALND and regional lymph node radiation (RLNR) being the most prominent treatment-related risk factors.

While less invasive surgical techniques, including SLNB, aim to minimize lymphatic disruption, other contributing factors such as body mass index (BMI), weight fluctuations, subclinical edema, and cellulitis remain critical in the development of BCRL. Current management strategies range from complete decongestive therapy (CDT) and maintenance interventions to surgical procedures aimed at mitigating persistent lymphedema. Preventive measures, including patient education on lifestyle modifications and limb care, play a vital role in reducing the burden of this debilitating condition. [11,12]

The present study focuses on analyzing the risk factors for lymphedema following breast cancer surgery, emphasizing the importance of a multidisciplinary approach to prevention, early detection, and management. By identifying key contributors to BCRL, this study aims to inform clinical practices that enhance patient outcomes and quality of life.

MATERIAL AND METHODS

Study Design: This prospective observational study was conducted at Dr. Susheela Tiwari Government Hospital, Haldwani, with the objective of evaluating risk factors for lymphedema following breast cancer surgery.

Study Duration: The study spanned **18 months**, starting from the date of approval from the Institutional Ethics Committee (IEC).

Sample Size: A total of **51 patients** undergoing surgery for carcinoma (Ca) breast at our institute were included, fulfilling the specified inclusion criteria.

Inclusion Criteria

- Patients aged **18 years or above** undergoing surgery for carcinoma breast.
- Patients providing **informed consent** to participate in the study.

Exclusion Criteria

- Patients unwilling to participate in the study.
- Patients with **pre-existing arm lymphedema** unrelated to carcinoma breast surgery.

Sample Collection

All patients meeting the inclusion criteria and undergoing surgery for carcinoma breast during the study period were systematically evaluated. Comprehensive **history taking and clinical examination** were performed to identify potential risk factors for developing lymphedema.

Methodology

Patients visiting the outpatient department (OPD) or admitted to the surgery department for carcinoma breast surgery were enrolled. The occurrence of arm lymphedema was assessed postoperatively, and risk factors were evaluated. Arm circumference was measured using a **flexible, non-stretchable tape** at the midpoint between the **acromion process (shoulder)** and the **olecranon process (ulna)**. Lymphedema was diagnosed if the volume difference between the affected and unaffected arms was **≥5%**.

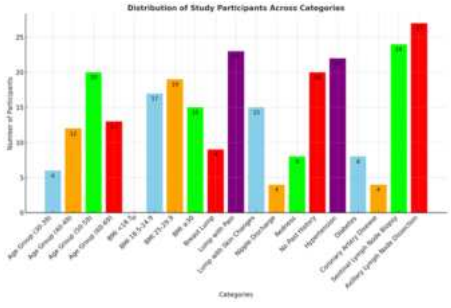
Statistical Analysis

Data were analyzed using **SPSS software**. Descriptive statistics were applied to continuous variables such as age, BMI, systolic and diastolic blood pressure, radiation dose, and lymphedema onset age. Frequency tables were used to summarize categorical variables, including year of treatment initiation, gender, marital status, treatment details, lymphedema location, and associated signs and symptoms. The results were presented as means, percentages, and ranges (minimum to maximum values).

RESULTS

Table 1: Distribution of Study Participants Across Various Categories

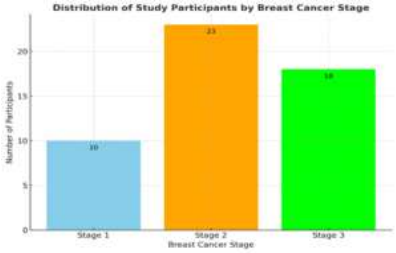
Category	Subcategory	Number of Participants	Percentage (%)
Age Group (years)	30-39	6	11.8
	40-49	12	23.5
	50-59	20	39.2
	60-69	13	25.5
BMI Range (kg/m²)	<18.5	0	0
	18.5-24.9	17	33.3
	25-29.9	19	37.3
	≥30	15	29.4
Chief Complaints	Breast Lump	9	17.6
	Lump with Pain	23	45.1
	Lump with Skin Changes	15	29.4
	Lump with Nipple Discharge	4	7.8
	Lump with Redness	8	15.7
Past History	None	20	39.2
	Hypertension	22	43.1
	Diabetes	8	15.7
	Coronary Artery Disease	4	7.8
Axillary Lymph Node Management Surgery	Sentinel Lymph Node Biopsy	24	47.1
	Axillary Lymph Node Dissection	27	52.9



The distribution of study participants according to breast cancer stages is shown in Table 2. The majority of participants were diagnosed at Stage 2 (45.1%), followed by Stage 3 (35.3%) and Stage 1 (19.6%). This highlights the prevalence of more advanced stages at diagnosis among the participants.

