# Effect of mechanical closure of dead space in reducing seroma formation after modified radical mastectomy

Prof. Dr. Haroun Abd Al-Karim Allam[1], Dr. Mohamed Mahfouz Mohamed[2] and Gamal Abdel Nasser Mohamed[3]

[1]Department of General Surgery, Faculty of Medicine, Al-Azhar University, Cairo, Egypt.
[2]Department of Pediatric Surgery, Faculty of Medicine, Al-Azhar University, Cairo, Egypt.
[3]Resident of General Surgery, Nasser Institute for Research and Treatment, Cairo, Egypt.
drgamnasser87@yahoo.com

**Abstract**: Seroma formation is the most frequent post operative complication after breast cancer surgery. It occurs in most patients after mastectomy. The surgical technique performed commonly has its role in seroma formation as the heavy dissection and elevation of skin flaps are the most important risk factors. Suture flap fixation is a surgical technique for securing flaps to underlying tissues to close the dead space with sutures. Although this technique is not commonly performed, it is interesting to note that this technique reduces seroma formation in patients undergoing mastectomy. In association with this, it has been proved that mastectomy without drainage does not increase seroma formation when this technique is applied. In our study the incidence of seroma in the flap fixation group was 20% versus 50% in the control group also we found that; the flap fixation technique significantly decreases the total amount of fluid drained with mean drainage volume of 524 cc versus 2017cc in the control group. We found that, this technique significantly decreases the drainage period. The mean duration of drainage is 5 days in the flap fixation group versus 13.4 days in the control group ($P < 0.001$). Additionally the flap fixation in our study was found to significantly decrease the mean days to seroma disappearance, the total aspirated volume, and the number of aspirations.

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**Key words:** breast cancer, mastectomy, seroma, flap fixation

## 1. Introduction

Seroma is a collection of serous fluid that accumulates in dead space and presents as a fluctuant swelling beneath a wound. In breast surgery, this can be deep to the mastectomy skin flaps, in the axilla after dissection or at the donor site following latissimus dorsi (LD) harvesting, **(1).**

Seroma is the most prevalent postoperative sequela after breast surgery, with an incidence of 10% to 85%, leading to significant morbidity (e.g. flap necrosis, wound dehiscence, predisposes to sepsis, prolonged recovery period, multiple physician visits) and discomfort and possibly delaying adjuvant therapy, **(2).**

The origin of seroma remains unclear. Recently it is concluded that seroma formation is an accumulation of lymph and serum as a result of an inflammatory process. Several interventions have been attempted to reduce seroma **(3)**.

Several factors make fluid accumulation likely after breast surgery. For example, if the dissection is extensive, it will result in a large dead space beneath the flaps. Irregularity of the chest wall, especially in the deep axillary fossa, makes it difficult for flaps to adhere. Constant chest wall movement due to respiration and shoulder use creates shearing forces that delay flap adhesion ***(4).***

Mechanical closure of the dead space is an easy technique, in which skin flaps are sutured to underlying muscle in the line of wound closure via absorbable material. A lower total drain volume reduces the incidence of seroma and increases patient comfort via early discharge from hospital, **(5)**

Obliteration of the dead space after breast cancer surgery by suture flap fixation is a safe and easy procedure, which significantly reduces postoperative seroma formation and duration of drainage, **(6)**

The aim of this study is to evaluate the effect of mechanical closure of dead space by suture fixation of the mastectomy flaps to the underlying chest wall, on the amount and duration of postoperative fluid drainage and incidence of seroma formation after mastectomy in female breast cancer.

## 2. Patients and Methods

This is a prospective study that was conducted on a random sample of forty female patients with breast carcinoma scheduled for modified radical mastectomy. The patients were divided into 2 groups, the study group (flap fixation) (20) and the control group (20).

The cases subjected to the study were performed in El Hussein and Nasser institute Hospitals.

**Inclusion Criteria:** Female patients with operable breast cancer.

**Exclusion Criteria:** Female patients;

1. Who received preoperative chemotherapy and radiotherapy
2. With previous axillary surgery.
3. Who underwent simultaneous reconstructive surgery and breast conservative surgery?
4. With Locally advanced breast cancer.

**- Preparation:**

- Informed consent was obtained from all the patients of the study for surgery and publication.

