Pilot Study of a Survey to Identify the Prevalence of and Risk Factors for Chronic Neuropathic Pain Following Breast Cancer Surgery

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Purpose/Objectives: To provide a preliminary determination of the prevalence rate of women who suffer from neuropathic pain post breast surgery (PPBS) and explore potential risk factors associated with its development.

Design: Prospective, quantitative, longitudinal survey.

Setting: Breast health clinic in western Canada.

Sample: A convenience sample of 17 women undergoing breast cancer surgery.

Methods: The Brief Pain Inventory was administered before surgery and 2 days, 10 days, and 3 months postsurgery. Demographic data also were collected preoperatively. Analysis included determining prevalence of PPBS; descriptive analyses on age, gender, and body mass index (BMI); presence of acute postoperative pain; type of surgery; and two-tailed t tests on age and BMI.

Main Research Variables: The symptom experience of chronic PPBS.

Findings: Twenty-three percent of the sample developed PPBS. Younger age (50 years or younger), more invasive surgery, acute postoperative pain, and less analgesic use during the acute postoperative period were factors associated with the development of PPBS.

Conclusions: Additional research is required to confirm the significance of these potential risk factors in the development of PPBS.

Implications for Nursing: Nurses are ideally situated to identify early signs of PPBS. In addition, nurses play a key role in the education of patients and healthcare professionals and can facilitate increased awareness about the possibility of developing PPBS, enabling earlier and more effective treatment of PPBS.

Breast cancer is the most common cancer among Canadian women; one in nine women will develop breast cancer in her lifetime and one in 29 will die from it (Canadian Cancer Society [CCS], 2011). Advances in screening, diagnosis, and treatment have led to a decreased mortality rate for women with breast cancer, which makes the study of chronic conditions more important as the breast cancer population ages. The primary treatment option for breast cancer is surgery (lumpectomy or mastectomy). Many patients also receive adjuvant therapies such as chemotherapy, radiation therapy, hormone therapy, targeted therapy, biologic therapy, or a combination of these therapies (CCS, 2010).

Mastectomies and lumpectomies can be done with or without complete axillary lymph node dissection (ALND) (CCS, 2010). A less invasive procedure introduced in the mid-1990s called sentinel lymph node dissection (SLND) (also known as sentinel node biopsy or sentinel lymph node biopsy) is used to sample the lymph nodes in early-stage breast cancer. The procedure entails the removal and examination of one or a few lymph nodes from the axilla called sentinel lymph nodes (CCS, 2010). Lumpectomy and mastectomy differ mainly in the amount of breast tissue to be excised, which, in turn, is determined by the tumor size in relation to the breast (CCS, 2009). Therefore, the most recent and least invasive procedure is a lumpectomy with SLND (Jung, Ahrendt, Oaklander, & Dworkin, 2003).

Breast cancer treatments are not without side effects. Chronic neuropathic pain post breast surgery (PPBS), also known as chronic post-mastectomy or -lumpectomy pain syndrome, is one such complication. However, variability exists in the prevalence rates for PPBS reported in the literature, ranging from 20%–68% (see Table 1). Such variability may be because of different definitions of chronic pain used; severity of pain cutoff points used for analysis; whether pain location is restricted to the arm, chest wall, or axilla (or all three); and the exclusion or inclusion of breast cancer

Table 1. Prevalence of Chronic Neuropathic Pain Post-Surgery From Past Studies

Study	N	Study Time[a]	Prevelance Rate (%)
Prospective			
Fassoulaki et al., 2000	22	3	50–68
Maunsell et al., 1993	201	3, 15	55
Poleshuck et al., 2006	95	3	48
Retrospective			
Bishop & Warr, 2003	68	61	49
Bruce et al., 2004	511	36	43
Carpenter et al., 1998	134	38	27
Gärtner et al., 2009	3,253	26	47
Gulluoglu et al., 2006	85	6	46
Hack et al., 1999	222	33	31
Peuckmann et al., 2009	1,316	60–120	29
Smith et al., 1999	408	–	43
Steegers et al., 2008	317	23	51
Stevens et al., 1995	95	–	20
Tasmuth et al., 1995	467	28–32	49
Vilholm et al., 2008	219	18	24
Wallace et al., 1996	282	12–72	22–49[b]

