

Oncological Safety of Pectoralis Fascia Preservation in Modified Radical Mastectomy

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Abstract

Background: In oncological mastectomy procedures, the pectoral fascia (PF) is frequently excised. The risk of bleeding, infections, and seroma following surgery may be lower if the PF is preserved. Better prosthesis coverage may also enhance reconstructive results, decreasing implant extrusion rates and enhancing cosmetic results. **Aim:** To assess the oncological safety and the early complications of pectoralis fascia preservation in modified radical mastectomy. **Patients and Methods:** This randomized control experiment was carried out in Suez Canal University Hospitals' operating rooms and surgical inpatient wards. There were two groups of patients: Between June 2020 and March 2022, patients in (Group A) received preservation of the pectoral fascia, and (Group B) underwent excision of the pectoral fascia. **Results:** Patients who had pectoralis fascia preservation had significantly lower cumulative seroma volume than those who had pectoralis fascia excision ($p < 0.001$). **Conclusion:** It is not required to routinely remove the pectoralis fascia. Regardless of tumor staging, PF can be safely preserved when the tumor is more than five millimeters distant from the deep aspect of the breast. However, care should be taken when handling situations where the breast's excessive distortion makes determining this distance challenge. Research should be done to find more effective techniques than the surgeon's perception of the invasion. Whenever possible, the fascia beneath the tumor should be partially resected.

Keywords: Breast cancer; Breast reconstruction; Breast implants

Introduction

Breast cancer is a disease in which cells in the breast grow out of control. Breast cancer is the most common cause of cancer death among women worldwide. Incidence rates are high in more developed countries whereas rates in less developed countries and Japan are low but increasing⁽¹⁾. In the USA each year more than 180

000 women are diagnosed with breast cancer. If current rates of increase remain constant, a woman born today has a 1 in 10 chance of developing breast cancer⁽²⁾. Breast cancer is the most prevalent cancer in women in Egypt, accounting for 18.9% of all cancer cases (35.1% in women and 3% in men) among the 10556 patients in the Egypt National Cancer Institute series for the year 2001, with an age-adjusted preval-

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ence of 49.6 per 100 000 people⁽³⁾. The mammary gland spans the anterior axillary line and the sternum, running vertically from the second rib to the seventh rib. The breast tissue continues into the axilla. The superficial fascia, which has two layers, including a tenuous superficial layer and a deep layer that covers the deep surface of the gland and contributes to a gliding plane on the PF that covers the underlying pectoral major muscle, encloses the breast gland⁽⁴⁾. Early in the 20th century, Halsted popularized radical mastectomy, which involved the removal of the skin covering the breast, major muscle, significant lymph node dissection, and pectoral. When more limited surgical procedures were established in the 1950s and 1960s as imaging modalities and adjuvant therapy choices advanced, the radical mastectomy was discontinued. The Patey-created modified radical mastectomy (MRM) left the pectoral muscle intact but removed the PF⁽⁵⁾. If PF preservation can lead to a superior oncological outcome, its necessity has been contested⁽⁶⁾. The PF is not a part of the breast glandular tissue; rather, it is a part of the muscular architecture, therefore theoretically, removing the PF has no advantage for treating cancer unless the PF has been invaded by a tumor. The PF adheres tightly to the underlying pectoral muscle (PM). Contrary to the deep fascia in many other body areas, there is no dividing epimysium between the PF and the PM (limbs, thoracolumbar fascia, rectal sheet, and neck fasciae). Therefore, the PF and PM should be seen as one myofascial unit, with the PF playing a part in proprioception because of its many nerve endings. Excision of the PF is therefore not the most obvious option from a functional and surgical technical perspective⁽⁷⁾. Therefore, it is debatable whether we can obtain several benefits of PE preservation, such as a reduction in postoperative bleeding

complications by preventing injury to the PM itself, a reduction in postoperative seroma formation, and the ability of the strong fibroblastic layer (mean thickness 151 37 μm) to aid in implant coverage⁽⁸⁾. Therefore, PF preservation might lower the incidences of postoperative implant extrusion. In some earlier research, the PF in the mediocaudal lower pole was even mentioned as a way to enhance projection and enable direct-to-implant reconstruction rather than stage I breast reconstruction. Thus, PF preservation may increase the scope of reconstructive options and enhance cosmetic results⁽⁹⁾. The study aimed to assess the oncological safety and the early complications of pectoralis fascia preservation in modified radical mastectomy.

