



A Comparative Study Between Mastectomy Flap Quilting Sutures with Axillary Drain Versus Conventional Sutures with Axillary and Pectoral Drain in Reducing Post-Modified Radical Mastectomy Seroma Formation

Mohit Bhagchandani^{1,2} · Vigya Shukla¹ · R. K. Maurya¹ · Ashish Chaudhary¹ · Kuldeep Kumar¹

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Abstract

The aim of this study was to compare quilting suture with axillary drain versus conventional sutures with axillary and pectoral drain on the formation of seroma after modified radical mastectomy with axillary lymph node dissection. The study was undertaken among 90 female patients with breast cancer who were candidates for modified radical mastectomy with axillary clearance. The intervention group ($N=43$) with quilting and axillary drain placement and the control group ($N=33$) without quilting with axillary and pectoral drain placement. All the patients were followed up for complications pertaining to this procedure. There were no significant differences between the two groups with regard to demographic characteristics, comorbidities, pre-operative chemotherapy, post-operative pathological findings, lymph node involvement or clinical staging. The incidence of seroma formation on follow-up was significantly lower in the intervention group than that in the control group (23% versus 58%; $p < 0.05$) whereas there was no significant difference with respect to flap necrosis, superficial skin necrosis and wound gaping between the two groups. Furthermore, it took a shorter duration for seroma to resolve in the intervention group (4 days versus 9 days; $p < 0.001$) with a smaller duration of hospital stay (4 days versus 9 days; $p < 0.001$). The use of quilting sutures for flap fixation in order to obliterate dead space post-modified radical mastectomy with placement of axillary drain significantly reduced seroma formation along with shorter duration of wound drainage and a smaller hospital stay with only slightly increased operative time. Therefore, we recommend quilting of flap as a routine step after mastectomy.

Keywords Quilting · Seroma · Modified radical mastectomy

Introduction

Breast cancer is a heterogeneous disease caused by progressive accumulation of genetic aberrations, including point mutations, chromosomal amplifications, deletions, rearrangements, translocations and duplications. The vast majority of breast cancers appear to occur sporadically and are attributed to somatic genetic alterations. Breast cancer is the most common malignancy among women around the world [1]. Breast cancer has remained the second leading cause of cancer death among women worldwide over the past three

decades and contributes significantly to cancer surgical load [2]. Surgery remains the mainstay of early breast cancer (EBC) and most locally advanced breast cancer (LABC) patients. All breast cancer patients should be treated using a protocol-based multi-modality treatment plan.

While an ever-increasing proportion of EBC and many post-NACT large operable breast cancer (LOBC) and LABC patients are now being offered and treated with breast conservation surgery. Modified radical mastectomy remains the most common surgical procedure employed in definitive management of breast cancer. MRM is indicated in all EBC and LABC patients who cannot be offered breast conservation (e.g. multicentric cancer, contraindication for radiotherapy, pregnancy, certain connective tissue disorders) or those who are not willing to undergo breast conservation.

A seroma is a collection of fluid containing fat, serum and lymph that develops at a surgical wound or dead space

✉ Mohit Bhagchandani
mohitbhagchandani291994@gmail.com

¹ Department of General Surgery, GSVM Medical College, Kanpur, India

² Lucknow, India

from surgery. Seroma formation is the most frequent post-operative complication seen after mastectomy and axillary surgery with an incidence of 3 to 85% [3]. Seroma is defined as a serous fluid collection that develops under the skin flaps or in the axillary dead space following mastectomy and/or axillary dissection. Throughout history, there have been many theories hypothesized regarding the origin of seroma. Several risk factors and predictors include age, breast size, comorbid conditions, presence and number of malignant nodes in the axilla, previous surgical biopsy and use of heparin or tamoxifen [4–6]. It has been conjectured that seromas form as an exudate from an acute inflammatory reaction following surgical trauma [6] to increase serous fluid collection in response to increased fibrinolytic activity in serum and lymph [7]. Low fibrinogen levels in seromas compared with those in plasma during the post-operative period [8] support the hypothesis that seroma most likely originates from lymph [9]. Seroma formation is influenced by an array of surgical techniques and devices [10–13], thus leading to varying incidences of seroma in different studies.

Many methods have been invented since time and again in order to reduce seroma formation which can help ease the discomfort associated with sequelae of the same. Drains have traditionally been used in the prevention of seroma formation to obliterate the dead space by opposing the mastectomy flap against the chest wall, encouraging discharge of patients with drain in situ. Nonetheless, prolonged drainage was found to be troublesome as it increased the risk of infection which in turn could significantly delay adjuvant therapy, discharge from hospital increasing morbidity and psychological anxiety of the patient.

