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REVIEW

Does Breast Cancer Surgery Impact Functional Status and Independence in Older Patients? A Narrative Review

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ABSTRACT

Surgery is the recommended treatment modality for primary breast cancer. Breast cancer surgery is non-visceral; therefore, it is often assumed that the subsequent impact on functional status in older women is less significant compared to other cancer types such as colorectal cancer. Evidence for this however, is lacking. The definition of functional status varies amongst healthcare professionals and patients, making comparisons between studies difficult. From the literature, the two most common themes in relation to functional status following breast cancer surgery are activities of daily living and quality of life. Both of these elements of functional status are adversely impacted in patients following breast cancer surgery. A more significant decline is seen in patients with pre-existing comorbidities and with greater intensity of surgery, which includes more invasive breast and/or axillary surgery as well as additional reconstructive procedures. Identifying and optimising pre-existing factors which may predict post-operative decline in functional status, such as cognitive impairment and deteriorating functional decline over the preceding year, may help in reducing deterioration in functional status after breast cancer surgery. Methods which may be employed to detect and optimise these factors include geriatric assessment and exercise intervention.

Keywords: Activities of Daily Living; Breast Cancer; Functional Status; Older Women; Quality of Life; Surgery

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Key Summary Points

Breast cancer surgery is assumed to have minimal impact on the functional status of older women compared to other types of cancer surgery, for example, for intra-abdominal cancers.

There is evidence of a deterioration in the ability to perform activities of daily living and quality of life after breast cancer surgery in older women.

The level of deterioration is associated with pre-existing comorbidities and greater intensity of the surgical procedure.

As healthcare professionals, we must identify possible risk factors for decline in functional status pre-operatively and have frank discussions with our patients about how we can most appropriately deal with these and the possibility of irreversible decline.

INTRODUCTION

Breast cancer is the most common malignancy in women worldwide, and its incidence is increasing. This is partly due to our aging population and the improvement in management of co-existing comorbidities in older patients. Surgery is the recommended treatment option for primary breast cancer irrespective of age. Primary endocrine therapy (PET) may be an alternative in selected older patients with significant comorbidities, as the overall survival benefit observed with surgery in certain subtypes of breast cancer may prove to be minimal when life expectancy is limited by other comorbidities [1, 2]. Furthermore, a survey involving surgical oncologists published by Ghignone et al. [3] highlighted that quality of life (QOL) and recovery of functional status (FS) were considered the most pertinent outcomes in onco-geriatric surgery, rather than overall survival.

The National Audit of Breast Cancer in Older Patients (NABCOP) 2020 annual report [4] described some key findings on how breast cancer management differed between older and younger women in England and Wales. It was noted that the proportion of women undergoing surgery for early invasive breast cancer decreased with increasing age, from 96% (age 50–69) to 75% (age 70+) within the first year of diagnosis. Furthermore, this decrease was reported to be more marked in older patients with oestrogen receptor-positive (ER+) breast cancer, likely due to the option of PET as a treatment alternative.

Baseline level of functioning should be considered when weighing up the risks and benefits of surgery for breast cancer, as it may serve to predict poor post-operative QOL outcomes [5]. Functional status refers to an individual's physical and cognitive capability to perform their usual activities of daily living (ADL), allowing for the maintenance of personal health and well-being [5–9]; however, this definition is quite broad, and actual domains of FS can vary between users. Commonly considered domains include physical and psychological functioning, cognition, social activity and independence with ADLs [6, 9]. The impact of surgery on FS is better documented in cases of colorectal cancer [8], whereas comparatively less is known about the effects of breast cancer surgery. It is hypothesised that because breast cancer surgery is non-visceral, its subsequent impact on functional decline may be less substantial; however, in part due to this assumption, there is limited evidence on the topic.

In this article we examine current evidence looking at FS after breast cancer surgery in older patients, in the most commonly reported domains—ADLs and QOL. We then discuss how pre-existing patient factors may predict post-operative decline in FS. Next, we outline two current prospective studies in the UK focusing on FS, and possible future directions for interventions in this field including geriatric assessment and exercise intervention.