[a] Time in months: mean, median, or range of follow-up duration after surgery, depending on the study

[b] This study considered breast reduction, mastectomy, and mastectomy with breast reconstruction; the pain prevalence for each of these was 22%, 31%, and 49%, respectively.

treatments other than surgery (e.g., radiation therapy, chemotherapy). Adjuvant therapies such as radiation and chemotherapy have been linked independently to chronic pain development and can themselves be additional sources of pain and related symptoms, making the diagnosis of PPBS more difficult (Andersen & Kehlet, 2011; Jung et al., 2003).

Advances in surgical treatment also may account for variable prevalence rates reported in the literature. The introduction of SLND has resulted in a decrease of ALND treatments (Miguel et al., 2001; Vilholm, Cold, Rasmussen, & Sindrup, 2008), and the morbidity of SLND has been shown to be less than that for ALND (Mansel et al., 2006; Schrenk, Rieger, Shamiyeh, & Wayand, 2000; Shons & Cox, 2001). The prevalence of PPBS may have changed because fewer individuals are undergoing ALND compared to SLND (Miguel et al., 2001).

Risk factors associated with PPBS development have been reported in the literature and include younger age (i.e., younger than 50 years) (Gärtner et al., 2009; Gulluoglu et al., 2006; Peuckmann et al., 2009; Poleshuck et al., 2006; Vilholm et al., 2008), increased body mass index (BMI) (25 kg/m^2 or greater) (Smith, Bourne, Squair, Phillips, & Chambers, 1999), increased invasiveness of the surgery (Gärtner et al., 2009; Gulluoglu et al., 2006; Peuckmann et al., 2009; Poleshuck et al., 2006; Steegers, Wolters, Evers, Strobbe, & Wilder-Smith, 2008; Vilholm et al., 2008), and increased acute postoperative pain (Fassoulaki, Melemeni, Staikou, Triga, Sarantopoulos, 2008; Poleshuck et al., 2006). Those factors are, therefore, of interest in the current study.

Women diagnosed with breast cancer want to be well informed regarding their treatment options (Bruera, Willey, Palmer, & Rosales, 2002); therefore, informing patients that PPBS is a potential postsurgical complication is important. As with other chronic pain syndromes, PPBS is not treated easily (Andersen & Kehlet, 2011), which speaks to the importance of early detection and intervention. Diagnosing neuropathic pain syndromes such as PPBS as early as possible is essential, as they may become chronic and more resistant to therapy if diagnosis and commencement of treatment is delayed (Johnson, 2004).

Determining the PPBS prevalence rate is an important step in increasing the understanding of this condition. The purpose of this feasibility study is to (a) provide a preliminary determination of the prevalence rate of women who suffer from chronic neuropathic pain after having breast cancer surgery, and (b) explore potential risk factors associated with women developing PPBS.

Methods

A longitudinal, quantitative survey design was used to address the study's aims. A convenience sample of consecutive female volunteers was recruited from a breast health clinic (BHC) in western Canada. Participants were eligible for the study if they were women aged 18 years or older; able to read, write, and speak English; diagnosed with breast cancer; slated to undergo breast cancer surgery; had no evidence of cognitive impairment as per consensus of the clinical staff at the BHC; and were willing to provide written informed consent. Exclusion criteria included having received any breast cancer treatment (e.g., surgery, chemotherapy, radiation therapy), having cognitive impairment, and being male.

Procedure

Prior to the onset of data collection, site access was secured from the BHC and ethical approval was obtained from the University of Manitoba Education and Nursing

Research Ethics Board. The BHC conducts presurgery information sessions bi-monthly. At the end of 14 presurgery sessions, the first author provided women who attended the session with a brief description of the study and the nature of their voluntary participation. Women who were interested in participating were given a package containing detailed information about the study, copies of the consent form, and study questionnaires.

