

Original Research Article

A prospective study of factors affecting seroma formation after modified radical mastectomy in patients of carcinoma of breast

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ABSTRACT

Background: Seroma, a clinically evident subcutaneous collection of serous fluid after breast cancer surgery, developing in approximately 30% of cases. To prevent seroma formation, it is important to estimate individual risk of seroma formation, i.e., the identification of predictive variables will be helpful in designing future trials aimed at reducing the incidence of this seroma. This study intends to find out the association between certain pre-operative, intra-operative, and post-operative factors related to MRM and incidence of seroma formation.

Methods: It was an observational prospective on 100 females undergoing MRM at Department of Gandhi Medical College Bhopal, Madhya Pradesh, India. Patients were observed postoperatively for seroma formation and factors affecting it.

Results: patients with seroma formation in this study tended to be older age (age, 62.60 ± 10.40 years versus 56.13 ± 10.31 years; $p < 0.001$) and more obese (BMI, 26.95 ± 4.2 versus 24.61 ± 3.61 ; $p < 0.001$). Higher amount of initial drain volume was directly related to seroma formation. Initiation of arm physiotherapy after surgery (3.14 ± 0.23 days versus 2.17 ± 0.74 days; $p = 0.043$).

Conclusions: The incidence of seroma is higher in older and in more obese patients. The incidence is decreased by flap fixation under muscles and early physiotherapy. Furthermore, few interventions in the operative period can help minimize the chances of seroma formation.

Keywords: Carcinoma breast, Modified radical mastectomy, Seroma

INTRODUCTION

Carcinoma of the breast is one of the most common malignancies. More than a million cases of breast cancer are diagnosed worldwide each year.¹ It is responsible for 30% of all cancers in women and causes 16-17% of all cancer-related deaths.²

The Consensus Development Conference on the treatment of breast cancer in 1979 stated that the modified radical mastectomy (MRM) was the standard of treatment for stages I and II breast cancer.³ Ever since the time of Halstead, who first carried out mastectomy in 1882, surgeons have faced several problems such as

necrosis of skin flaps, the breakdown of the wound, hematoma, seroma, and infection should be aware of the morbidity unique to mastectomy and axillary node dissection. Among them, seroma, a clinically evident subcutaneous collection of serous fluid within a surgical cavity, is the most frequent post-operative complication after breast cancer surgery, developing in approximately 30% of cases.⁴

To prevent seroma formation, it is very important to predict the individual risk of seroma formation, i.e., the identification of predictive variables will be helpful in designing future trials aimed at reducing the incidence of this common complication of mastectomy. This study was done to find out the association between pre-

operative, intra-operative, and post-operative factors which are related to MRM and incidence of seroma formation to achieve above mentioned objective.

METHODS

This was a prospective, observational hospital-based study involving 100 female patient undergoing MRM from 2017 to 2020 (over a period of 2.5 years) at Department of Gandhi Medical College and Hamidia Hospital, Bhopal, Madhya Pradesh, India between having histopathologically proven carcinoma breast. After taking approval from institutional ethical committee and individual patient consent, each patient underwent detailed history-taking, clinical examination and a series of investigations as per the proforma before selection. observation of patients from admission to final outcome of management at discharge or death was carried out. Preliminary ultrasound breast was conducted. Finally, all data thus collected, was compiled and presented in the tables.

The factors observed preoperatively in these patients were age, nutritional status (defined by body mass index), pre-operative hemoglobin (Hb) level, pre-operative serum protein level, presence or absence of clinically palpable lymph nodes, size of primary tumor while intraoperatively they were observed for modality used for dissection of flap (scalpel or electrocautery), axillary lymph node dissection by harmonic focus and electrocautery, mechanical closure of dead space done by suture fixation, technique of skin closure, total drainage volume on 1st post-operative day, days taken to reach drainage volume <30 ml and post-operative days after which physiotherapy of arm started.

