Original Article

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Evaluating the Effect of Axillary Lymph Node Involvement and Dissection in the Development of Post-Mastectomy Lymphedema

Ahmed N. Abdulnabi(CABS), [1] and Issam Merdan(FICMS). [2]

[1] CABS, Specialist of General Surgery, Al-Fayhaa Teaching Hospital, Basrah, IRAQ.

[2] FICMS, CABS, Consultant Surgeon, Alsadr Teaching Hospital, Professor of Surgery, Department of Surgery, College of Medicine, University of Basrah, Basrah, IRAQ.

Correspondence:
IssamMerdan
Email:
issam.alnajjar@yahoo.com
Mobile:
+9647801601761

Abstract

Background: Lymphedema of the upper extremity is a serious consequence of breast cancer surgery. Postmastectomy lymphedema of the upper limb is usually related to many risk factors, like axillary surgery, radiotherapy, venous obstruction, obesity, and infection. In the current study, the objective was to identify the relationship between the extent of lymph node involvement and axillary dissection on the development of lymphedema.

Patients and methods: One hundred and seventy patients managed by modified radical mastectomy with axillary dissection for mammary-invasive adenocarcinoma between January 2009 and December 2016 in Al-Fayhaa Teaching Hospital. The patients were divided into three groups according to the number of lymph nodes involvd, by pathology. The patients had been followed up for at least two years and assessed by standard lymphedema assessment, then categorized into three groups, according to the severity of lymphedema.

Results: After the analysis of patient parameters, the highest age group was 36–45 years. More than 60% of the patients had 4–9 lymph nodes involved. Forty-one patients from the 170 developed lymphedema postoperatively. Forty patients had seroma and twenty-one patients had wound infection postoperatively.

Conclusion: Post-mastectomy lymphedema is a sequelae of disease process related to the extent of lymph-node involvement and resection rather than operative fault.

Key words: breast cancer, mastectomy, lymphedema.

INTRODUCTION

Breast cancer is still the most frequently occurring malignancy in women. Worldwide over the past three decades, breast cancer has remained the number-two leading cause of cancer death among woman. [(1)] With the benefit of early detection methods, along with multimodality surgical options and adjuvant therapy, the overall survival is being improved. Modified radical mastectomy with axillary dissection remains the most popular procedure for the management of breast cancer. [(2,3)] Axillary dissection is an integral part of both radical and conservative breast cancer surgeries, both for prognostic and for curative purposes. [(4)] This procedure is not free of complications; among these is upper-limb lymphedema, which is the most

common occurrence after breast cancer surgery, with a registered incidence of 6% to 30%.[5] Lymphedema is a clinical manifestation of lymphatic system inadequacy and lymph transport impairment. [6] It is a collection of lymphatic fluid as a result of inadequate drainage, due to damage or obstruction of lymphatic vessels. [7] The lymphedema occurs when the transport capacity of the lymphatic system is below the lymphatic load. It may be categorized as either primary lymphedema, which develops as a result of congenital underdevelopment and/or hereditary pathology, or secondary lymphedema, which is usually caused by mechanical obstruction of the lymphatic channels and lymph nodes by radiation, surgery, trauma, and infection, secondary involvement of lymph nodes, or chemotherapy. [8,9] Post-mastectomy lymphedema is most commonly present as an obvious swelling of the upper limb on the side of mastectomy, with the gradual tightening of clothes or jewelry and impaired functionality.[10,11] Severe physical and psychological injury can occur among survivors with lymphedema after breast cancer surgery, resulting in a reduction of quality of life in terms of physical, functional, social and emotional wellbeing. [12] After the diagnosis of breast cancer or following surgery, the incidence of upper-limb lymphedema may increase, up to 2 years. [13,14]

The present study was conducted to assess the effect and extent of lymph node involvement and dissection on the development of lymphedema after modified radical mastectomy in patients with breast carcinoma.

PATIENTS AND METHODS

This prospective study included a total number of one hundred and seventy patients with breast carcinoma, who were diagnosed and then operated upon during the period between January 2009 and December 2016 in Al- Fayhaa Teaching Hospital, Basrah, Iraq. Patients' demographics, past history, family history, recent history, drug history, and accompanying systemic diseases were evaluated. All patients were operated upon by modified radical mastectomy, with the excision of nodal level one, two, and sometimes three, depending upon the extent of lymph node involvement. The patients were subdivided into three groups, according to the number of lymph nodes involved by the disease, under the umbrella of TNM classification. [3] The nodes were subsequently removed by surgery and sent for histopathological examination. The first group was comprised of those with the involvement of 1–3 lymph nodes; the second group had 4–9 lymph nodes involved; and the third group was comprised of those with ten or more lymph nodes involved.