The instrument used to measure and describe pain was the **Brief Pain Inventory (BPI)**, a 22-item self-rating instrument that measures the multidimensional symptoms associated with cancer pain (Cleeland & Ryan, 1994). It consists of a 0–10 numerical pain scale for pain intensity (0 = no pain, 10 = pain as bad as can be imagined), a body pain chart for pain location, and verbal adjectives for pain. The BPI has been found to be a valid and reliable measurement tool for assessing pain in surgical patients with cancer (Tittle, McMillan, & Hagan, 2003). Although the BPI has not been validated specifically for use in rating PPBS, it has been used as a pain measurement tool in past studies related to PPBS (Bishop & Warr, 2003; Carpenter et al., 1998; Gulluoglu et al., 2006).

No standard definition of what constitutes chronic pain is seen in the literature for PPBS. Previous studies have applied ranges from two to six months postsurgery (Jung et al., 2003), whereas more recent researchers have used the definition put forth by the International Association for the Study of Pain (IASP) (Gulluoglu et al., 2006; Macdonald, Bruce, Scott, Smith, & Chambers, 2005; Poleshuck et al., 2006). The IASP definition of chronic pain is pain that lasts three months beyond the normal healing time (Merskey & Bogduk, 1994). Katz and Seltzer (2009) note that "every chronic post injury or postsurgical pain was once acute," (p. 723), and PPBS has been described as "persistent pain" after breast cancer treatment (Gärtner et al., 2009, p. 1985). That implies that pain following breast cancer surgery continues and, therefore, pain that lasts beyond the normal healing time is the definition used in the current study.

Neuropathic pain typically is characterized by burning, shooting, or an electric shock-like sensation in the area around the treatment site (Polomano & Farrar, 2006) and often is described using the same terminology (Boureau, Doubrère, & Luu, 1990). Therefore, the adjectives *shooting*, *stabbing*, *burning*, and *numb* found in question 13 of the BPI were used to differentiate neuropathic pain from nociceptive pain in this study.

Pain character, location, and intensity were recorded on days 2 and 10 to determine clinically meaningful acute pain, and at three months postsurgery to assess for the presence of chronic pain. In previous research, severity scores for the BPI have included the cutoff points of 5 or greater and 7 or greater to indicate moderate and more severe pain (Lorenz et al., 2009). Past data have shown that pain at or beyond a cutoff point of 5 has a significant effect on physical and emotional functioning (Anderson, 2005; Jones, Vojir, Hutt, & Fink, 2007; Paul, Zelman, Smith, & Miaskowski, 2005). For that reason, clinically meaningful acute pain was categorized as being 5 or greater on the 0–10 pain rating scale in the current study. In addition, the following cutoff point ranges have been used to categorize acute postoperative pain: mild = 1–4, moderate = 5–6, and severe = 7–10 (Mendoza et al., 2004); these were used in the current study, as well.

Study participants were asked to complete a demographic questionnaire prior to surgery and the BPI at four time intervals: time 0 (T0), prior to surgery; time 1 (T1), at postoperative day 2; and time 2 (T2), on postoperative day 10. About two to six weeks postsurgery, depending on the participants' dates for radiation or chemotherapy, all women were reminded, via a telephone call from the first author, to complete the time 3 (T3) questionnaire. Because some research suggests that adjuvant therapy such as radiation or chemotherapy is associated with the development of chronic pain, the T3 questionnaires were completed prior to any adjuvant therapy commencement.

T0 assisted in identifying presurgery pain data, the T1 and T2 questionnaires detected if acute pain played a role in PPBS, and the T3 questionnaire captured chronicity and PPBS development. The same questionnaire was used during all four interviews to standardize the results.

Demographic data examining age, marital status, education, occupation, cultural and ethnic background, height and weight to assess for BMI, date of breast cancer diagnosis, type and stage of breast cancer, presurgery pain from breast cancer, and presurgery pain from some other cause(s) also were collected from participants at baseline. In addition, data were abstracted from participants' medical charts by the first author to determine surgery type and cancer status postsurgery and confirm BMI.

