

RESEARCH ARTICLE

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Evaluation of Complications of Short-term and Long-term Drainage Following Mastectomy with Removal of Axillary Lymph Nodes: A Randomized Clinical Trial

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Abstract

Background: Breast cancer is one of the most common cancers in Iran and round the globe. Seroma formation is the most common primary complication after mastectomy (partial/radical). Nowadays, drainage is used as a routine method to reduce seroma formation after mastectomy, although there is no consensus about the appropriate time to perform drainage after this surgery. This study evaluated the effects of short-term and long-term drainage after mastectomy along with removal of axillary lymph nodes. **Methods:** This randomized clinical trial was performed on 88 women who underwent mastectomy with ALND in hospitals in Yazd (were randomly divided into two groups). Suction drains were inserted for all patients at completion of surgery. The data collection tool was a researcher-made form based on variables. In the first group, the drain was removed 24 hours after surgery and the patients were discharged, but the second group was discharged with the drain in place after 24 hours and the drain was removed 5 days after surgery. Data were analyzed with SPSS18 using T-Test, Chi square, and Mann-Whitney U test. **Results:** The results showed that 28 (31.8%) participants had formed seroma, of whom 22 (50%) were in the 1-day drainage group and 6 (13.6%) were in the 5-day drainage group. There was a statistically significant correlation among seroma frequency, mean aspiration volume, mean number of aspirations, mean seroma volume in sonography one week after surgery, and mean seroma volume in sonography between the two groups three weeks after surgery ($P<0.05$). **Conclusion:** Based on the results, it can be concluded that long-term drainage reduces the risk of seroma formation after mastectomy with removal of axillary lymph nodes compared to short-term drainage. Complementary study be performed by considering other underlying factors such as comorbidities to obtain the best drain removal time in breast cancer patients.

Keywords: Drainage- breast- cancer- sonography

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Introduction

Today, cancers have been rendered as the leading cause of mortality in developed and developing societies. (Featherstone and Whitham, 2010). Approximately, 13 million cases of cancer are reported annually worldwide, with nearly 60% of these cases culminating in death in developing countries. Breast cancer is one of the most common malignancies among women (Jemal et al., 2011). According to GLOBOCAN statistics, breast cancer ranked as the first type of new cases of cancer in women in Iran and round the world (International Agency for Research on Cancer, 2020).

It is the most common cancer among women serving as the second leading cause of death in women. It has grown significantly in recent decades, especially in developing countries and in women over 50 years of

age (Goossensen et al., 2016; Zaidi & Dib, 2019). The interesting point regarding the incidence of breast cancer in Iran is the high proportion of cancer patients under 50 years of age compared to developed countries indicating the lower age group of breast cancer incidence in Iran compared to other countries (Fares., et al, 2019).

Surgery is one of the most common treatments for this cancer. Depending on the extent of the cancer, different methods may be used for surgery. Currently, the surgical method of choice for grade I and II breast cancer is lumpectomy (removal of the tumor and 1 to 2 cm of the surrounding breast tissue) or quadrantectomy (removal of the tissue and skin of one quarter of the affected area) along with resection of the axillary lymph nodes on levels I and II followed by radiotherapy (Brunicardi et al., 2018). The standard surgical treatment for invasive breast cancer, including resection of primary tumor along with axillary

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lymph nodes (ALND), is preferred over other treatments such as radiotherapy, chemotherapy, endocrine therapy, and molecular targeted therapy (Shima et al., 2021; Wen et al., 2022).

Nonetheless, mastectomy is associated with complications such as lymphedema of the upper extremities, infection, hematoma, wound dehiscence, necrosis of dermal flap, seroma formation and nerve damage, among which seroma formation and abnormal fluid accumulation are the most common primary complications after surgery. The incidence of these two complications has been reported from 15% to 85% depending on factors such as age, breast size, blood pressure, the presence of malignant nodules in the axilla and the number of malignant nodules, history of surgical biopsy, type of surgery, and heparin use (Droeser et al., 2009). Some surgeons consider seroma to be a minor, non-serious complication; nevertheless, this complication can lead to long-term hospitalization, delay in initiating neoadjuvant chemotherapy and delayed wound healing (He et al., 2011).

