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Closure of dead space after modified radical mastectomy: Does it reduce the incidence of seroma?

Ahmed Abdellatif Abdelkader

ABSTRACT

Breast cancer is the commonest cancer among females and considered as one of the leading causes of cancer deaths. Modified radical mastectomy (MRM) is the commonest procedure to be done for treatment of breast cancer in developing countries due to late diagnosis, and lack of screening programs. The aim of this study is to assess the importance of dead space closure technique after modified radical mastectomy as regards to; incidence of postoperative seroma, frequency of aspiration, and patient complications.

Methods and patients: This study was conducted on 40 female patients admitted to the Surgical Oncology Unit, Alexandria Main University Hospital, and were indicated to MRM during a period from April 2014 to December 2015. The patients were randomly divided into two equal groups; group A (20 patients had MRM with the closure of dead space by suturing the skin flaps to the underlying muscles (quilting), and group B (20 patients had MRM with the closure of wound by the conventional method without closure of dead space.

Results: Group (A) showed a significant reduction over the control group as regards to the daily drain output in the initial three postoperative days, the total amount of drained fluid and the drainage period (p=0.009, <0.001, <0.001 respectively), clinically significant seroma was observed in 22 of all patients. Group (A) showed a significant reduction in both rate and duration of seroma formation following drain removal compared to the control group. In cases of patients that develop seroma; the mean number of aspirations and the mean fluid volume aspirated were also decreased significantly in the group (A) compared to the control group.

Conclusion: It was found that closure of dead space significantly reduces the total amount of drained fluid leading to early drain removal, total volume of seroma aspirated, and post-operative wound complications had been decreased.

Key words: *Breast cancer surgery, seroma, dead space closure, modified radical mastectomy (MRM)*

Introduction

Breast cancer is the commonest cancer among females and considered as one of the leading causes of cancer deaths. Modified radical mastectomy (MRM) is the commonest procedure to be done for treatment of breast cancer in developing countries due to late diagnosis, and lack of screening programs [1,2].

Seroma is considered as a necessary evil after modified radical mastectomy; it is the most frequent complications after breast surgery; its incidence range from

Author affiliations : *Department of General Surgery, Faculty of Medicine, Alexandria University, Alexandria, Egypt*
Correspondence : *Ahmed Abdellatif Abdelkader, MD, Department of General Surgery, Faculty of Medicine, Alexandria University, Alexandria, Egypt*
e-mail: ahmedsurgery@yahoo.com
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15.5% to 90%. Seroma is defined as an abnormal collection of serous fluid in the dead space created after mastectomy or breast conservative surgery (BCS); it is either located under mastectomy flaps, axilla, or the cavity of excised mass in BCS. it usually causes sense of heaviness, limitation of shoulder movements, patient discomfort, and in sometimes it increases the incidence of wound dehiscence, infections, flap necrosis, and so delay in adjuvant therapy [3-8].

The management of seroma is usually done by frequent aspirations which may continue for months after surgery, or it may be self-limited if it is mild, but in sometimes seroma may be organized or encysted and need surgical intervention due to failure of conservative treatment [9].

The etiology of seroma is controversial; many studies were conducted on the composition of the fluid collected from seroma cavity and suggest an inflammatory nature, while others suggested that seroma is most likely to originate from the lymphatics. Some anatomical factors after MRM may also share in seroma formation [9-11].

Heavy axillary lymph nodes affection with subsequent extensive axillary dissection and skeletonization of axillary vein and neurovascular bundle results in damage to many blood vessels and lymphatics with subsequent oozing of lymph and blood. In addition to this, the space created after MRM with the shearing force between mastectomy flaps and chest wall which delay in fixation of the flap to the chest wall. However, in mastectomy with immediate reconstruction using the implant or tissue expanders the incidence of seroma was decreased by filling the dead space [12,13].

The optimal technique for reduction of seroma formation is still unknown, while many trials were done to reduce the incidence of seroma using fibrin glue, gentamycin, bovine thrombin application, buttress sutures. Application of tissue glue to close the dead space is still controversial, while mechanical pressure on mastectomy flaps doesn't reduce the incidence of seroma [14-21].

The aim of the study is to assess the importance of dead space closure technique after modified radical mastectomy as regards to; incidence of postoperative seroma, frequency of aspiration, and patient complications.

Material and Methods

This study was conducted on 40 female patients admitted to the Surgical Oncology Unit, Alexandria Main University Hospital, and were indicated to MRM during a period from April 2014 to December 2015. An informed written consent was taken from all patients included in the study after approval of hospital ethical committee.

