Incidence of Myofascial Pain Syndrome in Breast Cancer Surgery: A Prospective Study

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Background: Pain after breast cancer therapy is a recognized complication found to have an adverse impact on patient's quality of life, increasing psychosocial distress. In recent years, case reports about myofascial pain syndrome are emerging in thoracic surgery as a cause of postsurgery pain. Myofascial pain syndrome is a regional pain syndrome characterized by myofascial trigger points in palpable taut bands of skeletal muscle that refers pain a distance, and that can cause distant motor and autonomic effects.

Objective: The objective of this study was to assess the incidence of myofascial pain syndrome prospectively 12 months after breast cancer surgery.

Methods: Each participant was assessed preoperatively, postoperatively between day 3 and day 5, and at 1, 3, 6, and 12 months after surgery. A physical therapist, expert in the diagnosis of myofascial pain syndrome, performed follow-up assessments. Pain descriptions by the patients and pain pattern drawings in body forms guided the physical examination. The patients were not given any information concerning myofascial pain or other muscle pain syndromes.

Results: One year follow-up was completed by 116 women. Of these, 52 women developed myofascial pain syndrome (44.8%, 95% confidence interval: 35.6, 54.3).

Conclusion: Myofascial pain syndrome is a common source of pain in women undergoing breast cancer surgery that includes axillary lymph node dissection at least during the first year after surgery. Myofascial pain syndrome is one potential cause of chronic pain in breast cancer survivors who have undergone this kind of surgery.

Key Words: myofascial pain syndromes, incidence, breast cancer, pain

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Pain after breast cancer therapy is a recognized complication found to have an adverse impact on patients' quality of life,[1–5] including impaired physical functioning and increased psychosocial distress.[4,6–8] Pain prevalence varies from 20% to 65% depending on the diagnostic criteria.[1,3,4,7–11] Different types of pain have been found after successful treatment of breast cancer including phantom breast pain,[12,13] scar pain,[14] neuropathic pain,[15] and complex regional pain syndrome,[16] although, at present, all these types of pain are usually found under the generic name of postmastectomy pain syndrome.[4,5,7,10] Besides postmastectomy pain syndrome, pain of vascular origin arising from the axillary web syndrome (AWS) has been found in the early postoperative period after axillary surgery.[17–21] The etiology of pain appearing after treatment that includes surgery, chemotherapy, and radiation therapy in breast cancer survivors varies and includes surgical damage of sensory nerves and axillary dissection,[9,13,22,23] postoperative complications,[18–20,24–28] and complications of radiotherapy[1,9,10] and chemotherapy.[29,30]

In recent years, case reports about myofascial pain syndrome (MPS) are emerging in thoracic surgery.[31–33] The MPS is defined as the signs and symptoms caused by active myofascial trigger points (MTPs). An MTP can be defined as a hyperirritable nodule of spot tenderness in a palpable taut band of skeletal muscle. The spot is a site of exquisite tenderness to palpation, that refers pain a distance, and that can cause distant motor and autonomic effects.[34] MTPs are considered to be localized muscle contractures occurring at dysfunctional motor endplates. Hence, MPS is classified as a myopathy associated with disordered neuromuscular junction function.[34,35] MTPs can be classified as active (symptom-producing) or latent (not spontaneously symptomatic).[34,35] Latent MTPs can be activated by acute or chronic overload,[34,35] by leaving the muscle in a shortened position for a long period of time,[34,35] by surgical scars[36] or by surgical drains,[31] among other causes. Latent or inactive MTPs were not considered in this study, as they do not cause spontaneous or activity-induced pain. MTPs can be identified by the objective tests of magnetic resonance elastography,[37] by specific electromyographic (EMG) examination,[38] by ultrasound technology (grayscale 2D ultrasound, vibration sonoelastography,

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TABLE 1. Recommended Criteria for Identifying Myofascial Trigger Points.[35]

Palpable taut band
Exquisite spot tenderness of a nodule in a taut band
Patient's recognition of current pain complaint by pressure on the tender nodule
Painful limit to full stretch range of motion was assessed in each patient, but was considered confirmatory, although not necessary to the diagnosis of MPS