These patients were observed postoperatively for seroma formation which was defined as clinically apparent swelling in subcutaneous space in the axilla or under the flaps. The post-operative on which days seroma was first observed was also noted. The diagnosis was confirmed by aspiration and cytological analysis of aspirate. Drain removal was done when the drainage output reduced to a minimal amount in 48 hours or duration of drain removal was also noted.

Inclusion criteria

This study included all the female patients more than 18 years of age undergoing elective breast MRM surgery and Patients who are ready for investigation and treatment for their condition and gave the consent of study.

Exclusion criteria

Patients less than 18 year of age, those who refused investigation and treatment and patients undergoing conservative breast surgeries, immediate breast reconstruction, having metastatic disease, pregnancy,

lactation, medical contraindication for surgery, metabolic disorders or in whom primary closure of skin could not be achieved, were excluded from this study. Male patients with carcinoma breast were also excluded.

After tabulating the observations, statistical analysis was done using SPSS Statistics Data Editor Software. Incidence of seroma in the study sample was calculated, and Chi-square test and unpaired Student's t-test were applied to determine whether a particular factor significantly affected the incidence of seroma.

Operative technique

The choice of skin incision and the design of skin flaps were carefully planned with respect to the quadrant in which the primary neoplasm was located so that adequate margins could be ensured, and primary closure achieved. The limits used, were delineated laterally by the anterior margin of the latissimus dorsi muscle, medially by the sternal border, superiorly by the subclavius muscle, and inferiorly by the caudal extension of the breast approximately 3 to 4 cm below the inframammary fold. Removal of the breast was carried out from superior to inferior with the inclusion of the pectoralis major fascia. The breast, inclusive of the skin and elevated pectoralis fascia, was elevated en bloc. The loose areolar tissue of the lateral axillary space was then elevated after careful identification of the lateral extent of the axillary vein. Resection of the axillary nodes was performed en bloc to prevent disruption of lymphatics in the axilla. The medial limit of dissection was costo-clavicular ligament (Halstead's ligament) while laterally the tendon of latissimus dorsi (LD) and thoracodorsal pedicle (containing thoracodorsal nerve, artery and subscapular vein) were the reliable anatomical end points. The superior limit of axillary dissection was considered to be axillary vein while the floor is formed by subscapularis muscle and lower limit of axillary dissection, angular vein (that joint thoracodorsal vein to form the subscapular vein) to be reliable and constant landmark. The dissection of axillary lymph node level 1 with extirpation of central (level 2) groups and sometimes with apical nodal (level 3) groups. At least ten lymph nodes were procured for accurate prognostication. Care was taken to identify and preserve the thoracodorsal neurovascular bundle, which lies deep in the axillary space and is fully invested with loose areolar tissue and nodes of the lateral group. Once the chest wall and medial axillary space were encountered, the long thoracic nerve was identified and preserved. Then some wound flap was closed by quilting (quilting technique in the upper flap from medial to lateral by a continuous suture that fixes the under surface of the upper flap to the pectoral fascia with care to avoid entangling the dermis which results in unsightly dimpling. The second row was done by the same continuous suture from lateral to medial till the medial angle. The same was done for the lower flap. Lastly the axilla was obliterated by suturing its lateral wall to the fascia of the serratus anterior and medial axillary wall)

and some wound closed by without quilting after adequate haemostasis with two suction drains in place.

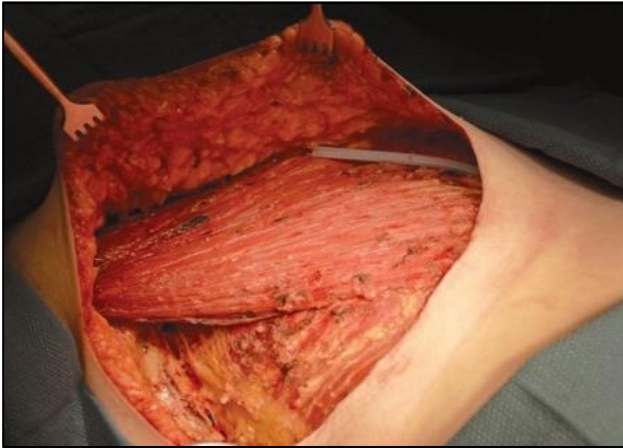


Figure 1: Elevation of flap in modified radical mastectomy.