Patients and Methods

From June 2020 to March 2022, female patients with early breast cancer who were sent to the Surgical Oncology department at Suez Canal University Hospitals underwent a single-blinded randomized controlled clinical trial. There were two groups of patients: Group A: those who underwent MRM while maintaining PF. Group B: those who had their pectoral fascia removed. Early-stage breast cancer (stage I and II), refusal of conservative surgery, the difficulty of strict follow-up for patients, and eligibility for modified radical mastectomy were inclusion criteria for PF preservation. Stages III and IV of breast cancer, inflammatory breast cancer, and tumors that are either penetrating or extremely near to the pectoralis fascia were the exclusion criteria for PF preservation (less than 5mm). The predicted sample size was 37 participants, however, the actual sample size in each group was 40 after accounting for the anticipated (dropout) rate of 10%. Sampling strategy: A single-blinded,

randomized, controlled clinical trial was used for this study.

Study procedure

Preoperative: 1) Take a thorough medical history, including information on the patient's age, place of residence, occupation, parity, gravidity, history of abortion or miscarriage, the outcome of any previous pregnancies, the presence of comorbid conditions (such as hypertension), medication allergies, hospitalizations, previous operations, and any history of breast cancer or breast masses. 2) General clinical examination: chest, heart, and abdomen exams; vital indicators such as blood pressure, heart rate, respiration rate, and temperature. 3) Breast examination. 4) Investigations: standard laboratory tests, breast ultrasound, and mammography. Intraoperatively, patients in Groups A and B had MRM with PF preservation and pectoral fascia removal, respectively. The whole range of pertinent information from the patient's case was gathered, including information on the tumor's features, histopathology, and immunohistochemistry. PF is defined in the context of this study as the fascia on the anterior face of the pectoralis muscle and the fat pad from the nearby retro mammary region. Following surgery, all patients were checked for drain output, seroma formation, and flap aesthetics as soon as possible.

Ethical approval

Permission from the faculty of medicine's ethics committee and institutional review board approval was acquired. All study participants were introduced to the researcher, who then requested their participation after briefly outlining the study's objectives. All participants got thorough information on the study's goal and anticipated advantages. The entire project was

conducted with the utmost ethical attention. All participants verbally consented after being fully informed, and information confidentiality was guaranteed. Deans of the medical school, the administrator of the hospital run by Suez Canal University, and the head of the surgical oncology division all provided official written letters of administrative permission. To secure their cooperation, the study's title and goals were explained to them.

Statistical Analysis

Version 20 of the Statistical Program for Social Science was used for data analysis (SPSS Inc., Chicago, IL, USA). Mean and standard deviation was used to characterize quantitative variables. Numbers and percentages were used to describe qualitative factors. Student t-test was used to compare parametric quantitative variables between two groups. When frequencies fell below five, the chi-square (χ^2) test or Fisher's exact test was used to compare qualitative variables. To evaluate the relationship between two normally distributed variables, Pearson correlation coefficients were used. A P value of 0.05 or lower is regarded as significant when a variable was not normally distributed.

Results

Table 1 summarizes the baseline characteristics of the studied sample. The study participants were divided into two groups: i) Group A: patients who will undergo modified radical mastectomy with pectoralis fascia preservation (n=49) and ii) Group B: patients who will undergo modified radical mastectomy with pectoralis fascia excision (n=52). There was no statistically significant difference between both groups regarding their baseline characteristics. A comparison of the intraoperative blood

loss between the two groups shows that patients who had pectoralis fascia preservation had significantly lower intraoperative blood loss than had pectoralis fascia excision ($p < 0.001$) (Table 2). A comparison

of the operative time between the two groups shows that patients who had pectoralis fascia preservation had significantly lower operative time than had pectoralis fascia excision ($p = 0.003$) (Table 2).