The patients were randomly divided into two equal groups:

Group (A) included 20 patients having MRM with suturing of skin and subcutaneous flaps to underlying muscles using running sutures, polyglycolic acid Vicryl (Ethicon, USA), size 2/0 (the pectoral skin flaps to pectoralis major and axillary skin flaps to serratus anterior muscle).

The sutures will be placed medial to lateral with five to seven stitches and returned back again creating three to five rows with 3 cm between them from cranial to caudal to the upper flap. The lower flap will be quilted from caudal to cranial by one to three rows.

Three to four separate inverted sutures will be placed at the incision closure site; each suture will incorporate the subcutaneous fat and the deep dermis on the edge of the flaps and the underlying muscle (Figures 1,2).

Group (B) included 20 patients having MRM with the conventional method for closure of skin and subcutaneous; (control group).

At the end of the operation for both groups two

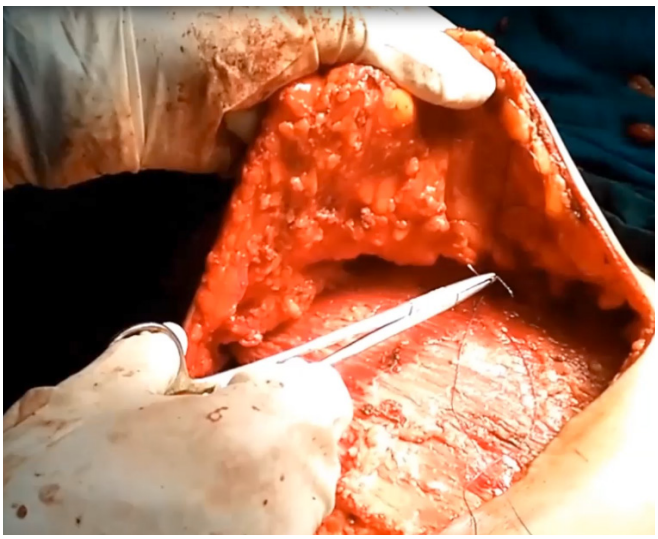

Figure 1. Closure of dead space by fixation of upper skin flap to pectoralis major muscle from medial to lateral.

Figure 2. Fixation of the lateral part of the upper skin flap to pectoralis major muscle after fixation of the medial part.

closed suction drains will be inserted, one in the axilla and one underneath the pectoral skin flaps, this is followed by application of light dressing.

All patients were encouraged to mobilize the shoulder from the first postoperative day and observed in the immediate postoperative days for occurrence of any complications as; hematoma, infection and flap necrosis. Drains were removed when they yield less than 50 cc for two consecutive days and then patients were observed at regular visits for detection of seroma formation.

Both groups were compared as regards clinically significant seroma formation, number and volume of aspirations and duration of seroma. The obtained results were recorded, represented and tabulated according to the collected data. The data obtained were analyzed according to the biostatistical tests of Chi-square test, Mann Whitney test, and Student t-test for comparing between the two groups.

Results

Demographic data:

The mean age of the studied patients was 54.43 years old; ranging from 35 - 85 years old. The majority of patients were between 40 to 60 years of age (70%).

The mean body mass index was 31.06 kg/m2 ranging from 24 kg/m2to 38.30 kg/m2. The majority of cases had body mass index between 30 and 35 kg/m2 (50%).

As regards to the breast size, bra cup size was used to assess the size of the breast. Most of the studied patients had breast cup sizes B and C.

Fourteen patients had history of using oral contraceptive pills (OCPs) (35%), while 26 patients (65%) gave no history of OCPs.

Eleven patients had positive family history of breast cancer in the first or second-degree relatives (27.5%), while 29 patients had no family history of breast cancer (72.5%).

Twenty-three patients had associated medical illness (57.5%); 17 of them had diabetes (42.5%),18 were hypertensives (45%) while 3 of them had cardiac problems (7.5%). Fifteen patients received neoadjuvant chemotherapy; of which seven patients were from the group (A), and eight patients were from the control group (B).

There was no significant difference between the two studied groups in relation to the factors as mentioned above.

Table 1. Comparison between the two studied groups according to amount and duration of drained serous fluid from the wound area.

