Evaluation of Post-Mastectomy Pain and Functional Outcome after Surgery for Early Breast Cancer

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ABSTRACT

Objective: This study was designed to evaluate post-mastectomy functional outcome as regards the frequency and severity of post-mastectomy pain syndrome (PMPS), occurrence of lymphedema (LE), occurrence of shoulder motion restriction, physical and psychological welfare after different types of surgery for early breast cancer. Patients and Methods: The study comprised 28 patients with early breast cancer divided into 3 groups according to operative procedure indicated; modified radical mastectomy (group A), pectoralis minor preservation mastectomy (group B) and breast conservative surgery (group C). Postoperative follow-up was conducted every 3 months for PMPS using McGill Pain Questionnaire, pain severity was recorded using 4-point verbal analogue scale. The frequency of occurrence and the degree of LE was reported using sequential circumferential measurements. Psychological and physical welfare was determined using a 4-subscale questionnaire. Results: 10 patients (35.7%) had PMPS with a non-significant difference between the three applied procedures as regards both the frequency and severity of PMPS. 2 patients in group A had painful shoulder with significant reduction of shoulder abduction and external rotation. Six patients (21.4%) developed LE with significant increase in the mean difference in arm circumference in group A & B compared to group C. Patients included in group C had significantly higher scores of psychological and physical welfare compared to other groups. Conclusion: It could be concluded that PMPS is not strictly related to the type of surgical procedure and whenever indicated breast conservative surgery has better functional outcome with the least incidence of complications. (Egypt J. Neurol. Psychiat. Neurosurg., 2007, 44(1): 111-122).

INTRODUCTION

Breast-conservation therapy (BCT) is an oncologically equivalent and cosmetically preferable alternative to mastectomy for most early-stage breast cancer. The progressive reduction of the extension of surgery in the breast and in the axilla is now accompanied by a reduction of the radiation field. The highest incidence of local relapse after breast-conserving surgery is observed in the same area as the primary tumor. This factor provides the rationale for reducing the radiation field to a limited area of the breast primarily affected by carcinoma¹.

Breast cancer treatment may result in long-term upper limb morbidity: reduced range of shoulder motion, muscle weakness of the arm and hand, lymphedema, pain and numbness². Chronic pain following surgical procedures for breast cancer was thought to be rare; however, the results of multiple studies suggest that the incidence of chronic pain following breast cancer surgery may be over 50%³.

Post-mastectomy pain syndrome can follow surgical treatment for breast cancer, including radical mastectomy, modified radical mastectomy, and lumpectomy⁴, and is thought to develop from surgical nerve damage especially in mastectomy patients undergoing axillary dissection⁵. However, several other factors can be hypothesized to increase the risk of developing PMPS after breast cancer surgery, including younger age at diagnosis, a larger tumor size and axillary node invasion⁶. Chemotherapy and radiotherapy can be additional sources of pain and related symptoms and make diagnosis difficult⁷. Moreover, postoperative complications such as bleeding, infection, or seroma formation may increase the risk of developing PMPS⁸.
This prospective comparative study was designed to evaluate the post-mastectomy functional outcome as regards the frequency and severity of PMPS, occurrence of lymphedema, occurrence of shoulder motion restriction, psychological and physical welfare after different types of surgery for early breast cancer.

**PATIENTS AND METHODS**

This study was conducted at General Surgery in conjunction with Neurology Departments, Benha University Hospital over a period of 3 years, started October 2003. The study included 28 patients with mean age of 47.1±5.5; range 35-56 years. All patients underwent full clinical examination, preoperative mammography, patients assigned to undergo BCT underwent preoperative fine needle aspiration cytology, and those assigned for mastectomies underwent preoperative excision biopsy. The preoperative state of the patients including pain and psychological aspects was assessed & no patient complained of pain preoperatively.

Patients were grouped according to indicated operative procedure into 3 groups:

* Group A (n=12 patients) assigned to undergo modified radical mastectomy (Patey's Operation) in which pectoralis major was preserved with sacrification of pectoralis minor to remove axillary lymph nodes up to level III as described by Magnant.