-All patients were admitted the day before the surgery.

- They all were fasting before surgery for not less than 8 hours.

-General anesthesia for all patients and IV prophylactic broad spectrum antibiotic were given with skin incision.

- Operative time was calculated beginning with the skin incision until the closure of wound.

**-Operative technique:**

All patients in both groups underwent modified radical mastectomy

- After completing the modified radical mastectomy procedure:

a) In the study group (flap fixation): after completing the modified radical mastectomy procedure, using fine absorbable sutures (vicryl 3/0), multiple alternating stitches 3 cm apart were taken, in raws, between the subcutaneous tissues of the skin flaps and the underlying muscles at various parts of the flap and also, at the wound edge. Special attention is taken to the obliteration of the largest potential dead space, the empty axillary apex. Two closed suction drains are used one in the axillary space and the other under the skin flaps.

- Skin closure by subcuticular sutures.

b) In the control group:

- The wound was closed in the conventional method, were only the skin closed by subcuticualar sutures.

- Two closed suction drains were, also used one in the axilla and the other under the skin flaps.

**Data recording and follow up:**

- Patients' characteristics and operative related factors were recorded. The amount of drained fluid has been recorded daily. The drains were removed when the amount became less than 50 cc /24 hours. Patients were examined clinically for presence of seroma one week after drain removal. Local chest wall ultrasound over the flaps and axilla was done 2 weeks after removal of drains to document or exclude the presence of any collections. The total amount and duration of drained fluid and the formation of seroma have all been recorded. The number of aspirations till seroma disappearance. The results have been compared between the two groups and the effect of flap fixation on the amount and duration of fluid drainage and formation of seroma will be concluded.

## 3. Results

The study involved 40 female patients suffering from breast carcinoma. They were scheduled for modified radical mastectomy. They were randomized into two equal groups, either with flap fixation or no flap fixation. The first group is the Flap fixation Group (n = 20) and the second group is the No-flap fixation Group (n = 20).

The mean age of the quilting (study) group was 50 ± 8 years (range 37- 62), while in the control group It was 54 ± 10 years with range (38 –72), with a non significant difference.

Similarly, no significant difference was detected between the two studied groups concerning the histological type, stage and grade (**table 1**).

**Table 2**: shows that the two groups were comparable regarding the operative characteristics. The operative time was prolonged in flap fixation group by around 20 minutes ($p < 0.001$). There was no significant difference between the two groups in number of lymph nodes removed, either the total number ($p = 0.273$) or the number of positive nodes ($p = 0.775$).

**Table 3**: shows that in the Flap fixation group, the drain was removed in significantly shorter time compared to the No-Flap fixation group ($p< 0.001$). The total amount of fluid drained was significantly lower in the flap fixation group ($p < 0.001$). During the last days before drain removal the amount of drained fluid was comparable in the two groups ($p = 0.175$). So, flap fixation technique significantly decreases the total amount and duration of drainage after mastectomy.

**Table (1) Tumor Characteristics of the two studied groups**

| | Flap fixation Group (n = 20) | No-flap fixation Group (n = 20) | P value |
|---|---|---|---|
| **Histological types** | | | |
| Intraductal carcinoma (IDC) | 18 (90%) | 18 (90%) | 1.000 |
| Intralobular carcinoma (ILC) | 1 (5%) | 1 (5%) | |
| Mixed | 1 (5%) | 1 (5%) | |
| **Grade of cancer** | | | |
| II | 16 (80%) | 15 (75%) | 1.000 |
| III | 4 (20%) | 5 (25%) | |
| **T stage** | | | |
| T1 | 1 (5%) | 1 (5%) | |
| T2 | 15 (75%) | 10 (50%) | 0.242 |
| T3 | 4 (20%) | 6 (30%) | |
| T4 | 0 | 3 (15%) | |
| **N Stage** | | | |
| N0 | 12 (60%) | 6 (30%) | 0.178 |
| N1 | 6 (305) | 10 (50%) | |
| N2 | 2 (10%) | 4 (20%) | |