MPS indicates myofascial pain syndrome.

and Doppler),[39] or by sophisticated microdialysis techniques assaying characteristic biochemical markers.[40] Central hypersensitization associated with MTP activation is objectively visualized on functional magnetic resonance imaging studies.[41] In the clinical setting, MTPs are identified by physical examination.[34] Recent studies have shown that clinicians with adequate training in muscle palpation techniques have a high degree of reliability in identifying MTPs, not only in the same muscle, but the same trigger point within the muscle. Thus, the most widely used diagnostic criteria[35] (Table 1) have shown a good overall interrater reliability.[42–44] The examiner in this study has had extensive experience in MTP examination and treatment. The objective of this study was to assess the incidence of MPS prospectively 12 months after breast cancer surgery.

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METHODS

Patients

Women diagnosed with breast cancer between May 2005 and June 2007, and undergoing unilateral surgery with axillary lymph node dissection (ALND) at the Príncipe de Asturias Hospital in Alcalá de Henares, Madrid (Spain), were considered for inclusion in the study. Patients without ALND or with bilateral breast cancer, systemic disease, or local/regional recurrence were excluded. After biopsy confirmation of breast carcinoma, patients under the care of any one of 4 breast surgeons participating in the study were approached by the investigators for inclusion in the study. One hundred and twenty women out of 270 women who met the inclusion criteria agreed to participate, giving their written informed consent. The flow of patients through the phases of the study is shown in Figure 1.

Assessment

Each participant was assessed preoperatively then postoperatively on hospital discharge (between day 3 and day 5), 4 weeks, and 3, 6, and 12 months after surgery. In addition to these scheduled examinations, each patient was instructed to report if they experienced pain, and were assessed at that time. A physical therapist, expert in the diagnosis of MPS, performed follow-up assessments.

During the preoperative assessment, demographic data were collected on all patients including age, race, marital status, body mass index, job, educational level, socioeconomic status, information regarding breast cancer, and medical history. Patients were also asked an open question about whether they felt any pain. If they did, a physical examination was conducted to find the source of pain, including evaluation for active MTPs. Location, duration, and intensity of pain were recorded. The location was marked by every patient on a multiple-view diagram. Pain intensity was registered by visual analog scale. Patients who did not report pain were not examined for latent MTPs.

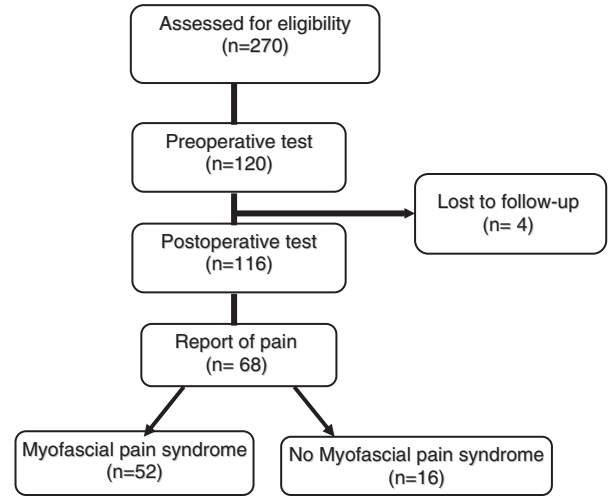

FIGURE 1. Patient flow chart.

In postoperative assessments, data were collected regarding the type of surgery performed, the number of lymph nodes removed, the use of adjuvant treatment, and the development of seroma, infection or pain. If there was pain, the patient was again examined to determine the cause, including assessment of active MTPs. Pain descriptions by the patients and pain pattern drawings in body forms guided the physical examination, to determine the cause of pain. The patients were not given any information concerning MPS or other muscle pain syndromes. The diagnosis of MPS was based on the major criteria proposed by Simons et al,[35] shown in Table 1.

Design

A prospective and longitudinal study was used. Príncipe de Asturias Hospital's Human Research Ethics Committee approved the study.

Specific physical therapy treatment for pain was made available for patients identified with MPS or with any other pain syndrome at any time during the study.