* Group B (n= 9 patients) assigned to undergo Aucincloss technique, as described by Iglehart & Kaelin in which pectoralis major & minor were preserved. Interpectoral lymph nodes were exposed, dissected and excised, (Fig.1a) with preservation of the lateral pectoral nerve (Fig. 1b) supplying pectoralis major, pectoralis minor was retracted medially for exposure of intercostobrachial nerve and medial pectoral nerve that were preserved, (Fig. 1c), then pectoralis major was retracted medially and pectoralis minor laterally for complete axillary evacuation up to level III, (Fig. 1d & e). In both group A and B, wounds were closed after application of wound and axillary drains.

* Group C (n=7 patients) with lesions <4 cm in diameter assigned to undergo BCT as described by Dixon. Through the surgical procedure lumpectomy was performed with 1 cm margin of surrounding normal breast tissue, (Fig. 2a), axillary vein was exposed and dissected and intercostobrachial nerve was exposed and preserved, (Fig. 2b). Complete axillary evacuation up to level III was carried on with preservation of the thoracodorsal and long thoracic nerves (Fig. 2c & d), then wounds were closed after axillary drainage, (Fig. 2e).

Immediate postoperative care was provided in post-anesthetic care unit and patients received postoperative analgesia in form of intravenous pethidine. Cannulation of the ipsilateral limb was avoided. Arm exercises were started from the 1st postoperative day. All patients were discharged 24 hours after surgery. Wound care and follow-up was conducted at Surgery outpatient clinic, drains were removed when the drainage was less than 30 mL a day and after wound healing and removal of stitches patients were scheduled for radio and/or chemotherapy. Patients were examined 2 and 4 weeks after surgery and every 3 months thereafter for 4 visits at Neurology outpatient clinic.

**Follow-up schedule**

The McGill Pain Questionnaire was used to define characteristics of post-mastectomy pain. Chronic pain defined as continuous or intermittent pain lasting for longer than 3 months. Pain severity was recorded according to 4-point verbal analogue scale as mild (not requiring treatment), moderate and responding to treatment or severe but responding to treatment with partly restricting quality of life and severe, considerably restricting quality of life and partly responding to treatment. Also, the effectiveness of supplied treatment was determined.
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Fig. (1a): Interpectoral LN exposed & dissected.

Fig. (1b): Dissection & preservation of lateral pectoral nerve (L) seen piercing pectoralis major muscle.

Fig. (1c): Pectoralis minor retracted medially for exposure of intercostobrachial (I) and medial pectoral (M) nerves which are preserved.

Fig. (1d): Pectoralis major was retracted medially & pectoralis minor was retracted laterally to dissect level III axillary LN.

Fig. (1e): Complete axillary evacuation up to level III

Fig. (1): Pectoralis minor preserving procedure.
Fig. (2a): lumpectomy of the tumor with safety margin & axillary incision.

Fig. (2b): Dissection of axillary vein (V) and intercostobrachial nerve (I) exposed.

Fig. (2c): Preservation of intercostobrachial nerve (I), long thoracic (LT) & Thoracodorsal (TD) nerves.

Fig. (2d): Axillary Dissection Completed.

Fig. (2e): Both lumpectomy and axillary wound were closed with axillary drainage.

Fig. (2): Breast conservative surgery procedure.
The frequency of occurrence and the degree of lymphedema (LE) was reported using sequential circumferential measurements at level of five selected anatomical sites along both arms and hands; namely humeral head (circumference of the axilla), mid-humeral shaft (circumference of mid arm), olecranon process (circumference of elbow), head of radius (circumference of wrist) heads of metacarpals (circumference of extended hand) and the presence of LE was determined if there was ≥2 cm differences between sites.

For determination of psychological and physical welfare, a 4-point (4: normal, 3: partially disturbed, 2: disturbed and 1: distressing) questionnaire of four subscales including a) physical well-being, b) physical autonomy, c) relational life and psychological well-being and d) total psychological and physical welfare.

Statistical analysis
Data were analyzed using t-test and Chi-square test. Results of postoperative questionnaires were analyzed. Statistical analysis was conducted using the SPSS (Version 10, 2002) for Windows statistical package. A P value <0.05 was considered statistically significant.

RESULTS

All patients completed the study and follow-up with no missing cases. There was a non-significant (P>0.05) difference between the three groups as regards patient's age. There were 12 patients with lesion's diameter ≤2 cm, with no clinically palpable axillary lymph nodes, and 16 patients with lesion diameter ranging between ≥2 and ≤5 cm; 4 of them had no clinically palpable lymph nodes and 12 had palpable lymph nodes (N1), (Table 1).

