The Use of Closed Suction Drainage After Lumpectomy and Axillary Node Dissection for Breast Cancer

A Prospective Randomized Trial

ROBERT G. SOMERS, M.D., LISA K. JABLON, M.D., MARK J. KAPLAN, M.D., GLENN L. SANDLER, M.D., and NANCY K. ROSENBLATT, M.D.

Closed suction drainage has been used to prevent seroma formation after lumpectomy and axillary node dissection for breast cancer. To study the efficacy of closed suction drains, the authors conducted a prospective randomized study from 1987 to 1990 of 227 axillary dissections. One hundred eight were randomized to a drain group (DG) and 119 to a no drain group (NDG). Drains were removed on the first postoperative day just before patient discharge. Postoperatively, all palpable axillary collections were aspirated on each follow-up visit. The volume aspirated, the number of aspirations, the time to seroma resolution, and all complications were recorded. The mean number of aspirations in the DG was significantly lower than the NDG (2.2 ± 2.2 *versus* 3.3 ± 2.1; $p \leq 0.002$). Mean volume aspirated in the DG (146.3 ± 181.1 mL) was less than the NDG (266.1 ± 247.6 mL; $p \leq 0.003$), and the time to seroma resolution was decreased in the DG as compared with the NDG (11.5 ± 10 days *versus* 18 ± 10.1 days; $p \leq 0.0002$). Closed suction drainage after lumpectomy and axillary node dissection is advantageous in decreasing the incidence and degree of seroma formation and need not delay early hospital discharge.

From the Department of Surgery, Albert Einstein Medical Center, Philadelphia, Pennsylvania

BREAST CONSERVATION THERAPY is an accepted form of treatment for stage I and stage II breast cancer. Lumpectomy and axillary node dissection with radiation therapy has survival rates equal to mastectomy and is becoming a more frequently used method of therapy for breast cancer.[1]

The most common complication of axillary node dissection (level I and level II nodes) is seroma formation. Postoperative wound seromas occur in up to 53% of patients undergoing mastectomy,[2] but little has been published concerning the incidence of seromas after axillary node dissection. Traditionally, closed suction drains have been used to obliterate the space beneath skin flaps and thus to decrease seroma formation.[3] These drains were first applied to mastectomy wounds by Murphy in 1947 and are currently used in the management of the axilla after axillary node dissection.[3]

The appropriate length of time needed to drain the axilla after axillary node dissection varies according to institution and surgical practices. Drains are often left in place until the volume of drainage is minimal (≤30 mL/day).[2,4] Others question the need for drains at all.[5] We recently completed a prospective randomized study to assess the value of closed suction drainage in the management of the axilla in 225 women undergoing lumpectomy and axillary node dissection for breast cancer.

Patients and Methods

All women undergoing lumpectomy and axillary node dissection at our institution by a single group of surgeons, between December 1987 and November 1990, were included in our study. The length of follow-up ranged from 2 months to 35 months, and the following information was recorded: age, clinical and pathologic stage, number of nodes removed, number of positive nodes, estrogen and progesterone receptor status, pathologic findings, intraoperative blood loss, type of anesthesia (local or general), postoperative complications, and adjuvant therapy.

Axillary node dissection was performed through a transverse skin incision with *en bloc* dissection of level I and level II lymph nodes. The axillary contents were cleared from the inferior edge of the axillary vein extending from the chest wall to the latissimus dorsi muscle. Pectoralis major and minor muscles were elevated and axillary contents dissected to the medial border of the pectoralis minor muscle. Inferiorly, the specimen was transected at the fourth intercostal space. The long thoracic nerve, thoracodorsal nerve, lateral pectoral nerve,

Address reprint requests to Lisa K. Jablon, M.D., Albert Einstein Medical Center Suite 501, Klein Professional Building, Philadelphia, PA 19141.

Accepted for publication July 2, 1991.

and subscapular vessels were all spared. Clips were used to ligate all small blood vessels and lymphatics. Once adequate hemostasis was achieved, a Jackson–Pratt closed suction drain was requested. At this point, randomization occurred to use a drain or to close without drainage based on the last digit of the patient's admission number. Once a drain was requested, no further attempt at hemostasis was allowed according to our protocol. Incisions were closed in a standard fashion using subcuticular polyglactin sutures. No attempt was made to eliminate dead space in the axilla. No perioperative antibiotics were used in either group.

All drains were removed on the first postoperative day regardless of drainage volume. Before their removal, all drains were emptied and reconstituted every 8 hours by nursing personnel, and the drainage volume was recorded on the bedside chart. Patients were discharged on the first postoperative day and were encouraged to exercise without limitation.

Each patient had two scheduled office visits in the first postoperative week, and weekly thereafter or more frequently as needed. At each visit, the axilla was assessed for seroma formation and signs of infection. A seroma was defined as any palpable or ballottable fluid collection. For the purpose of this study, all collections were aspirated using aseptic technique regardless of size or symptoms. The volume and date of each aspiration were recorded. For each patient we calculated total volume of drainage, total number of aspirations, and total number of days from surgery to final aspiration.