Data Analysis

Sample-size Calculations

To evaluate the incidence of MPS after ALND we recruited 120 women. Sample-size estimation was done assuming an incidence of MPS of 50% in the control group, according to the findings in earlier studies.[45–48] With such a sample size, an incidence difference of 20% can be detected with a power of 90%, setting the type 1 error at 0.05, and allowing for a 15% of drop-out rate.

Statistical Analysis

Statistical analyses were performed using Statistical Package for the Social Sciences software (SPSS for Windows , Version 12.0, SPSS Inc, Chicago, 2008). Data were collected in a questionnaire form and introduced in an ACCESS database (Microsoft Office, 2003, Microsoft

TABLE 2. Characteristics of the 116 Patients Who Underwent Breast Cancer Surgery

	All Sample		No MPS		MPS		
Valid Individuals	**116**	**100%**	**64**	**100%**	**52**	**100%**	***P*§**
Categorical Variables							
Surgical procedure							0.772
Quadrantectomy*	47	41%	25	39%	22	42%	
Modified mastectomy†	42	36%	25	39%	17	33%	
Lumpectomy‡	27	23%	14	22%	13	25%	
Postsurgical treatment							
Radiotherapy	93	80%	49	77%	44	85%	0.279
Chemotherapy	95	82%	49	77%	46	89%	0.098
Hormone therapy	72	62%	36	56%	36	69%	0.152
Axillary web syndrome	56	48%	25	39%	31	60%	0.028
Seroma	33	28%	17	27%	16	31%	0.617
Wound infection	11	9%	6	9.3%	5	9.6%	0.957
Working	47	41%	27	42%	20	39%	0.684
Numerical variables	Mean	SD	Mean	SD	Mean	SD	*P*‖
No. dissected lymph nodes	13.6	5.3	13.6	5.5	13.7	5.1	0.764
Age (y)	53.6	11.5	53.2	11.4	54.2	11.8	0.667
Body mass index	27.1	5.2	26.9	5.5	27.3	4.7	0.677
Days of drainage	4.3	2.2	4.6	2.5	4.0	1.6	0.261

*Excision of breast quadrant + pectoralis major fascia + lymphadenectomy.
†Mastectomy with excision of pectoralis major fascia + lymphadenectomy.
‡Excision of local tumor with margins + pectoralis major fascia + lymphadenectomy.
§*P* values from χ^2 test.
‖*P* values from *t* test and Mann-Whitney test.

Corporation, Seattle, Washington). These analyses included the 116 patients with ALND that completed baseline and 12-month follow-up assessments.

The one-sample Kolmogorov-Smirnov test was used to test the normal distribution of the variables. We used the nonparametric χ^2 test and Mann-Whitney test to analyze the association of the categorical and continuous variables. The sample-size and the incidence were estimated with the !NP, !NPD, and !CIP macros.[49,50]

RESULTS

One hundred and sixteen women completed all the follow-up assessments; 4 were excluded because they did not attend the first postsurgery assessment and were lost to follow-up. For a descriptive summary of the variables in the whole sample see Table 2.

TABLE 3. Cause of Pain

Cause of Pain	# Patients
Myofascial pain syndrome	52
Axillary web syndrome	56
Infection	3
Neuropathy	1
Fibromyalgia	2
Carpal tunnel syndrome	1
Supraspinatus tendonitis	3
Pneumothorax	1
Osteosarcoma	1
Chemotherapy allergic reaction	1
Herpes zoster	1
Not determined*	6

*Generalized pain associated with chemotherapy and hormonotherapy.

Incidence of MPS

The number of women detected with active MTPs was 52 out of the 116 (44.8%, 95% confidence interval: 35.6, 54.3). During the 12-month follow-up, other pain conditions were also found (Table 3). For a muscle-specific incidence of MPS see Table 4.

The incidence of MPS was not influenced either by the surgical procedure (χ^2 test, $P = 0.685$) or by radiotherapy (χ^2 test, $P = 0.171$), nor by the number of dissected lymph nodes (independent-samples *t* test, $P = 0.733$). The relationship between the incidence of MPS and chemotherapy did not reach significance in this study (χ^2 test, $P = 0.098$). MPS developed mainly during the 6-month period after surgery. The onset of MPS, expressed as mean (SD) was 6.1 (2.6) months (Fig. 2).