Operative time showed a non-significant (P>0.05) decrease in group C compared to the other groups with a non-significant (P>0.05) increase in duration of surgery in group B compared to group A, (Fig. 3).

During surgery, all nerves were tried to be preserved; however, intercostobrachial nerve was injured in 23 cases (82.1%) to allow axillary clearance; 4 in group C, 7 in group B and in all cases in group A. Lateral pectoral nerve was preserved in all cases, whereas medial pectoral nerve was sacrificed in all patients underwent Patey's procedure and in one case (11.1%) underwent pectoralis minor preservation. No pectoral nerve injury occurred in group C, (Fig. 4).

Two cases (7.1%); one in each of group A and B developed wound infection that responded to conservative treatment.

No patient complained of PMPS at the first 2- and 4-weeks visits, whereas at 3-months visit 4 patients (14.3%); 2 (7.2%) in group A and one (3.6%) in each of group B and C, had PMPS, at 6-months 7 patients (25%) had PMSP; 3 (10.7%) in group A and 2 (7.2%) patients in each of groups B and C and at 9 and 12-m after surgery 10 patients (35.7%) had PMPS; 3 (10.7%) in group A, 4 (14.3%) in group B and 3 (10.7%) in group C. There was a non-significant increase in the number of patients complaining of PMPS throughout the study period, (Χ²=0.51, P>0.05) and between the three groups, (Χ²=0.88, 0.47 & 0.45, P>0.05). Furthermore, the frequency of pain showed progressive increase reaching maximum at 3-6 months and remained stationary after 9 months of surgery (Table 2, Fig. 5).

Only 4 patients (14.3%) had severe pain, 2 of them had mild and 2 had moderate at 3-month visit and were maintained on non-steroidal anti-inflammatory analgesics and local application of a topical anesthetic and analgesic cream (EMLA cream: Lidocaine 2.5% & Prilocaine 2.5%), next visit at 6-month, pain became more severe and irresponsive to the treatment, limiting sleep hours and daily activities, these patients were prescribed anxiolytic drugs in addition to their treatment, next visit pain became tolerable and responding to treatment. All other patients had pain ranging between mild and moderate pain and maintained on oral and topical treatment, (Table 2). As regards site of pain, patients had more than one site of pain that involved the axilla in 7 patients (25%), the medial upper arm in 5 patients (17.9%), the anterior chest wall in 3 patients
(10.7%), and the shoulder in 2 patients (7.1%). Four patients reported continuous pain that was worse with movement, 3 patients stated that pain was manifested itself with daily activities, and the other 3 reported a sleep disturbance. Both patients in group A with painful shoulder that was aggravated during movement, started to limit shoulder abduction and external rotation to a minimum and at 9-month visit there were signs of frozen shoulder in one patient. One patient underwent pectoralis minor preservation developed phantom breast pain.

Six patients (21.4%) developed LE; 4 in group A and 2 in group B, but non in group C. The mean difference in arm circumference in group A (1.7±1.03 cm) showed a significant (P<0.05) increase compared to difference recorded in group C (0.89±0.18 cm) with a non-significant difference compared to group B (1.42±0.65 cm), with a significant increase in difference in group B compared to group C, (Fig. 6). All patients with severed intercostobrachial nerve had numbness of the upper medial aspect of the arm.

Patients included in group C showed significantly increased scores of psychological and physical welfare compared to both other groups with a non-significant (P>0.05) difference between groups A and B, (Table 3, Fig. 7).

### Table 1. Patients' clinical data.

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
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<tbody>
<tr>
<td>Number</td>
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<td>7</td>
<td>28</td>
</tr>
<tr>
<td>Age (years)</td>
<td>47.4±6.1</td>
<td>46.9±5</td>
<td>47±5.6</td>
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<td>Clinical tumor size (cm)</td>
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<td>3</td>
<td>4</td>
<td>5</td>
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<td></td>
<td>&gt;2–≤5</td>
<td>9</td>
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<td>2</td>
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<tr>
<td>Clinical nodal status</td>
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<td>4</td>
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<td></td>
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<td>6</td>
<td>5</td>
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### Table 2. Number of patients complaining of PMPS and its severity throughout the follow-up period.

