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Effect of mechanical closure of dead space on seroma formation in modified radical mastectomy

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Aim: Seroma is an important complication of breast surgery. This study investigated the effects of fixation of the flaps and obliterating the dead space on seroma formation.

Materials and methods: Patients undergoing modified radical mastectomy were separated into 2 random groups of 50 according to wound closure methods: either flap fixation/mechanical obliteration or standard wound closure group. The fluid that collected under the flaps assessed at the physical examination after the drains were removed was accepted as seroma. The patients' characteristics, duration of the operation, drainage amount, removal time of the drains, flap necroses, and infection were recorded. The groups were compared via chi-square and Levene tests. Significance was determined for $P \leq 0.05$.

Results: In both groups, characteristics and complication rates were similar. The seroma rates in the first and second groups were 12 (24%) and 6 (12%), respectively ($P < 0.05$). The average time for the removal of the drains was 6.7 ± 2.6 days in the first group and 5.6 ± 1.7 days in the second ($P = 0.012$). The average amount of drainage was 873 ± 513 and 630 ± 271 mL for the first and second groups, respectively ($P = 0.02$).

Conclusion: Mechanical closure between subcutaneous tissue and pectoral muscle with stitches at the incision may decrease the amount of drainage and contribute to early removal of the drains.

Key words: Seroma, breast cancer, flap fixation, mastectomy, risk factor, wound complication

Modifiye radikal mastektomide ölü boşluğun kapatılmasının seroma gelişimine etkisi

Amaç: Meme cerrahisinde en sık karşılaşılan komplikasyon seroma gelişimidir. Bu çalışmada modifiye radikal mastektomi kesisi kapatılırken cilt altı dokusunun pektoral kasa tespit edilmesinin seroma gelişimine etkisini araştırıldı.

Yöntem ve gereç: Meme kanseri tanısıyla modifiye radikal mastektomi yapılan hastalar iki gruba randomize edildiler. Mastektomi insizyonu birinci gruptaki 50 hastada cilt altı 3/0 polyglactin 910 sütur materyali ile tek tek, cilt 4/0 polypropylene sütur materyali ile subkutan devamlı olarak kapatıldı. İkinci gruptaki 50 hastada ise cilt altı süturlar alttaki kastan geçilerek fleplere tespit edildi, cilt aynı şekilde kapatıldı. Dren çekildikten sonra flepler altında muayene ile saptanan sıvı birikimleri seroma olarak kabul edildi. Hasta özelikleri, operasyon süresi, dren getirileri, dren çekilme zamanı, seroma oluşumu, flep nekrozu ve enfeksiyon durumu kayıt edildi. İki grup arasındaki karşılaştırma chi-square ve Levene testi ile yapıldı. $P < 0.05$ anlamlı kabul edildi.

Bulgular: Her iki grupta hasta özellikleri ve komplikasyon oranları benzerdi. Birinci grupta 12 (% 24) hastada, ikinci grupta 6 (% 12) hastada seroma saptandı ($P > 0,05$). Birinci grupta ortalama dren çekilme zamanı 6,7 ± 2,6 gün, ikinci grupta ise 5,6 ± 1,7 gün olarak bulundu ($P = 0,012$). Birinci grupta ortalama toplam drenaj miktarı 873 ± 513 mL iken ikinci grupta 630 ± 271 mL idi ($P = 0,02$).

Sonuç: Mastektomi kesisinin cilt altında alttaki kasa tespit edilerek ölü boşluğun oblitere edilmesi toplam drenaj miktarını azaltarak erken dren çekilmesini sağlayabilir.

Anahtar sözcükler: Seroma, meme kanseri, flep tespiti, mastektomi, risk faktörleri, yara komplikasyonu

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Introduction

Seroma formation is one of the most serious and common complications of mastectomy and axillary dissection. Seroma is a serous fluid collection whose origin is unclear. The definition of the seroma changes in the literature and frequency of this complication is variable as well. Seroma follows breast surgery and it causes discomfort to the patient, prolonged hospital stay, flap necrosis, and infection at the operation site and reoperations (1,2).

The etiology of seroma is not clear and it is discussed widely at the literature. Seroma is usually in the form of exudate. Exudate occurs either from an acute inflammatory reaction or fibrinolytic activity in serum or lymph drainage. These are the most discussed ways of pathophysiology (3-5).

Seroma is influenced by a large dissection area, dead space under the skin flaps and axillary region, chest movement because of breathing, and shoulder movement, which affects attachment of skin flaps. The incidence of seroma is correlated with certain factors. Obesity, patient's age, hypertension, breast volume, presence of malignant nodes in the axillary region, number of metastatic nodes, number of dissected nodes, early shoulder exercise, and the use of some drugs, i.e. tamoxifen and heparin, affect the pathophysiology (1,2,6,7). While the use of electrocautery decreases bleeding, it increases total drain output, causing a higher rate of seroma formation (8,9). In addition, electrocautery dissection increases pro-inflammatory cytokine response in wound fluid, which in turn may reflect an aggravated inflammation and increased tissue damage influencing seroma formation (10).