Statistical Analysis

Data were analyzed using SPSS®, version 16.0. Prevalence of PPBS was based on the percent of women in the sample who developed PPBS. Descriptive analyses were done to assess the demographic and clinical characteristics of the sample. Frequency counts, means, and standard deviations were conducted to provide a preliminary determination of the prevalence rate of women with PPBS.

Independent samples t tests (with Levene's test for equality of variances applied) and the Mann-Whitney U test for continuous variables (e.g., age, BMI) were conducted. Crosstabs χ^2 tests for categorical variables (e.g., younger than age 50 versus 50 years or older, BMI

Table 2. Sample Characteristics

Characteristic	n
Unrelated presurgery pain	
Yes	5
No	12
Marital status	
Married	11
Widowed	3
Separated	1
Divorced	1
Never married or single	1
Education	
High school	4
Some college (at least one year)	3
College graduate	6
Professional or graduate training	4
Occupation	
Professional	5
Management	3
Clerical	2
Homemaker	2
Other	5
Ethnicity	
Caucasian	16
Other	1

N = 17

less than 25 versus BMI 25 or greater, marital status, education, occupational status, occupation, surgery type, clinically meaningful [e.g., less than 5 versus 5 or greater] preoperative pain, clinically meaningful postoperative pain at T1 and T2) were conducted, as well. Those tests compared the demographic and clinical measures of patients who did not develop chronic pain to explore potential risk factors associated with women developing PPBS. Those p values equal to or less than 0.05 were considered statistically significant.

Results

A convenience sample of 17 participants was recruited over a seven-month period from March 2009 to October 2009. Table 2 illustrates patient demographic data and information collected from the chart review.

Brief Pain Inventory Data

PPBS was identified to have developed in participants who (a) indicated their pain location on the surgical side, (b) responded "yes" to at least one of the four pain adjectives on the BPI identified as being a neuropathic characteristic (*shooting*, *stabbing*, *burning*, or *numb*), and (c) had surgery at least 30–90 days prior (calculated based on the date they completed the T3 questionnaire minus the date of their surgery); that range has not been statistically accounted for because of limitations related to the small sample size. Four women met these criteria; therefore, the prevalence rate of PPBS in this pilot study was 24%. For all participants, the mean time from the date of surgery to completion of the T3 questionnaire was 53.7 (SD = 16) days, with a range of 32–89 days. Of the four women who developed PPBS, the time elapsed since surgery was 34, 38, 55, and 72 days, respectively, with a mean of 49.75 (SD = 17.4) days; that completion time was similar to that of the overall participants.

Potential Risk Factors

Table 3 illustrates the descriptive statistics for age and BMI in this study. The independent samples t test with Levene's test for equality of variances applied was conducted to determine whether a statistically significant difference existed between the mean ages and mean BMI of the women who developed PPBS and those who did not. Based on the independent samples t test, women who developed PPBS appeared, on average, to be younger than those who did not develop PPBS (p = 0.029). In contrast, the independent samples t test for BMI (p = 0.289) did not indicate a significant difference in the mean BMI of women who did and did not develop PPBS.

The Mann-Whitney U test also was applied to explore age and BMI between groups. The Mann-Whitney U test indicated a difference in the median ages (p = 0.023) between the women who did and did not develop PPBS; those who developed PPBS appear to be younger, on average, than those who did not. In contrast, the Mann-Whitney U test for BMI (p = 0.308) did not indicate a significant difference in the median BMI of women who did and did not develop PPBS. Although the small sample size (N = 17) precludes attaching a great degree of statistical significance to these results, the data suggest an association between age and PPBS development in both the independent samples t test and the Mann-Whitney U test.

