Frequency of Breast Cancer Surgery Related Arm Lymphedema at King Abdulaziz University Hospital 2008 – 2015, a Tertiary Center Experience, Jeddah, Saudi Arabia

Sabah S. Moshref¹, FRCS, Yasir S. Jamal¹, FRCSI, Zuhoor K. Al Gaithy², MD, FRCSI, Shadi S. Alkhayyat³, MBBS, FRCP, Basim A. Awan¹, FRCS, Mahmoud Fakiha⁴, MD, DESC, Hossam Ammar¹, CAB / PL S, EBPRS, Abdullah Bamashmos¹, MBBC, MSc Surgery, Mawaddah Alrajraji¹, MBBC, Mohammad Abolhamayl¹, MBBC

¹Department of Surgery, Division of Plastic Surgery, ²Department of General Surgery, ³Department of Medicine, Division of Oncology, Faculty of Medicine, King Abdulaziz University
⁴Department of Surgery, Division of Plastic Surgery, Faculty of Medicine, University of Jeddah, Jeddah, Saudi Arabia

Abstract
The purpose of this retrospective study was to investigate the frequency of breast cancer-related lymphedema at King Abdulaziz University Hospital and factors associated with it. Eighty-four breast cancer-related lymphedema patients were recruited from Plastic and Reconstruction Surgery Unit, King Abdulaziz University Hospital, Jeddah, Saudi Arabia after breast cancer treatment during the period from 2008 till 2015. According to the circumference difference between healthy and affected arm, lymphedema degree was categorized into mild (> 5-10%), moderate (> 10-15%) and severe (> 15%). From a total of 598 patients who underwent breast cancer resection, 84 (14.05%) patients developed breast cancer-related lymphedema. In out of the 84 patients who developed arm lymphedema, the treatment was mostly modified radical mastectomy and radiotherapy (n = 59, 70.24%); followed by lumpectomy plus axillary lymph node dissection and radiotherapy (n = 18, 21.43%), simple mastectomy (n = 5, 5.95%) and lumpectomy with sentinel lymph node dissection and radiotherapy (n = 2, 2.38%) with statistical significant difference between them (P = 0.0001). The frequency of lymphedema in our institution is 14.05%. It is mostly moderate, appears during the 1st year after surgery in patients who underwent modified radical mastectomy and radiotherapy, aged more than 60 years and obese.

Keywords
Breast cancer related lymphedema; Sentinel lymph node biopsy; Mastectomy; Morbidity
Lymphedema is a condition caused by a disruption of lymph transport. This perturbation leads to the accumulation of protein-rich fluid, resulting in swelling within the subcutaneous tissues of the affected body part\(^1\). The condition may be acute or chronic, transient or progressive. Lymphedema can generally be classified into primary and secondary etiologies. Primary lymphedema is rare with no known acquired causes. It develops from an insufficiency in the structure and/or function of the lymphatic system that is characterized by malfunction of the lymphatic system in keeping up with the lymph load demands of the affected body part\(^2\). Secondary lymphedema is often caused by the disruption or compression of the lymphatic system resulting from tumors or their treatment. A recognized risk factor for secondary lymphedema is the surgical removal of axillary lymph nodes and/or radiation therapy to the axilla for breast cancer-related lymphedema (BCRL), which can result in swelling of the arm, hand, or adjacent trunk quadrant\(^3\).

About 12 million cancer survivors currently reside in the USA, and at least 2.5 million are female breast cancer survivors\(^4\). In recent decades, breast cancer mortality rates have declined. Meanwhile, breast cancer survivors continue to experience various challenges after cancer and its active treatment. One of the potentially debilitating complications experienced by breast cancer survivors is lymphedema. When the lymphatic system is damaged, fluid accumulates in the affected limb, leading to swelling, fibrosis, reduced range of motion (ROM), decreased function, and, in later stages, infection and pain\(^5\). Due to advancements in care and surgical techniques such as the sentinel lymph node biopsy (SLNB), incidence rates have decreased substantially, with a 5-8% incidence in patients who undergo SLNB and a 14-16% incidence in patients who undergo axillary lymph node dissection (ALND), including only levels I and II\(^6\). Reports on cohorts with longer follow up report incidence rates of lymphedema as high as 34–94%\(^7\), depending on the methods of lymphedema measurement and quantification. The condition may result in physical and psychological consequences, which can negatively impact a woman’s quality of life (QOL) and compromise her emotional well-being. Lymphedema can physically impair arm function by limiting ROM, as well as causing feelings of pain, heaviness, and numbness in the upper extremity. Psychologically, women may have decreased self-confidence due to a disturbance in body image, and experience negative emotions such as anxiety, frustration, sadness, anger, and increased self-consciousness\(^8\).