A wound infection was defined as erythema, warmth, or purulent drainage at the incision site. Any evidence of infection was treated with a 7-day course of oral antibiotics. Other complications, including lymphedema, impaired shoulder movement, hematoma, or wound dehiscence, also were recorded.

Nearly all patients received radiation therapy at our institution. Radiation was limited to the breast. Follow-up was maintained at 3-month intervals for the first year, followed by 6-month intervals.

Data was entered on an IBM PS/2 computer. Statistical analysis was done using Solo 3.0 (BMPD Statistical Software). Data were analyzed by calculating means with standard deviations, and cohort comparisons made by chi square, Fisher's 2 × 2 test (for cells < 5) and multivariant analysis of data groups for linear relationships. Data were considered significant with a p value < 0.05.

Results

There were 225 patients with 231 axillary node dissections consecutively randomized from December 1987 to November 1990 to a drain group (DG) or a no drain group (NDG). Six patients had bilateral node dissections, and for the purpose of this study each axilla was considered as a separate patient. Four patients in the DG were excluded because drains were left in place for more than 1 day. The remaining 227 axillary dissections form the basis of this report. There were 108 randomized to the DG and 119 to the NDG.

There were no significant statistical differences by chi square analysis between the two groups (Table 1). Statistical analysis compared patient age, intraoperative blood loss, pathologic stage, node positivity, total number of nodes removed, estrogen and progesterone receptor status, radiation therapy, and adjuvant therapy.

In the DG, two patients (1.9%) had *in situ* lesions, 63 patients (58.3%) were stage I, 41 patients (38%) were stage II, and 2 patients (1.9%) were stage III. This is comparable to the NDG, which had 8 patients (6.7%) with *in situ* lesions, 68 patients (57.1%) with stage I disease, 33 patients (27.3%) with stage II disease, and 10 patients (8.4%) with stage III disease.

End points used in evaluation of the two groups were the number of aspirations to resolution of the seroma, number of days from operation to resolution of the seroma, number of patients requiring no aspirations, total volume aspirated, infection, hematoma, lymphedema, wound dehiscence, and frozen shoulder. The mean number of aspirations in the DG was 2.2 (± 2.2), with a range of 0 to 11, and 3.3 (± 2.1) in the NDG, with a range of 0 to 11. These differences were found to be significant with a p value of 0.002. Mean time to resolution of drainage was 11.5 (± 10) days, with a range of 0 to 43 in the DG and 18 (± 10.1) days in the NDG, with a range of 0 to 73. The difference also was significant, with a p value of 0.0002. Mean volume aspirated for the DG was 146.3 mL (± 181.1) with a range of 0 to 885, and 266.1 mL (± 247.6) for the NDG with a range of 0 to 1875 (p value of 0.003) (Table 2). Overall 81.5% of patients had seromas postoperatively. Twenty-nine patients in the DG (26.8%) required no aspirations, compared with 13 patients (10.9%) in the NDG. These findings were significant with a p value of 0.008 (Table 2).

TABLE 1. *Patient Characteristics*

Characteristic	Drain (n = 108)	No Drain (n = 119)	p
Age (yr)	60.1 ± 12.8	59.3 ± 13.8	NS
Blood loss (mL)	70.7 ± 55.8	64.2 ± 32.1	NS
Node positivity	33 (30.6%)	32 (26.9%)	NS
Total nodes	15.7 ± 5.7	16.7 ± 5.7	NS
ER positive	64 (59.2%)	73 (61.3%)	NS
PR positive	67 (52.8%)	73 (61.3%)	NS
Adjuvant therapy	77 (71.3%)	82 (68.9%)	NS
Radiation (rad)	5708 ± 1264	5805 ± 1269	NS

Mean ± SD.
ER, estrogen receptor; PR, progesterone receptor.

TABLE 2. *Seroma Resolution*

	Drain	No Drain	p
No. of aspirations	2.2 ± 2.2	3.3 ± 2.1	0.002
Days to resolution	11.5 ± 10	18 ± 10.1	0.0002
Total volume aspirated (mL)	146.3 ± 181.1	266.1 ± 247.6	0.003
No. of patients who did not need aspiration	29 (26.9%)	13 (10.9%)	0.008

Mean ± SD.

TABLE 4. *Evaluation of 30 mL drainage within 24 Hours as Criteria to Remove Closed Suction Drains*

	≤30 mL (n = 33)	>30 mL (n = 76)	p
No. of aspirations	2.1 ± 1.8	2.2 ± 2.4	NS
Total seroma volume (mL)	143.9 ± 162.7	143.7 ± 188.7	NS
Time to seroma resolution (days)	11.8 ± 9.4	11.2 ± 10.3	NS

Mean ± SD.

There were three patients (2.8%) in the DG that had axillary infections and 12 patients (10.1%) in the NDG that had infections. This was significant with a p value of 0.032. There were no significant differences between the groups for incidence of postoperative hematomas, lymphedema, wound dehiscence, or frozen shoulders (Table 3).

Data from the DG were used also to evaluate other previously described criteria (≤30 mL/day) for the removal of drains postoperatively. There were 33 patients in the DG who had less than 30 mL of drainage before drain removal. We retrospectively compared this subset of patients with those 76 patients who drained more than 30 mL. There was no significant difference between the two groups with respect to seromas in terms of mean number of aspirations required, days until seroma resolution, or total volume aspirated (Table 4).