A worst pain rate of 5 or greater on a scale of 0–10 (0 = no pain, 10 = pain as bad as you can imagine) was used as the cutoff point to indicate clinically meaningful

Table 3. Descriptive Statistics for Age and BMI in Women and PPBS Development

	Developed PPBS (N = 4)				Did Not Develop PPBS (N = 13)			
Variable	Min	Max	$\bar{X}$	SD	Min	Max	$\bar{X}$	SD
Age (years)	46	58	52	6.4	48	77	63	8.4
BMI (kg/m^2)	21.5	28.6	25	3.3	20.2	40.6	28.7	6.3

BMI—body mass index; max—maximum; min—minimum; PPBS—pain post breast surgery

acute pain in this study. None of the four women who developed PPBS experienced any preoperative pain (see Table 4). Although the average and worst pain rate comparisons between the women who did and did not develop PPBS were similar, a noticeable difference existed in the frequency counts of women with clinically meaningful pain at T1, the acute postoperative time period. At T1, three of the women (75%) who developed PPBS had clinically meaningful acute pain versus four of the women (57%) who did not develop PPBS, but did report pain. The T2 frequency counts for clinically meaningful acute pain were the same between groups; two of the three women (67%) who developed PPBS and reported pain had clinically meaningful acute pain versus four of the women (67%) who did not develop PPBS. In addition, very little difference existed in the T3 frequency counts between groups; one of the women (25%) who developed PPBS had clinically meaningful acute pain versus one of the three women (33%) that did not develop PPBS but did have non-breast cancer–related pain.

Table 4. Descriptive Statistics for Pain in Women Who Did and Did Not Develop PPBS

	Women Who Did Develop PPBS (N = 4)					Women Who Did Not Develop PPBS				
Pain	Min	Max	$\bar{X}$	SD	n[a]	Min	Max	$\bar{X}$	SD	n[a, b]
Average										
T0	–	–	–	–	–	1	6	3.1	1.8	2
T1	1	5	3	1.6	1	1	7	3.4	1.8	1
T2	1	4	2.7	1.5	–	2	4	2.7	0.8	–
T3	–	4	1.8	1.7	–	1	4	2.7	1.6	–
Worst										
T0	–	–	–	–	–	2	8	5.3	2.3	4
T1	2	7	5	2.2	3	2	10	5.6	2.8	4
T2	2	7	4.7	2.5	2[c]	4	7	5	1.1	4
T3	1	5	3.3	1.7	1	3	6	4	1.7	1

[a] Frequency count of women with clinically meaningful pain, rated 5 or greater

[b] N = 7 at T0 and T1, N = 6 at T2, and N = 3 at T3

[c] N = 3 because one participant did not report pain at T2 but did develop PPBS at T3

Max—maximum; min—minimum; PPBS—pain post breast surgery; T—time

Note. Rating scale ranges from 0 (no pain) to 10 (pain as bad as you can imagine).

At T1, T2, and T3, all of the women who developed PPBS believed their pain was from their surgery (see Table 5). Only three of the women who developed PPBS reported pain at T2, although all four women reported pain at T1 and T3. All four women at T3 had a neuropathic component to their pain. In the women who did not develop PPBS but reported pain at each of the time intervals, 67% of those with pain at T3 were characterized as having a neuropathic component.

Analgesic use at T1 varied, with none of the women who developed PPBS using analgesia regularly, three (75%) using analgesia as necessary (prn), and one (25%) not using any analgesia. In contrast, of the women who did not develop PPBS but had pain at T1, two (29%) used analgesia regularly, five (71%) used analgesia prn, and none reported not using any analgesia. Thus, all of the women who had pain at T1 but did not develop PPBS had used some amount of analgesia at T1, the acute postoperative period.

One woman (25%) who developed PPBS had a lumpectomy with SLND (the least invasive form of surgery), whereas the majority of the women (62%) who did not develop PPBS had this surgery (see Table 6). None of the women in either group had a mastectomy with ALND. Overall, of the women who developed PPBS, two (50%) had a lumpectomy, and two (50%) had a mastectomy with immediate breast reconstruction; in terms of lymph node biopsies, two (50%) had SLND and two had (50%) had ALND. Of the women who did not develop PPBS, 10 (77%) had a lumpectomy and 3 (23%) had a mastectomy; in terms of lymph node biopsies, 10 (77%) had SLND and 3 (23%) had ALND. Of the total women who had a mastectomy with reconstruction at the same time (n = 3), two (67%) developed PPBS.