This retrospective study aimed to record frequency of BCRL in the breast cancer patients operated at King Abdulaziz University Hospital, Jeddah, Saudi Arabia during a seven year period from 2008 to 2015; also, to determine the cross tabulation between onset and severity of lymphedema and type of breast cancer related treatment.

**Patients and Methods**

Eighty-four patients with breast cancer surgery related lymphedema recruited to this retrospective study from Plastic and Reconstruction Surgery Unit, King Abdulaziz University Hospital, Jeddah, Saudi Arabia who underwent unilateral breast cancer treatment at our hospital from January 2008 to January 2015. This study met the requirements of the Declaration of Helsinki (2013) and was approved by the Local Ethics Committee of the King Abdulaziz University. Inclusion criteria of patients were women who had unilateral breast cancer treatment from more than six months; absence of active disease; absence of functional change in the affected limb before surgery, which could lead to swelling of the limb; and simulating or masking symptoms of lymphedema, such as bursitis, tendonitis, and work-related musculoskeletal disorders. Exclusion criteria were women with unilateral disease but less than six months duration from surgery; bilateral breast cancer; a history of previous surgery in the axilla or lympho-venous alteration of the limb before surgery, those with known arterial or venous disease, history of recurrent infections, active rheumatic disease, history of organs transplantation, ulcers in the affected arm, or skin metastases.

The following variables were collected from the patient’s medical record: Patient’s age, body mass index (BMI), type of breast surgery, stage of disease, tumor size, number of axillary lymph nodes dissected, sentinel lymph node involvement, onset of swelling after surgery, degree of swelling severity, symptoms and signs, patient education about lymphedema and adjuvant therapy (radiotherapy and/or chemotherapy).

Diagnosis of lymphedema was made by comparison of circumferential difference between affected and contralateral limb. Circumferential measurement of affected limb is an easy, inexpensive
method to diagnose and monitor limb lymphedema and it had been used by the American Physical Therapy Association classification of lymphedema. Measuring the circumference of affected limb was made at three determined anatomical landmarks (upper arm at 15 cm from the olecranon process, forearm at 10 cm difference from the olecranon process and middle of the hand) with the limb fixed at a parallel plane with the floor in comparison with the unaffected limb. Measurements were taken keeping both the limbs in a similar position with 90° elbow flexion. The difference between the affected limb and the contralateral limb was calculated and expressed as an absolute value and percentage difference. Diagnosis of lymphedema was considered if the circumference of affected limb is greater than the unaff ected by ≥ 2 cm. Difference between two-limb circumferences at any level of ≤ 3 cm (> 5-10%) was considered as mild lymphedema, from 3-5 cm (> 10-15%) as moderate lymphedema and ≥ 5 cm (> 15%) as severe lymphedema.

Statistics Analysis

Data analysis was made using IBM SPSS Statistics for Windows, Version 20 (IBM Corp., Armonk, NY USA). Data was expressed as mean ± standard deviation or number (%) as appropriate. Significant between non-parametric data was done using chi-square test and between related parametric parameters using paired student’s “t” test. Levels of significance was P < 0.05.

Results

The total number of patients with mastectomy were 598 cases, the types of breast surgery were mostly modified radical mastectomy (MRM) +RT (n = 189, 31.60%), followed by lumpectomy +SLNB+RT (n = 187, 31.27%), simple mastectomy (n = 120, 20.07%) and lastly lumpectomy +ALND+RT (n = 102, 17.06%). The patients who developed lymphedema were 59 (31.21%) in MRM+RT, 18 (17.65%) in lumpectomy+ALND+RT, 5 (4.17%) in simple mastectomy, 2 (1.07%) in lumpectomy+SLNB+RT (Table 1).

The age group in BCRL patients was mostly ≥ 60 years (39.28%) then 40 – 49 years, 30 – 39 years and 20 – 29 years (29.76%, 23.81%, 5.95% and 1.19%, respectively) with significant difference between them (P = 0.0001). Body mass index in BCRL patients was mostly obese (40.47%) followed by overweight (17.86%) and normal weight (17.86%) with significant difference between them (P = 0.009). The percentage of patient’s education source about lymphedema by general surgery and reading how to prevent lymphedema were 11.90% and 7.14%, respectively. The onset of swelling after surgery was mostly 6 m - 1 year (60.72%) followed by 1 - 2 years, 2-3 years and > 3 years (9.52%, 2.38% and 2.38%, respectively) with significance difference between them (P = 0.0001). The side of lymphedema was slightly more in left than right arm (51.19% vs. 48.81%, P = 0.827) (Table 2).