Approaches such as suction drainage, ultrasound dissection, dead space destruction, sclerotherapy with tetracycline, external compression dressing, thrombin spray, long-term shoulder exercises, and the use of fibrin adhesive to minimize seroma, improve function, and maintain patient appearance (cosmetic aspect) were used; yet, the mentioned measures did not exert any significant effect (Andeweg et al., 2011; Petito et al., 2014).

Since 1947 when Murphy first used drainage after breast cancer, it has been used as a routine method to reduce seroma formation after mastectomy along with ALND. Thus, many surgeons believe that lack of use of drainage after surgery leads to a significant increase in seroma incidence. However, it should be noted that the use of drainage may lead to pain and discomfort, increased length of hospital stay, increased cost of treatment, and wound complications and infections. This is because the drain transmits bacteria from the surface into deep skin (Gil-Londoño et al., 2017). There is discrepancy among different studies as to whether drainage is required after mastectomy with ALND, or as to when drainage should be performed after surgery and in which postoperative day, the patient's drain should be removed. A review study conducted on six randomized clinical trials examined whether postoperative drainage was required and found that postoperative drainage was effective in diminishing seroma formation, aspiration, and drainage volume (Konishi et al., 2021; Taylor et al., 2013).

Consequently, due to disparities among studies regarding the appropriate time to perform drainage after mastectomy with removal of axillary lymph nodes, this study compared the effects of short-term (one-day) and long-term (5-day) drainage after mastectomy along with dissection of axillary lymph nodes. The findings of this study will be useful in the field of better management and reduction of hospitalization costs for breast cancer patients who have undergone surgery.

Materials and Methods

This randomized clinical trial was carried out in the surgical wards of Shahid Sadoughi Hospital, Shahid Rahnemoun Hospital, and Mortaz Hospital in Yazd serving as the main centers for breast cancer surgeries. The study population consisted of women undergoing mastectomy with ALND in the hospitals under study. According to previous similar studies and using the formula: $\beta=20\%$, $\alpha=5\%$, $P1=57\%$, and $P2=25\%$, the required sample size of 37 patients for each group was obtained. Considering a subject attrition rate of 15% for each group, the final sample size of 44 patients for each group was achieved and thus, a total of 88 patients were included in the study using simple random sampling. The inclusion criterion for the samples was: performance of various breast surgeries along with ALND. Those who did not present for postoperative examination and follow-up for any reason and patients who did not sign informed written consent for participation were excluded from the study.

The women were randomly divided by using the simple randomization method and the individual unit and division of people was done using the Research Randomizer software, version 3.0 and random allocation with a ratio of 1: 1 into two groups.

Treatment Protocol

Axillary lymph node dissection (ALND) is part of the treatment of breast cancer in breast conserving therapy as well as in mastectomy. All patients with breast carcinoma who underwent ALND were included in this prospective randomized study. Patients underwent either mastectomy or wide local excision in combination with ALND. Drainage of the axilla was done through placement of a low vacuum closed suction drain inferior to the incision.

Patients were randomly assigned into two equal groups of 44 and a suction drain was inserted in place for all patients at the end of the surgery. In the first group, the drain was removed 24 h after surgery and the patient was discharged. In the second group, the patient was discharged with a drain in place after 24 h and their drain was removed 5 days after surgery.