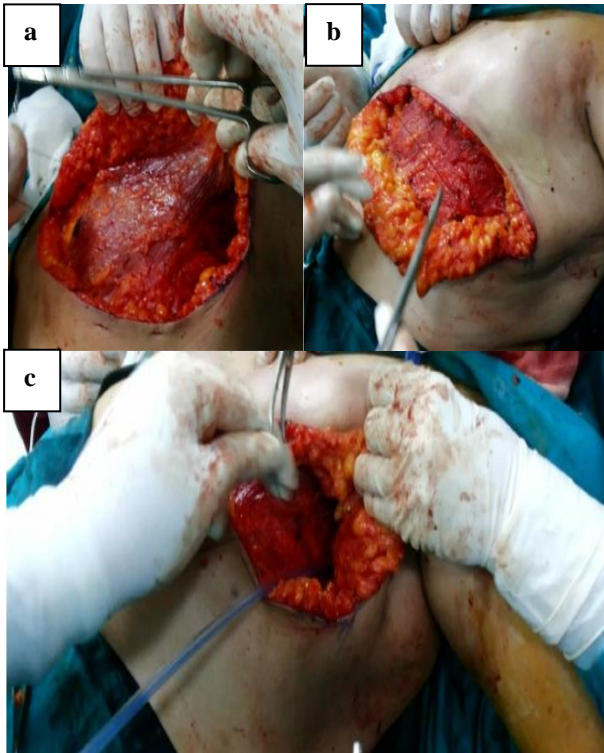


Figure 2: (a) Quilting of upper flap, (b) the lower flap, and (c) the axilla.

On statistical analysis, chi-square and student's t-test were applied on these observations and p values were obtained. $P < 0.05$ were considered significant.

RESULTS

Tables represent that patients with seroma formation in this study tended to be older (age, 62.60 ± 10.40 years versus 56.13 ± 10.31 years; $p < 0.001$) and more obese (BMI, 26.95 ± 4.2 versus 24.61 ± 3.61 ; $p < 0.001$).

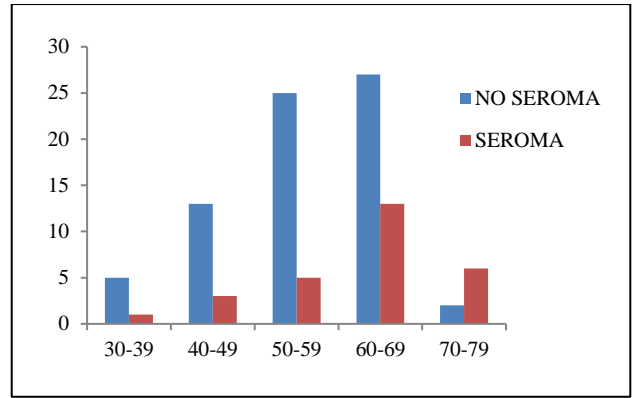


Figure 3: Correlation between age and seroma formation.

This graph is directly correlated with seroma formation.

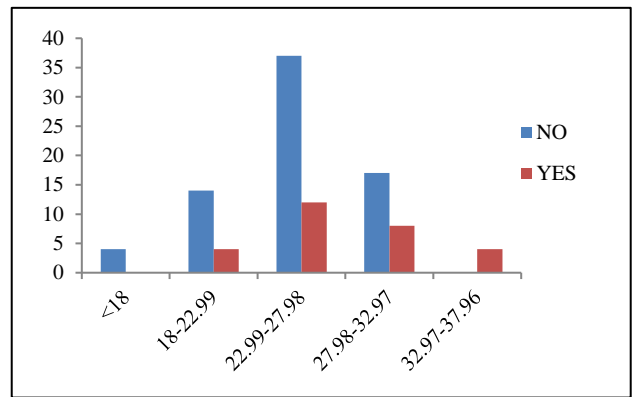


Figure 4: Correlation between BMI of patients and seroma formation.

