Modification of transverse skin incision: a successful idea for reducing seroma formation after mastectomy and axillary dissection for breast cancer

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Purposes
The aim of this study was to assess the importance of making the lateral part of transverse skin incision for mastectomy vertical along the anterior axillary fold, for decreasing postmastectomy seroma in breast cancer.

Background
Seroma after mastectomy represents annoying problem for the surgeon and the patient; it may delay adjuvant therapy and is also associated with prolonged recovery period and multiple physician visits. Moreover, it may lead to significant morbidity. Despite there are many methods for dealing with this seroma, it remains in question.

Patients and methods
The study included 100 female patients: 11 (11%) were below 40 years of age, 66 (66%) were between 40 and 50 years of age, and 23 (23%) were above 50 years of age. All patients underwent clinical evaluation, laboratory assessment, ultrasound and soft-tissue mammography examination, and tissue biopsy. All patients underwent modified radical mastectomy during which the patients were divided into two groups: group A with transverse skin incision crossing the anterior axillary fold and group B with modification of transverse skin incision (making its lateral part vertical along the anterior axillary fold). Postoperative follow-up was performed during the first 4 months.

Results
Decreased seroma formation was observed in group B with transverse skin incision with vertical lateral part along the anterior axillary fold to a great extent ($P < 0.01$).

Conclusion
Transverse skin incision with vertical lateral part along the anterior axillary fold combats seroma formation, and hence this modification not only decreases morbidity and recovery period, but also allows early adjuvant therapy.

Keywords:
breast cancer, mastectomy, morbidity, seroma

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Introduction

Lymphatic drainage of the breast plays an important role to explain postoperative seroma formation; two main lymphatic drainage routes of the breast are: an external system and an internal system. The external route from the nipple, the integuments, and the lactiferous tubules was shown to run to the axilla. The internal route from the dorsal part of the breast was thought to perforate the pectoral and intercostal muscles. Within the intercostal spaces, these lymphatics were seen to subsequently join the plexus coming from the liver and the diaphragm and then to run on each side of the internal mammary artery and veins [1].

Subcutaneous drainage to the contralateral axilla is unlikely to occur unless the ipsilateral drainage is impaired by lymphatic obstruction caused by surgery. Blockage of normal lymph flow can also cause drainage in a retrograde direction to the liver through the internal mammary chain [2].

Breast cancer surgery is treated with either modified radical mastectomy (MRM), wide local excision, and axillary lymph node dissection (ALND), or sentinel lymph node biopsy. Common complications of breast surgery include bleeding, infection, lymphedema, and nerve damage [3].

The most common complication following breast surgery is seroma formation. The incidence of seroma ranges from 10 to over 85% [4].

Seroma is defined as a serous fluid collection that develops under the skin flaps during mastectomy or in the axillary dead space after axillary dissection [5].

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Seroma formation generally begins on the seventh day postsurgery, reaches a peak rate of growth on the eighth day, and slows continuously until the 16th day when it generally resolves [6].

This seroma depends not only on how it was defined, but also on the detection method used [7–12]. Seroma formation, a common sequel to axillary dissection, has been shown to be associated with an increased incidence of wound hematoma, delayed wound healing, and lymphedema. Although seromas are not life threatening, they can lead to significant morbidities [e.g. flap necrosis, wound dehiscence, predisposition to sepsis, impaired shoulder function (muscle strength weakness), prolonged recovery period, and multiple physician visits] and may delay the initiation of adjuvant therapy [13,14].

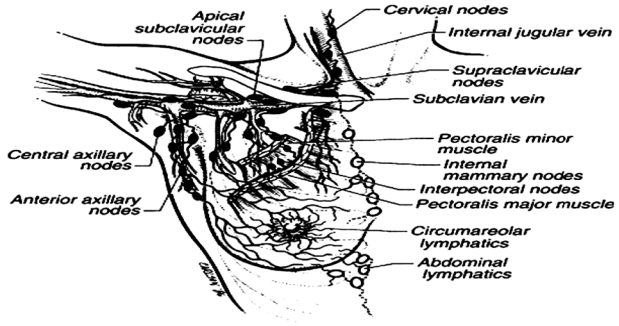
Axillary drainage fluid is initially an inflammatory exudate that changes to the nature of lymph when the drainage is prolonged. Traditionally, lymph leakage from the upper extremity through the transected axillary lymph trunks is believed to be an important factor in fluid secretion and seroma formation and postoperative arm use, acting as a pump that forces large quantities of lymph into the empty axillary fossa [15].