The number of seromata formed in the two groups was assessed by a physician during ultrasound examination for follow-up surgery. The volume of aspiration was measured and recorded by the physician from the time the rubber drain was inserted until it was removed. Wound infection was also assessed during the physical examination for postoperative follow-up, based on the clinical manifestations of infection including erythema, tenderness, discharge, and non-healing of the wound. Other variables such as the frequency of seroma aspiration, rehospitalization and drainage, and the number of visits to the physician in each group were assessed and recorded by the physician during follow-up. It should be noted that these variables were studied and recorded by a different physician in each group. Gleaned data were analyzed with SPSS18 using T-Test, Chi-square, and Mann-Whitney U test.

Ethical Considerations

Informed written consent was obtained from all patients before surgery. The patient did not incur any additional costs.

Results

In this study, 130 women participated in the first phase. Of those, 36 failed to meet the inclusion criteria and 6 women were unwilling to participate and therefore were excluded. Finally, 88 women entered the main phase of the study (Figure 1).

The mean age of participants was 50.86 ± 11.53 years in the 1-day drainage group and 47.59 ± 13.03 years in the 5-day drainage group which was not statistically different. The mean body mass index of patients and the mean number of patient visits in the two case groups were not statistically significantly different ($P > 0.05$). There was a statistically significant difference between patients' mean volume of aspiration, patients' mean number of aspirations, the mean volume of seroma on ultrasound one week after surgery and the mean volume of seroma on ultrasound three weeks after surgery in the 1-day drainage and 5-day drainage groups ($P < 0.05$) (Table 1).

Based on the results, 50% of the patients in the one-day drainage group and 13.6% of the patients in the 5-day drainage group had seroma complications, which was statistically significant ($P < 0.0001$). Besides, 18.2% of the one-day drainage group and 6.8% of the 5-day

drainage group developed wound infection during the study, but this difference in frequency distribution was not statistically significant between the two groups ($P = 0.107$). Based on the results of sonography one week after the operation, it was found that 52.3% of the patients in the one-day drainage group and 13.6% of the patients in the

Table 1. Comparison of Age, BMI, Number of Visits, Volume and Frequency of Aspiration and Seroma Volume in Sonography One and Three Weeks after Surgery in the Two Groups Under

Variable	Type of drainage	Mean \pm SD	P-value
Age	1-day	50.86 \pm 11.53	*0.237
	5-day	47.59 \pm 13.03	
BMI	1-day	26.91 \pm 4.36	*0.890
	5-day	24.40 \pm 3.6	
Number of Visits	1-day	2.48 \pm 0.7	**0.082
	5-day	2.23 \pm 0.56	
Aspiration Volume	1-day	246.59 \pm 490.77	***<0.0001
	5-day	5.68 \pm 22.14	
Frequency of aspirations	1-day	0.82 \pm 1.16	***<0.0001
	5-day	0.07 \pm 0.25	
Seroma volume in sonography 1 week after surgery	1-day	161.25 \pm 285.64	**0.0001
	5-day	7.50 \pm 22.76	
Seroma volume in sonography 3 weeks after surgery	1-day	37.39 \pm 101.68	**0.002
	5-day	0.0 \pm 0.0	