	Group A (n= 20)	Group B (n= 20)	t	p
Total amount of drained fluid in first 3 days				
Min. – Max.	250.0 – 450.0	330.0 – 660.0		
Mean ± SD.	357.0 ± 51.21	414.50 ± 77.22	2.775*	0.009*
Median	365.0	410.0		
Total amount of drained serous fluid (ml)				
Min. – Max.	190.0 – 1340.0	430.0 – 3170.0		
Mean ± SD.	723.45 ± 363.64	2284.9 ± 1062.7	6.217*	<0.001*
Median	677.0	3047.0		
Day till drain removal				
Min. – Max.	5.0 – 14.0	10.0 – 19.0		
Mean ± SD.	10.10 ± 2.99	14.15 ± 1.95	5.071*	<0.001*
Median	10.50	14.0		

t, p: t and p values for Student t-test for comparing between the two groups. *: Statistically significant at p ≤ 0.05

Table 2. Comparison between the two studied groups according to rate and duration of seroma.

	Group A (n= 20)		Group B (n= 20)		Test of sig.	p
	No.	%	No.	%		
Seroma formation						
No	13	65.0	5	25.0	X^2=6.465*	0.011*
Yes	7	35.0	15	75.0		
Duration of Seroma	(n = 7)		(n = 15)			
Min. – Max.	6.0 – 27.0		6.0 – 42.0			
Mean ± SD.	10.29 ± 7.50		23.87 ± 12.91		Z=2.515*	0.012*
Median	8.0		21.0			

X^2, p: X^2 and p values for Chi-square test for comparing between the two groups. Z, p: Z and p values for Mann Whitney test for comparing between the two groups. *: Statistically significant at p ≤ 0.05.

Table 3. Comparison between the two studied groups according to the number of aspirations and volume of aspirated serous fluid.

	Group A (n= 7)	Group B (n= 15)	Z	p
Number of aspirations				
Min. – Max.	1.0 – 3.0	1.0 – 7.0		
Mean ± SD.	1.43 ± 0.79	3.13 ± 2.26	1.992*	0.046*
Median	1.0	2.0		
Volume of aspirations				
Min. – Max.	20.0 – 170.0	40.0 – 280.0		
Mean ± SD.	74.29 ± 63.73	139.33 ± 71.56	2.190*	0.029*
Median	50.0	120.0		

X^2, p: X^2 and p values for Chi-square test for comparing between the two groups. Z, p: Z and p values for Mann Whitney test for comparing between the two groups. *: Statistically significant at p ≤ 0.05.

Table 4. Comparison between the two studied groups according to postoperative pain.

	Group A (n= 20)	Group B (n= 20)
Postoperative pain (analgesic amp /day)		
1	1 (5.0%)	0 (0.0%)
2	3 (15.0%)	7 (35.0%)
3	10 (50.0%)	10 (50.0%)
4	6 (30.0%)	3 (15.0%)
Min. – Max.	1.0 – 4.0	2.0 – 4.0
Mean ± SD.	3.05 ± 0.83	2.8 ± 0.70
Median	3.0	3.0
Z (p)	1.219 (0.223)	

Z, p: Z and p values for Mann Whitney test for comparing between the two groups

Postoperative data:

Group (A) showed a significant reduction over the control group as regards to the daily drain output in the initial three postoperative days, the total amount of drained fluid and the drainage period (p=0.009, <0.001, <0.001 respectively); (Table 1).

Table 2 showed that clinically significant seroma was observed in 22 of all patients. Group (A) showed significant reduction in both rate and duration of seroma formation following drain removal compared to the control group.

In cases of patients that develop seroma; the mean number of aspirations and the mean fluid volume aspirated were also decreased significantly in the group (A) compared to the control group; (Table 3).

Table 4 showed that there was no significant difference between the two studied groups in relation to postoperative pain; (p = 0.223).

Morbidity in our study is minor, as complications had developed in 8 patients (20%). Four cases (10%) developed mild infection that was treated medically, three cases (7.5%) developed partial flap necrosis, and one case (2.5%) developed mild hematoma. There was no significant difference between the two

Table 5. Comparison between the two studied groups according to postoperative complications.

	Total (n=40)		Group A (n= 20)		Group B (n= 20)		X^2	FEp
	No.	%	No.	%	No.	%		
Hematoma	1	2.5	0	0.0	1	5.0	1.026	1.000
Infection	4	10.0	2	10.0	2	10.0	0.000	1.0000
Flap necrosis	3	7.5	1	5.0	2	10.0	0.360	1.000

X^2, p: X^2 and p values for Chi-square test for comparing between the two groups. FE: Fisher Exact for Chi-square test

Table 6. Relation between seroma formation and BMI in each group.