Nearly all patients in group one had level-one and two axillary lymph node dissections, while the second and third groups had, beyond this, a level-three dissection. Patients were followed in the outpatient department and private clinic for two years after surgery.

Those patients who developed arm and/or hand swelling; a feeling of tightness, heaviness, or fullness; skin thickening; and pain or redness in the arm or hand, were subjected to standard

lymphedema assessment methods as described by Markowski et al. [15] and Margaret et al. [16]

Measurements and comparison of the circumference of both upper limbs were taken at five fixed levels from the olecranon process, two above the process (11.5 and 21 cm) and three levels below it (7.5, 14 and 24 cm). Any difference in the circumferences between the two limbs at any level was regarded as lymphedema. The lymphedema was subdivided into mild, where the difference in the arm circumferences was 3cm or less; moderate, if it was between 3 and 5 cm; and severe, when exceeding 5 cm.

RESULTS

Age distribution of breast cancer patients is summarized in Table 1. This table shows that breast carcinoma was more common in patients of the age group between 36 and 45 years.

Table 1: Age distribution of patients undergoing surgery

Age in years	No. of patients	Percentage
Less than 25	0	0%
25–35	11	6.47%
36–45	73	42.94%
46–55	43	25.29%
56–65	31	18.23%
Above 65	12	7%
Total	170	100%

Table 2 shows the extent of lymph-node involvement among patients with mastectomy. More than 67% (114 patients) had 4 to 9 lymph nodes involved (group two).

Table 2: Extent of axillary lymph node involvement

Group	No. of lymph node involvement	No. of patients	% of patients
One	1–3	45	26.47%
Two	4–9	114	67.05%
Three	>9	11	6.47%
Total number		170	100%

From the 170 cases, only 41 patients (24.11%) developed lymphedema at the site of mastectomy; 58.53% of them were mild, as shown in Table 3.

Table 3: Type of lymphedema developed postoperatively

Lymph-oedema	No. of patients	% of patients
Mild	24	58.53%
Moderate	11	26.82%
Sever	6	14.63%
Total	41	100%

More than 68% (28 patients) from those who developed lymphedema were from group two, and nearly three-quarters of them (22/28) had mild lymphedema. All the patients of group three had moderate-to-severe lymphedema, as shown in Table 4.

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Table 4: The frequency and severity of lymphedema among the three groups

Group	No. of patients developed lymphedema	% of patients developed lymphedema	Mild	Moderate	Severe
One	2	4.87%	2		
Two	28	68.29%	22	5	1
Three	11	26.82%		6	5
Total	41	100%			

Twenty-one patients (12.35%) developed wound infection postoperatively, with more than 52% (11 out of 21) in group two, as shown in Table 5.

Table 5: The number and percentage of wound infection among three groups

Group	No. of patients	% of patients	No. of patients for each group	% of Wound infection in each group
One	9	42.82 %	45	20%
Two	11	52.38 %	114	9.6%
Three	1	4.76 %	11	9%
Total	21	100%	170	

Wound seroma developed postoperatively in 40 patients (23.52%), and this appeared more in the second group (25/40), as shown in Table 6.

Table 6: The number and percentage of patients who developed a seroma

	No. of patients	% of patients	No. of patients for each group	% of Wound infection in each group
One	11	27.5 %	45	24.44 %
Two	25	62.5 %	114	21.92 %
Three	4	10%	11	36.3%
Total	40	100%	170	

From the total of 170 patients who were operated upon, only twenty-five patients

received radiotherapy: nine patients from group two and sixteen patients from group three, as shown in Table 7.

Table 7: The number of patients receiving radiotherapy postoperatively

Group	No. of patients	No. of patients for each group	% of patients in each group
One	0	45	0
Two	16	114	14
Three	9	11	81.8
Total	25	170	

From the above tables, we see that there is a significant increase in the incidence of lymphedema with an increased number of lymph nodes involved. As the number of removed lymph nodes by dissection increase, the risk of lymphedema development also increases. Only 4.4% (2/45) of the patients from group one, who had three lymph nodes involved or less, developed lymphedema postoperatively, while 24.5% (28/114) of the patients from group two, who had 4–9 lymph nodes involved, developed lymphedema. And 100% of the patients (11/11) in group three developed a moderate-to-severe form of lymphedema (more than 10 lymph nodes involved). Severe lymphedema was more prevalent in the third group.