The size of breast tumor was mostly > 3 cm (36.91%) then 2.0-2.9 cm, < 1.5 cm and 1.6-1.9 cm (17.86%, 11.90%, 8.33%, respectively) with significant difference between them (P = 0.0001). Tumor stage was mostly stage 2 (54.76%) then stage 3, stage 1 and lastly stage 4 (25.00%, 10.71% and 9.53%, respectively) with significant difference between them (P = 0.0001). The percentage of ALND, SLNB, surgical and radiotherapy treatment and chemotherapy treatment were (91.67%, 53.57%, 69.05% and 97.62%, respectively). The number of lymph nodes removed was mostly 1 - 10 nodes (28.57%) then ≥ 16 nodes, none, and 11 - 15 nodes (17.86%, 16.67%, 11.90%, respectively) (Table 3).

The patients presenting symptoms and signs were swelling (73.81%); numbness (50.00%); heaviness (47.62%); pain (40.48%); stiffness (29.76%); itching (23.81%); poor ROM (20.24%); cellulitis (13.10%);

### Table 1. Incidence of lymphedema among different types of breast cancer treatment.

| Types of Breast Cancer Treatment | Population | Patients with Lymphedema | Significance |
|----------------------------------|------------|-------------------------|--------------|
|                                  |            | Yes                     | No           |
| MRM+RT                           | 189 (31.60%) | 59 (31.21%)              | 130 (68.78%)  | 0.0001        |
| Lumpectomy+SLNB+RT               | 187 (31.27%) | 2 (1.07%)                | 185 (98.93%)  | 0.0001        |
| Simple mastectomy                | 120 (20.07%) | 5 (4.17%)                | 115 (95.83%)  | 0.0001        |
| Lumpectomy+ALND+RT               | 102 (17.06%) | 18 (17.65%)              | 84 (82.35%)   | 0.0001        |
| Total                            | 598 (100.00%) | 84 (14.05%)              | 514 (85.95%)  | 0.0001        |

Data expressed as number (%). Percentage of surgery according to total number of patients; while percentage of presence or absence of lymphedema is according to treatment type. Significance was made using chi-square test.

MRM: modified radical mastectomy; ALND: axillary lymph node dissection; RT: radiotherapy, SLNB: sentinel lymph node biopsy.
recurrent cellulitis (5.95%); and wound infection (3.57%). The degree of lymphedema was mostly moderate (50.00%) then severe (27.38%) and lastly mild (22.62%) with significant difference between them (P = 0.005). The mean of absolute circumferential difference pretreatment was 5.36 cm (Table 4).

The pretreatment circumferential size was significantly higher than contralateral upper limb size of mid-arm, forearm and mid-hand (P = 0.0001, for all). In all the patients, the mean of percentage difference between pretreatment and contralateral limb size of mid-arm, forearm and mid-hand were 11.42, 15.91 and 9.49, respectively (Table 5).

The age of edema appearance after surgery, in MRM+RT was mostly 6 months – 1 year (59.32%) then 1-2 years, 2-3 years and > 3 years (11.87%, 3.39% and 1.69%, respectively) with significant difference between them (P = 0.0001); in lumpectomy+SLNB+RT was mostly 6 months – 1 year (77.78%) then 1-2 years (5.55%) with significant difference between them (P = 0.019); in simple mastectomy was 6 months – 1 year (20.00%); in lumpectomy+ALND+RT was 6 months – 1 year (50.00%). The percentage of patients who didn’t report swelling in MRM+RT, lumpectomy+ALND+RT, simple mastectomy and lumpectomy+SLNB+RT were 23.73%, 16.67%, 80.00%, 50.00%, respectively. The degree of swelling after surgery, in MRM+RT was mostly moderate, then severe and mild with significant difference between them (52.54% then 28.81% and 18.65%, respectively; P = 0.005); in lumpectomy+ALND+RT was mostly moderate, then severe and mild with insignificant difference between them (55.55% then 27.78% and 16.67%, respectively; P = 0.115); in simple mastectomy was mostly mild then severe with insignificant difference between them (80.00% then 20.00%, P = 0.180); in lumpectomy+SLNB+RT was equally mild and moderate with insignificant difference between them (50.00% and 50.00%, P = 1.000) (Table 6).