		Seroma formation				Test of sig.	p
		No		Yes			
		No.	%	No.	%		
Group A	BMI	n=13		n=7			
	<30 kg/m2	6	46.2	1	14.3		
	30 – 35 kg/m2	7	53.8	3	42.9	X^2=5.984*	MCp=0.045*
	>35 kg/m2	0	0.0	3	42.9		
	Min. – Max.	24.0 - 35.0		27.80 – 38.30			
	Mean ± SD.	30.27 ± 3.28		34.59 ± 3.34		T=2.775*	0.017*
	Median	30.30		34.60			
Group B	BMI	n=5		n=15			
	<30 kg/m2	5	100.0	4	26.7		
	30 – 35 kg/m2	0	0.0	10	66.7	X^2=7.793*	MCp=0.016*
	>35 kg/m2	0	0.0	1	6.7		
	Min. – Max.	25.40 – 28.40		28.50 – 35.70			
	Mean ± SD.	26.76 ± 1.21		31.53 ± 1.96		T=11.526*	<0.001*
	Median	26.80		31.30			

c2, p: c2 and p values for Chi-square test for comparing between the two groups. MC: Monte Carlo for Chi-square test. t, p: t and p values for Student t-test for comparing between the two groups. *: Statistically significant at p ≤ 0.05

studied groups in relation to postoperative complications; (Table 5).

By comparing the length of operation in the two groups: group (A) has shown prolonged duration of average 20 minutes over the control group, and this seems to be the main and only disadvantage of this technique.

On analyzing factors influencing the development of seroma; it was found that body mass index and hypertension have been significant influencing factors for seroma formation (Table 6, 7 respectively). However, diabetes mellitus, neoadjuvant therapy, breast size, tumor size, number of lymph nodes removed either total or positive, drainage volume during the initial three postoperative days, the total amount of drained serous fluid and drainage period have no significant relationship with seroma formation.

Discussion

The overall incidence of clinically significant seroma in our study was (55%); which appear to be high because of most of the Egyptian females have large sized breast, and complete axillary clearance was done in all patients. Closure of the dead space technique after mastectomy is associated with lower incidence of clinically significant seroma (35%) as compared to the control group (75%). In case of patients who developed seroma, the mean number of aspirations, the mean fluid volume aspirated and the duration of seroma decreased significantly after closure of the dead space compared to the control group. Chilson et al. noticed that after flap tacking, the incidence of seroma was decreased with reduction of the frequency of postoperative visits for aspiration [22]. The same finding was

Table 7. Relation between seroma formation and medical illness in each group.

		Seroma formation					
		No		Yes		X^2	FEp
		No.	%	No.	%		
Group A	**Medical illness**	**n=13**		**n=7**			
	DM	4	30.8	3	42.9	0.292	0.651
	HTN	2	15.4	5	71.4	6.282*	0.022*
	Cardiac	1	7.7	2	28.6	1.556	0.270
Group B	**Medical illness**	**n=5**		**n=15**			
	DM	0	0.0	4	26.7	1.667	0.530
	HTN	0	0.0	11	73.3	8.148*	0.008*
	Cardiac	0	0.0	0.0	0.0	-	-

X^2, p:X^2 and p values for Chi-square test for comparing between the two groups. MC: Monte Carlo for Chi-square test. t, p: t and p values for Student t-test for comparing between the two groups. FE: Fisher Exact for Chi-square test. *: Statistically significant at $p \leq 0.05$.

found in a prospective randomized trial, Coveney et al. comparing closure of dead space by suturing the skin flaps to underlying muscle with the conventional skin flap closure, it was found that the incidence of seroma was less with low amount of drainage fluid in the studded group compared to control group. O'Dwyer et al. showed that closure of the dead space is associated with low incidence of seroma with early drain removal after mastectomy [23].

In this study, after closure of dead space technique the total amount of fluid drained was significantly decreased with mean drainage volume of 723 ml in studied group versus 2284 in the control group. Ackroyd et al. noticed that the total drainage volume might reach up to 5 liters if the dead space not closed with no flap fixation [24].

We found that this technique significantly decreases the drainage period with mean duration of drainage is ten days in the studied group versus 14 days in the control group. These results do agree with the results recorded by Inwag et al. 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 [25]. Our results do also agree with the results achieved by Kopelman et al. who have mentioned that most of the surgeons tend to remove the drain if the amount of drained fluid is 50 ml or less in the preceding 24 h and this usually takes about 14 days if the flap fixation technique was not used [26].

