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Patterns and predictors of emergency department visits among older patients after breast cancer surgery: A population-based cohort study☆

Tracy Westley [a], Ania Syrowatka [b], David Henault [c], Young-Soo Rho [d], Francois Khazoom [c], Sue-Ling Chang [a], Robyn Tamblyn [a,b,e], Nancy Mayo [b,e,f], Ari N. Meguerditchian [a,d,g,*]

[a] Clinical and Health Informatics Research Group, McGill University, 1140, Pine Avenue West, Montreal H3A 1A3, Canada
[b] Department of Epidemiology, Biostatistics and Occupational Health, McGill University, 1020 Pine Avenue West, Montreal H3A 1A2, Canada
[c] Department of Surgery, University of Montreal, P.O. Box 6128 Centre-Ville, Montreal H3C 3J7, Canada
[d] Department of Surgery, McGill University, 1001 Décarie Boulevard, Montreal H4A 3J1, Canada
[e] Department of Medicine, McGill University, 1001 Décarie Boulevard, Montreal H4A 3J1, Canada
[f] School of Physical and Occupational Therapy, McGill University, 3654 Promenade Sir William Osler, Montreal H3G 1Y5, Canada
[g] Department of Oncology, McGill University, 546 Pine Avenue West, Montreal H2W 1S6, Canada

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ABSTRACT

Objectives: To characterize rates, reasons for, and associated predictors for emergency department (ED) visits after breast cancer (BC) surgery.
Methods: All women over 65 years undergoing curative surgery for non-metastatic incident BC (1998–2012) were identified using Quebec's universal healthcare administrative databases. Reasons for ED visits within 45 days of operation were reported. Associated factors were estimated using Cox regression.
Results: Of 24,463 patients, 12.8% had postoperative ED visits. Most frequent reasons were: *superficial infection*, *noninfectious gastrointestinal*, *trauma or wound* (other than breast), *noninfectious respiratory*, and *breast wound disruption*. Significant predictors included localized (aHR, 1.24, CI 1.04–1.49) or regional disease (aHR 1.64, CI 1.41–1.92), mastectomy (aHR 1.22, CI 1.10–1.34), each operation before definitive oncologic control (aHR 1.12, CI 1.03–1.21), lower institutional volume (aHR 1.23, CI 1.09–1.38), having 6–10 prescriptions (aHR 1.23, CI 1.15–1.31) or >10 (aHR 1.53, CI 1.33–1.77), benzodiazepine use (aHR 1.09, CI 1.01–1.18), anticoagulant use (aHR 1.29, CI 1.13–1.46), cardiovascular disease (aHR 1.15, CI 1.05–1.26), diabetes (aHR 1.11, CI 1.00–1.24), past hospitalization (aHR 1.25, CI 1.17–1.34), and lower income (aHR 1.12, CI 1.04–1.20).
Conclusion: Identification of risk factors in older patients before BC surgery could help prevent postoperative ED visits.

1. Introduction

Breast cancer (BC) incidence is rising among older populations [1–3]. In fact, women 65 years or older now comprise 42% of all new BC cases [4]. Most of these patients will appropriately be considered for surgery [5,6], despite having a higher number of comorbidities that may increase postoperative complication risk [7–12]. Adverse events after BC surgery have been extensively studied, however the use of emergency services by older patients after BC surgery has not yet been adequately characterized [13,14].

Care within EDs is challenged by overcrowding, time-constraints, incomplete clinical information, and limited multidisciplinary, senior-specific resources [15–21]. Older patients may not receive optimal care in this setting, [22–25] and face greater risks of subsequent adverse events, declines in functionality, ED returns, delays in adjuvant cancer care, and increased mortality [25–35]. Therefore, an ED visit not only represents an adverse event in itself [36] but after BC surgery reflects a gap in the quality of cancer care [37,38]. Optimal strategies for postoperative BC care would identify risk factors before surgery and apply appropriate preventative care measures to reduce ED visits. This study aims to identify the frequency, timing, reasons and potential risk factors of ED visits within 45 days of curative BC surgery among women over 65 years old.

Abbreviations: BC, breast cancer; ED, emergency department; ICD-9, International Classification of Diseases, 9th Revision; RAMQ, Régie de l'assurance maladie du Quebec; CCI, Charlson Comorbidity Index; aHR, adjusted hazard ratio; HFED users, high-frequency emergency department users.

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* Corresponding author at: 1140 Pine Avenue West, Montreal H3A 1A3, Canada.
E-mail address: ari.meguerditchian@mcgill.ca (A.N. Meguerditchian).

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2. Methods

2.1. Population and Study Design

This study took place in Quebec (Canada) where universal health insurance covers ~99% of the population [39,40]. Health insurance registrant, medical claims, and hospitalization databases were used to select all women over 65 years old receiving surgery for incident, non-metastatic BC [41]. (International Classification of Diseases, 9th Revision, [ICD-9]) between 1998 and 2012 (e-Table 2, Supplement). A historical, prospective design followed patients for 45 days after their most definitive BC surgery achieving oncological control. Patients were excluded if they had preoperative chemotherapy [42] or radiotherapy [43], which have known independent risk profiles, or interrupted medical or drug insurance from one year before BC diagnosis to the completion of the 45-day post-surgery follow-up.

2.2. Data Sources

Anonymized data was provided by Quebec's provincial universal health insurance agency (RAMQ - Régie de l'assurance maladie du Quebec), which also provides mandatory public drug insurance for all residents ≥65 years old [39,40]. Universal health coverage enabled all information on in-patient and out-patient medical services and prescriptions to be measured using previously validated administrative databases [44–48]. Appropriate ethical clearances were obtained from the McGill University Ethics Review Board and the Provincial Access to Information Office.