All the women had ductal breast cancer. The women in this study who developed PPBS had a cancer rated as stage I or II. None of the women who developed PPBS had a previous history of breast cancer.

An attempt was made to conduct a crosstabs χ^2 test for the categorical variables younger than 50 years versus 50 years or older, BMI less than 25 versus BMI of 25 or greater, marital status, education, occupational status, occupation, surgery type, and clinically meaningful pain (T0, T1, and T2). However, for each of those variables, some cells had an expected count of less than five and, therefore, no statistical relevance could be applied to those results.

Discussion

A PPBS prevalence rate of 24% was determined based on the preliminary data. That prevalence rate is on the low end of the range of reported prevalence rates, but as Miguel et al. (2001) and Vilholm et al. (2008) noted, the prevalence of PPBS may have decreased more recently because fewer women are undergoing ALND treatment compared to SLND.

Congruent with some prior research, this study found some association between younger age and PPBS development (Gärtner et al., 2009; Gulluoglu et al., 2006; Peuckmann et al., 2009; Poleshuck et al., 2006; Steegers

Table 5. Demographic and Clinical Data Related to Pain Characteristics

Variable	Developed PPBS (N = 4)[a]	Did Not Develop PPBS (N = 13)
Pain at T0	–	7
• From breast cancer	–	2
• Other cause	–	5
Pain at T1	4	7
• From surgery	4	7
• Neuropathic pain	2	7
Analgesic use		
– Regular	–	2
– As necessary	3	5
– None	1	–
Pain at T2	3	6
• From surgery	3	5
• Neuropathic pain	2	5
Analgesic use		
– Regular	1	2
– As necessary	1	3
– None	1	1
Pain at T3	4	3
• From surgery	4	–
• Neuropathic pain	4	2
Analgesic use		
– Regular	1	1
– As necessary	2	1
– None	1	1

[a]N = 3 at T2, because only 3 of the 4 women who developed PPBS reported pain at this time. The woman who did not report pain at T3 had a time from surgery to T3 of 34 days.

PPBS—pain post breast surgery; T—time

et al., 2008; Vilholm et al., 2008). As reported by others, increased BMI was not found to be a significant risk factor for PPBS within this small sample (Peuckmann et al., 2009; Steegers et al., 2008; Vilholm et al., 2008). However, increased BMI is still a very important factor to consider for several reasons. Having an increased BMI is a strong indicator for the development of diabetes or glucose intolerance (National Diabetes Information Clearinghouse [NDIC], 2011b). Diabetes and glucose intolerance, in turn, are strongly associated with the development of a variety of neuropathies, as well as poorer health outcomes in general (NDIC, 2011a). Therefore, increased BMI has a high potential to be associated with, for example, diabetic neuropathic pain states and overall poorer health outcomes. Those additional sources of pain and related symptoms might make diagnosis of PPBS more difficult, similar to the confounding effects chemotherapy-associated neuropathies have on PPBS diagnosis. In a review article on persistent pain post-breast cancer treatment, Andersen and Kehlet (2011) recommend inclusion of BMI in future studies because of the variability related to determining its exact association in the development of chronic pain.

Some indication exists in the study findings of an association between increased acute postoperative pain and PPBS development, in agreement with some previous studies (Fassoulaki et al., 2008; Poleshuck et al., 2006). The frequency findings of surgery type in this study support a positive association between PPBS development and invasiveness of surgery, which is in congruence with some past studies (Miguel et al., 2001; Poleshuck et al., 2006), as well as between having an ALND versus SLND (Mansel et al., 2006). All of the women with PPBS in the current study exhibited neuropathic and nociceptive pain.