Many alternatives have emerged for obliteration of dead space which have been used either in collaboration with or by completely replacing the use of drains former resulting in an increased efficiency overall. The use of quilting sutures can not only reduce seroma formation but also help in accelerating the re-alignment of tissue planes post-mastectomy curbing the cause in its crib. The aim of the current study was to emphasise the essence of quilting after mastectomy in significantly reducing post-mastectomy sequelae.

Patients and Methods

This study was conducted in the Department of General Surgery, associate LLR hospitals, GSVM Medical College, Kanpur, from January 2021 to October 2022 on patients who were admitted from casualty and outpatient's department with a diagnosis of carcinoma breast. Patients in good general condition undergoing MRM for breast carcinoma within 18 to 70 years of age willing for regular follow-up were enrolled in this study. Patients undergoing mastectomy without axillary dissection or those opting for breast

conservation surgery and those with inoperable disease were excluded.

The sample size was calculated and decided by the ready reckoner. It was calculated against the population size of 100 patients with a confidence interval of 95% and a 5% margin error. In this study, randomized cases were divided into two groups—the study group and the control group. Both groups were compared using statistical techniques. Due to the implications of COVID-19 infection, the sample size is comparatively small with 45 patients in each group. The loss to follow-up both in the control arm and the study arm is due to the stigma of COVID-19 as a result of which most of them tried to avoid visiting hospital premises. The study was approved by the Ethics Committee of the GSVM Medical College and informed consent forms were obtained from all the patients.

The prospective randomized control study was conducted in one surgical unit of a tertiary care centre over a period of 2 years, Department of Surgery, GSVM Medical College Kanpur. Ninety FNAC (fine-needle aspiration cytology)/TRUECUT biopsy-proven cases of early breast carcinoma and locally advanced breast cancer were randomized (using randomly ordered sealed chits, which were opened immediately at the time of surgery) into 43 cases where quilting sutures were applied for closure along with axillary drain placement and 33 cases of conventional wound closure with drain placement both at the pectoral and the axillary area connected to a single vacuum port outside. The two groups were comparable in respect of age, BMI, type of operation i.e. modified radical mastectomy (MRM) and extent of axillary dissection.

Following a complete routine and metastatic workup, all patients underwent Auchincloss's modification of radical mastectomy. Surgery was performed by the same surgical team comprising five surgeons (two senior and three resident surgeons) using a standardized technique with a scalpel and electro-cautery to achieve haemostasis. Axillary dissection was done up to level II/III in all the cases and the difference with respect to dissection done up to level II/III among the two groups was statistically insignificant (0.698). The boundaries of axillary dissection were defined by superior limit as the posterolateral border of the pectoralis major muscle and axillary vein, medial limit being clavipectoral fascia or Hallstead's ligament, lateral limit as the anterior border of Latissimus dorsi and the inferior limit being the angular vein joining the thoracodorsal vein. The long thoracic and thoracodorsal nerves were identified, dissected and preserved. Universal precautions such as maintaining a mastectomy flap thickness of more than 8mm, avoiding flap closure under tension, compression bandaging were practised in both groups.

Two silicone tube drains (16Fr) (one axillary and pectoral) were inserted in patients where conventional closure