The theories of etiology are important in determining the most likely surgical technique for prevention. Various techniques have been studied in an attempt to minimize postmastectomy drainage volumes and the incidence of seroma. None, however, have been found to be consistently successful, and consequently none are used in common practice. It is believed that the disrupted lymphatics in the axillary fossa are central to etiology [6].

Patients and methods

The current study was conducted at the Department of General Surgery, Benha University Hospital from January 2012 to October 2013 so as to allow 4-month follow-up period for the last patient operated upon. After obtaining written fully informed patients consent, all patients presenting were admitted to the General Surgery ward for clinical evaluation, laboratory assessment, and underwent ultrasound and soft-tissue mammography examination and tissue biopsy for assuring the diagnosis.

Figure 1

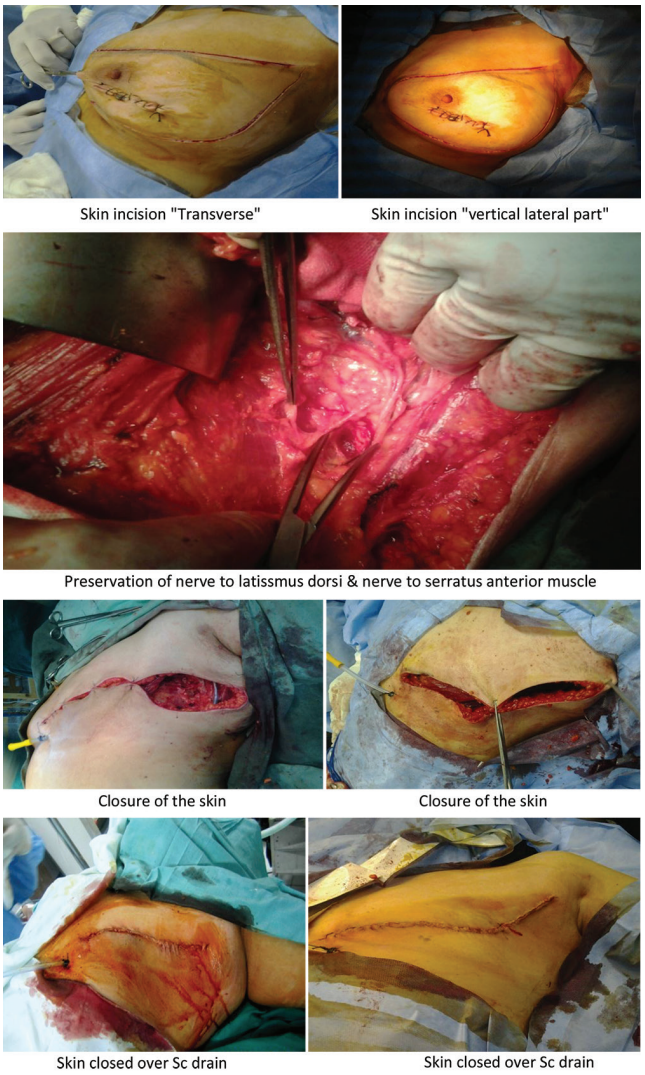


Lymphatic drainage of the breast [2].

Operative procedure: ‘modified radical mastectomy’

An MRM removes all breast tissues, the nipple–areola complex, necessary skin, and the level I, II, and III axillary lymph nodes. After positioning of the patient and applying betadine antiseptic solution, skin incision was made: in group A (50 cases, Fig. 1), transverse skin incision was made crossing the anterior axillary fold, whereas in group B (50 cases, Fig. 2) modification was applied to that incision — its lateral part was made vertical along the anterior axillary fold. Then, skin flaps were developed with consistent thickness to avoid creation of devascularized subcutaneous tissues, which

Figure 2



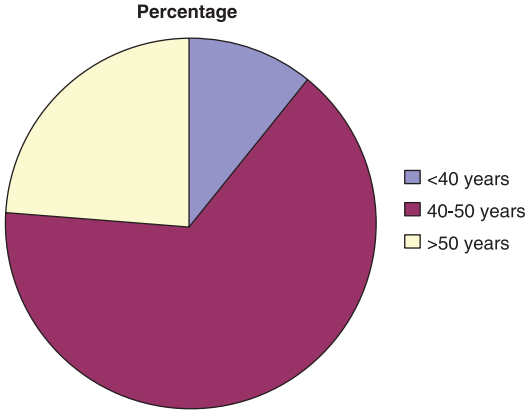
“Transverse” skin incision.

can contribute to wound seroma, skin necrosis, and flap retraction, using cautery or scalpel and were extended to the boundaries of dissection for the MRM, which are

(a) The anterior margin of the latissimus dorsi muscle laterally,
(b) The midline of the sternum medially,
(c) The subclavius muscle superiorly, and
(d) The caudal extension of the breast, which is 3–4 cm inferior to the inframammary fold, until the rectus sheath.