This prospective randomized study was carried out to compare the effects of fixation of the flaps to the pectoral muscle with sutures on the drainage volume, drain removal time, and incidence of seroma formation.

Materials and methods

In this study 100 patients who underwent modified radical mastectomy (MRM) at the Ankara Oncology Hospital 4th General Surgery Clinic between 2005 and 2007 were included. All 100 patients with operable breast cancer were enrolled in the study after their informed consent was obtained. The research was prospective and randomized. Two closed suction drains were used for the drainage of the operation site.

Patient Groups

We formed 2 groups of patients in order to compare the effects of obliterated dead space with the suture technique on the formation of seroma. In the non-fixation group, which comprised of 50 patients, the subcutis was closed with 3/0 polyglactin 910 stitches one by one and the skin was closed continuously by subcuticular suturing with 4/0 polypropylene sutures. In the fixation group, which also comprised of 50 patients, the skin flap was sutured to the pectoral muscles with 3/0 polyglactin 910 stitches and the skin was closed by the same method.

The medical records of the patients were reviewed with regards to age, body mass index (BMI) (kg/m^2), total lymph nodes removed, number of positive lymph nodes, tumor size, stage, first day closed vacuum drainage volume, total drainage volume, drain removal time, seroma volume, and puncture amount.

Randomization

Patients were numbered at the time they were hospitalized. Patients with even numbers were regarded as the first group and those with odd numbers as the second group. The even numbered group was the fixation group and the odd numbers group was the non-fixation group. Patients who had undergone neoadjuvant chemotherapy, breast conservation therapy, or immediate breast reconstruction were not included in the study.

Surgical Techniques

Skin flap dissection, the excision of the breast with pectoral fascia, and dissection of axillary lymph nodes were performed with a scalpel. Control of the small bleeding vessels was sustained with coagulate on current. The patient underwent level 1-2-3 axillary lymph node dissection by cutting the pectoral minor muscle. Daily drainage was recorded. The drains were removed when the daily drainage was less than 50 mL. In this study, we defined seroma as any clinically

apparent fluid collection under the skin flaps or in the axilla. When seroma occurred, it was aspirated with needle percutaneously during the hospitalization period. Pressure dressing was used only during the follow up period after the observance of seroma.

Statistical Analysis

For the statistical analysis we used SPSS version 10.0. The adverse outcomes in the groups were compared by using chi-square and Levene tests. $P < 0.05$ was considered statistically significant.

Results

In the non-fixation group of patients, mean age was 48.1 ± 11.4 and in the fixation group mean age was 51.8 ± 10.9. The 2 groups were similar with respect to age, BMI, total removed axillary nodes, positive nodes, previous biopsy, operation time, stage, and co-morbidities (hypertension and diabetes mellitus) (Table 1).

The clinical measures are shown in Table 2. In the non-fixation group, removal time of the drains was 6.7 ± 2.6 days, whereas it was 5.6 ± 1.7 days in the fixation group. Moreover, first day drainage volume in the former group was 218.9 ± 86.7 mL, and it was 219.2 ± 64.0 mL in the latter ($P > 0.05$). Total drain volumes in the non-fixation and fixation groups were 873.5 ± 513.9 and 630.7 ± 271.6 mL, respectively ($P < 0.05$). Seroma was aspirated when it was symptomatic for the patient. The patients in the non-fixation group needed aspiration for 8.8 ± 11.6 days (2-45 days), and those in the fixation group needed it for 6.1 ± 4.5 days (2-15 days).

Table 1. Characteristics of patients in the skin fixation and non-fixation groups.

	Non-fixation group (n = 50)	Fixation group (n = 50)
Age (years)	48.1 ± 11.4	51.8 ± 10.9
BMI (Body Mass Index)	28.2 ± 4.7	27.1 ± 4.1
Duration of surgery (min)	197.4 ± 35.5	189.4 ± 29.9
Total dissected lymph nodes	25.2 ± 10.3	25.4 ± 9.8
Metastatic lymph nodes	3.2 ± 6.9	3.8 ± 5.8
Hypertension	10 (20%)	13 (26%)
Diabetes mellitus	6 (12%)	4 (8%)
Smoking	10 (20%)	8 (16%)

NS: Non-significant.

Wound complications, including wound infection and skin necrosis, were similar in the groups. We used oral antibiotherapy for infection, and wound dressing and debridement were used for necrosis. Wound dressing was standard in both of the groups.

Seroma was observed in 12 (24%) patients in the non-fixation group and in 6 (12%) patients in the fixation group ($P < 0.05$). The average time for the removal of the drains was 6.7 ± 2.6 days in the non-fixation group and 5.6 ± 1.7 in the fixation group ($P = 0.012$). The average amount of drainage in the non-fixation group was 873 ± 513 mL, whereas it was 630 ± 271 mL in the fixation group ($P = 0.02$) (Table 2).