In this study also revealed that after closure of dead space technique; the daily amount of drain in the first three postoperative days was significantly decreased with mean drainage volume of 357 versus 414 in control group. These results do agree with the results obtained from the Chinese randomized controlled trial recorded by Gong Y et al. which revealed that drainage rates in the quilting group were reduced in the first 72 hours following mastectomy [27].

In the current study, there was no statistically significant difference between the frequency of seroma and; histological type of the tumor, tumor size, tumor location, stage of cancer, neoadjuvant therapy, smoking, age of patient, breast size, and diabetes mellitus. Similarly Several studies showed no association between seroma formation with other factors such as diabetes mellitus, smoking, breast size (Say CC, et al. 1974), neoadjuvant therapy (Loo WT, et al. 2007), stage (Somers, et al. 1992), tumor size, side, grade, age of patient (Lumachi, et al. 2004), histological type (Chilson, et al.1992), and tumor location (Kumar, et al. 1995) [6,22,28-31]. On the other hand, our results indicate a positive correlation between seroma formation and body mass index and hypertension. Kumar et al. documented that hypertension is associated with an increase of seroma formation [6]. In contrast, the findings of the study conducted by Lumachi et al. did not find a significant association between body mass index and seroma formation [31].

Also in this study; there is no significant association between the number of lymph nodes removed either

total or positive and seroma formation which is similar to that obtained by Browse et al. who claimed that there is no association between positivity of lymph nodes and the incidence of seroma formation [32]. This was also proved by Lumachi et al. who reported that evidence was inconclusive regarding a correlation between number of positive lymph nodes, total number of removed lymph nodes and the incidence of seroma formation [31].

In the assessment of the relation between seroma formation and drainage volume during the first three postoperative days and the total amount of drained serous fluid and drainage period, this study revealed that there is no positive association between seroma formation and any of the factors as mentioned above. These findings correlate with the study done by Ackroyd et al. and Bonnema et al. that revealed no correlation between seroma formation and the total amount of drained serous fluid [24,33]. In contrast, Katsumasa et al. had reported a positive association between seroma formation and drainage volume during the initial three postoperative days [34]. Also, Tadych et al. found a significant relationship between the total hospital drain output and the frequency of seroma after modified radical mastectomy [3]. On the other hand, Akinci et al proved that there is no significant association between drainage period and seroma formation [35].

As regards to complication; in our study, the overall complications rate is 20% (8/40) of cases with no mortality. This rate is less than that showed by Hoefer et al who documented that surgical morbidity from breast and/or axillary surgery occur in up to 30% of cases [36].Additionally, in the closure technique only two cases (10%) developed cellulitis that was treated medically and one case (5%) developed partial flap necrosis , while in the control group 2 cases developed cellulitis, 2cases developed partial flap necrosis and one case developed hematoma.

Closure of dead space technique offers many advantages; easily performed by any breast surgeon, requires no supplementary material, very low cost and seems to be an option that aims to restore the integrity of tissue planes.

Ten Wolde et al. identified the increase in surgery time and the potential increase in postoperative pain as potential drawbacks to the closure of dead space technique [37]. Results from the present study did not show any significant difference in postoperative pain. As regards to difference in length of operation in the two groups; closure of dead space group has required approximately 20 minutes over the control group, and this seems to be the main and only disadvantage of this technique, but this difference became modest as operating skills improved. Other potential drawbacks are; the tight closure resulting from the sutures seems to give rise to some discomfort which could affect shoulder mobility. For this reason, all patients were advised for early shoulder movement from the first day after surgery to avoid long-term effects such as chronic pain and need for physiotherapy. And so no additional complications as dysfunction of shoulder mobility were observed. Also, the skin dimples result from the local traction from each fixation point of quilting sutures considered one of the drawbacks, at follow-up this effect disappear gradually resulting in a smooth looking of the overlying skin.

Overall, closure of dead space technique appears to be a more clinically and cost-effective treatment option for patients undergoing modified radical mastectomy compared with the conventional method of closure by potentially reducing the costs of postoperative complications (seroma formation, prolonged hospital stay, nursing care, repeated clinic visits, and longtime of morbidity). It also provides better cosmetic with less skin breakdown with high patients satisfaction.

We can conclude that closure of dead space technique after MRM significantly decreases the daily drain output in the initial three postoperative days and the total amount of drained fluid allowing early removal of the drains. It also reduces the rate and duration of seroma formation. Also, it significantly decreases the number of aspirations and volume of aspirated fluid.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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