DISCUSSION

While many surgical options are available for the treatment of breast cancer, modified radical mastectomy with axillary clearance was the procedure most commonly undergone by the participants in our study. [3] Axillary lymph node dissection remains an integrative step of conservative and radical breast cancer surgery, both for prognostic reasons and for curative purposes. [2,3]

The issue of morbidity is discussed in a variety of articles and has been categorized in terms of early and late surgical complications. Early ones are seroma, wound infection, paresthesia, hematoma, hemorrhage, flap necrosis, and muscle paralysis, while late complications include lymphedema, shoulder stiffness, brachial plexopathy, and psychosexual disturbances.

In a meta-analysis of 72 studies discussed by Disipio et al. in 2013, the estimate of postmastectomy lymphedema incidence was 16.6%; it was 21.4% when data were restricted to prospective cohort studies. [13] The overall incidence of lymphedema varies from 8% to 56% at two years of follow-up after surgery. [16] The incidence of upper-limb lymphedema has a wide range limit of between 2% and 40% among women having breast cancer surgery and/or radiotherapy. [18] In the current study, the incidence of lymphedema was 24.11%. The reasons for the wide reported range of the prevalence of postmastectomy upper-limb lymphedema include the lack of standard universal diagnostic and assessment criteria, slowly developed onset, clinically prolonged course, and limited physician knowledge.

The American Cancer Society reviewed the most common risk factors for the

development of lymphedema after breast cancer surgery and found them to be axillary radiation after axillary dissection, upper outer-quadrant tumor location, infection, postoperative axillary trauma, seroma and hematoma, axillary tumor recurrence, extent of axillary lymph node dissection (level 3), and a large number of axillary lymph nodes involved by pathology.[4,19]

The incidence of wound infection in this study was higher in group one (20 %, or 9/45) when compared with the other groups (9.6%, or 11/114, and 9%, or 1/11, respectively), in which there were less lymph-node involvement and dissection and less lymphedema development. For this reason, it cannot be regarded as a major risk factor in the development of lymphedema in this patient sample.

The incidence of seroma formation was higher in group three, in which there was extensive axillary lymph node dissection because of massive axillary lymph-node involvement. There are several factors implicated in seroma development; in addition to the number of positive nodes and the extent of lymph node dissection, other factors are intraoperative lymphatic channel ligation, postoperative radiation, preoperative chemotherapy, unusual arm activity postoperatively, and extensive use of electrocautery and vascular disruption.[3,20,21] This is also confirmed by Petrik et al., in a prospective randomized trial which showed that the most significant factors causing the seroma were the number and the extent of axillary lymph node involvement. [22]

Regarding axillary dissection in groups one and two, it was mainly limited to levels one and two and sometimes extended to level three' while for group three, the dissection involved the level three lymph nodes in nearly all patients.

From the 170 patients in the study, only twenty-five patients received radiotherapy: nine from group two and sixteen from group three (because of their limitation in the previous years). In all patients, the field of radiotherapy was restricted only to the mastectomy bed, excluding the axilla. This explains why the effect of radiotherapy in the development of lymphedema in this patient sample is very minimal.

From these findings, the study discovered that, as the number of lymph nodes involved and the degree of dissection of the lymph nodes increased, the risk of developing lymphedema increased. This finding is supported by much of the literature. The higher number of lymph nodes dissected, proportional with the extent of lymph node involvement during axillary surgery, is, therefore, a predictor of lymphedema development. [23,24,25]

Nowadays, most people have a less invasive procedure, in the form of sentinel node biopsy, removing fewer lymph nodes than axillary dissection. This means a lower risk of lymphedema. [26,27,28] Breast cancer survivors who have sentinel biopsy are about four times less likely to develop lymphedema than those who have an axillary dissection. [14]

CONCLUSION

The present study concluded that the extent of axillary lymph node

dissection, which predicted and was related to the number of lymph nodes involved, is the most important factor in the development of lymphedema.

Postmastectomy lymphedema was found to be a part of the disease process because it was predicted by the extent of lymph-node involvement and resection, and not a complication of surgery.

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