*T, test; **, Mann-Whitney U Test

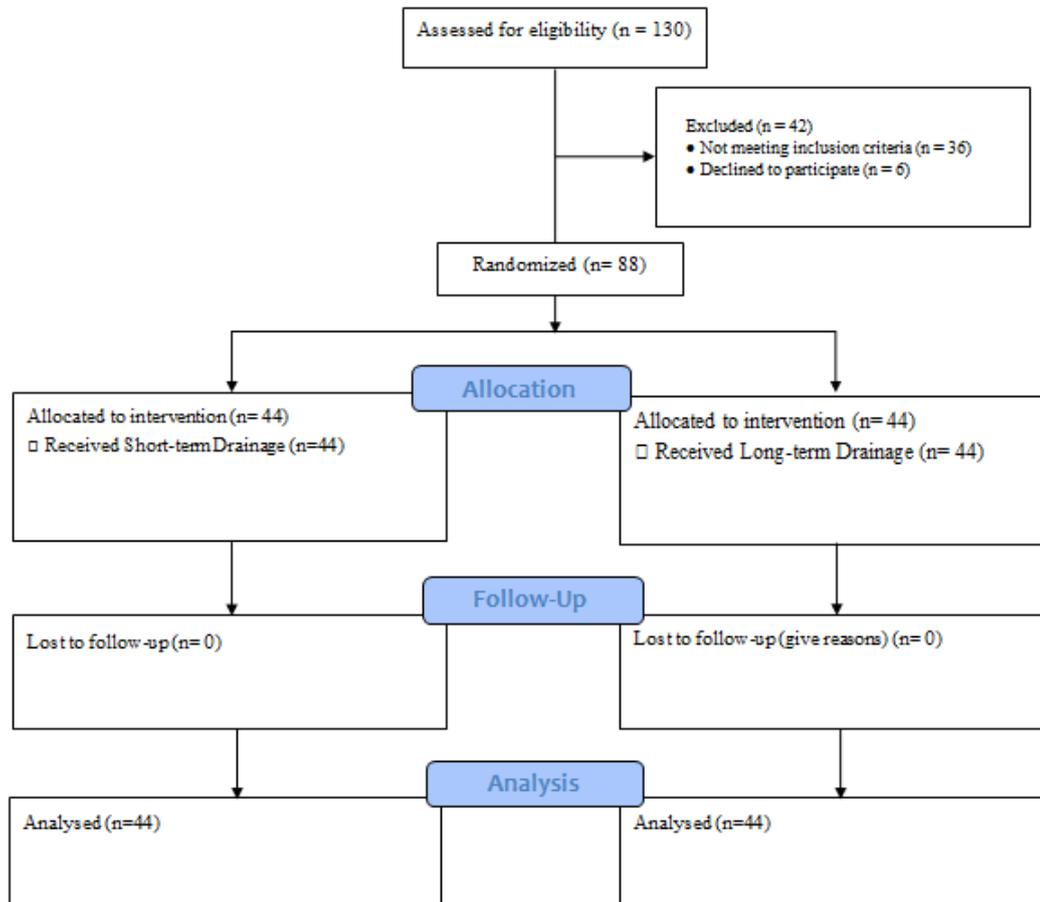


Figure 1. Consort Diagram of the Study

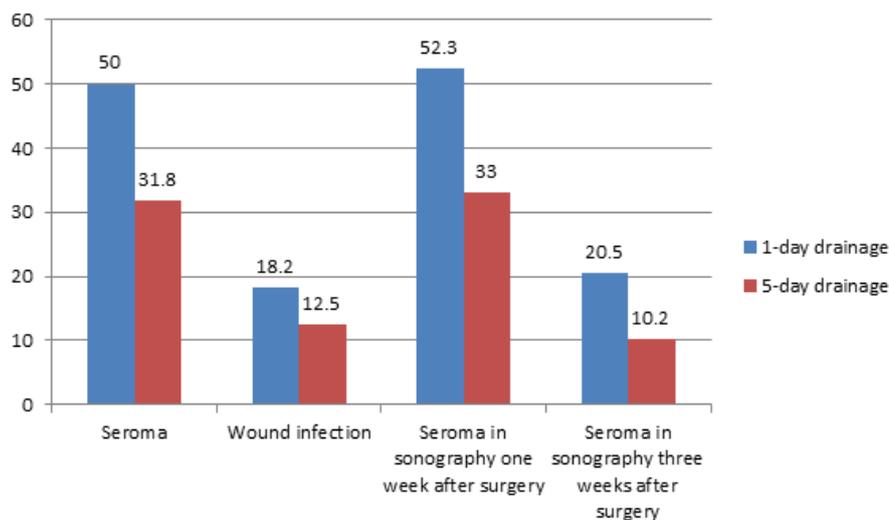


Figure 2. Percentage of Seroma Complications, Wound Infection and Seroma in Sonography One and Three Weeks after Surgery in the Two Groups