This article is based on previously conducted studies and does not contain any new studies

with human participants or animals performed by any of the authors. Ethical approval was not required.

A summary of the key findings in each of these areas is presented in Table 1.

EFFECTS OF BREAST CANCER SURGERY ON FUNCTIONAL STATUS OUTCOMES

Several studies [5–11] have reported the negative impact of elective cancer treatment on subsequent FS trajectories by examining how it affects the broad areas of ADL and QOL.

Activities of Daily Living

An observational study by Tang et al. [9] studied the impact of different types of breast cancer surgery on FS and survival amongst 5969 nursing home residents aged ≥ 67 years (mean age 82) using the Minimum Data Set for Nursing Home Activities of Daily Living summary score (MDS-ADL). This is scored between 0 and 28, 0 indicating independence and 28 indicating total dependence in all measured activities. Of the residents, 55–60% exhibited functional decline at 1 year post-surgery, with an average drop in MDS-ADL score of 2.8 points following lumpectomy, 4.1 points after mastectomy and 4.6 points post-axillary lymph node dissection (ALND). In support of this, Singh et al. [5] showed that bilateral mastectomies in 314 older Appalachian women aged ≥ 65 years were associated with poorer functional preservation ($p = 0.03$) when compared to patients who underwent a unilateral mastectomy or lumpectomy, demonstrating the more apparent decline in FS outcomes after more extensive surgery. A systematic review on the subject [6], which included 10 studies, further summarised how patients post-ALND experienced appreciable impairment in their autonomy in carrying out their ADLs.

A prospective cohort study by Abbema et al. [12] examined the impact of age, cancer diagnosis and treatment on FS decline in older patients with breast and colorectal cancers. This was achieved by looking at two age groups with cancer who had undergone surgery; 179 patients aged ≥ 70 and 341 patients aged 50–69 were compared. In addition, 317 participants aged ≥ 70 without cancer were included as a control group. Functional status was assessed at baseline and at 12 months using the Katz ADL scale, scored 0–6 (0, unable to perform any activity; 6, able to perform all activities) and the Lawton instrumental ADL (IADL) scale, scored 0–5 and 0–8 for men and women, respectively (0, unable to perform any activity; 5 and 8, able to perform all activities). Results demonstrated that there was a decline in ADL and IADL of 16.7% and 12.6%, respectively, for younger cancer patients, compared to 26.8% and 31.3%, respectively, in older cancer patients and 16.7% and 17.4%, respectively, in older participants without cancer. Overall FS deterioration in younger and older cancer patients was 24.6% and 43.6%, respectively, with a 28.1% decline in older non-cancer participants [12].

These studies outline how breast cancer surgery has a measurable negative impact on the independence of older patients in carrying out their ADLs. This deterioration in FS appears to be more apparent in patients undergoing more extensive surgery. Therefore, treatment plans should be individualised accordingly to preserve post-operative FS where possible.

Quality of Life

A longitudinal cohort study by Mandeblatt et al. [10] assessed different domains of QOL outcomes post-ALND in 571 patients aged ≥ 67 years using the 12-Item Short Form Survey (SF-12). It was noted that long-term arm problems (defined as swelling or limitation in arm, hand or finger movements) post-breast cancer surgery were the main determinants for reductions in both physical ($p = 0.0001$) and mental ($p = 0.04$) performance. This study reported that 60% of patients, of which 83% underwent axillary surgery, demonstrated impaired arm functioning at 2 years. Pre-existing arthritis was another notable predictor of long-term arm symptoms and showed a multiplicative effect in women who also underwent

Table 1 A summary of the findings of studies examining the effect of breast cancer surgery on functional status outcomes in older women