Once the skin flaps were developed, the breast parenchyma and pectoralis major fascia were elevated from the underlying pectoralis major muscle in a plane parallel to the muscle bundles as they course from their medial origin (ribs 2–6) to their lateral insertion on the humerus. Perforating vessels from the lateral thoracic or anterior intercostal arteries, which are end arteries, were individually secured. Elevation of the breast parenchyma and pectoralis major fascia was continued laterally until the lateral edge of the pectoralis major muscle and the underlying pectoralis minor muscle were exposed. Once elevation of the breast parenchyma and pectoralis major muscle fascia from the underlying pectoralis major muscle was completed, an incontinuity ALND was performed. The pectoralis minor muscle was defined, and the lymph nodes, which may lie between the pectoralis muscles (Rotter nodes), were cleared. As the ALND proceeded, the loose areolar tissue of the lateral axillary space was elevated with identification of the lateral extent of the axillary vein in its course anterior and caudal to the brachial plexus and axillary artery (the axillary contents were removed in a medial to lateral direction). The investing layer of the axillary vein was dissected sharply, allowing complete visualization of the anterior and ventral surfaces of the vein. Ligation and division of intervening venous tributaries was performed.

Graph 1



Age distribution of the patients.

Dissection continued until complete axillary clearance (levels I, II, and III) was performed with preservation of nerve to serratus anterior and nerve to latissimus dorsi muscle. After assuring hemostasis, skin flaps were closed over medially placed drain [16–20].

Outcome items

Postoperative outcome items included incidence of seroma formation, duration and amounts of seroma, removal of the drain, hematomas, wound infection, and skin loss. All deaths that occurred during this study because of nonsurgical cause — that is, pulmonary embolism, myocardial infarction, stroke, etc. — were excluded. All patients were followed for seroma at 10, 20, and 30 days and after 45 days by the drain.

Statistical analysis

Analysis of data was performed using SPSS version 16 (Bristol university; in United Kingdom). Qualitative data were presented as numbers and percentages and were compared between groups using the *Z*-tests. *P*-value greater than 0.05 was insignificant, whereas *P*-value less than 0.05 was considered statistically significant and *P*-value less than 0.01 was considered statistically highly significant.

Results

The basal data of the two groups did not differ significantly. This study included 100 female patients, with same number of patients in the two groups (50 patients in each group); 11 patients (11%) were below 40 years of age, 66 (66%) were between 40 and 50 years of age, and 23 (23%) were above 50 years of age. Indication for surgery was operable breast cancer. All patients were fit for surgery (Table 1, Graph 1).

The site of tumor origin was in the upper outer quadrant in 72 (72%) patients, in the lower outer quadrant in 10 (13%), in the upper inner quadrant in nine (9%), in the lower inner quadrant in seven (7%), and in the axillary tail in two (2%) patients. The mean tumor diameter was 2.4 ± 0.4, range: 1.5–3.5 cm. Surgical margin showed no microscopic infiltration; two patients had carcinoma involving the margin at the level of the uncinate process adjacent to the superior mesenteric vein and the other two had a positive microscopic margin at the pancreatic neck–body transaction site. Twenty-eight patients (56%)

Table 1 Preoperative data

Age (in years)	Strata
Age strata (in years) (%)	
<40 years	11
40–50 years	65
>50 years	24

showed perineural invasion and three patients (6%) showed vascular invasion. Ninety-five patients (95%) had histologically positive lymph node metastases in the resection specimen and the mean total number of resected lymph nodes was 18 ± 1.8, range: 16–21 nodes (Table 2).