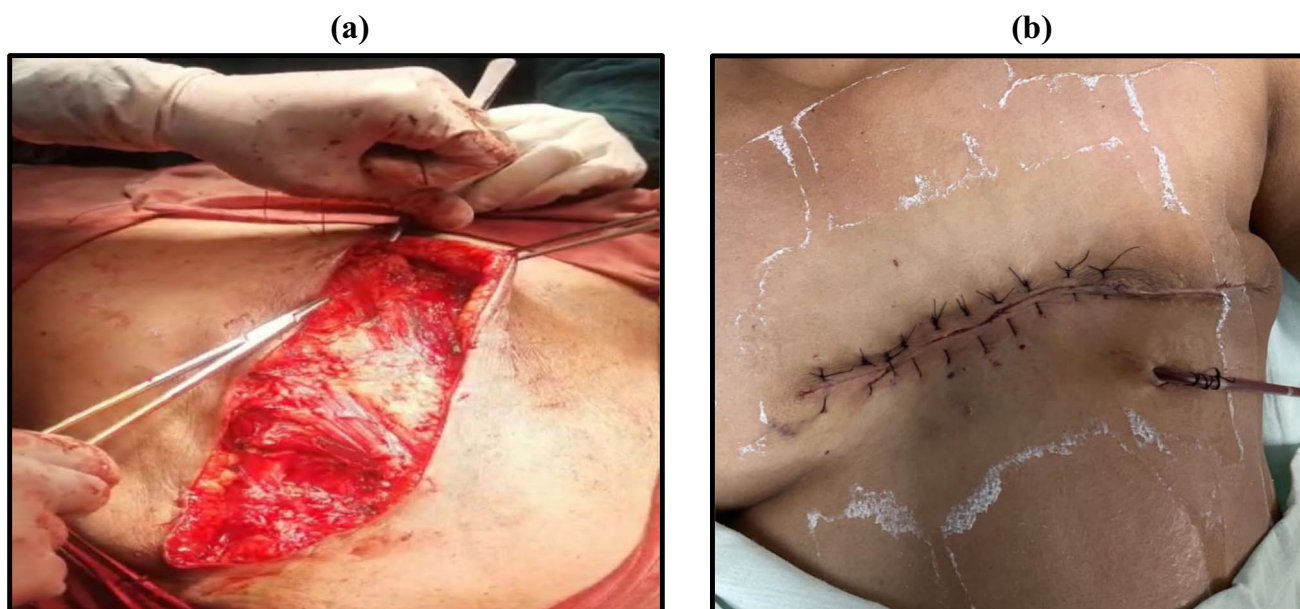


Fig. 1 a Quilting technique; b post-operative photograph after wound closure with quilting technique

of the wound was done whereas in the intervention group quilting sutures were applied in two rows using interrupted vicryl 2–0 sutures along the inferior and medial border of the flaps in the intervention group along with placement of a single drain in the axillary area (Figs. 1 and 2).

All resected specimens were examined and the lymph nodes dissected, counted and assessed histo-pathologically for metastasis. Compression dressing consisting of a circumferential chest wrap of two 6-inch crepe bandages, held in place by circumferential Elastoplast bandage, was applied by the same resident. No patient received an intra-operative blood transfusion. The drains were connected to a single 800 ml suction bottle (Romo Vac, Romson) using complete vacuum negative suction (700 g/m^2).

The two groups were comparable with respect to age, body mass index and type of operation indicating the success of randomization. The drain was emptied every 24 h to reset suction at the respective pressures and to measure the daily drain output. Following drainage and dressing, the patients were encouraged to do active and passive shoulder exercises few on POD 1 and others on POD 5. The outcomes measured were morbidity in the form of seroma, axillary drainage volume, superficial skin necrosis, flap necrosis, wound gaping and the length of hospital stay. The total drain output was measured and recorded daily in both groups, the drains were removed once the output was less than 30 ml in 24 h and the patients were discharged on the same day. The mean total drain output was measured in each group and compared. The mean hospital stay in both groups was calculated and compared. The associated

morbidity in the form of seroma formation (where seroma is defined as a collection of fluid containing fat, serum and lymph that develops at a surgical wound or dead space from surgery), flap necrosis and wound infection during the post-operative period was recorded and compared in both the groups.

Patients were discharged 24 h after drain removal with no other wound complications. After discharge from the hospital, all the patients were followed up on an outpatient basis for 4 weeks, to check for any seroma formation by palpation and for sterile tapping if present any. Patients were also followed up for other complications like skin necrosis, flap necrosis, wound gaping and other comorbidities if any and managed accordingly.

Data Processing and Analysis

Statistical analysis and descriptive statistics were performed with SPSS version 25. The data normality was checked by using the Kolmogorov–Smirnov test. The comparison of variables which were quantitative and not normally distributed was analysed using the Mann–Whitney test and variables which were quantitative and normally distributed in nature were analysed using the independent *t* test. The comparison of variables which were qualitative in nature was analysed using the chi-square test. The significance level was considered as 0.05 in this study.