DISCUSSION

This is the first published study to address the incidence of MPS among breast cancer survivors. The

TABLE 4. Incidence of Involved Muscles With Active Myofascial Trigger Points

Muscles	N	%	95% CI
Latissimus dorsi	30	25.9	18.2, 34.8
Serratus anterior	28	24.0	16.7, 33.0
Pectoralis major	24	20.7	13.7, 29.2
Infraspinatus	22	19.0	12.3, 27.3
Trapezius	16	13.8	8.1, 21.4
Teres major	10	8.6	4.2, 15.3
Teres minor	10	8.6	4.2, 15.3
Pronator teres	6	5.2	1.9, 10.9
Levator scapulae	1	0.9	0.0, 4.7
Supraspinatus	1	0.9	0.0, 4.7

CI indicates confidence interval.

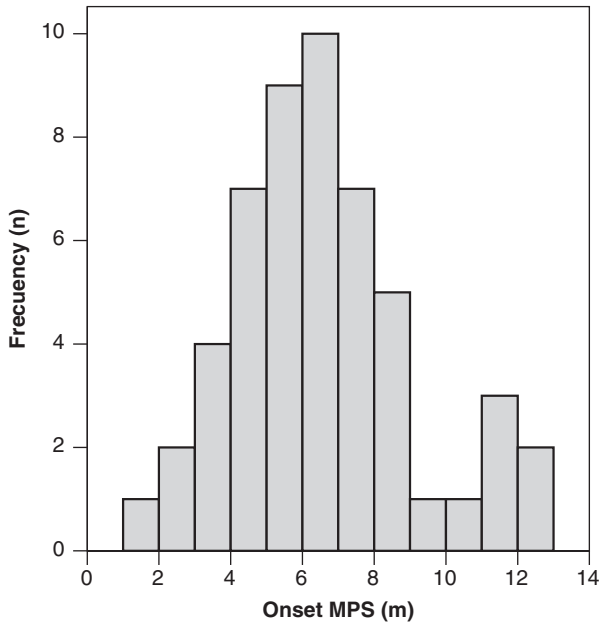

FIGURE 2. Onset distribution of myofascial pain syndrome in months after surgery.

results of this study give an insight into incidence of this underreported pain syndrome in women after surgical treatment of breast cancer. Fifty-two out of the 116 women (44.8%) experienced MPS, the majority having onset within the first 6 months after surgery. This high incidence supports the need for identifying and treating the often underdiagnosed and misdiagnosed MPS found in these patients.

Most patients with MPS had active MTPs in muscles of the shoulder girdle. This would be expected since the most likely activation factors in these patients would be related to positioning of the shoulder during surgery,[33] maintaining muscles in a shortened position after surgery,[34,35] the surgical scar,[36] the surgical drains,[31] the manipulation, and excision of pectoralis fascia during surgery or the adaptation of upper extremity movement after surgery.

Some of the muscles involved in our patients (pectoralis major, serratus anterior, and upper trapezius) have shown EMG abnormalities related with pain and dysfunction in shoulder activity after breast cancer treatment.[51] Active MTPs, by definition, always cause pain,[34,35] and muscle dysfunction is a well-known effect of both active and latent MTPs,[35,52] which could account for the reported EMG abnormalities. Studies are needed to find out whether the EMG abnormalities documented in muscles after breast cancer surgery have any relationship with either active or latent MTPs.

There are at least 2 possible reasons to explain the tightness that is often found in the pectoralis major muscle after surgery: (1) the ablation of the pectoralis major muscle fascia, and (2) the positioning of the arm in abduction and external rotation during surgery. Furthermore, the patients' efforts to protect their surgical sites through thoracic flexion and scapular protraction may account for the high presence of MTPs in the pectoralis major (Table 4). The pectoral tightness pulls the scapula into a protracted position, and the arm into internal rotation, increasing the risk of subsequent MTPs in shoulder rotators, and in scapula retractors, as well as in back and neck muscles. Radiation fibrosis of the pectoral muscles may produce greater tightness and contribute to the problem.[53–56]

As most MTPs were activated after the treatment had concluded, it is possible that radiotherapy and chemotherapy acted as activation factors. However, no statistically significant relationship could be found between these 2 therapies and the activation of MTPs.