Besides, there was a trend of increasing post-operative seroma formation in patients having initially higher amount of drainage volume on first post-operative day has longer significant drainage volume (72.36 ± 29.42 ml versus 48.40 ± 19.20 ml; $p < 0.001$).

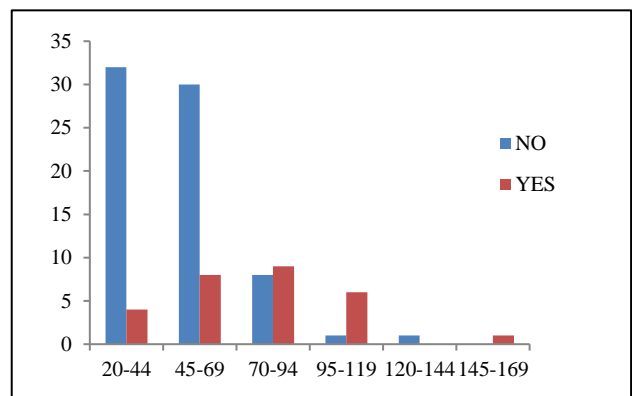


Figure 5: Correlation first post-operative day drain volume and seroma formation.

First post-operative days has been analyzed in association with incidence of seroma in any of the studies that we

reviewed (72.32 ± 29.4 seroma group versus 48.40 ± 19.20 nonseroma group $p < 0.003$) (Figure 5) and significantly longer time taken to reach drain volume below < 30 ml (TTV30, 7.14 ± 2.03 days versus 5.22 ± 1.65 days; $p < 0.001$) (Figure 5).

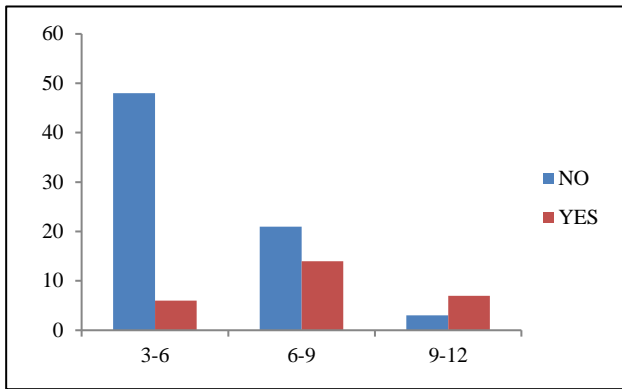


Figure 6: Correlation between drain remove day and seroma formation.

The interventions which resulted in a significantly decreased proportions of patients developing seroma were suture fixation of skin flap to the underlying muscle layer (6.67% versus 42.86%; $p < 0.001$) and earlier initiation of arm physiotherapy after surgery (3.14 ± 0.23 days versus 2.17 ± 0.74 days; $p = 0.043$).

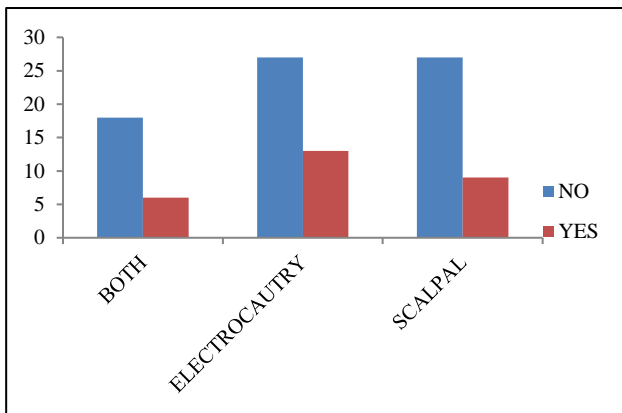


Figure 7: Correlation between method of dissection of flap and seroma formation.