**Discussion**

With the transformation of breast cancer into a chronic disease, there is a greater emphasis on quality of life
Table 3. Risk factors of lymphedema in the patients (n = 84).

| Data                          | Number (%) | Significance |
|-------------------------------|------------|--------------|
| **Tumor Size**                |            | 0.0001       |
| <1.5 cm                       | 10 (11.90%)|              |
| 1.6 - 1.9 cm                  | 7 (8.33%)  |              |
| 2.0 - 2.9 cm                  | 15 (17.86%)|              |
| > 3 cm                        | 31 (36.91%)|              |
| Not Available                 | 21 (25.00%)|              |
| **Tumor Staging**             |            | 0.0001       |
| Stage 1                       | 9 (10.71%) |              |
| Stage 2                       | 46 (54.76%)|              |
| Stage 3                       | 21 (25.00%)|              |
| Stage 4                       | 8 (9.53%)  |              |
| **Axillary Lymph Node Dissection** |     | 0.0001       |
| Yes                           | 77 (91.67%)|              |
| No                            | 7 (8.33%)  |              |
| **Number of Lymph Nodes Removed** |     | 0.0001       |
| 1 - 10 nodes                  | 24 (28.57%)|              |
| 11 - 15 nodes                 | 10 (11.90%)|              |
| > 16 nodes                    | 15 (17.86%)|              |
| None                          | 14 (16.67%)|              |
| Not Documented                | 21 (25.00%)|              |
| **Sentinel Lymph Node Biopsy** |            | 0.0001       |
| Yes                           | 45 (53.57%)|              |
| No                            | 5 (5.95%)  |              |
| Not Documented                | 34 (40.48%)|              |
| **Surgical and Radiotherapy Treatment** | | 0.0001       |
| Yes                           | 58 (69.05%)|              |
| No                            | 26 (30.95%)|              |
| **Chemotherapy Treatment**    |            | 0.0001       |
| Yes                           | 82 (97.62%)|              |
| No                            | 2 (2.38%)  |              |

Significance was made using chi-square test.

Table 4. Characteristics of patients with breast cancer related lymphedema (n = 84).

| Data                                | Number (%) | Significance |
|-------------------------------------|------------|--------------|
| **Symptoms and Signs**              |            |              |
| Swelling                            | 62 (73.81%)|              |
| Numbness                            | 42 (50.00%)|              |
| Heaviness                           | 40 (47.62%)|              |
| Pain                                | 34 (40.48%)|              |
| Stiffness                           | 25 (29.76%)|              |
| Itching                             | 20 (23.81%)|              |
| Poor Range of Motion                | 17 (20.24%)|              |
| Cellulitis                          | 11 (13.10%)|              |
| Recurrent Cellulitis                | 5 (5.95%)  |              |
| Wound Infections                    | 3 (3.57%)  |              |
| **Absolute Circumferential Difference Pretreatment (cm)** | 5.36 ± 3.09 |              |
| **Degree of Lymphedema Pre-Operative** |     | 0.005        |
| Mild                                | 19 (22.62%)|              |
| Moderate                            | 42 (50.00%)|              |
| Severe                              | 23 (27.38%)|              |

Statistics made using chi-square test.
(QOL) and long-term post treatment sequelae. There is an expectation on the part of patients, their families and caregivers that the patient should lead a near normal life style. Except for breast cancer recurrence, no event is more dreaded than the development of lymphedema.

The results of present study revealed that frequency of BCRL in patients with unilateral breast cancer was 14.05%. The incidence of breast cancer–related lymphedema varies greatly in the literature, ranging from 2% to 83%[12,13]. This wide range in incidences is attributed to more than one factor. There is no clear and universal definition of lymphedema and there are variations in the methods of its diagnosis and measurement. Some methods depend on circumference measurements, but other methods exist, including water displacement, bioelectrical impedance, or bioimpedance spectroscopy which reflects increased water content[14]. Since those tests do not completely agree with each other the results are expected to be different[14].

Perimetry, which was the diagnostic method used in this study, is based on comparing the measurement of the circumference of the affected arm with the contralateral arm[16,17]. Although water displacement and circumference measurement are both reliable techniques in clinical practice, the use of arm circumferences is the most popular method for assessing lymphedema. This is probably related to its simplicity and practicality. Hayes et al.[12] found that, compared with bioimpedance spectroscopy, 40% to 60% of patients measured with circumferential or self-report tools went undetected. Further, a false diagnosis of lymphedema was given to 12% of those diagnosed using circumferential tools and 40% of those using self-report instruments.