Table 1: Baseline characteristics of the studied sample			
Variables	Pectoralis fascia preservation (n= 49)	Pectoralis fascia excision (n= 52)	p-value
Age	50.1 ± 3.7	53.2 ± 4.7	0.24 ^a
Pathology			
Invasive ductal carcinoma	45 (91.8)	48 (92.3)	0.85 ^b
Invasive lobular carcinoma	3 (6.1)	4 (7.7)	
Paget's disease of the breast	1 (2.1)	0 (0)	
Stage			
I	4 (6.7)	0 (0)	0.15 ^b
II	45 (93.3)	52 (100)	
Multi-centricity	0 (0)	2 (3.8)	0.28 ^b
No. Excised LNS	15.37 ± 4.9	17.47 ± 5.7	0.41 ^a
Receptor positive			
PR	26 (53.1)	28 (53.8)	0.56 ^b
ER	23 (46.9)	21 (40.4)	
Her2n	0 (0)	3 (5.8)	

^a=Mann-Whitney U test. ^b=Fisher exact test. Statistical significance at $P < .05$

A comparison of the total volume of seroma between the two groups shows that patients who had pectoralis fascia preservation had significantly lower cumulative seroma volume than those who had pectoralis fascia excision ($p < 0.001$) (Table 2). Table 2 shows that fascia preservation during modified radical mastectomy showed 5 -day reduction in mean days to drain removal compared with the group with fascia excision (log-rank p -value= 0.01). Table 2 shows that there was no statistical significance between both patients regarding the postoperative stay in the hospital ($p = 0.849$). Table 3 shows that there was no incidence of recurrence at 6-month, 12-month, and 18-month follow-up in both patients with pectoralis fascia preservation and pectoralis fascia excision. Table 4 shows that the most common post-operative oncological management used

on patients with modified radical mastectomy was radiotherapy followed by chemotherapy. Neoadjuvant therapy was given to 10.2 % and 7.6% of patients in the pectoralis fascia preservation group and pectoralis fascia excision, respectively. Radical mastectomy (removal of the pectoralis major and minor muscles) and modified radical mastectomy (sparing the muscles) are two different surgical procedures used to treat breast cancer. The pectoralis fascia was nevertheless removed during an oncological mastectomy, though. Recent studies about the pectoralis fascia's inadequate lymphatics have been published⁽¹⁰⁾. Suami reviewed the history of breast lymphatic investigations and questioned whether, contrary to popular opinion, the flow of lymph must necessarily drain into the sub-areolar plexus before moving toward the axilla. Despite the fact that his approach

only allowed him to show lymphatic vessels larger than 0.1 mm, the same author

was unable to demonstrate any lymphatic network near the deep pectoralis fascia⁽¹¹⁾.

Table (2): Comparison between pectoralis fascia preservation and excision regarding intraoperative blood loss.

Variables	Pectoralis fascia preservation (n= 49)	Pectoralis fascia excision (n= 52)	p-value*
Intraoperative blood loss (ml),	221.4± 27.8	338.4± 60.8	<0.001*
Operative time (min),	72.8± 5.2	93.3± 6.9	0.003* ¹
Total volume of seroma (ml)	505.6 ± 209.3	1674.1± 1373.8	<0.001*
Analysis on time to drain removal in both groups	7.4	12.6	0.01
Hospital length of stay (hrs)	46.5 ± 1.12	48.05 ± 0.56	0.849

Data are presented as mean± SD; * Mann-Whitney U test. Statistical significance at p<0.05

The study's objective is to identify the advantages and evaluate the oncological safety of pectoral fascia preservation in MRM patients. According to Da Silva et al.⁽¹⁰⁾ the patients' mean age was 59.6 years. Invasive ductal carcinomas made up 24 (80%) of the tumors, whereas invasive lobular carcinomas made up 6% of them. Eight of the 30 individuals under study exhibited PF tumor invasion. 5.28 cm was the average tumor size (range 1.7-12 cm). In 10 cases, of which 8 showed PF invasion, the distance between the tumor and the fascia was equal to or less than 2 millimeters. Regardless of any other variable status, no patients with tumors more than 2 mm away from the deep aspect of the breast displayed PF invasion. In the study by Abdelhamid et al.⁽⁹⁾ 73 women who had Grade 1 or 2 breast cancer underwent either a mastectomy with PF preservation or PF removal. The median length of follow-up was 41 months (34–48 months). No information on local recurrences, far-reaching metastases, or mortality rates was given, and there was no statistically significant difference between the two groups in terms of the tumor stage and the number