With respect to postoperative seroma formation, drain was removed when its serosanguinous fluid became less, 30 ml/day, after ensuring no collection by ultrasound. On the 10th day, in group A no drain was removed (patients with still drain; 50) but in group B drain was removed from 31 patients (patients with still drain; 19, $P = 0.00000002$, highly significant). On the 20th day, in group A drain was removed from 10 patients (patients with still drain; 40), but in group B drain was removed from another 11 patients (patients with still drain; 8, $P = 0.000002$, highly significant). On the 30th day, in group A drain was removed from another 25 patients (patients with still drain; 15), but in group B drain was removed from another four patients (patients with still drain; 4, $P = 0.005$, significant). Finally, after the 45th day, in group A drain was removed from another 10 patients (patients with drain; 5), but in group B drain was removed from another three patients (patients with drain; 1, $P = 0.09$, insignificant) (Table 3, Graph 2).

Other postoperative complications recorded during this study included hematoma in five patients in each group ($P = 1$); these patients were managed conservatively without operative intervention. Partial skin loss was detected in two patients in group A, which was managed conservatively. Wound infection was noted in three patients in each group, which was managed by proper antibiotics according to the culture and sensitivity. Wound dehiscence was noted in one patient in group A, which was managed by secondary suturing (Table 4).

After removal of the drain, seroma recollection was noted in some patients; this seroma recollection was managed conservatively: in group A, in 3/10 (30%) patients on 20th day, in 5/35 (14.2%) patients on 30th day, and in 2/45 (4.4%) patients after 45 days but in group B, in 4/42 (9.5%) patients on 20th day, in 1/46 (2.1%) patients on 30th day, and in 1/49 (2%) patients after 45 days (Table 5, Graph 3).

Table 2 Pathological data of excised specimens

Data	Findings
Site [*N* (%)]	
Upper outer quadrant	72 (72)
Lower outer quadrant	10 (13)
Upper inner quadrant	9 (9)
Lower inner quadrant	7 (7)
Axillary tail	2 (2)
Size (cm)	
Diameter in its longest axis	2.4 ± 0.4 (1.5–3.5)
Surgical margin invasion [*N* (%)]	
Yes	0 (0)
No	100 (100)
Lymph node status [*N* (%)]	
Positive	95 (95)
Negative	5 (5)
Total number of resected lymph nodes	18 ± 1.8 (16–21)

Data are presented as mean ± SD and number; ranges and percentages are in parentheses.

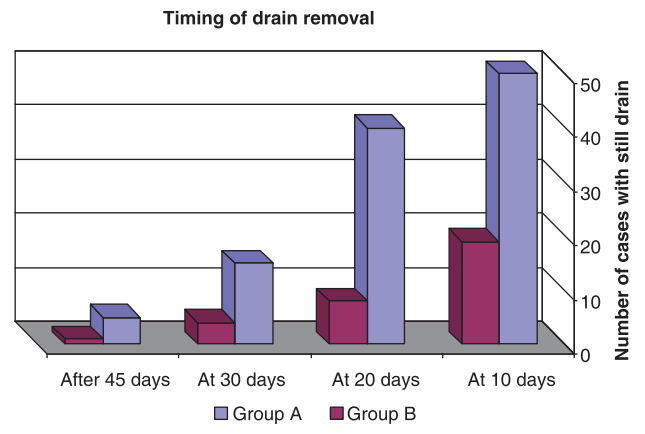
Table 3 Postoperative data: seroma, still drain

Seroma; Still drain	Group A	Group B	*Z*-value	*P*-value
On 10th day	50	19	6.7	0.00000002
On 20th day	40	8	6.4	0.000002
On 30th day	15	4	2.8	0.005
After 45 days	5	1	1.6	0.09

Table 4 Other postoperative complications

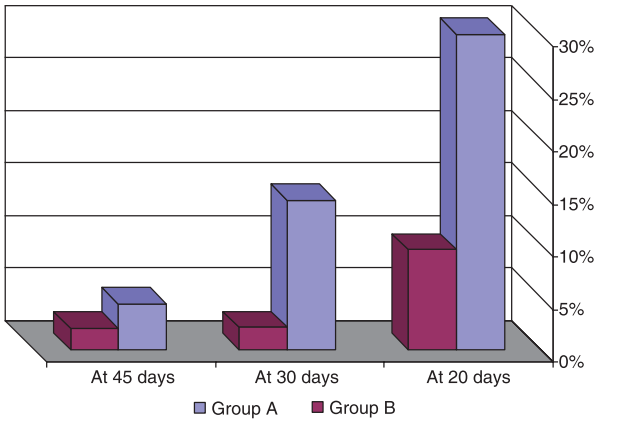
Complications	Group A	Group B	*P*-value
Hematoma	5	5	1
Skin loss	2	0	0.15
Wound infection	3	3	1
Wound dehiscence	1	0	0.3

Graph 2



Postoperative data: seroma, drain is still present.