	Current evidence
Effects of breast cancer surgery on FS outcomes	Activities of daily living
	Functional decline is noted after breast cancer surgery and is more apparent after extensive surgery [5, 9]
	Cancer diagnosis and treatment, along with older age, are important predictors of decline in both ADL and IADL [12]
	Quality of life
	Long-term arm problems post-breast cancer surgery disrupted upper body function and were the main determinants for reductions in both physical and mental performance [9, 10]
	Following post-mastectomy reconstruction, older patients (65–77 years) showed poorer outcomes in physical function compared to younger patients (25–64 years), but demonstrated better social functioning and mental health outcomes [11]
Pre-existing factors influencing FS outcomes	Pre-existing patient factors such as advanced age, multiple comorbidities, obesity, lower educational attainment and smoking are possible predictors of subsequent functional decline [6]
	Higher stage breast cancer ($p = 0.02$) and weakness at time of diagnosis ($p = 0.04$) were significantly associated with FS decline [5]
	Pre-operative declines in ADL and cognitive impairment prior to surgery were significantly linked to deteriorating functional trajectories at 1 year in breast cancer patients who underwent a lumpectomy, mastectomy and ALND [9]
Examples of UK-based prospective studies	Bridging the age gap
	Phase 1 showed that older patients (70–95 years) undergoing breast cancer surgery experienced a long-term negative impact on QOL and independence up to 2 years [14]
	For ER+ breast cancer, patients who underwent either S+ET or PET both exhibited a decline in global health status scores, with a sharper decline in the surgery group at 6 weeks and failure to return baseline [1]
	Nottingham Research Programme
	Updated findings were conflicting, showing areas of improvement related to FS and a decline in others. No clear pattern was identified [16]

Table 1 continued

	Current evidence
Potential for intervention	Geriatric assessments
	GAs aid in identifying health deficits that can potentially be optimised pre- or post-operatively. They may also predict life expectancy and tolerance to oncological treatments [2, 18]
	Updated recommendations regarding the use of GAs to guide oncology treatment were published in 2021 [2]
	Screening tools can be used prior to a full GA due to time constraints [20]
	It is feasible to develop and utilise a cancer-specific GA in clinical practice [18]
	Exercise interventions
	Two RCTs demonstrated the positive effects of exercise interventions on improving physical function in breast cancer patients [21, 22]

ADL activities of daily living, *ALND* axillary lymph node dissection, *BCSS* breast cancer-specific survival, *DESI* decision support instruments, *ER+* oestrogen receptor-positive, *FS* functional status, *GA* geriatric assessment, *IADL* instrumental activities of daily living, *PET* primary endocrine therapy, *QOL* quality of life, *RCT* randomised controlled trial, *S+ET* surgery with endocrine therapy, *SIOG* International Society of Geriatric Oncology, *TUG* timed up-and-go

ALND. These women subsequently required more physical therapy services than those without arm-related issues (22% vs 6%, $p = 0.0001$). These findings were supported by Tang et al. [9] who reported that over one-third of women experienced symptoms (pain and reduced range of motion) which disrupted upper body function 6 months following breast surgery, irrespective of procedure type.

An observational study by Girotto et al. [11] looked at the effects of breast reconstruction (two-stage implant reconstruction, free or pedicled myocutaneous flaps) post-mastectomy on QOL outcomes in 316 patients aged 65–-77 years. This was measured using the self-reported 36-Item Short Form Health Survey (SF-36), which is scored between 0 and 100 (0 being equivalent to maximum disability, 100 being equivalent to no disability). Older women (65–77 years) exhibited poorer outcomes in physical function compared to younger women (25–64 years). However, they demonstrated higher scores than the younger group when comparing social functioning and mental health outcomes, which is likely attributable to the psychological benefits associated with an improvement in self-image succeeding reconstructive surgery.

Given the adverse impact that different types of breast cancer surgery have on older patients' QOL, careful consideration of patient preferences, life expectancy and predicted survival benefits should be weighed when making decisions about their care.