2.3. Study Outcomes

The primary outcome was an initial ED visit within 45 days [49–52] of definitive BC surgery achieving oncological control. This follow up period was chosen to allow the assessment of surgical efficacy beyond short-term mortality, and focus on patient-centered outcomes [53]. A 45-day cut off also ensured that ER visits were not related to other subsequent cancer treatment modalities such as radiation therapy that is typically initiated within 6 weeks of breast surgery [54]. A full calendar day lapse was required between the reported discharge date from definitive surgery and a first ED visit date was required to identify that ED visit as an outcome of interest. Number of days to initial ED visit, total ED visits per patient, and any inpatient admissions after surgery were reported. Reasons for ED visits (initial and subsequent) were captured as ICD-9 diagnostic codes. These reasons were counted and organized into broad classes and subclasses, based on disease physiology and treatment approach (e-Table 2, Supplement).

2.4. Patient Characteristics

Age and economic status (receipt of monthly financial assistance given to lower income Quebec residents over 65 years old) were measured [55,56]. Romano's adaptation of the Charlson Comorbidity Index (CCI) was used to measure patient co-morbidity [57–59]. Treatment for cardiac disease, diabetes, and any hospitalizations in the year before BC diagnosis was captured. Billing for an annual comprehensive health exam with a general practitioner indicated accessing primary care (e-Table 1, Supplement). Number of active prescriptions at diagnosis was measured as an indicator of polypharmacy [60,61]. Use of benzodiazepines [62–65], anticoagulants [66], or steroids [67–69] were included for their associated risks to adverse events.

2.5. Disease, Surgery, and Institutional Characteristics

BC and treatment characteristics included stage, number of surgeries to achieve oncologic control, and type of breast surgery (e-Table 1, Supplement). Ductal carcinoma in situ (DCIS) was selected as the reference group in the analysis, based on lower reported complication risks and less extensive surgical requirements [70]. More than one BC surgery to reach oncological control was considered a reoperation. A minimum of one day date difference was required between procedures to rule-out reoperation for an immediate complication (e.g. bleeding). Once oncological control was achieved, the 45-day follow-up capturing ED visits began. Institutional volume was categorized as <100, 100–200, or >200 BC surgeries performed in the patient's surgical institution in the year before their definitive surgery.

2.6. Statistical Analysis

Univariate and multivariate Cox proportional hazards models were used to estimate the association between patient, surgical and institutional characteristics, and the risk of an initial ED visit during the postoperative period. A Pearson correlation matrix estimated associations between variables. All models adjusted for clustering effects by surgical institution using PROC PHREG [71]. Postoperative receipt of radiotherapy (n = 49) or chemotherapy (n = 80) occurring prior to an initial ED visit was included in the full model. CCI was excluded over diabetes. Lymph node surgery was excluded over disease stage. Customized hazard ratios and estimation of interaction terms in the full model tested potential interaction effects. Kaplan–Meier graphs confirmed the proportionality assumption. All significant variables estimated the final multivariate Cox model. P-values were two-sided with significance $p \leq 0.05$ using SAS statistical software, version 9.4 (SAS Institute, Carey, NC).

3. Results

We identified 24,463 eligible patients (e-Fig. 1, Supplement) having undergone curative surgery. Cohort characteristics are reported in Table 1. Over the 45-day postoperative follow-up, 3129 patients (12.8%) had 3859 ED visits (Table 2). Median time to initial ED visit was 14 days (Fig. 1). Of the 3129 visitors, 554 (17.7%) were subsequently admitted for inpatient care while 82.3% had same-day ED discharges.

The full model was estimated (Table 3). Compared to in-situ disease, localized (adjusted HR [aHR], 1.24; 95% CI, 1.04–1.49) or regional disease (aHR, 1.64; 95% CI, 1.41–1.92) demonstrated higher likelihoods of an ED visit, as did mastectomy versus lumpectomy (aHR, 1.22; 95% CI, 1.10–1.34). At least one reoperation before definitive oncologic control (per additional surgery, aHR, 1.12; 95% CI, 1.03–1.21) and institutional volume <100 BC surgeries/year demonstrated increased risks (aHR, 1.23; 95% CI, 1.09–1.38).

Polypharmacy exhibited an exposure-response relationship, when comparing 0–5 prescriptions to 6–10 (aHR, 1.23; 95% CI, 1.15–1.31) and >10 (aHR, 1.53; 95% CI, 1.33–1.77). Use of benzodiazepines (aHR, 1.09; 95% CI, 1.01–1.18) and anticoagulants (aHR, 1.29; 95% CI, 1.13–1.46) demonstrated independent risks. Active cardiac disease (aHR, 1.15; 95% CI, 1.05–1.26), diabetes (aHR, 1.11; 95% CI, 1.00–1.24), and hospitalizations in the year preceding the BC diagnosis (aHR, 1.25; 95% CI, 1.17–1.34) also increased risk of initial ED visit, as did lower income (aHR, 1.12; 95% CI, 1.04–1.20).

3.1. Reasons for ED Visits

All diagnoses per patient visit were captured, bringing the number of diagnoses for all 3859 ED visits to 5013 (Table 4). The most diagnoses given to one patient in a single visit was four, while the majority (83.1%) of diagnoses was given singularly. The most frequently cited classes are further described in Table 4: infectious disease (n = 967), musculoskeletal-trauma-wound (n = 637), other (n = 615), surgical site issues (n = 594), process of care (n = 187), and 2013 remaining noninfectious diagnoses. The most frequent subclasses were *superficial infection potentially attributable to breast* (n = 569), *noninfectious gastrointestinal complication* (n = 439), *noninfectious trauma or wound*

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