Despite the numerous publications in the literature, the precise definition of lymphedema is still debated, leading to confusion regarding the presence of “clinically significant” lymphedema. In this study, diagnosis of lymphedema was considered if the circumference of affected limb is greater than the unaected limb by ≥ 2 cm. Difference between two-limb circumferences at any level of ≤ 3 cm was taken as mild lymphedema, from 3-5 cm as moderate lymphedema and ≥ 5 cm as severe lymphedema. In all the patients, the degree of lymphedema in this study were mostly moderate (50.00%) followed by severe (27.38%) and lastly mild (22.62%). In cases of

| Table 5. Comparison of pretreatment circumferential limb measurement with contralateral limb at different points. |
|---|---|---|---|
| Data | Mid-Arm | Forearm | Mid-Hand |
| Pretreatment (cm) | 35.64 ± 5.83 | 27.00 ± 4.84 | 20.15 ± 2.40 |
| Contralateral Side (cm) | 31.72 ± 5.53 | 22.54 ± 3.40 | 18.51 ± 1.94 |
| Significance | 0.0001 | 0.0001 | 0.0001 |
| % Different (%) | 11.42 ± 7.61 | 15.91 ± 9.27 | 9.49 ± 8.17 |

| Table 6. Cross tabulation between types of breast surgery and onset and degree of edema in 84 patients of BCRL. |
|---|---|---|---|---|---|
| Data | Type of Breast Cancer Surgery | Onset of Edema | Degree of Edema |
| | MRM+RT | Lumpectomy + ALND+RT | Simple Mastectomy | Lumpectomy +SLNB+RT |
| | (n = 59, 70.24%) | (n = 18, 21.49%) | (n = 5, 5.95%) | (n = 2, 2.38%) |
| 6 months - 1 year | 35 (59.32%)* | 14 (77.78%)* | 1 (20.00%)* | 1 (50.00%)* |
| 1 - 2 years | 7 (11.86%) | 1 (5.55%) | - | - |
| 2 - 3 years | 2 (3.39%) | - | - | - |
| > 3 years | 1 (1.69%) | - | - | - |
| Didn’t report swelling | 14 (23.73%) | 3 (16.67%) | 4 (80.00%) | 1 (50.00%) |
| Significance | 0.0001 | 0.019 | 0.180 | 1.000 |

| Data | Type of Breast Cancer Surgery | Degree of Edema |
| | Mild | Moderate | Severe |
| | 11 (18.65%) | 31 (52.54%) | 17 (28.81%) |
| Significance | 0.005 | 0.015 | 0.180 |

*The percentage is out of the 84 patients with BCRL

Statistics made using chi-square test.

MRM: Modified radical mastectomy; RT: Radiotherapy; ALND: Axillary lymph node dissection; SLNB: Sentinel lymph node biopsy.
MRM+RT and lumpectomy+ALND+RT, the degree of lymphedema was mostly moderate, while in cases of simple mastectomy was mostly mild. Some practitioners consider a maximum girth difference of ≥ 2 cm or a volume difference of ≥ 200 mL in the involved limb compared to the uninvolved limb to indicate a diagnosis of lymphedema[18].

Another factor explaining the varying incidence of lymphedema is related to the fact that patients are evaluated at different time periods following their surgery. Although lymphedema usually develops within the first 2-3 years after surgery, it is well known that it can develop many years later[16]. Our results indicate that most lymphedema (59.32%) occurred within 6 months - 1 year after breast surgery followed by 1 year - 2 years (11.87%), 2-3 years (3.93%) and > 3 years (1.69%). Other series showed that 75-80% of patients who develop lymphedema do so within the first or second year after surgery[10]. Approximately 10% of patients developed lymphedema after the third year[10]. Data from Armer and Stewart's 60-month follow-up demonstrated that cases of lymphedema continued to develop at five years[31]. In a six-year follow-up, Hayes et al.[1] reported some new cases at that time, albeit much less than in the first 2 years[1]. The risk of developing lymphedema lasts for a lifetime[17], so this sense of vulnerability can be difficult for many patients to overcome. So, more frequent surveillance throughout this time (e.g., once every 3–6 months) seems reasonable[17]. In attempting to reestablish the lymphovenous balance of the upper limb and breast region after breast cancer treatment, the body makes use of compensatory mechanisms, which attempt to avoid edema. However, some factors such as trauma, aging, and repetitive or non-repetitive episodes of infections can overwhelm the lymphatic system, changing the balance. Therefore, the longer the time elapsed since surgery, the greater the risk of developing lymphedema[11].