PRE-EXISTING FACTORS INFLUENCING FUNCTIONAL STATUS OUTCOMES

In addition to the impact of breast cancer surgery on FS, various co-existing patient factors can also act as possible predictors of subsequent functional decline. These include advanced age, multiple comorbidities, obesity, lower educational attainment and smoking [6, 7]. Singh et al. [5] describe functional decline as an increase of at least one point on the Eastern Cooperative Oncology Group (ECOG) score within one year of breast cancer diagnosis. Their study reported that higher stage disease ($p = 0.02$) and feeling of physical weakness

($p = 0.04$) at time of diagnosis were significantly linked to subsequent FS decline.

Nursing home residents in the study by Tang et al. [9] were described as being cognitively impaired if they (1) had a pre-existing diagnosis of dementia; (2) were diagnosed with dementia on their Minimum Data Set (MDS) assessment; or (3) were measured as cognitively impaired with the MDS Cognitive Performance Scale (CPS) or Brief Interview of Mental Status (BIMS). It was noted that pre-operative declines in ADL (increase of ≥ 2 points on the MDS-ADL score) and cognitive impairment prior to surgery were significantly associated with further deteriorations in both these domains at 1 year following breast cancer surgery (ALND, lumpectomy or mastectomy).

This interplay between pre-existing comorbidities and baseline function on subsequent FS decline in older cancer patients has highlighted the importance of recognising such comorbidities in a timely manner, optimising them where feasible and individualising oncological treatment regimens as appropriate.

EXAMPLES OF UK-BASED PROSPECTIVE STUDIES

Much of the current evidence looking at FS in older patients after breast cancer surgery as discussed thus far are retrospective in nature and individually examine smaller cohorts of patients. Two studies have been highlighted here due to their contribution in strengthening the evidence base in this area.

Bridging the Age Gap (BTAG)

The BTAG study [13] was a multicentre UK study with two phases. Phase 1 was a prospective observational cohort study conducted from 2013 to 2018, that recruited 3375 patients across 57 different sites. It aimed to investigate breast cancer management in older women and narrow the gap in their treatment outcomes compared to younger women. Phase 1 outcomes demonstrated that older patients between 70 and 95 years (median 76) undergoing breast cancer surgery experienced a long-term negative impact on their QOL and independence when followed up for 2 years [14]. Phase 2 [13, 15] was a cluster-randomised controlled trial nested within the larger BTAG cohort study and aimed to evaluate the use of clinical predictive tools and decision support instruments (DESIs) in clinical decision-making in older women with breast cancer.

In addition, BTAG examined the survival outcomes and QOL in women aged 69–102 (median age 77) with operable ER+ breast cancer following either surgery with endocrine therapy (S+ET) or PET; the median follow-up was 52 months. With regard to post-treatment QOL and functional independence, both arms exhibited a decline in their global health status scores; nonetheless, the decline was sharper in the surgery group 6 weeks from baseline, demonstrating its acute impact on older patients. Moreover, this score failed to return to baseline level, highlighting its long-term effects on FS [1].

Moving forward, these findings along with a validated clinical predictive tool (https://agegap.shef.ac.uk/) can help individualise breast cancer treatment selection by enabling shared decision-making between clinicians and their patients.

Nottingham Research Programme on Primary Breast Cancer in Older Women

A prospective pilot study [16] is currently being conducted in the Nottingham area. Patient recruitment commenced in 2009 and invites women aged ≥ 70 years with early-stage operable primary breast cancer to participate. The aim is to examine the value of using a validated cancer-specific comprehensive geriatric assessment (CGA) [17] to assess older patients undergoing surgery versus non-operative treatment. The CGA is performed within 6 weeks and 6 months post-diagnosis, supplemented with the European Organisation for Research and Treatment of Cancer Quality of Life of Cancer Patients (EORTC QLQ C-30) and breast cancer-specific (BR23) questionnaires as formal measures of QOL.