of LNs removed. The outcomes of 220 individuals who underwent 256 mastectomies with PF preservation were reported by Sargarello et al.⁽¹²⁾. The PF was used to cover the prosthesis in the lower pole during an initial one-stage reconstruction for all patients. Invasive breast cancer (n = 234, 91.5%) or DCIS (n = 22, 8.5%) were the two different types of tumors. The follow-up period was relatively brief, averaging only 29 months (range: 3 months–5 years). In the current study, we discovered that individuals who had their pectoralis fascia preserved experienced much lower intraoperative blood loss than those who had their pectoralis fascia excised (p< 0.001). According to Abdelhamid et al.⁽⁹⁾ the average intraoperative blood loss in the pectoral fascia excision group was 300 ml, while it considerably decreased to 198ml (P<0.001) in the pectoral fascia preservation group. Tumor-pectoral fascia distance ranged from 48 mm to 5 mm, and all cases of group I (excised group) pectoral fascia showed negative deep pectoralis margin. According to Dalberg et al.⁽¹³⁾, there was no statistically significant difference between the pectoral fascia excision and

preservation groups in terms of seroma production, intraoperative hemorrhage, or procedure time. Patients who had the pectoralis fascia preserved had considerably shorter surgical times than those who had the pectoralis fascia excised ($p=0.003$), according to a comparison of the two groups

operating times. We demonstrated that a comparison of the total volume of seroma between the two groups reveals that patients who had pectoralis fascia preservation had significantly lower cumulative seroma volume than those who had pectoralis fascia excision ($p < 0.001$).

Table 3: Comparison between pectoralis fascia preservation and excision regarding recurrence.

Variables	Pectoralis fascia preservation (n=49) No. (%)	Pectoralis fascia excision (n= 52) No. (%)	p-value
6-month recurrence			
Present	0 (0)	0 (0)	0.22
Absent	49 (100)	52 (100)	
12-month recurrence			
Present	0 (0)	0 (0)	0.22
Absent	49 (100)	52 (100)	
18-month recurrence			
Present	0 (0)	0 (0)	0.22
Absent	49 (100)	52 (100)	

Table (4). Comparison between pectoralis fascia preservation and excision regarding post-operative oncological management

Variables	Pectoralis fascia preservation (n= 49)	Pectoralis fascia excision (n= 52)	p-value
Hormonal therapy	26 (53.1)	28 (53.8)	0.96
Chemotherapy	15 (30.6)	16 (30.7)	0.96
Radiotherapy	19 (38.7)	22 (42.3)	
Neoadjuvant therapy	5 (10.2)	4 (7.6)	

P values are based on as Fisher exact test. Statistical significance at $P < .05$

This was supported by Abdelhamid et al.⁽⁹⁾ who reported that the operative time was approximately 80 min (mean) in group I and decreased significantly to 59 min in group II ($P=0.00001$). Seroma occurred in nine patients in group I, but only two patients in group II, according to Abdelhamid et al. (9) ($P=0.025$). In the axilla or any place along the skin incisions, Dalberg et al.⁽¹³⁾ defined a seroma as any clinically detectable collection of fluid needing aspiration. Of the 244 patients who participated

in this experiment, information on the occurrence of seroma was gathered for 198 of them. Comparatively, 39 out of 98 patients (39.8%) in the PF removal group developed seroma, as opposed to 31 out of 100 patients (31%) in the PF preservation group. The difference ($P = 0.20$) was not statistically significant. The incidence of seroma was significantly lower in the PF preservation group (5.6 percent versus 24.3 percent, $P = 0.025$), according to Abdelhamid et al. ⁽⁹⁾ 3 seromas were noted in

the investigation by Salgarello et al.⁽¹²⁾ (1.3 percent). However, neither of the investigations gave a definition of seroma. Seroma was not mentioned in the report of Sandelin et al.⁽¹⁴⁾ on this topic. According to Da Silva et al.⁽¹⁰⁾, only the distance from the tumor to the PF exhibited a statistically significant relationship with the invasion of the PF ($p = 0.034$ OR = 0.333 CI = 0.121 0.922). In our study, we discovered that, compared to the group who had their fascia removed, those who kept their fascia following a modified radical mastectomy experienced a 5-day shorter mean time until drain removal (log-rank p -value = 0.01). According to Abdelhamid et al.⁽⁹⁾, group II's first 7-day drain output volume was substantially lower than group I's, at 501 ml as opposed to 791 ml ($P=0.00001$). Regarding drain duration, it was 15.3 days in group I but it was considerably lower in group II at 8.7 days ($P=0.00001$). According to Dalberg et al.⁽¹³⁾, there was no statistically significant difference in the chest wall recurrence rates in the PF preservation group (18 patients, or 14.6%), and the PF removal group (10 patients, or 8.3%). There was no discernible difference in the number of regional recurrences, with 7 (5.7%) in the PF preservation group and 8 (6.6%) in the PF removal group. 39 (31.7%) patients in the PF preservation group versus 35 (28.9%) of the $n = 121$ patients in the PF removal group experienced distant metastases, although there was no difference ($P = 0.61$) in the mortality rates. The Abdelhamid et al. RCT showed no local recurrences in either group⁽⁹⁾. Locoregional recurrences were reported in the retrospective analysis by Sandelin et al.⁽¹⁴⁾, in 13 of 203 patients (6.4%), of which 9 (4.4%) were chest wall recurrences and 4 (2.0%) were regional recurrences. Six patients were reported to have distant metastases (3 percent). 31 patients (15.4%) passed away from advanced breast