Effective identification of the risk factors for the development of breast cancer related lymphedema is fundamental for the prevention, early diagnosis and management. Patients also differ in stage and grade of their disease, and in the adjuvant treatment received. Patients with more advanced tumors usually receive more aggressive treatment, including mastectomy, axillary dissection, and radiotherapy, which have been shown in different studies to be associated with increased risk of lymphedema[12,18]. In our series, 59 (31.21%) out of 189 breast cancer patients developed lymphedema after modified radical mastectomy and radiotherapy, 18 (17.65%) of 102 patients developed lymphedema after lumpectomy, ALND and radiotherapy, five (4.17%) of 120 patients developed lymphedema after simple mastectomy, two (1.07%) of 187 patients developed lymphedema after lumpectomy, SLNB and radiotherapy. The most frequently-cited risk factor for lymphedema secondary to breast cancer treatment is ALND[17,19,20]. A recent meta-analysis indicated that women who underwent ALND as part of their surgical treatment for breast cancer had a 4-times higher incidence of lymphedema compared with those who underwent SLNB (19.9% vs. 5.6%, respectively)[17]. Other articles reported incidence rates of 33% to 48% of lymphedema developed after ALND and radiation therapy[21] and 5% to 14% after sentinel node biopsy and radiotherapy[22]. Say and Donegen[23] reported that simple mastectomy without axillary dissection carried an incidence of 9.1% of lymphedema compared to 31.5% in patients following modified radical mastectomy. Schünemann and Willich[24] reported a lymphedema prevalence of 39% following radical mastectomy, 24% following modified radical mastectomy and 9% following breast conservation surgery. Also, Nesvold and co-workers[25] reported that secondary lymphedema was more prevalent in patients who had radical mastectomy (27%) than in breast-conserving surgery (8%) and in SLNB (3%). Meanwhile, some authors had noted that the extent or level of axillary node dissection does not show statistically significant association with the risk of development of lymphedema[26].

Additional lymphedema risk factors that have been suggested include, higher BMI or obesity, experience of the surgeon, dominant limb, nodal radiation, mastectomy, number of lymph nodes removed and number of positive lymph nodes, presence of extra capsular spread, size and grade of the primary tumor, co-morbid conditions, adjuvant chemotherapy, and decreased physical activity levels[12,17–19,25,27,28].

Patient characteristics have been evaluated as risk factors such as high BMI, age at diagnosis, hypertension, history of infection and inflammation, handedness and excessive use of limb[29]. In this study, the mean age of the patients was 55.43 years, the patient’s age group who BCRL was mostly in ≥ 60 years (39.28%) followed by 40 – 49 years (29.76%), 50 – 59 years (23.81%), 30 – 39 years (5.95%) and lastly 20 – 29 years (1.19%). Age is a variable often associated with lymphedema[26,30]. Along with the aging process, anatomical and physiological changes related to lymphatic obstruction occur, which
may predispose to the development of lymphedema, with the main mechanism being the opening of lympho-venous anastomoses\textsuperscript{[19]}. The higher incidence of lymphedema in older patients observed in some studies\textsuperscript{[31]} may be due to a progressive loss of these anastomoses because of the aging process\textsuperscript{[19]}. Hayes et al.\textsuperscript{[12]} showed that age above 50 may increase the risk of lymphedema incidence to 3.3 times. Meanwhile, a study by Yen et al.\textsuperscript{[30]} who investigated self-reporting of the risk factors for lymphedema in older women, found no significant difference between women with and those without lymphedema. The difference in evaluation methods and the average age of the women involved in these studies may be responsible for the discrepancy of results.

In this study, the mean of BMI of BCRL patients was 30.10 (kg/ m\textsuperscript{2}). Most of our patients were obese (n = 34, 40.47%) followed by overweight (n = 15, 17.86%), while normal weight was found in 15 (17.86%) patients. The association between BMI and lymphedema has been approved in many studies\textsuperscript{[32,33]}. Soran and co-workers\textsuperscript{[34]} believed that it is not clear whether obesity is a direct risk factor for arm edema; it is certainly a risk factor for infection and poor wound healing. Foldi et al.\textsuperscript{[35]} believes that lymphedema combined with obesity is more than the sum of the two diseases. So, they suggested that controlling BMI can be helpful in reducing lymphedema, even though it may not be a direct risk factor for it\textsuperscript{[18]}.

In this study, the types of education about lymphedema among BCRL patients were by general surgery doctors (11.90%) and reading how to prevent lymphedema (7.14%). Lower incidences of lymphedema were found in women who exercised regularly, received lymphedema education before treatment, and performed preventive self-care activities\textsuperscript{[18]}. Bani et al.\textsuperscript{[36]} found that provision of education on lymphedema was associated with use of lymph-drainage massage services.