We examined numerous factors to search for an association with seroma formation. The incidence or degree of seroma formation did not correlate with any of the following factors: total number of lymph nodes removed, node positivity, stage of cancer, intraoperative blood loss, type of anesthesia, estrogen or progesterone receptor status, or patient age.

Discussion

Postoperative seroma formation is one of the most common problems seen in the management of axillary wounds.[6–8] In an attempt to decrease this complication, the use of closed suction drains has become an accepted form of wound management.[2,9] There have been no prospective controlled trials to our knowledge that demonstrate the efficacy of drains in axillary wounds for patients who have undergone axillary node dissections. The length of time in which drains are left in place before removal also has been highly variable. In studies of mastectomy wounds where closed suction drains were used, mean duration of drainage ranged from 3 to 13 days. These patients often were kept hospitalized during this period. Even with these lengthy drainage times, seromas still occurred in 24% to 53% of the patients.[6,9–11]

TABLE 3. *Complications*

Complication	Drain	No Drain	p
Infection	3 (2.8%)	12 (10.1%)	0.032
Hematoma	2 (1.9%)	2 (1.7%)	NS
Lymphedema	3 (2.8%)	0	NS
Wound dehiscence	1 (0.9%)	2 (1.7%)	NS
Frozen shoulder	1 (0.9%)	1 (0.8%)	NS

To decrease costs and hospital stay, we routinely discharged patients on the first postoperative day. Our report clearly demonstrates an advantage to drainage of the axilla compared with no drain placement. Those patients randomized to the DG had less volume aspirated, less frequent aspirations, and a shorter duration of time to seroma resolution. We also noted a decreased incidence of infection in those patients who received a drain.

Our reported incidence of postoperative seromas was quite high in comparison to the range reported in the literature. To decrease subjectivity, our protocol required all palpable or ballottable collections to be aspirated regardless of symptoms. Many small fluid collections might have never required removal based on symptoms alone.

A recent paper by Siegel et al.[5] reported a seroma incidence of 4.2% after axillary lymphadenectomy in the treatment of breast cancer. None of their patients received a drain. The mean number of nodes removed was nine (range, 2 to 22), compared with a mean of 16 (range, 6 to 36) in the present study. In evaluation of our own data, we could find no significant correlation between number of lymph nodes removed and presence or degree of seroma formation. We therefore cannot explain the discrepancy between the two studies based on number of lymph nodes extracted. Siegel et al. aspirated only symptomatic individuals, which may account for some of the difference in our results.[5]

Various reported series use the criteria of no more than 30 mL/day of drainage to determine time of drain removal.[2,4] Applying this criteria to our data, we could find no significant difference in the incidence or degree of later seroma formation between those who had minimal drainage (≤30 mL) and those who had increased drainage (>30 mL) recorded from their closed suction drains within a 24-hour period.

This study clearly demonstrates a significant benefit in using a closed suction drain postoperatively in axillary

wounds for patients undergoing level I and level II axillary node dissections for breast cancer. There is a decreased incidence and degree of fluid accumulation beneath the skin flaps in those patients who receive drains compared with those who have no drain placed. There is also a decreased incidence of infection in those who have a drain placed, compared with those without a drain.

References

1. Fisher B, Redmond C, Poisson R, et. al. Eight year results of a randomized clinical trial comparing total mastectomy and lumpectomy with or without irradiation in the treatment of breast cancer. N Engl J Med 1989; 320:822–828.
2. Aitken R, Hunsaker R, James AG. Prevention of seromas following mastectomy and axillary node dissection. Surg Gynecol Obstet 1984; 158:327–330.
3. Moss JP. Historical and current perspectives on surgical drainage. Surg Gynecol Obstet 1981; 152:517–527.
4. Cohen AM, Schaeffer N, Zu-Ying Chen, et al. Early discharge after modified radical mastectomy. Am J Surg 1986; 151:465–466.
5. Siegel BM, Mayzel KA, Love SM. Level I and II axillary dissection in the treatment of early-stage breast cancer. Arch Surg 1990; 125:1144–1147.
6. Tejler G, Aspegren K. Complications and hospital stay after surgery for breast cancer: a prospective study of 385 patients. Br J Surg 1990; 160:481–484.
7. Jansen RFM, van Geel AN. Immediate versus delayed shoulder exercises after axillary lymph node dissection. Am J Surg 1990; 160:481–484.
8. Harris MN, Gumport SL, Maiwandi H. Axillary lymph node dissection for melanoma. Surg Gynecol Obstet 1972; 135:936–940.
9. Morris AM. A controlled trial of closed wound suction. Br J Surg 1973; 60:357–359.
10. Say CC, Donegan W. A biostatistical evaluation of complications from mastectomy. Surg Gynecol Obstet 1974; 138:370–375.
11. Orr RK, Ketcham AS, Robinson DS, et al. Early discharge after mastectomy: a safe way of diminishing hospital costs. Am Surg 1987; 53:161–163.