cancer. Two chest wall recurrences were reported by Salgarello et al. as (1.1 %)⁽¹²⁾. There was no information on distant metastases, regional recurrences, or fatality rates. Regarding the postoperative hospital stay, there is no statistically significant difference between the two patients in our study ($p=0.849$). Early drain removal, according to Dalberg et al.⁽¹³⁾ was not linked to a rise in wound complications but was related to a noticeably shorter hospital stay. In the current study, we discovered that both patients who had their pectoralis fascia preserved and those who had it excised saw no recurrence at the 6-month, 12-month, or 18-month follow-up visits. The follow-up length for patients in Abdelhamid et al. study ranged from 34 to 48 months⁽⁹⁾, with a mean follow-up period of 41 months. Clinical examination and CA15-3 were used to monitor our patients for chest wall recurrence. If there is a suspicion of induration, breast ultrasonography, chest radiography, and chest computed tomography was done. In both groups, there were no local recurrences throughout this time. According to Dalberg et al.⁽¹³⁾, long-term follow-up showed that the preservation of pectoral fascia had no meaningful impact on chest wall recurrence or overall survival, but that patients who had their fascia preserved had a 1.8-fold higher chance of local recurrence. According to Dalberg et al.⁽¹³⁾, patients assigned to preserved fascia had a small increase in chest wall recurrences. In total, 16 patients who received pectoral fascia preservation compared to 8 patients who received pectoral fascia removal experienced chest wall recurrence (hazard ratio: 2.0, 95 percent confidence interval: 0.9-4.7). The hazard ratio was the same after nodal status, tumor size, and ER status were considered in the multivariate analysis. Postoperative chest wall irradiation was performed on eight of

the patients with chest wall recurrence who were assigned to pectoral fascia preservation as opposed to three of the patients who were assigned to pectoral fascia excision. Postoperative irradiation lowers the rate of locoregional recurrence, according to Cuzick et al.⁽¹⁵⁾, and when paired with chemotherapy, has an even greater impact, according to Overgaard et al.⁽¹⁶⁾. Having lymph node metastases as the main risk factor for a locoregional recurrence following mastectomy⁽¹⁷⁾. After mastectomy, the reported locoregional recurrence rate for node-positive individuals is 19–27%.⁽¹⁸⁾ The rate of localized recurrence is greatly decreased by postoperative radiotherapy⁽¹⁵⁾. In patients with big tumors or lymph node metastases in the axilla who are at high risk for local recurrence, postoperative irradiation combined with chemotherapy results in a lower rate of loco-regional recurrences as well as a lower risk for distant metastases⁽¹⁹⁾. There is no significant difference between the oncological outcomes of local, regional, or distant metastasis in this systematic study. Salgarello et al.⁽¹²⁾ found no difference between the two groups in terms of seroma formation. But similarly, in our work, Abdelhamid et al.⁽⁹⁾ reported that there is significance between the two groups. The results of all immediate reconstructions with definitive prostheses ranged from very good to good in 78.6 percent of patients, acceptable in 14% of cases, and unsatisfactory in 7.3%. Salgarello et al.⁽¹²⁾ found that extra surgery was required in 5.4% of cases to improve cosmetic outcomes, which encourages others to take reconstruction in patients with pectoralis fascia preservation into account⁽²⁰⁾.

Conclusion

It is not required to routinely remove the pectoralis fascia. Regardless of tumor

staging, PF can be safely preserved when the tumor is more than five millimeters distant from the deep aspect of the breast. When dealing with situations where severe breast distortion makes it challenging to judge this distance, vigilance must be exercised. Research should be done to find more effective techniques than the surgeon's perception of the invasion. When in doubt, we ought to partially resect the fascia that the tumor is embedded in.

Conflict of interest statement

The authors declare that they have no conflict of interest.

Authors contribution

All authors are equally contributed.

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