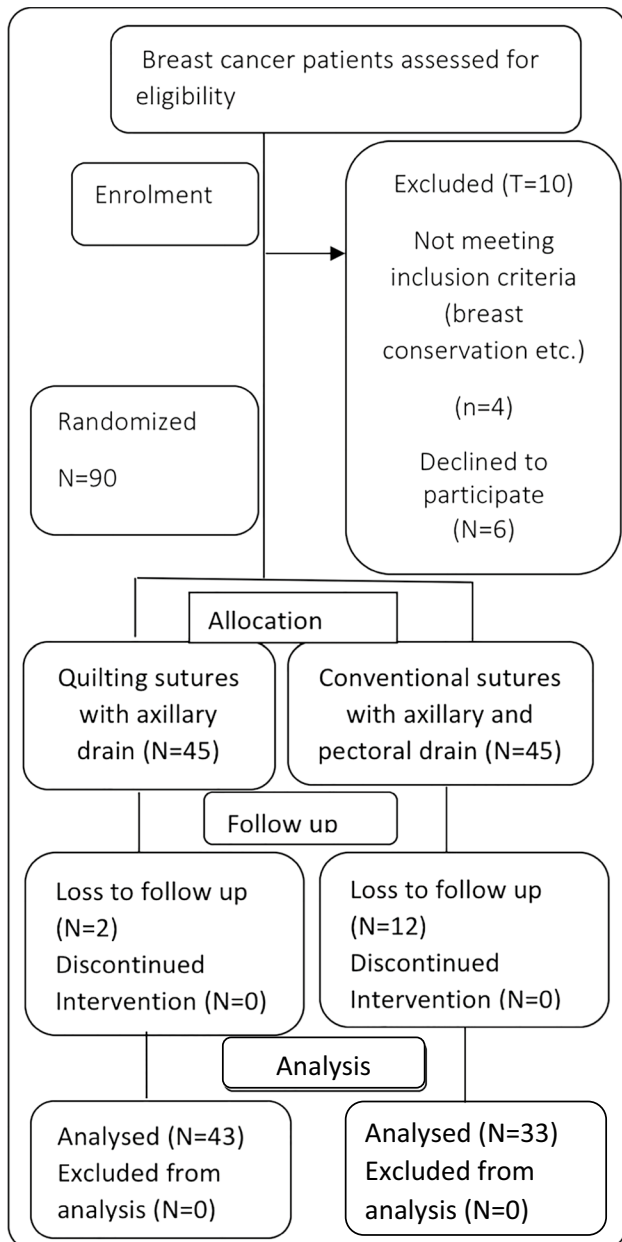


Fig. 2 Total patient enrolment and exclusion flowchart

Results

On follow-up, the incidence of seroma formation was significantly lower in the quilting group as compared to the conventional group ($p < 0.00407$).

The operative time was slightly increased in the quilting group (70 min) than in the conventional group (64 min) ($p < 0.0001$).

The length of hospital stay was 4 days in the quilting group versus 9 days in the conventional group ($p < 0.0001$).

Table 1 shows the comparison of baseline characteristics such as age, body mass index, clinical stage of the disease, comorbidities such as diabetes and hypertension and

neoadjuvant chemotherapy among the two groups. There was no significant difference in the baseline characteristics of the two groups that is the groups are similar with respect to these characteristics.

Table 2 shows a comparison of the two groups with respect to seroma formation, superficial skin necrosis, flap necrosis, wound gaping, time of drain removal and duration of hospital stay.

Although there was an increased operative time in the quilting group, there was a marked reduction in seroma formation with an earlier drain removal and patient discharge which greatly comforted the patients.

Discussion

Modified radical mastectomy is still a common procedure for breast cancer patients [14]. Seroma formation is the most common complication after breast cancer surgery [16]. Quilting of the flaps to the underlying muscle has proven benefits over simply suturing the edges of the flap together with drain placement [15]. Seroma is a collection of serous fluid in the space between the chest wall and skin flaps following mastectomy or axillary dissection occurring at rates ranging from 3 to 85% [16]. There are many methods that have the potential to reduce the incidence of seroma, although not one single method truly prevents seroma formation [17]. In assessing the severity of seroma, the Common Terminology Criteria for Adverse Events v3.0 grades seroma as grade 1 if asymptomatic, grade 2 if symptomatic (medical intervention or simple aspiration indicated) and grade 3 if symptomatic (interventional radiology or operative intervention indicated). Moreover, seroma formation can in turn delay wound healing, increase rates of surgical site infection and bear the brunt on the health as well as psychological status of the patient in addition to halting the adjuvant therapy.

Although the etiopathogenesis of seroma formation is unclear, many factors are thought to play a pivotal role in its formation [18]. In the current study, seroma formation was significantly increased in overweight patients. However, with respect to other risk factors such as age and comorbidities such as diabetes and hypertension, neoadjuvant chemotherapy had no significant impact on seroma formation.