In our lymphedema patients, the percentage of patients with ALND was 91.67% and sentinel lymph node biopsy was 53.57%. The number of lymph nodes removed was mostly 1 - 10 nodes (28.57%) then ≥ 16 nodes (17.86%) and 11 - 15 nodes (11.90%). The size of breast tumor was mostly > 3 cm (36.91%) then 2.0-2.9 cm (17.86%), <1.5 cm (11.90%) and 1.6-1.9 cm (8.33%). The breast cancer stage was mostly stage 2 (54.76%) then stage 3 (25.00%), stage 1 (10.71%) and lastly stage 4 (9.53%). Many reports cited that vulnerability of lymphedema increases with the number of nodes excised, as well as with the number of positive nodes in the dissection\textsuperscript{[37]}. Removal of lymph nodes, rather than type of lymph node surgery, may be more germane to risk of BCRL. In a retrospective study of 1,338 older breast cancer patients who were diagnosed with in situ and invasive cancer and self-reported having BCRL, an increased risk of BCRL was observed with successive removal of nodes but not with type of surgery\textsuperscript{[40]}. In spite of many studies which had introduced the higher number of excised lymph nodes as a predictor of lymphedema\textsuperscript{[38-40]}, in some valid studies only a higher number of involved lymph nodes or a higher stage of disease were noticed to be related to lymphedema\textsuperscript{[24]}. Observational studies have documented a lower risk of BCRL and other arm morbidity symptoms among patients who underwent SLNB only compared to ALND\textsuperscript{[26,42]}. For example, Francis et al.\textsuperscript{[26]} observed a 16.8% incidence of BRCL after SLNB using the Common Terminology Criteria for Adverse Events (CTCAE) v3.0 criteria for diagnosis, compared to an increased risk of 47.1% after ALND. In contrast, no differences in risk at one year of follow-up were observed between women who underwent SLNB and ALND alone in the American College of Surgeons Oncology Group (ACOSOG) randomized clinical trial\textsuperscript{[27]}. Although the evidence is suggestive that SLNB compared to ALND is associated with lower risk of BCRL\textsuperscript{[43]}, likely due to fewer lymph nodes removed with SLNB, it was found that with even one removed node, a woman is at an increased risk (4.1%) for BCRL. It is expected that by early diagnosis of breast cancer in lower stage, the incidence of lymphedema would decline.

The incidence of lymphedema in the current study in patients receiving postoperative radiotherapy with surgery was 69.05% and in patients receiving chemotherapy was 97.62%. In this respect, Kissin et al.\textsuperscript{[44]} reported lymphedema incidence of 8.3% following radiotherapy alone and 38.3% with a combination of axillary dissection and radiotherapy. Radiotherapy is considered as a risk factor for development of lymphedema, mainly when axillary irradiation is applied\textsuperscript{[12,37]}. Zhu et al.\textsuperscript{[45]} reported that radiation therapy doubles the risk, and chemotherapy contributes to the development of lymphedema. A likely explanation is the occurrence of lymphedema due to the blockage of lymph vessels or their compression by fibrosis caused by this treatment\textsuperscript{[45]}. Hence following axillary dissection radiotherapy to axilla shouldn’t be used judiciously and
unnecessary over treatment of axilla. There has also been reference to lymphedema developing during treatment secondary to chemotherapy regimens\(^ {46}\). The rationale for this association remains unclear and is a phenomenon that requires further study.

The detrimental effects of lymphedema on a breast cancer survivor’s physical and psychosocial health can be overwhelming, particularly because lymphedema is a risk that lasts for the survivor’s life time\(^ {47}\). In this study, the symptoms and signs of lymphedema were mostly swelling (73.81\%) followed by numbness (50.00\%), heaviness (47.62\%), pain (40.48\%), stiffness (29.76\%), itching (23.81\%), poor ROM (20.24\%), cellulitis (13.10\%), recurrent cellulitis (5.95\%) and wound infection (3.57\%). Assessment of post–breast cancer lymphedema is largely dependent on the evaluation of subjective symptoms and objective signs. Changes in fit of jewelry/clothing, skin changes, decrease in ROM, and feelings of heaviness, pain, and swelling are all indicators of lymphedema\(^ {48}\). In this respect, it had been reported that although women with lymphedema report a variety of physical symptoms, including pain, heaviness, tenderness, numbness, limited Range of Motion (ROM), and stiffness, arm swelling is the most common\(^ {49}\). Pain is also a common symptom in lymphedema patients. For example, in Paskett and Stark’s\(^ {50}\) study 72\% of the lymphedema patients reported pain in addition to edema, and 57\% of them had intermittent pain, and Moffatt et al.\(^ {51}\) showed that 50\% of patients had experienced pain or discomfort from their edema. Verbeleen et al.\(^ {52}\) reported that even after two years women with a negative SLNB complain of pain (range 5.6-51.1\%), numbness (range 5.1-51.1\%), loss of strength (range 0-57.7\%), decreased internal rotation (44.4\%), and decreased abduction (range 0-41.4\%). Persons with lymphedema are especially at risk for cellulitis because of the presence of stagnant lymph fluid in the limbs creating ideal conditions for bacteria to thrive\(^ {37}\). In addition to limitations, women with lymphedema are subject to potential psychosocial problems including depression, anxiety, poor adjustment to illness, and low self-esteem\(^ {49}\).