Thirteen out of 52 patients (25%) had single muscle MPS, primarily involving latissimus dorsi or serratus anterior muscles. In addition to the activation factors already mentioned, the manipulation of the thoracodorsalis nerve and thoracicus longus nerve, respectively, that can occur during surgery[9,13] could put these muscles at further risk for developing MTPs. Some reports show how mechanical stress applied to the endplate region by tensing the motor nerve produces in rats the same type of EMG abnormalities found in MTPs.[57,58] In the case of serratus anterior muscle, the most likely source of MPS is scar formation where the muscle adheres to overlying skin.

The only nonshoulder girdle muscle we found involved in our patients was the pronator teres. This muscle presented active MTPs in 6 patients, all of which concurrently had AWS. The AWS is a self-limiting and frequently overlooked cause of significant morbidity in the early postoperative period after axillary surgery due to lymphovenus damage, hypercoagulation, superficial venous and lymphatic stasis as a result of the disruption of superficial lymphatics and vessels during axillary surgery. The AWS is characterized by painful cords of tissue extending from axilla into the medial arm made visible or palpable by shoulder abduction.[18–20,27,59] The reason for the concurrence of pronator teres MPS and AWS is unknown, although protective splinting by the muscle, to avoid painful stretch of tight lymphatic vessels at elbow level may be causative.

Postmastectomy syndrome refers to any pain persisting beyond the normal period of healing after breast cancer treatment, and is most often considered to be neuropathic in origin.[4,5,7,10,24] Some authors suggest the necessity of developing valid and reliable evaluation instruments,[12,60] and others state that studies are needed to assess neuropathic versus non-neuropathic pain as a cause of pain after treatment.[13,15,61,62] Currently, the first criterion considered necessary for the presence of neuropathic pain is "pain with a distinct neuroanatomically plausible distribution."[63] In most studies of postmastectomy syndrome[5,7,10] pain was evaluated by pain questionnaires without any physical examination. At present time, the only reliable way to identify an MTP clinically is by physical examination performed by a trained and experienced examiner.[34,42,43] Thus, questionnaires cannot identify MTPs among possible causes of postsurgical pain. Our findings suggest that it is rather likely that some cases diagnosed as postmastectomy syndrome in some studies,[5,7,10] were actually MPS caused by MTPs. Studies are needed to address this issue.

One of the limitations of this study is that there is presently no validated list of diagnostic criteria for MTPs.[34] The diagnostic criteria used in our study[35] are the most frequently used, both in clinical practice and in research studies. These criteria have shown to be highly reliable when used by trained and experienced examiners.[38,42,43] In our study, the examiner was a trained physical therapist with more than 10 years of experience in the diagnosis and

treatment of MTPs, who had previously shown reliability in identifying MTPs.[64]

Another limitation of the study is the fact that all patients came from a single hospital, although the patients were treated surgically by 4 different surgeons. Larger multicenter studies are needed to confirm that our results can be extrapolated to other samples.

Although we achieved very good results in the control of pain of our patients by means of a specific physical therapy treatment of MTPs (O. Mayoral, PT, unpublished data, 2007; M. Torres, PT, unpublished data, 2008), the fact that we did not have a control group to evaluate the effectiveness of our treatment does not allow any conclusion to be drawn regarding this issue. Controlled studies with longer follow-up are needed to evaluate the effectiveness of different specific treatments of MPS in these patients to be certain about the real contribution of MTPs to their pain.

CONCLUSIONS

MPS is a common source of pain in women undergoing breast cancer surgery that includes ALND, at least during the first year after surgery. Since the genesis of MPS among breast cancer patients could be multifactorial, a proper differential diagnosis and an adequate treatment approach are essential. Acknowledging the incidence of MPS is an important issue in this regard, as is the understanding of the severity and constancy of the pain that MPS can cause to these patients. Further studies, with longer follow-up, are needed to clarify if the MPS could be related, or even be the source of chronic pain in breast cancer survivors.

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