Shoulder movement time was similar for both groups. In the first 3 days after surgery, immobilization was provided by a sling. On the fifth day after surgery, all patients were referred to a physical therapist for shoulder movement education.

Discussion

MRM is still the most common surgical procedure for treating breast cancer. Seroma formation is a common problem occurring after mastectomy under the dead space of skin and the axillary region. Seroma is discussed with respect to its terminology and pathophysiology, as well as prevention and treatment (1). Seroma needs treatment when it is symptomatic and causes discomfort to the patient (11). Multiple needle aspiration or insertion of a new drain under the flaps is necessary in treatment. The optimal closure of the wound should decrease seroma formation, by obliterating the dead space. Techniques

Table 2. Complication rate and drainage volumes in the groups.

	Non-fixation group (n = 50)	Fixation group (n = 50)
Seroma	12 (24%)	6 (12%)
Wound infection	3 (6%)	4 (8%)
Flap necrosis	3 (6%)	1 (2%)
First day drainage volume (mL)	218.9 ± 86.7	219.2 ± 64.0
Total drainage volume (mL)*	873.5 ± 513.9	630.7 ± 271.6
Removal time of the drain (day)*	6.7 ± 2.6	5.6 ± 1.7

* $P < 0.05$

should minimize the lymph spillage and serum ooze, and facilitate the rapid removal of accumulating fluid (11).

Some authors have used ultrasonography to detect seroma at the dead space. In the radiological techniques a small amount of fluid accumulation can be detected when it is not palpable at the physical examination (11). The incidence of seroma varies between 10% and 85%, due to the difference in detection methods (2,11). However, a small amount of serous fluid does not necessitate treatment. Trying to treat this small amount of seroma does not help the patients and causes discomfort. In our experience if the amount is small and the patient has no complaints about seroma, treatment is not necessary. A careful physical examination is important in confirming seroma. Jeffrey et al. showed that seromas resolve in 1 month at the physical examination and 4 months at the ultrasonographic examination (12). In our practice we did not use ultrasonography for detecting seroma formation because of its cost inefficiency.

What is more important than the existence of the seroma is the probability of infection. Infected seroma is a serious problem for the patient. Prophylactic antibiotics are not suggested at the breast surgery. Infected dead space area seromas result in abscesses, which need surgical drainage. Long term use of drains and lack of attention to sterility during aspiration puncture increase the risk of infection. Suction drains were first used by Murphey, in 1947. Afterwards, Morris et al. showed that closed suction drainage obliterates the dead space and accelerates wound healing (13,14). Suction drainage decreases the seroma and also affects the occurrence of complications like necrosis and infection (1).

Different methods were used in order to reduce seroma. Pressure wound dressing has no effect on the reducing the amount of the seroma (14,15). Different chemical methods are used for obliterating the dead space, such as fibrin glue, tissue adhesive and sclerotherapy agents. Yet, the effects of chemical agents are not clear. Some authors have stated that fibrin glue significantly reduces the total seroma drainage, allows earlier drain removal, and reduces hospital stay (16-19). On the other hand, some other studies report no advantage of using fibrin glue (1,19,20). Tetracycline is also used for obliteration and sclerotherapy. Yet, because of the pain, the use of tetracycline has been abandoned (21). Mobilization of the shoulder in the early period increases the seroma amount (22,23). However, some authors report that the immobilization of the shoulder has no effect on seroma formation (1).

In our practice we thought that early shoulder mobilization increases the incidence of seroma. Because of this, we suggested immobilization of the shoulder for 5 days. In our routine treatment, we work with physical therapists by incrementally increasing the shoulder movements.

For the first time, Halsted used suturing with interrupted silk to the fascia and tried to achieve mechanical obliteration of the dead space (1,24). Aitken et al. tried to obliterate the dead space during radical mastectomy and modified radical mastectomy with dexon tacking sutures to skin flaps (1,25). They detected a 9.5% seroma rate in the 204 patients (25). Chilson et al. designed a randomized study and reported a rate of 38.6% in the no flap fixation group (26). They found a 25% seroma rate in the flap fixation group to the muscle in different levels. Because of the long operation time and increased necrosis ratio, O'Dwyer suggests that flap fixation at the incision decreases the seroma rate from 85% to 25%, and it causes less total drain output (27,28). In our experience we detected no difference in the operation time or necrosis rate. Flap suturing is an easy method for wound closure. Care must be taken during suturing to ensure that the skin flap is not pulled, which can break the blood flow and prevent wound healing.

Schuijtvlot et al. showed that skin flap fixation decreases the seroma rate from 52% to 24% (29). Purushotham et al. did not use drains and patients were discharged from hospital earlier when flap fixation suturing was used (30).

In conclusion, 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. The effects of suturing techniques on the medical economics and life quality will be useful to evaluate in further studies.

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