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Psychological, surgical, and sociodemographic predictors of pain outcomes after breast cancer surgery: A population-based cohort study

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ABSTRACT

Chronic postsurgical pain (CPSP) is a common postoperative adverse event affecting up to half of women undergoing breast cancer surgery, yet few epidemiological studies have prospectively investigated the role of preoperative, intraoperative, and postoperative risk factors for pain onset and chronicity. We prospectively investigated preoperative sociodemographic and psychological factors, intraoperative clinical factors, and acute postoperative pain in a prospective cohort of 362 women undergoing surgery for primary breast cancer. Intraoperative nerve handling (division or preservation) of the intercostobrachial nerve was recorded. At 4 and 9 months after surgery, incidence of chronic painful symptoms not present preoperatively was 68% and 63%, respectively. Univariate analysis revealed that multiple psychological factors and nerve division was associated with chronic pain at 4 and 9 months. In a multivariate model, independent predictors of CPSP at 4 months included younger age and acute postoperative pain (odds ratio [OR] 1.34, 95% confidence interval [CI] 1.12 to 1.60), whereas preoperative psychological robustness (OR 0.70, 95% CI 0.49 to 0.99), a composite variable comprising high dispositional optimism, high positive affect, and low emotional distress, was protective. At 9 months, younger age, axillary node clearance (OR 2.97, 95% CI 1.09 to 8.06), and severity of acute postoperative pain (OR 1.17, 95% CI 1.00 to 1.37) were predictive of pain persistence. Of those with CPSP, 25% experienced moderate to severe pain and 40% were positive on Douleur Neuropathique 4 and Self-Complete Leeds Assessment of Neuropathic Symptoms and Signs pain scales. Overall, a high proportion of women report painful symptoms, altered sensations, and numbness in the upper body within the first 9 months after resectional breast surgery and cancer treatment.

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1. Introduction

Improvements in breast cancer survival resulting from earlier diagnosis and advances in therapy have refocused efforts toward reducing the long-term sequelae of cancer treatment. Persistent or chronic postsurgical pain (CPSP) is a well-recognised adverse event, with prevalence studies suggesting up to half of women report pain persisting for 1 to 2 years after breast cancer surgery [1,19]. We previously reported on the long-term prognosis and impact of persistent pain after mastectomy, whereby half of women reporting chronic pain at 3 years postoperatively continued to experience painful symptoms up to 12 years postoperatively, with

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associated reduced quality of life compared to those whose chronic pain had resolved [29,48].

Recent research has focused attention upon the identification of subgroups at greatest risk of adverse painful outcomes, with calls made for prospective surgical studies incorporating detailed assessment of multiple factors at repeated time points [23,27,51]. Epidemiological studies with larger sample sizes are required to elucidate the relative contribution of psychosocial and clinical risk factors for acute pain onset and pain chronicity.

Current thinking, supported by empirical evidence, accepts that CPSP is predominantly but not entirely neuropathic in character. A recent review suggested that two-thirds of women with CPSP after breast cancer surgery experience neuropathic pain, although this judgement was retrospectively applied to older studies undertaken before the development of standardised neuropathic assessment instruments [20]. To date, no studies have assessed the contribution of preoperative neuropathic pain to CPSP after breast cancer surgery; it is theoretically plausible that women experience continuation of pre-existing painful symptoms. No large-scale epidemiological studies have accounted for the contribution of intraoperative nerve handling as a potential risk factor or effect modifier to pain development. In breast cancer surgery, the intercostobrachial nerve (ICBN) can be sacrificed during axillary dissection for lymph node sampling or clearance, but there is lack of agreement regarding attribution of postoperative chest and upper arm pain to intraoperative nerve damage [17,32,43]. Despite changes in surgical technique with increasing rates of breast conservation surgery and sentinel lymph node biopsy (SLNB), the proximity of the intercostobrachial nerve (ICBN) to surgical incision and sentinel node(s) may result in nerve irritation, damage, or division, potentially contributing to subsequent postoperative sequelae. Acute postoperative numbness and sensory abnormalities may mask painful symptoms that subsequently become apparent after wound and tissue healing.