Coveney et al. [19] were the first to publish a prospective study on flap fixation after mastectomy using sutures. There are a plethora of studies available which have elaborated on the use of tissue glue or flap fixation for the mechanical obliteration of the dead space created post-mastectomy. Van Bastelaar et al. [20] conducted a retrospective study comparing these two methods of flap fixation with conventional wound closure and demonstrated a significant reduction in seroma formation after mechanical flap fixation using either technique. Although literature claims quilting to be

Table 1 Comparison of baseline characteristics such as age, body mass index, clinical stage of the disease, comorbidities such as diabetes and hypertension and neoadjuvant chemotherapy among the two groups

Character		Quilting sutures with axillary drain	Conventional sutures with axillary and pectoral drain	P value
Age	> 50	24	21	0.852
	< 50	19	12	
BMI	> 25	13	10	0.995
	< 25	30	23	
Stage	I & II	27	18	0.595
	III & IV	15	15	
Presence of hypertension	Yes	10	6	0.591
	No	33	27	
Presence of diabetes	Yes	3	1	0.628
	No	40	32	
Neoadjuvant chemotherapy	Yes	21	16	0.827
	No	19	17	

Table 2 Comparison of the two groups with respect to seroma formation, superficial skin necrosis, flap necrosis, wound gaping, time of drain removal and duration of hospital stay

	Quilting sutures with axillary drain (%)	Conventional sutures with axillary and pectoral drain (%)	P value
Seroma formation	10 (23.26)	19 (57.58)	0.002
Superficial skin necrosis	18 (41.86)	9 (27.27)	0.188
Flap necrosis	5 (11.63)	3 (3.95)	1
Wound gaping	1 (2.33)	2 (6.06)	0.576
Drain removal	4.2 (SD=1.1)	8.9 (SD=2.7)	0.0001
Duration of hospital stay	4.28 (1.1)	9.76 (2.25)	0.0001

associated with pain and skin dimpling at the site of traction caused by quilting sutures, our study did not report any such side effects. Moreover, in the post-operative period, since compression was given in both groups i.e. matching was done to avoid bias due to confounding factors.

Larsen et al. [21] reported that the quilting method allowed smoother, more prompt recovery, and less disability after mastectomy. Similarly, this technique significantly reduced the incidence of seroma formation, breakdown of wound edges and prolonged serous discharge, and did not lead to a reduced functional range of shoulder motion among patients who underwent conventional mastectomy. Moreover, it allowed the early and safe removal of drains at 48 h or 72 h after surgery [22, 23].

In our study, the patients in the quilting group had significantly lower seroma formation rates compared to the conventional group which was backed up by the study done by Larsen et al. [21]. Differences with respect to other variables such as pain, flap necrosis and superficial skin necrosis were not significant. The operative time was slightly increased by 6 min in the interventional group which was statistically significant. The loss to follow-up was higher due to the stigma associated with COVID-19 infection and the inability of the patients to show up for follow-up. However, the effect of this on the analysis was found to be statistically insignificant. These findings are supported by that of Ten Wolde et al. [23]

that quilting suture was applied after axillary lymph node dissection and mastectomy, and it required approximately 10 to 20 more minutes to operate than the conventional way. Nonetheless, the drain which was singularly placed in the axilla in the interventional group was removed earlier with a decreased overall output as compared to the control group. This made the handling of the drains during patient mobilization hassle-free. The duration of hospital stay was also reduced which made quilting not only efficacious and proficient but also cost-effective.

Therefore, the quilting of mastectomy flaps along with the placement of axillary drains has proved beneficial to the patients economically as it reduced the number of outpatient visits and interventions in managing various sequelae of seroma formation, mentally and physically.

Conclusion

Evidently, seroma formation has now become an inevitable consequence of mastectomy augmented by axillary dissection. In order to reduce this complication and its sequelae, quilting sutures have been useful in our study with added benefits of reduced hospital stay and therefore we recommend it to be routinely done post any mastectomy with or without axillary clearance.

Data Availability The authors confirm that the data supporting the findings of this study are available within the article. Raw data that supports the findings of this study are available from the corresponding author upon reasonable request.