In conclusion, the incidence of BCRL in our hospital (14.05\%) is presently high in comparison with the most recent meta-analysis indicating the seriousness of this condition. Although most of our patients with lymphedema have moderate degree of severity, it is still associated with significant physical morbidity mostly swelling of affected limb. Old age of patients and obesity as well as surgical method, the extent of the axillary approach, radiotherapy, and chemotherapy, are associated with the presence of lymphedema. Close monitoring of breast cancer survivors in the first 3 years after breast cancer treatment is crucial for early detection and start lymphedema treatment measures as early as possible to decrease the development of progressive lymphedema which is a very devastating condition affecting the QOL of breast cancer survivors.

**Conflict of Interest**

The authors have no conflict of interest.

**Disclosure**

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**Ethical Approval**

Obtained.

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تواتر الوذمة اللمفية للذراع المرتبطة بجراحة سرطان الثدي في مستشفى جامعة الملك عبدالعزيز في الفترة 2008-2010م، خبرة مركز ثالثي، جدة، المملكة العربية السعودية

صباح صالح مشرف، ويارس صالح جمال، وزهور ك. الغيثي، وشادي س. الخياط، وياسم أ. عوان، ومحمود فقيهاً، وعبد الله بامشمساً، ومودة الرجاريً، ومحمد أبو الحمامل

depend onجامعة حراجة التجميل قسم الجراحة، وقسم الجراحة العامة، وقسم الباطنية، كلية الطب جامعة الملك عبدالعزيز، شعبة حراجة التجميل قسم الجراحة، كلية الطب، جامعة جدة، المملكة العربية السعودية

المستعرض. كانت غاية هذه الدراسة الاستعمادية استقصاء تواتر الوذمة اللمفية المرتيبة بسرطان الثدي في مستشفى جامعة الملك عبدالعزيز والمواد المرتيبة بها. تم دراسة 84 مريضة مصابة بالوذمة اللمفية المرتيبة بسرطان الثدي جاوزها إلى وحدة جراحة التجميل وإعادة البناء، مستشفى جامعة الملك عبدالعزيز، جدة، المملكة العربية السعودية، بعد خضوعهن لمعالجة سرطان الثدي في الفترة من 2008م إلى 2010م. تم تصنيف درجة الوذمة اللمفية بحسب الفرق في الكفاف (المحلي) بين الذراعين السليمة والمصابة إلى خفيفة (5-15%) ومعتدلة (15-40%) وشديدة (>40%). من بين مجموعة 598 مريضة خضعن لاستئصال سرطان الثدي، أصيبت 84 مريضة (14%) بالوذمة اللمفية المرتبطة بسرطان الثدي. عند المرضى اللواتي أصبنت بالوذمة اللمفية للذراع، كان نمط المعالجة في الغالب استئصال الذري الجذري المعالج والإشعاعية (العدد 59 مريضة 48 مريضة بنسبة 24.2%)، تلاه نمط المعالجة المشتمل على استئصال الذري وال🌐إشعاعية (العدد 18 مريضة بنسبة 4.2%)؛ تلاه استئصال الذري البسيط (العدد 5 مريضة ونسبة 5.9%). ثم استئصال الكتلة مع تسلخ العقدة اللمفية الخارجة والمعالجة الإشعاعية (العدد مريضات بنسبة 6.8%) مع وجود فرق إحصائي معيد بين هذه الأنماط (الاختلاف = 10000). بلغ تواتر الوذمة اللمفية في مستشفينا 21.5% وكانت في الغالب معتدلة، وظهرت في أثناء السنة الأولى بعد الجراحة عند المرضى اللواتي خضعن لاستئصال الذري الجذري المعالج والمعالجة الشعاعية، والبالغة أعمارهن أكثر من 60 سنة والسنوات.