Figure 7 suggests that seroma formation is more with the use of electrocautery.

Table 1: Correlation between method of flap fixation to underlying structure and seroma formation.

Seroma quilting	Seroma formed	
	No	Yes
No	34	17
Yes	38	11

Suture fixation with muscles also known as quilting is associated with lower incidence of seroma formation.

Table 2: Correlation between post op arm physiotherapy day and seroma formation.

Post op arm physiotherapy day	Seroma formed	
	No	Yes
1-2	25	1
2-3	36	7
3-4	9	14
4-5	2	6

Early induction of physiotherapy is associated with reduced risk if seroma formation.

Table 3: Correlation between harmonic focus versus electrocautery ALND dissection and seroma formation.

Modality used	Seroma formed	
	No	Yes
Electrocautery	35	17
Harmonic	37	11

The harmonic focus versus electrocautery dissection of axillary lymph node was statically not significant in relation to seroma formation ($p > 0.05$) and delay in recovery post operation day harmonic focus versus electrocautery was statically significant ($p < 0.05$).

Table 4: Observations and statistical analysis for categorical variables.

Characteristic	Seroma	No seroma	P value
Size of primary tumor (cm)			
1-3	2	15	0.704
3-5	1	23	
5-7	8	26	
7-9	11	7	
9-11	5	1	
11-13	1		
Clinically evident axillary lymph nodes			
Yes	15	31	0.442
No	13	41	
Method of dissection of flaps			
Scalpel	9	27	0.422
Electrocautery	13	27	
Both	6	18	
Suture fixation of flap to muscle layer done			
Yes	11	38	$< 0.001^*$
No	17	34	
Method of skin closure			
Simple	14	43	0.396
Subcuticular	14	29	
Axillary lymph node dissection		> 0.05	
Harmonic focus	11	37	
Electrocautery	17	35	

*Indicates significant association ($p < 0.05$)

DISCUSSION

Seroma is the most common complication of axillary surgery in patients of carcinoma breast.⁴ The incidence of seroma has been reported variably as 2.5-51% in different series.⁶ In our study, the incidence reported was 28% (N=28) which is consistent in range with most of the studies.

In our study, we found a significant association of increasing age of the patient with a higher incidence of seroma (62.60±10.4 years seroma group versus 56.13±10.13 years non seroma group $p<0.001$). This observation was consistent with other contemporary studies conducted by Lin et al (58.71 seroma group vs 51.00 years non seroma group $p<0.001$).⁸ In different study trail (seroma formed 18% of total 80 patients, age 65.00±6.10 years seroma group versus 49.05±8.76 years non seroma group $p<0.001$) and Akinci et al study.

A total of 40 patients with a mean±age of 53±11 years was included in this study. Nine patients (27.5%) developed seroma after mastectomy. Two out of 21 patients less than 50 years of age developed seroma (9.5%) with an incidence statistically similar to older patients (36.8%).

As in our study, higher the BMI i.e. more obese (BMI, 26.95±4.2 versus 24.61±3.61 $p<0.001$) higher incidence of seroma was noted in obese patients who were in accordance with series of Burak et al and van Bommel et al and Anjani et al (BMI- 28.33±0.60 seroma group versus 22.81±2.98 non seroma group $p<0.001$).¹⁰⁻¹² And other study Suresh et al study. In this study 54 patients have done MRM in patients BMI more than >30 in which 19 patients developed seroma and 29 patients' BMI was less than 30 in which 4 patients developed seroma (p value <0.03) which was significant. This can be explained based on increased serous exudation in tissues with higher content of adipose cells, and associated comorbidities commonly found in obese.