Table 2: Distribution of Study Participants by Breast Cancer Stage

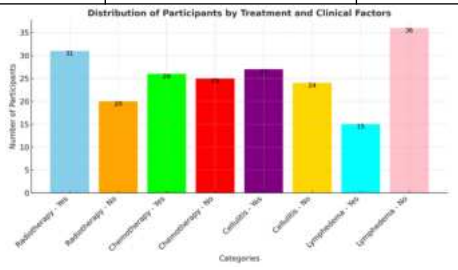
Breast cancer stage	Number of Participants	Percentage (%)
Stage 1	10	19.6
Stage 2	23	45.1
Stage 3	18	35.3
Total	51	100.0



The distribution of study participants based on key treatment and clinical factors, including radiotherapy, chemotherapy, cellulitis, and lymphedema is shown in Table 3. Among the participants, 60.8% received radiotherapy and 51.0% underwent chemotherapy. Cellulitis was observed in 52.9% of the participants, while lymphedema was present in 29.4%. This data highlights the prevalence of these factors and their potential significance in the context of breast cancer treatment outcomes.

Table 3: Distribution Of Participants By Treatment And Clinical Factors

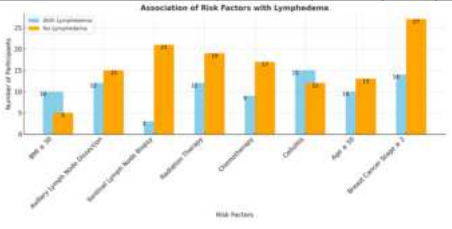
Category	Number of Participants	Percentage (%)
Radiotherapy		
Yes	31	60.8
No	20	39.2
Chemotherapy		
Yes	26	51.0
No	25	49.0
Cellulitis		
Yes	27	52.9
No	24	47.1
Lymphedema		
Yes	15	29.4
No	36	70.6



Association between various risk factors and the development of lymphedema among breast cancer surgery patients is shown in Table 4. Key findings indicate significant associations for BMI ≥ 30, axillary lymph node dissection, sentinel lymph node biopsy, and cellulitis, with their respective p-values highlighting statistical significance. Other factors such as radiation therapy, chemotherapy, age ≥ 50, and advanced breast cancer stage showed less significant associations.

Table 4: Association Of Risk Factors With Lymphedema

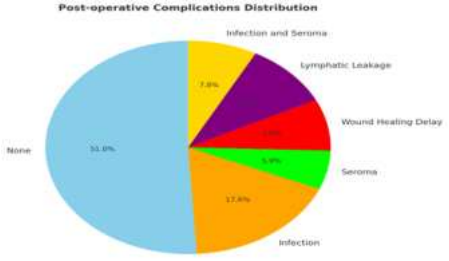
Risk factor	With Lymphedema	No lymphedema	Total	p value
BMI ≥ 30	10	5	15	**<0.001**
Axillary Lymph Node Dissection	12	15	27	**0.028**
Sentinel Lymph Node Biopsy	3	21	24	**0.028**
Radiation Therapy	12	19	31	0.133
Chemotherapy	9	17	26	0.631
Cellulitis	15	12	27	**<0.001**
Risk factor				
Age ≥ 50	10	13	23	0.091
Breast cancer stage ≥ 2	14	27	41	0.264



The distribution of post-operative complications among study participants is shown in Table 5. The majority of participants (51.0%) experienced no complications. Infection (17.6%) was the most common complication, followed by lymphatic leakage (9.8%), wound healing delay (7.8%), seroma (5.9%), and combined infection and seroma (7.8%). This data highlights the prevalence and types of complications observed post-surgery.

Table 5: Distribution Of Post-operative Complications

Post-op Complications	Number of Participants	Percentage (%)
None	26	51.0
Infection	9	17.6
Seroma	3	5.9
Wound healing delay	4	7.8
Lymphatic leakage	5	9.8
Infection and seroma	4	7.8
Total	51	100.0



DISCUSSION

This observational study included 51 participants who underwent breast cancer surgery and were followed for six months to monitor the occurrence of lymphedema. Most participants were aged 50–59 years (39.2%), followed by 25.5% in the 60–69 years group. The 40–49 years age group made up 23.5%, while the 30–39 years group was the smallest at 11.8%. The average age of participants was 53.6 years, with a standard deviation of 8.7 years. These findings align with Ugur S et al. (2013) [13], who reported a mean participant age of 50.6 years, and McDuff SGR et al. (2018) [14], who found an average age of 55.1 years.