<table>
<thead>
<tr>
<th>Number of patients</th>
<th>3-M</th>
<th>6-M</th>
<th>9-M</th>
<th>12-M</th>
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</thead>
<tbody>
<tr>
<td>Group A</td>
<td>2 (7.2%)</td>
<td>3 (10.8%)</td>
<td>3 (10.8%)</td>
<td>3 (10.8%)</td>
</tr>
<tr>
<td>Group B</td>
<td>1 (3.6%)</td>
<td>2 (7.2%)</td>
<td>4 (14.4%)</td>
<td>4 (14.4%)</td>
</tr>
<tr>
<td>Group C</td>
<td>1 (3.6%)</td>
<td>2 (7.2%)</td>
<td>3 (10.8%)</td>
<td>3 (10.8%)</td>
</tr>
<tr>
<td>Total</td>
<td>4 (14.4%)</td>
<td>7 (25%)</td>
<td>10 (35.7%)</td>
<td>10 (35.7%)</td>
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</tbody>
</table>

#### Pain severity

<table>
<thead>
<tr>
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<th>6-M</th>
<th>9-M</th>
<th>12-M</th>
</tr>
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<tbody>
<tr>
<td>Mild</td>
<td>Group A</td>
<td>1</td>
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<td>0</td>
</tr>
<tr>
<td></td>
<td>Group B</td>
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<td>0</td>
</tr>
<tr>
<td></td>
<td>Group C</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Moderate</td>
<td>Group A</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Group B</td>
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</tr>
<tr>
<td></td>
<td>Group C</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Severe</td>
<td>Group A</td>
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<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Group B</td>
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<td>2</td>
</tr>
<tr>
<td></td>
<td>Group C</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 3. Psychological and physical welfare scores among studied groups.

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical well-being</td>
<td>2.58±1*</td>
<td>3.1±0.78*</td>
<td>3.86±0.38</td>
</tr>
<tr>
<td>Physical autonomy</td>
<td>2.42±0.9*</td>
<td>2.78±0.67*</td>
<td>3.71±0.49</td>
</tr>
<tr>
<td>Psychological well-being</td>
<td>2.17±0.72*</td>
<td>2.44±0.73*</td>
<td>3.71±0.49</td>
</tr>
<tr>
<td>Psychological and physical welfare</td>
<td>2.39±0.87*</td>
<td>2.78±0.75*</td>
<td>3.76±0.44</td>
</tr>
</tbody>
</table>

Data are shown as mean±SD
*: significant versus group C

Fig. (3): Mean duration of surgery in the three groups.
Fig. (4): Patients’ distribution according to the frequency of nerve injury among the studied groups.

Fig. (5): PMPS frequency in the three groups throughout the study period
Fig. (6): Mean difference in arm circumference in patients included in studied groups.

Fig. (7): Psychological and physical welfare scores among studied groups.
DISCUSSION

All patients underwent smooth operative procedures with no intraoperative complications. The operative time was non-significantly longer in group A and being shorter in group C. Successful full axillary clearance was achieved in all cases without impending insult to important axillary structure nor noticeable difficulty. These results illustrated the feasibility of complete axillary evacuation in either pectoralis minor preservation or conservative breast surgery. These results agreed with Costa et al.\textsuperscript{1}, and Chadha et al.\textsuperscript{17}, who reported that conservative breast surgery is the preferable modality for early breast cancer and enables early patient discharge with less postoperative complications and is oncologically similar to other procedures.

The frequency of PMPS showed progressive increase throughout follow-up visits up to 35.7\% of studied patients at end of follow-up. These results coincided with that obtained by Smith et al.\textsuperscript{18}, who through a retrospective study reported that 43\% of patients suffered from PMPS, also, Rietman et al.\textsuperscript{2}, who reported high variation in prevalence of postmastectomy pain in range of 12-51\%.

Moreover, there was a non-significant difference between the three applied procedure as regards both the frequency and severity of PMPS. These results agreed with Tasmuth et al.\textsuperscript{19}, and Carpenter et al.\textsuperscript{3}, who reported that the incidence of post-mastectomy and ipsilateral arm pain found in patients who had breast conserving surgery versus those who had mastectomy showed no difference due to the same risk of damage to intercostobrachial nerve.