Graph 3



Postoperative seroma recollection that needed conservative treatment.

However, number of patients who needed reinsertion of the drain was: 2/10 (20%) patients on 20th day, 3/35 (8.5%) patients on 30th day, and 1/45 (2.2%) patients after 45 days in group A but 3/42 (7.1%) patients on 20th day, 0/46 (0%) patients on 30th day, and 0/49 (0%) patients after 45 days in group B (Table 6, Graph 4).

Discussion

The most common complication following breast surgery is seroma formation. The incidence of seroma ranges from 10 to over 85% [4].

Gardner and colleagues [21–24] suggested that there are seven causative factors contributing to seroma formation:

(a) Poor adherence of flaps to chest wall,
(b) Division of several larger lymph trunks,
(c) Large dead space/large raw area in the axilla,
(d) Pump action of the upper limb increasing lymph flow,
(e) Local inflammatory mediators,
(f) Irregular shape of chest wall and axilla, and
(g) Shear forces during respiration.

In this study, there was significance in the use of the modification of the skin incision by making its lateral part vertical (P = 0.00000002 on the 10th day, 0.000002 on the 20th day; highly significant and P = 0.005, significant in reducing postmastectomy seroma); this depends on the fact that lymphatic drainage of the medial part of the upper flap is to internal mammary lymph nodes and its lateral part is drained to the supraclavicular lymph nodes, but the lower skin flap lymphatics join the plexus coming from the liver and the diaphragm and internal mammary lymph nodes [2].

Hence, modification of transverse skin incision (by making its lateral part vertical) shortens the upper flap (drained medially by internal mammary lymph nodes and small lateral part by supraclavicular lymph nodes, and hence less seroma).

Various methods have been used to prevent seroma formation — that is, fibrin glue, closure of the axillary space; in addition, sharp dissection with scalpel without electrocautery resulted in less inflammation. However, the use of this modification of skin transverse incision resulted in decreased surface area drained by the axillary lymph nodes, and hence decreased seroma.

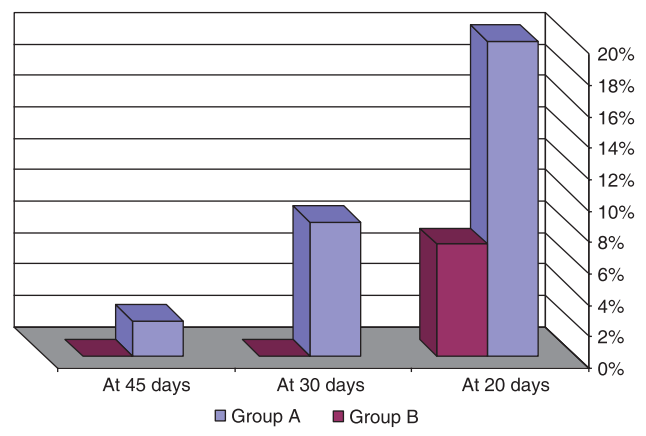
Table 5 Postoperative seroma recollection that needed conservative treatment

After drain removal	Group A [*N* (%)]	Group B [*N* (%)]
On 20th day	3/10 (30)	4/42 (9.5)
On 30th day	5/35 (14.2)	1/46 (2.1)
After 45 days	2/45 (4.4)	1/49 (2)
Total	10/50 (20)	6/50 (12)

Table 6 Postoperative seroma recollection that needed reinsertion of drain

After drain removal	Group A [*N* (%)]	Group B [*N* (%)]
On 20th day	2/10 (20)	3/42 (7.1)
On 30th day	3/35 (8.5)	0/46 (0)
After 45 days	1/45 (2.2)	0/49 (0)
Total	6/50 (12)	3/50 (6)

Graph 4



Postoperative seroma recollection that needed reinsertion of drain.

Conclusion

Transverse skin incision with vertical lateral part along the anterior axillary fold combats seroma formation, and hence this modification not only decreases morbidity, recovery period, and allows early drain removal, but also allows early adjuvant therapy.

Acknowledgements

Conflicts of interest

None declared.

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