Table 2. Comparison of the Frequency of Seroma Complications, Wound Infection and Seroma in Sonography One and Three Weeks after Surgery in the Two Groups under Study

Type of complication	Status	1-day drainage N (%)	5-day drainage N (%)	Total N (%)	P-value
Seroma	Yes	22 (50)	6 (13.6)	28 (31.8)	*<0.0001
	No	22 (50)	38 (86.4)	60 (68.2)	
Wound infection	Yes	8 (18.2)	3 (6.8)	11 (12.5)	0.107
	No	36 (81.8)	41 (93.2)	77 (87.5)	
Seroma in sonography one week after surgery	Yes	23 (52.3)	6 (13.6)	29 (33)	*<0.0001
	No	21 (47.7)	38 (86.4)	59 (67)	
Seroma in sonography three weeks after surgery	Yes	9 (20.5)	0 (0.0)	9 (10.2)	0.002
	No	35 (79.5)	44 (100)	79 (89.8)	

Chi-Square test

5-day drainage group formed seroma; the difference in relative frequency distribution was statistically significant between the two groups ($P<0.0001$). Ultrasound three weeks after surgery suggested that 20.5% of the patients in one-day drainage group showed seroma whereas there was no evidence of seroma in the 5-day drainage group. The difference in relative frequency between the two groups was statistically significant ($P=0.002$) (Table 2).

The results of the study on the presence of seroma in terms of type of surgery in the 1-day (short-term) drainage

group showed that there was no statistically significant relationship between the frequency distribution of seroma complications in terms of type of surgery in the 1-day drainage group ($P=0.062$). Regarding the presence of seroma in terms of type of surgery in the 5-day drainage group, the results also indicated that there was no statistically significant relationship between the frequency distribution of seroma complications in terms of type of surgery in the 5-day drainage group ($P=0.538$) (Table 3).

Discussion

This study evaluated and compared the effects of short-term and long-term drainage after mastectomy with axillary lymph node dissection. Forty-four patients undergoing short-term drainage (1 day) and 44 patients undergoing long-term drainage (5 days) were studied.

The results of the study concerning the mean volume of aspiration revealed that the average volume of aspiration in the 1-day drainage group was significantly higher than the 5-day drainage group. Consistent with these results, in one study, the volume of aspiration in the group that used drainage was significantly lower than the group that did not use it (He et al., 2011). In the Andeweg et al., (2011)

Table 3. Comparison of Frequency of Seroma Complications in Terms of Type of Surgery in 1-day and 5-day Drainage Groups

Group	Status	Type of surgery		P-value
		BCT N (%)	MRM N (%)	
1-day drainage	Yes (n=22)	15 (42.9)	7 (77.8)	0.062
	No (n=22)	20 (57.1)	2 (22.2)	
5-day drainage	Yes (n=6)	3 (11.1)	3 (17.6)	0.538
	No (n=38)	24 (88.9)	14 (82.4)	

Chi-Square test; BCT, Breast conservative treatment; MRM, Modified radical mastectomy

study, similar results were obtained. In another study, no significant difference was observed between the groups in terms of aspiration volume, which was not consistent with the results of our study (Taylor et al., 2013). The difference in the results can be attributed to the method of the study, so that in the study above, patients who underwent surgery in three different ways were evaluated. In another study, the results were not consistent with our findings and the average volume of aspiration in the 8-day drainage group was more than that of the 5-day group and this difference was statistically significant (Gupta., 2001).

The mean number of aspirations in the 5-day drainage group in our study was significantly lower than the 1-day drainage group. In one study, a significant difference was found between the number of aspirations between the two groups, with the difference that in one group the drain was removed 2 days after the daily drainage volume reached less than 30 mL whereas in the other group, it was removed 24 hours after the daily drainage volume reached less than 30 mL (Barton et al., 2006). In a study by Gupta et al., (2001), the number of aspirations in the 8-day drainage group was higher than the 5-day drainage group. It seems that after 5 days, the volume of aspiration and the number of aspirations increase over time. In another study, the frequency of aspiration in the drainage group was significantly lower than the non-drainage group (He et al., 2011).