References

1. <https://www.wcrf.org/cancer-trends/breast-cancer-statistics>
2. <https://www.cancer.org/cancer/breast-cancer/about/how-common-is-breast-cancer.html>
3. Manouras A et al (2008) Modified radical mastectomy with axillary dissection using the electrothermal bipolar vessel sealing system. *Arch Surgery* 143(6):575–580
4. Bryant M, Baum M (1987) Postoperative seroma following mastectomy and axillary dissection. *Br J Surg* 74:1187
5. Willett WC, Rockhill B, Hankinson SE, Hunter DJ, Colditz GA (2000) Epidemiology and nongenetic causes of breast cancer. In: Harris JR, Lippman ME, Morrow M, Osborne CK (eds) *Diseases of the Breast*, 2nd edn. Lippincott Williams & Wilkins, Philadelphia, pp 175–220
6. Watt-Boolsen S, Nielsen VB, Jensen J, Bak S (1989) Postmastectomy seroma. A study of the nature and origin of seroma after mastectomy. *Dan Med Bull.* 36:487–489
7. Oertli D, Laffer U, Haberthuer F, Kreuter U, Harder F (1994) Perioperative and postoperative tranexamic acid reduces the local wound complication rate after surgery for breast cancer. *Br J Surg* 81:856–859
8. Bonnema J, van Geel AN, Wiggers T, Ligtenstein DA (1994) Perioperative and postoperative tranexamic acid reduces the local wound complication rate after surgery for breast cancer. *Br J Surg* 81(11):1693. <https://doi.org/10.1002/bjs.1800811144>
9. Bonnema J, Ligtenstein DA, Wiggers T, van Geel AN (1999) The composition of serous fluid after axillary dissection. *Eur J Surg* 165:9–13
10. Tejler G, Aspegren K (1985) Complications and hospital stay after surgery for breast cancer: a prospective study of 385 patients. *Br J Surg* 72:542–544
11. Keogha GW, Doughty JC, McArdle CS, Cookea TG (1998) Seroma formation related to electrocautery in breast surgery: a prospective randomized trial. *Breast* 7:39–41
12. Porter KA, O'Connor S, Rimm E, Lopez M (1998) Electrocautery as a factor in seroma formation following mastectomy. *Am J Surg* 176:8–11
13. Kerin MJ, O'Hanlon DM, Kenny P, Kent PJ, Given HF (1996) Argon-enhanced cutting and coagulation confers advantages over conventional electrocautery for mastectomy. *Eur J Surg Oncol* 22:571–573
14. Agarwal G, Ramakant P (2008) Breast cancer care in India: the current scenario and the challenges for the future. *Breast care* 3(1):21–27
15. Wu Y, Wang S, Hai J et al (2020) Quilting suture is better than conventional suture with drain in preventing seroma formation at pectoral area after mastectomy. *BMC Surg* 20:65. <https://doi.org/10.1186/s12893-020-00725-8>
16. Srivastava V, Basu S, Shukla VK (2012) Seroma formation after breast cancer surgery: what we have learned in the last two decades. *J Breast Cancer* 15(4):373–80. <https://doi.org/10.4048/jbc.2012.15.4.373>
17. (2022) Factors affecting seroma formation after modified radical mastectomy in patients of carcinoma breast: a prospective study. *Eur J Mol Clin Med* 9(3):10507–10513
18. De Rooij L et al (2021) Reducing seroma formation and its sequelae after mastectomy by closure of the dead space: a multi-center, double-blind randomized controlled trial (SAM-Trial). *Ann Surg Oncol* 28(5):2599–2608. <https://doi.org/10.1245/s10434-020-09225-8>.
19. Van Bastelaar J, Theunissen LLB, Snoeijs M, Beets G, Vissers Y (2017) Flap fixation using tissue glue or sutures appears to reduce seroma aspiration after mastectomy for breast cancer. *Clin Breast Cancer* 17:316–321
20. Larsen BB, Hugan C Jr (1955) Fixation of skin flaps in radical mastectomy by subcutaneous sutures; observations. *AMA Arch Surg* 71:419–423
21. Coveney EC, O'Dwyer PJ, Geraghty JG, O'Higgins NJ (1993) Effect of closing dead space on seroma formation after mastectomy—a prospective randomized clinical trial. *Eur J Surg Oncol* 19:143–146
22. Chilson TR, Chan FD, Lonser RR, Wu TM, Aitken DR (1992) Seroma prevention after modified radical mastectomy. *Am Surg* 58:750–754
23. Ten Wolde B, van den Wildenberg FJ, Keemers-Gels ME, Polat F, Strobbe LJ (2014) Quilting prevents seroma formation following breast cancer surgery: closing the dead space by quilting prevents seroma following axillary lymph node dissection and mastectomy. *Ann Surg Oncol* 21(3):802

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