**Table (2)**: Operative Characteristics of the two studied groups

| | Flap fix Group (n = 20) | No-flap fix Group (n = 20) | p value |
|---|---|---|---|
| **Operative time in minutes** | | | |
| Mean±SD | 127 | 105 | < 0.001 |
| Median (Range) | (90-160) | (80-139) | |
| **Total Number of lymph nodes removed** | | | |
| Mean±SD | 18.9±3.8 | 20.8±10.1 | |
| Median (Range) | 19 (12-30) | 19.5 (7-37) | 0.273 |
| **Number of Positive lymph nodes removed** | | | |
| Mean±SD | 2.8±4.8 | 5.9±12.7 | 0.775 |

**Table (3)**: Postoperative Characteristics of the two studied groups regarding drainage of serous fluid from the wound area.

| | Flap fixation group | Control group | P value |
|---|---|---|---|
| **Day of drain removal** | 5 (2-12) | 13.4(5-22) | < 0.001 |
| **Total amount of drained fluid (ml)** | 524.8 (170-1525) | 2017(455-4615) | < 0.001 |
| **Amount of drained fluid in last 3 days (ml)** | 207(130-300) | 213(125-600) | <0.175 |
| **Amount of drained fluid in last day (ml)** | 35(20-50) | 51(25-200) | <0.002 |

**Table (4)**: Frequency of seroma and its aspiration in the two studied groups

| | Flap fixation Group (n = 20) | No-flap fixation Group (n = 20) | P value |
|---|---|---|---|
| **Clinical Diagnosis** | | | |
| No | 18 (90%) | 12 (60%) | 0.028 |
| Yes | 2 (10%) | 8(40%) | |
| **Ultrasonographic Diagnosis** | | | |
| No | 16 (80% ) | 10 (50%) | 0.047 |
| Yes | 4 (20%) | 10 (50%) | |
| | | | |
| **Days till seroma disapperacce** | 2.3±4.9 | 10±4.2 | < 0.001 |
| | | | |
| **Numbers of aspirations** | 2.1±0.6 (2-4) | 4.7±2.1(3-7) | < 0.001 |
| **Total volume of aspirations** (ml) | 45±15(0-250) | 189±60(0-380) | < 0.001 |

The overall clinical incidence of seroma in the whole study was 25% (10/40). Four more cases are detected by ultrasonography, increasing the radiological incidence to 35% (14/40). The Flap fixation group showed a significantly lower frequency of seroma formation compared to the No-flap fixation group, both clinically ($p = 0.028$) and ultrasonographically ($p = 0.047$) as shown from **table (4)**. Because ultrasonography (US) is a more accurate tool for diagnosis of seroma formation, we considered the US diagnosis as the definitive diagnosis of seroma. Additionally the average number of aspirations till disappearance of seroma and the average number of days till seroma disappearance were smaller in flap fixation group compared with control group.

Morbidity in our study is minor, as complications had developed in 6 patients (6/40) (15%). In the group with flap fixation only 2 cases (10%) developed cellulites that were treated medically, while in the control group 2 cases developed cellulites and 2cases developed partial flap necrosis.

## 4. Discussion

**Seroma** is a collection of serous fluid that accumulates in dead space and presents as a fluctuant swelling beneath a wound. In breast surgery, this can be deep to the mastectomy skin flaps, in the axilla after dissection or at the donor site following latissimus dorsi (LD) harvesting. **(1).**

**Incidence:** It is the most prevalent postoperative sequela after breast surgery, with an incidence of 10% to 85%, leading to significant morbidity (e.g. flap necrosis, wound dehiscence, predisposes to sepsis, prolonged recovery period, multiple physician visits) **(2)** and discomfort and possibly delaying adjuvant therapy **(3).**

Ideal wound closure should minimize lymph spillage and serum oozing, provide a means of holding skin flaps securely to the chest wall structures, obliterate dead space, and allow rapid removal of fluid as it forms. For this, several techniques of flap fixation or wound drainage, as well as limitation of postoperative shoulder movement and the use of adhesive glue, have been investigated to improve primary healing and minimize seroma formation **(7).**

The overall clinical incidence of seroma in our study is 25% (10/40), most of them are grade 2 (90%). Four more cases are detected by ultrasonography, increasing the radiological incidence to 35% (14/40), the 4 cases are grade 1 minor seromas that are clinically asymptomatic and not detected by the patient. This incidence falls within the range reported by most authors that varies widely between 15 and 81%. **(8).**