However, the etiology of PMPS is a matter of debate and could not be relied only on damage to intercostobrachial nerve, as in the current study it could be preserved in 3 of 7 cases in group C and damaged in all cases included in group A, but pain occurred in 3 cases in each group, this signified that other factors could operate in the development of pain after conservative treatment, or absence of pain after mastectomy. One explanation is occurrence of allodynia; pain on such touch of easily irritated skin, which is related to injury of nerve endings without transecting the whole trunk of the nerve thus increasing neuronal feedback and central nervous system sensitization to the wound area, superimposed the extensive nerve injury during modified mastectomy may provide wide areas of hypoesthesia thus decreasing the frequency of pain sensation. Similar explanations were provided by Baron et al.\textsuperscript{20}.

Pain may be attributed to axillary dissection irrespective of the extent of dissection, however, Baron et al.\textsuperscript{20}, reported pain, despite being less, with just sentinel axillary lymph node removal. Moreover, Wallace et al.\textsuperscript{21}, reported that prevalence of any pain was greatest in patients after mastectomy with reconstruction versus without reconstruction and in women who had breast implants than in patients who had reconstruction without implants (30\%). Also Gottrup et al.\textsuperscript{22}, reported that sensitization seems to be a feature in breast cancer-operated women with pain, but not in pain-free women. This signified that pain could be attributed to local mechanism in breast itself not totally related axillary manipulations. In support of this assumption is the reported relieving effect of topical treatment, such effect was previously reported by Fassoulaki et al.\textsuperscript{23}, on local application of EMLA cream containing local anesthetics.

Earlier reports on arm morbidity usually focused on lymphedema, and it was not until the past few years that investigators started paying more attention to other arm symptoms. In this study Six patients (21.4\%) developed mild lymphedema which did not progress by time; 4 in group A and 2 in group B, but non in group C. These results agreed with Ozaslan & Kuru\textsuperscript{24}, who reported frequency of lymphedema of 28\% after modified radical mastectomy. So we recommend management of LE as soon as detected by elastic compression.
Two patients with painful shoulder that limited shoulder abduction and external rotation to a minimum and at 9-month visit there were signs of frozen shoulder in one patient. These observations go in hand with Kwan et al.\textsuperscript{16}, who reported significant reduction of shoulder abduction in 3.9\% of patients after breast cancer surgery. This shows that the problems reported by the symptomatic patients should not be ignored as trivial and we recommend early encouragement of shoulder movement after surgery.

Patients included in group C showed significantly increased scores of psychological and physical welfare compared to both other groups. Psychological welfare could be attributed to breast conservation and cosmetic wound appearance; the physical welfare could be attributed to the psychological elements, preservation of shoulder muscles and absence of lymphedema, similar results were obtained by Gottrup et al.\textsuperscript{22}.

It could be concluded that PMPS is not strictly related to the type of surgical procedure and whenever indicated conservative breast surgery has better functional outcome with the least incidence of complications.

\textbf{REFERENCES}


المراجعة العربية

تقييم الألم والتحسن الوظيفي بعد جراحات أورام الثدي الأول

وقد أجريت هذه الدراسة لتقييم الأداء الوظيفي ومعدل حدوث الألم ومقداره بعد جراحات أورام الثدي الأول وتأثير ذلك على مستوى الارتجاح الليفاوى وحركة الكتف والتأثير الجسدي والنفسى على المرضى وذلك باستخدام أنواع مختلفة من جراحات أورام الثدي السرطانية.

وقد اشتملت هذه الدراسة على 28 مريض بسرطان الثدي في المرحلة الأولى وتم تقسيمهم إلى ثلاث مجموعات حسب نوع الجراحة المستخدمة. وقد تم متابعة الحالات بعد الجراحة باستخدام مقياس سكال جيل للألم وقد تم تسجيل درجة الألم باستخدام أربع مقياسات مختلفة. كما تم تقييم مدى التحسن الوظيفي والنفسى باستخدام أربع مقياسات تحت المقياس الأساسي.

وقد أوضحت هذه الدراسة أنه لا فرق في نوعية الألم أو مقداره باختلاف نوع الجراحة المستخدمة ولكن توجد هنالك تحسين ذو دلالة للتحسن الوظيفي والنفسى ونسبة أقل في الأعراض الجانبية باستخدام أسلوب أورام الثدي التحفظي.