In our study drainage volume on first post-operative days has been analyzed in association with incidence of seroma in any of the studies that we reviewed (72.32±29.4 seroma group versus 48.40±19.20 non seroma group $p<0.003$), but in general, higher drainage volumes have been significantly associated with higher incidence of seroma in studies by Lin et al and Burak et al and Anjani et al (drain volume first postoperative day 111.11±20.26 seroma group versus 53.39±24.81 non seroma group $p<0.001$) show significant association in this study.^{8,10,12}

Similar observations were noted for the time duration taken after surgery by the drainage volume to reduce to <30 ml (TTV30). In our study TTV <30 ml (7.14±2.03 in day in seroma group and 5.22±1.65 days in non-seroma group $p<0.001$). This signifies that in patients having more and longer drain outputs are more likely to develop

seromas in studies Anjani et al (18.61±1.24 in days in seroma group and 3.77±0.96 days in non-seroma group $p<0.001$).¹²

Third interventions in our study showed negative influence on seroma incidence in our study. First of them, suture fixation of skin flap to underlying pectoral muscles significantly and dramatically resulted in seroma prevention, probably by reducing the dead space under the flaps. 49 patients in our study flap fixation done the 11 patients developed seroma and 51 patients flap fixation was not done show 17 patients develop seroma $p<0.001$ show significant association. In Anjani et al study 45 patients done flap fixations 3 patient developed seroma and in 35 patients flap fixation was not done and 15 developed seroma $p<0.001$.¹² This is consistent with observations of Ozaslan et al and van Bommel et al.^{11,13}

Also, results of our study show that an earlier mobilization and physiotherapy of ipsilateral shoulder and arm can result in decreased seroma incidence (post-operative days after which arm therapy started seroma group 3.14±0.23 and non-seroma group 2.17±0.74 $p<0.043$) delayed physiotherapy cause more seroma. In Anjani et al study post-operative days after which arm physiotherapy started 3.06±0.64 days seroma group and 2.65±0.77 in non-seroma group $p<0.03$.¹² This is contrary to results of van Bommel et al while most other studies report an inconclusive relationship between them.¹¹

Use of harmonic focus showed negative influence on seroma incidence in our study than the use of electrocautery. Seroma formation is decreased by use of harmonic in place of electrocautery. The delay in recovery post operation harmonic focus versus electrocautery in axillary lymph node dissection are statistically significant that means in usage of harmonic post op recovery is better than electrocute likewise in study by Qinging He et al.¹⁴ In this study harmonic focus was used on 64 patients and electrocautery was used for other 64 patients in axillary lymph node dissection. 2 patient developed seroma in harmonic focus group and 3 patients developed seroma by electrocautery. In our study in 48 patients done axillary lymph node dissection was done by harmonic focus and 11 of them developed seroma; 58 patients were done electrocautery ALND sand 17 patients developed seroma (p value >0.05) was not significant but harmonic focus use for axillary lymph node dissection decrease seroma formation and associated morbidity. In Khan et al study, in 75 patients ALND was done by harmonic and 16 patients developed seroma; 75 patients ALND was done by electrocautery and 25 patients developed seroma ($p=0.071$) which was not significant. But use of harmonic focus decreased seroma formation.

The factors which did not show any significant positive or negative impact on seroma incidence in our study sample were gender, tumor size, clinically detectable axillary lymphadenopathy, pre-operative Hb, pre-

operative serum total protein, modality used for dissection of flaps and method of skin closure, diabetes mellitus and hypertension.

CONCLUSION

Seroma is not just an unnecessary complication, but a significant contributor to morbidity in carcinoma breast patients. As mastectomy itself is emotionally and physically trauma to the patient, it is important to identify the risk factors for seroma formation and stratify the patients in high-risk and low-risk groups to have a high index of suspicion and early diagnosis and appropriate intervention in affected cases, which has been the aim of this study. Furthermore, few interventions in the perioperative period can help minimize the chances of seroma formation, but further ongoing research in this regard is much needed. On above observations and discussion, we conclude that older, more obese patients with longer and higher drain outputs should be closely scrutinized for seroma.

Since our study was conducted in a relatively small sample, it is recommended to repeat similar studies in larger and more variable study sample to fortify the statistical power of the observations. Furthermore, as our study does not take into account the various chemical and biological additives that have been used in different studies to reduce seroma formation, it is recommended to include their role in further studies.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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