The most recent findings presented at the International Society of Geriatric Oncology (SIOG) 2019 annual conference reported results from 88 women who underwent surgery [18]. Results were conflicting in that there was an improvement in some questions related to FS and a decline in others, with no clear pattern. Results remained conflicted even when taking into consideration intensity of surgery. Although this study has demonstrated some evidence to date indicating a decline in certain aspects of FS following breast cancer surgery, further research into the subject is required to provide more concrete conclusions to guide future treatment strategies. This study is currently ongoing and involves several centres across the UK and Hong Kong [19], with the aim of recruiting over 1000 patients.

POTENTIAL FOR INTERVENTION

Increasing awareness that FS may decline after breast cancer surgery is the first step in highlighting the need for solutions to overcome it. Relevant assessments along with timely interventions can help improve FS in older patients following breast surgery. The validity of utilising GAs in older cancer patients has been demonstrated and represents an area of ongoing research [2, 16, 18]. One example of a strategic intervention to improve physical functioning following concerns identified with a GA includes exercise interventions, which will be discussed below. Figure 1 demonstrates potential areas for intervention in older women undergoing breast cancer surgery.

Geriatric Assessment

Most recently, the European Society of Breast Cancer Specialists (EUSOMA) and SIOG published updated recommendations [2] on the management of older patients with breast cancer. Routine use of GAs to guide oncology treatment decisions in older patients was advocated. Geriatric assessments aid in understanding older patients' overall health status and may predict life expectancy and tolerance to treatments. Given that this population comprises a physiologically heterogenous group, the GA serves as a useful pre-operative adjunct in differentiating between fit susceptible and frail older individuals, allowing for the appropriate adjustments to treatment strategies.

A study by Hurria et al. [17] looked at the feasibility of developing a cancer-specific GA that meets the needs of the oncology community. They focused on the essential domains that are critical in assessing cancer patients, such as FS, comorbidities, cognition, psychological health, nutrition, social functioning and support. This study was valuable as it highlighted the difference in assessment goals between the oncology and geriatric specialties; a standard GA performed by a geriatrician may take up to 2 hours, whilst not precisely addressing the specific needs of oncologists who require a more concise tool to identify the subset of older patients whose limited physiological reserves render them unsuitable for more rigorous treatment regimes. The CGA proposed here was primarily self-administered and brief, requiring a mean time of 27 minutes to complete. As mentioned above, the Nottingham pilot study [16] has also demonstrated the

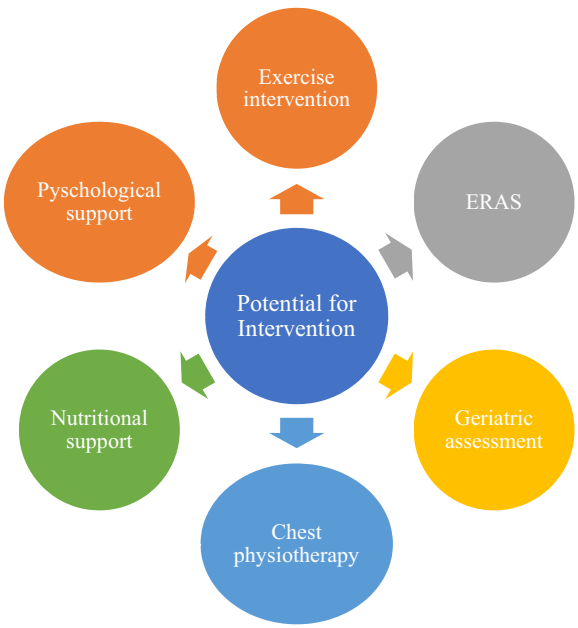

Fig. 1 Examples of areas for pre- and post-operative intervention to help improve FS in older patients following breast surgery

feasibility of conducting a CGA in the research setting.