Of the seven women who had breast cancer surgery-related pain at T1 but did not end up developing PPBS, all used some amount of analgesia, whether prn or regular use. In contrast, three of the women (75%) who did end up developing PPBS reported only prn use of analgesic at that acute postoperative time. Similarly, at T2, five of the six (83%) women who reported pain but did not develop PPBS used some amount of analgesia, whereas two of the three (67%) women who developed PPBS did so. That may have important implications, indicating that the use of a more aggressive pain management regime during the acute postoperative period might alleviate or prevent the development of PPBS. A larger study is needed to confirm those trends.

Strengths and Limitations

The strengths of this study are its prospective and longitudinal design and the high completion rate (94%); however, a number of limitations also must be acknowledged. This pilot study used a small non-random sample recruited from a single clinic, limiting generalizability. The sample also lacks cultural variability, and was limited to women with a highest clearly identified cancer stage of stage II ductal carcinoma.

Identifying the prevalence of this pain condition and the associated risk factors not only addresses a gap in current literature but also forms the basis for future research to help with managing and treating this pain. The findings from this pilot study will be used to inform the development and design of a planned, larger-scale survey that will use an equivalent target population.

Implications for Nursing Practice and Education

Assessment and management of pain are important clinical aspects of nursing practice. Nurses, particularly those working in outpatient settings, are ideally situated to identify early signs of chronic neuropathic PPBS. Nurses need to be taught how to conduct a careful and complete history of the patient to identify those who may develop PPBS. Their assessment should center on factors such as younger age (i.e., 50 years or younger),

possibly increased BMI, type of procedure, decisions related to timing of breast reconstructive surgery (immediate or delayed), and acute postoperative pain. Although increased acute pain intensity is expected in the immediate postoperative period, the neuropathic pain descriptors tend to manifest later.

Neuropathic pain is under-recognized and often not treated adequately (Hans, Masquelier, & De Cock, 2007; Lavoie Smith et al., 2009). Neuropathic pain, like other chronic conditions, also is difficult to diagnose and treat and, therefore, presents a clinical challenge for nursing practice (Herr, 2004; Johnson, 2004). Improving nursing education related to neuropathic pain and its assessment and treatment is essential. A recent study that looked at increasing nurses' knowledge about neuropathic pain assessment and treatment found that enacting system changes to improve screening and assessment practices formed a strong basis for neuropathic pain improvement (Lavoie Smith et al., 2009). Lavoie Smith et al. (2009) recommended the use of neuropathic-specific scales, healthcare professional education, and periodic reinforcement of learning to improve neuropathic pain screening and assessment in patients with cancer.

Neuropathic pain assessment and diagnosis is done most commonly via clinical evaluation (e.g., history, physical, neurologic examination, use of pain assessment tools), rather than through diagnostic testing (e.g., nerve conduction studies, magnetic resonance imaging, quantitative sensory testing) (Herr, 2004). Pain assessment should focus on increased intensity on a pain scale; neuropathic pain descriptors such as *hot*, *burning*, *sharp*, *stabbing*, and *cold*; and allodynia and common non-painful sensations such as tingling, prickling, itching, numbness, and pins and needles (Gilron, Watson, Cahill, & Moulin, 2006).

Nurses are in a very good position to identify patients who are likely to develop neuropathic pain so that early treatment can be initiated (Johnson, 2004). If early signs are identified, pain management interventions should be initiated by the clinical staff, with referrals to pain clinics as appropriate.

Pain management involves the use of early and effective pharmacologic treatments. No single pharmacologic agent is effective for relieving all forms of neuropathic pain (Galluzzi, 2007; Gilron et al., 2006; Stillman, 2006), and treatments must be individualized to take into account the various pathophysiologic responses to pain. Pharmacologic interventions that have been identified in the literature as being useful include anti-inflammatory agents, opioid analgesics, antidepressants, antiepileptic agents, and N-methyl D-asparate antagonists, alone or in combination (Davis, 2007; Stillman, 2006; Stubblefield & Custodio, 2006).