Depression, pain catastrophizing, and psychological distress are associated with established CPSP and predict acute postoperative outcome when measured preoperatively. Certain psychological traits, such as dispositional optimism, appear to be protective, predicting improved recovery and a range of favourable postoperative outcomes [36,37,46]. We have previously reported acute postoperative pain outcomes from our prospective epidemiological study of women undergoing surgery for breast cancer; chronic preoperative pain and dispositional psychological robustness were independent predictors of severe acute pain in the first week after surgery [10]. Our primary aim, herein reported, was to investigate the relative contribution of psychological, sociodemographic, perioperative, and acute postoperative factors associated with the persistence of pain at 4 and 9 months after breast cancer surgery.

2. Methods

2.1. Study design and participants

The Study of Recovery after Breast Cancer Surgery (The Recovery Study) was an epidemiological, prospective cohort study that recruited women from 4 breast cancer units serving a large catchment population across the north of Scotland. Study methodology and calculation of sample size has been fully described in a previous publication [10]. In brief, we aimed to recruit 405 women age 18 years or over, with newly diagnosed, histologically proven primary invasive or noninvasive breast cancer, requiring surgical excision of tumour with or without axillary surgery. Men, women ages <18 years, pregnant women, and those with a history of major psychiatric disorder, previous breast or axillary surgery, bilateral surgery, recurrent disease, or detectable metastatic disease at the time of initial diagnosis were excluded.

2.2. Recruitment procedure

Participant recruitment and consent was undertaken at breast clinics and screening centres or on the hospital ward when patients were admitted before surgery. Clinical or research staff invited patients to participate and provided packs containing an information sheet, consent form, and baseline questionnaire. Consent was obtained for access to medical records for research purposes. Ethical approval was granted by Fife and Forth Valley National Health Service Multicentre Research Ethics Committee, with local governance approvals obtained from each regional National Health Service organisation.

2.3. Data collection

Data collection was undertaken at 4 time points: preoperatively, and at 1 week, 4 months, and 9 months postoperatively. Questionnaires and data collection tools were modelled on our previous studies investigating CPSP and informed by literature review [2,8,29,41,48]. Instruments were piloted on a sample of women to assess face validity. Sociodemographic variables including age, marital status, highest educational qualification achieved, employment status, and residential location were measured preoperatively by questionnaire. Social deprivation was captured using a geographical-based relative measure of deprivation based on postcode: participants were allocated to a Scottish Index of Multiple Deprivation quintile, whereby 1 equates to most deprived and 5 to most affluent [10].

2.4. Preoperative pain

Preoperative pain history, incorporating pain character, location, and duration of any existing pain, was assessed by self-completion questionnaire. The International Association for the Study of Pain definition of continuous or intermittent pain lasting for 3 months or longer was used to define chronicity of preoperative pain [21]. Participants reporting any ache, pain, discomfort, altered sensations, or numbness experienced in the previous week were asked to complete upper body maps, pain-related symptom grids, and validated neuropathic pain instruments. Upper body diagrams were modified from standard 4-view body diagrams widely used in chronic pain research. Pain diagrams were redrawn to illustrate different positions, including arms raised, to allow reporting of location of reported symptoms. Neuropathic pain scales included the Self-Complete Leeds Assessment of Neuropathic Symptoms and Signs pain scale (S-LANSS) [3], the Douleur Neuropathique 4 (DN4) questionnaire [5], and the Brief Pain Inventory (BPI) [12]. The S-LANSS and DN4 have been used in epidemiological surveys, whereby scores of $\geqslant 12$ and $\geqslant 3$ respectively are indicative of pain with neuropathic characteristics.

Given that preoperative investigative tests can cause pain and restrict function, we assessed arm morbidity before surgery using the Functional Assessment of Cancer Therapy–Breast questionnaire (FACT-B+4) arm subscale [13]. This scale captures ipsilateral and contralateral swelling/tenderness, numbness, painful movement, poor range of movement, and stiffness in arm/side of planned breast surgery. Lower scores indicate greater arm morbidity (range 0 to 20). A chronicity question was added to distinguish pain potentially arising from diagnostic/investigative tests (eg, fine-needle biopsy) from chronic symptoms: participants were asked whether preoperative painful symptoms had lasted for more than 3 months before surgery.

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