The mean number of visits in the 5-day drainage group in this study was slightly less than the 1-day drainage group, but this difference was not statistically significant. In Barton's et al., (2006) study, the number of visits between the two groups was significantly different. This was not consistent with the results of our study. This difference may also become significant with increasing sample size.

The results of the present study concerning the frequency of wound infection in the two groups showed that the frequency of wound infection in the 5-day drainage group was less than the 1-day drainage group, but this difference was not significant. The results of similar studies were all similar to the results of the present study and there was no statistically significant difference between the two groups in terms of wound infection (Droeser et al., 2009; Kelley et al., 2012; Peeters et al., 2005).

Many studies have been carried out on the frequency of seroma formation after partial/radical mastectomy in patients with breast cancer. The results of these studies are contradictory, so that in some studies, similar results were obtained as our findings and the rate of seroma formation was significantly lower in the long-term drainage group compared to the short-term drainage group (Andeweg et al., 2011; Gupta et al., 2001). In other studies, in spite of the difference in the mean seroma formation between the groups, no statistically significant difference was observed between the two groups (Okada et al., 2015; Peeters et al., 2005; Taylor et al., 2013). It appears that the surgeon's skill in surgery and proper insertion of the drain appear to exert some effect on the inconsistency of the results. Nonetheless, a systematic review (2012) failed to determine the appropriate time for drain removal

(Kelley et al., 2012)). Hence, it is necessary to conduct a complementary study by considering all the factors affecting the complications of mastectomy to find the appropriate time for drain removal.

In conclusion, given that the risk of seroma formation in long-term drainage (5-day) was less than short-term drainage (1-day) and that this correlation was significant, it can be concluded that removal of drain in patients with breast cancer after mastectomy and removal of the axillary lymph nodes, will create less risks of seroma formation if done after 5 days. Furthermore, due to the lower frequency of wound infection in long-term drainage compared to short-term drainage, it can be asserted that the best time for removing drain of patients with breast cancer after mastectomy is 5 days after surgery. Statistical significance of mean volume of aspiration, mean number of aspirations, frequency of seroma complications in sonography one and three weeks after surgery and mean volume of seroma in sonography one and three weeks after surgery between the two groups all suggest the preference of long-term drainage over short-term drainage. It is recommended that a complementary study be performed by considering other underlying factors such as comorbidities to obtain the best drain removal time in breast cancer patients, in order to reduce the patient's drainage time and achieve the most desirable time with the least complications and costs.

List of abbreviations

ALND: axillary lymph node dissection

Author Contribution Statement

JJN and M.H.D.R have designed the study and supervised the thesis. M.H.D.R collected the data and analyzed it. They also prepared the first draft of the manuscript. S.K and M.H.L has edited and finalized the manuscript. All authors read the manuscript and approved it.

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Declarations

Ethics approval and consent to participate: The article's proposal was approved by the ethics committee of Shahid Sadoughi University of Medical Sciences with id IR.SSU.MEDICINE.REC.1396.7. Patients admitted to our hospital are asked to sign a general consent upon admission, which covers the collection of patient data and publication of these results. We received administrative permission from (Secretary of University/Regional Research Ethics Committee Shahid Sadoughi University of Medical Sciences) to access and use the data. Data used in the study were anonymized. The ethics committee approved this procedure with the above ethical code. The present study was conducted in terms of the principles of the revised Declaration of Helsinki.

Availability of data and material

The data-sets used and/or analyzed during the current study available from the corresponding author on reasonable request.

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Competing interests

All authors declare that they have no conflict of interest regarding this study.

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