In terms of prevention, strategies may include preoperative application of an eutectic mixture of local anesthetics (Fassoulaki, Sarantopoulos, Melemeni, & Hogan, 2000), preserving the nerves during surgery, minimizing invasive procedures, and decreasing injury to tissue and nerves through meticulous surgical technique (Jung, Herrmann, Griggs, Oaklander, & Dworkin, 2005). Prevention also can be achieved by minimizing the acuity of pain postsurgery via adequate IV analgesia (Jung et al., 2003), use of paravertebral blocks (Iohom et al., 2006; Kairaluoma, Bachmann, Rosenberg, & Pere, 2006; Vila,

Table 6. Clinical Data Related to Breast Cancer Characteristics

Variable	Developed PPBS (N = 4)	Did Not Develop PPBS (N = 13)	All Participants (N = 17)
Surgery type			
L and SLND	1	8	9
L and ALND	1	2	3
M and SLND	–	2	2
M and ALND	–	–	–
M, SLND, and BR	1	–	1
M, ALND, and BR	1	1	2
Cancer type			
Ductal	4	13	17
Cancer stage			
0	–	3	3
I	1	4	5
II	2	5	7
III	–	–	–
Unknown	1	1	2
Cancer grade			
1	1	3	4
2	1	6	7
3	1	2	3
Unknown	1	2	3
Hormone status			
ER+/PR+	1	9	10
ER–/PR–	1	2	3
Unknown	2	2	4
HER2 status			
HER2+	2	1	3
HER2–	1	8	9
Unknown	1	4	5
Breast cancer history	–	1	1

ALND—axillary lymph node dissection; BR—breast reconstruction; ER+/– —estrogen receptor positive/negative; HER2+/– —HER2 positive/negative; L—lumpectomy; M—mastectomy; PPBS—pain post breast surgery; PR+/– —progesterone receptor positive/negative; SLND—sentinel lymph node dissection

Note. Cancer stage 0—ductal carcinoma in situ or lobular carcinoma in situ; stage 1—cancer has not spread outside the breast; stage 2—cancer has spread to lymph nodes or is 2–5 cm in size; stage 3—cancer has spread to lymph nodes and nearby tissue; stage 4—cancer has spread to parts of the body other than the breast

Note. Cancer grade 1—low grade (slow growing, less likely to spread); grade 2—moderate grade; grade 3—high grade (fast growing, more likely to spread)

Liu, & Kavasmaneck, 2007), and adequate analgesic use during the acute postoperative period (Jung et al., 2003).

Nurses also play a key role in the education of patients, who need to be informed presurgery about the possibility of developing PPBS. Postsurgery teaching should emphasize the importance of managing acute pain at home to minimize the chance of later chronic pain development. If PPBS does develop in the face of diagnosed breast cancer, patients need to be reassured that the neuropathic pain is not a sign of the cancer reoccurring, but rather a side effect of their cancer treatment. Educating patients and healthcare professionals can help to increase awareness of this often debilitating condition and optimize patient outcomes.

Implications for Nursing Research

The findings in this prospective pilot study have some important implications for nursing research. Although age is a static variable, and the invasiveness of the surgery a woman receives is largely dependent on the type and grade of cancer, preemptive and perioperative analgesic use, acute postoperative pain management, and the decision to have reconstruction surgery at the same time as a mastectomy are factors that can be addressed to help minimize the development of this chronic pain. The risk factors examined in this pilot study require additional investigation with a larger and more varied sample.

Although the BPI questionnaire used in this study has generated very pertinent and useful information, its length may preclude its use in a busy, clinical setting. The BPI is not geared specifically toward assessing and differentiating neuropathic pain from nociceptive pain. Therefore, nurses should develop pertinent, streamlined instruments to facilitate the assessment of PPBS. The majority of research examining PPBS has relied on retrospective designs and small sample sizes. Longitudinal work using larger, robust sampling approaches is needed in future studies. In addition, a paucity of literature exists examining the long-term effects of living with PPBS. Given that women diagnosed with breast cancer are now living longer, research examining the real life experiences of those with chronic PPBS is warranted.

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Digital Object Identifier: 10.1188/12.ONF.E141-E149

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