We are reporting the eficacy of the use of mastectomy with fixation of flaps using suture and obliteration of the axillary space in reducing the postmastectomy seroma using a randomized design. Several trials used adhesive glues and sclerosant agents to reduce the postmastectomy seroma. However, a recent meta-analysis showed that such preventive techniques are still not convincing,**(9).**

As electrocautery was associated with a higher incidence of seroma formation, there was a trend towards the use of scalpel mastectomy or harmonic shear, ( **10).**

In our study the incidence of seroma in the flap fixation group was 20% versus 50% in the control group. This was in line with that described by Coveney, et al.1993 who described an incidence of 25% in the suture group versus 85% in the control group **(11).** A similar figure was reported by Khater, et al.2015 with an incidence of 20% in the quilting group versus 78.6% in the control group **(12)**. Also in a study by Ten Wolde, et al. 2014, there was a decrease of seroma from 80.5% in the control group to 22.5% in the quilting group **(13).** In 2011 Sajid et al stated that, the use of quilting technique decreased seroma incidence and volume (further enhanced by fibrin sealants)**(14).** also in 2013 Seenivasagam et al**.,** stated that Quilting significantly decreased seroma formation and duration of drainage while external compression offers no advantage **(6).**

In our study, also we found that; the flap fixation technique significantly decreases the total amount of fluid drained with mean drainage volume of 524 cc versus 2017 cc in the control group (P value < 0.001). Similar results were reported by Khater, et al.2015 with a mean drainage volume of 710 cc in the quilting group versus 1160 cc in the control group **(12).** similar results were concurred by Sajid et al (2011) and Seenivasagam et al (2013) who stated that quilting technique dose decrease the total amount of drained volume **(14,6).**

It has been reported by some authors that the total drainage volume may reach up to 5 liters if the technique of flap fixation was not used **(15)**.

In our study, we found that, flap fixation technique significantly decreases the drainage period. The mean duration of drainage is 5 days in the flap fixation group versus 13.4 days in the control group (P < 0.001). A similarly significant finding was described by Khater, et al.2015**(12)**.

Quilting can reduce both seroma volume and decrease time to drain removal and is useful following mastectomy, LD flap harvest and axillary surgery, as stated by Turner et al (2014)**(1)**.

Similar results were concurred by Gisquet et al. (2010) and Seenivasagam et al (2013) **( 16,6).**

Our results does agree with the results recorded by Inwag, et al.1991 which revealed that removing the drain when the daily drainage volume is minimal takes between 10 to 14 days in case of not using the suture flap fixation technique **(17).** Our results does also agree with the results achieved by **Kopelman, et al**.**1999** who has mentioned that most surgeons tend to remove the drain when the drainage volume is less than 50 ml. in the preceding 24 h and this usually takes about 10 days if the flap fixation technique was not used **(18).** In 2003 **Rios et al**., stated no statistical significance in day of drain removal **(19).**

In our study, the flap fixation technique was found to significantly decrease the mean days for seroma to disappear, the total aspirated volume, and the number of aspirations (2.3versus 10 days, 45 ml versus 189 ml and 2.1 versus 4.7 aspirations, resp). This was similar to that reported by Ten Wolde, et al. 2014, who stated a decrease in the mean number of aspirations from 4.86 to 2.40 and the volume of aspirations from 1660 ml to 611 ml with the non fixation group the earlier and the fixation group the later **(13).**

In (2006**)** Daltrey et al., stated; Significant reduction in seroma incidence, volumes and median numbers of aspirations. Trend towards decreased drainage. No change in hospital stay. In a subset analysis, quilting reduced the number of symptomatic seromas requiring aspiration in both extended autogenous and implant based procedures **(20).**

It was not a surprise to find that this maneuver prolongs the operative time significantly and we consider this the expense for reduction of postmastectomy seroma and all its sequels.

In our series, the overall complications rate is 15% (6/40) of cases with no mortality. This rate is less than that reported in most studies. Reported studies document that surgical morbidity from breast and or axillary wound occur in up to 30% of cases **(21).** Additionally, in the group with flap fixation only 2 cases (10%) developed cellulitis that was treated medically, while in the control group 2 cases developed cellulitis and 2 cases developed partial flap necrosis, this mean that the morbidity is less wih flap fixation.

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