Regarding BMI, the most common category was 25–29.9 (37.3%), followed by 18.5–24.9 (33.3%) and ≥30 (29.4%). None of the participants had a BMI under 18.5. The average BMI was 28.4, with a standard deviation of 3.5 kg/m². In the study by **Ugur S et al. (2013) [13],** 79% of participants had obesity (BMI ≥25), with 32% developing lymphedema. Similarly, **McDuff SGR et al. (2018) [14]** reported a median BMI of 26.5 kg/m², indicating most participants were overweight.

Hypertension was the most common pre-existing medical condition, observed in 43.1% of participants. Diabetes and coronary artery disease were present in 15.7% and 7.8%, respectively. Notably, 39.2% of participants had no reported medical history. These results are comparable to the findings of **Ren Y et al. (2005) [15],** where hypertension was present in 42.9% and diabetes in 14.2% of participants.

In terms of surgical management, Sentinel Lymph Node Biopsy (SLNB) was performed on 47.1% of participants, while Axillary Lymph Node Dissection (ALND) was performed on 52.9%. This contrasts with **McDuff SGR et al. (2018) [14]**, who reported that 8.8% of their participants had no axillary surgery, 67.1% underwent SLNB, and 24.1% had ALND. In our study, all participants underwent axillary surgery.

Radiotherapy was administered to 60.8% of participants, while 39.2% did not receive it. This finding is similar to **McDuff SGR et al. (2018) [14],** where 64% of participants underwent radiotherapy. Chemotherapy was almost evenly distributed, with 51.0% receiving treatment and 49.0% not. **McDuff SGR et al. (2018) [14]** reported a higher proportion (65.5%) of participants receiving adjuvant chemotherapy.

Stage 2 breast cancer was the most prevalent in our study (45.1%), followed by Stage 3 (35.3%), with Stage 1 being the least common (19.6%). **Ugur S et al. (2013) [13]** reported early-stage breast cancer (Stage I and II) in 68% of their participants, with 24% developing lymphedema.

In this study, 29.4% of participants developed lymphedema, while 70.6% did not. According to a recent meta-analysis, the overall incidence of chronic arm edema following breast cancer treatment is estimated at 21.4%, highlighting that Breast Cancer-Related Lymphedema (BCRL) remains a widespread issue, affecting approximately one in five patients. Variability in incidence rates, ranging from less than 5% to over 50%, can be attributed to differing diagnostic criteria. **Ugur S et al. (2013) [13]** also reported early lymphedema (within 0–6 months post-surgery) in 36% of patients.

Significant associations were observed between lymphedema and modifiable risk factors, including BMI ($p < 0.001$), ALND and SLNB ($p = 0.028$), and cellulitis ($p < 0.001$). In contrast, radiotherapy and chemotherapy did not show significant associations. Consistent with our findings, **Jammallo et al. (2013) [16]** identified BMI ≥30 kg/m² as an independent risk factor for BCRL. **Ferguson et al. (2015) [17]** also demonstrated that cellulitis infections significantly increased BCRL risk ($p < 0.001$).

Non-modifiable factors, such as age and breast cancer stage, showed trends but were not statistically significant. Age ≥50 years indicated a trend toward increased risk ($p = 0.091$), while breast cancer stage ≥2 showed a similar trend ($p = 0.264$). **Meeske KA et al. (2008) [18]** reported that younger age at diagnosis was associated with arm lymphedema (odds ratio per year of age = 0.96, CI = 0.93–0.99); however, no such association was found in our study.

CONCLUSION

Breast cancer-related lymphedema (BCRL) is a prevalent and impactful complication following breast cancer surgery, observed in 29.4% of the study participants. The study identified significant associations between modifiable risk factors such as elevated BMI (≥30), axillary lymph node dissection, sentinel lymph node biopsy, and cellulitis with the development of lymphedema. Although non-modifiable factors like age ≥50 and advanced breast cancer stages indicated a trend towards increased risk, they were not statistically significant. These findings underscore the need for early risk factor identification and comprehensive management strategies to improve patient outcomes and quality of life.

Recommendations

- Emphasize the implementation of early risk assessment tools, including BMI monitoring and cellulitis prevention, to reduce lymphedema risk.
- Encourage the adoption of minimally invasive surgical techniques such as sentinel lymph node biopsy wherever feasible.
- Promote patient education on lifestyle modifications and self-monitoring to enhance early detection and management of BCRL.
- Conduct larger multicenter studies to validate findings and explore additional risk factors.

Limitations

- The study's sample size was relatively small, limiting generalizability to larger populations.
- Follow-up duration was restricted to six months, which may not capture long-term lymphedema development.
- The observational design limits the ability to establish causality between risk factors and lymphedema.
- Lack of standardized diagnostic criteria for lymphedema may introduce variability in diagnosis.

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Consent: Written consent secured.

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