In summary, the use of a pre-operative GA in cancer patients is evidently valuable; however, there is a lack of consensus regarding a standardised assessment measure, with multiple different models available [2, 17]. Moreover, due to time and resource constraints, a full GA is not always practical in the clinical setting. The latest SIOG guidelines [2] suggest that a screening tool should be employed as a minimum; in practice, this will allow for quick identification of patients aged $\geq$ 70 years with potential frailties that warrant further systematic evaluation. Numerous screening tools exists, but the highest sensitivity has been observed with the use of the G8, Flemish version of the Triage Risk Screening Tool (TRST), Oncogeriatric screen, Study of Osteoporotic Fractures, Eastern Cooperative Oncology Group-Performance Status and Senior Adult Oncology Program (SAOP) 2 screening, as reported by Decoster et al. [20].

Therefore, moving forward, both screening tools and GAs should be used in combination given their complementary functions in identifying potentially optimisable health issues that can be acted on pre- and post-operatively with appropriate strategies.

Exercise Interventions

Exercise interventions represent a well-studied area with evidence supporting the use of prescribed physical activity to recover function in older patients following breast cancer surgery [21, 22].

Arrieta et al. [21] conducted a randomised controlled trial (RCT) in cancer patients aged $\geq$ 70 years undergoing curative treatment (surgery, chemotherapy, radiotherapy). The study was divided into two arms, with 301 participants distributed between the usual care group (UCG) who received national recommendations on physical activity, and the intervention group (IG), who received individually tailored physical activity advice for 1 year. Functional decline was defined as a drop in $\geq$ 1 point in the short physical performance (SPPB) score. Breast represented the most frequent tumour site in this study (35.7%). After 2 years, a decline in SPPB of 29.8% in the UCG and 5% in the IG group was noted amongst breast cancer participants ($p = 0.006$), demonstrating an effective slowing in physical decline; however, similar encouraging results were not observed after 1 year ($p = 0.119$).

Next, the RESTORE RCT by Anderson et al. [22] examined the effectiveness of a moderate, tailored exercise intervention compared to usual care (patient education) on physical function, health-related QOL (HRQOL) and arm volume in women with newly diagnosed stage I–III breast cancer receiving treatment. A total of 104 patients were randomised into two arms within 4–12 weeks post-surgery and followed up for 18 months. It was noted that 46% of participants underwent breast-conserving surgery, 79% had axillary node dissection, 59% received chemotherapy and 64% radiotherapy. Physical function was assessed with the 6-minute walk test (6MWT) and HRQOL with the Functional Assessment of Cancer Therapy–Breast Cancer (FACT-B). Results showed that patients receiving exercise interventions demonstrated a significant increase in physical function, with a longer distance walked (593.2 m vs 558.9 m; $p = 0.0098$) for the 6MWT compared to the usual care arm. Nonetheless, there was no significant effect on FACT-B scores for HRQOL and arm volume.

Given the evidence that exists regarding the value in utilising GAs and exercise programmes in older cancer patients, these areas of assessment and subsequent intervention should be adopted in clinical practice to allow for optimisation of patients' pre- and post-treatment function. Other types of interventions include the Enhanced Recovery after Surgery (ERAS) pathway, pre-habilitation nutritional support, active chest physiotherapy and psychological support [3]. These areas are beyond the scope of discussion of this article but have been covered in a full systematic review of the subject by Harrison et al. [6].

CONCLUSION

There is limited evidence regarding FS outcomes after breast cancer surgery in older patients; however, from the evidence available, there does appear to be a degree of decline in FS post-operatively, and this decline appears to be related to the intensity of surgery.

Notably, the interaction between breast cancer surgery and co-existing comorbidities may result in the overall survival benefits being limited in more frail women. It has been noted that patients place as much importance on their QOL as their length of life [7]. Therefore, a more tailored approach to the decision-making process surrounding breast cancer treatment should be adopted, as older patients represent a physiologically heterogenous group where treatment planning should not be determined based on chronological age alone.

Examples of areas for intervention have been highlighted in this review, such as the use of a pre-operative GA in older cancer patients to assess for fitness for treatment. In addition, the incorporation of exercise programmes should also be considered, to allow for patient optimisation and improved functional recovery where possible. Other interventions such as nutritional and psychological support, as well as the established ERAS pathway, can also be explored.

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