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Surgical treatments for older breast cancer patients: A systematic review and meta-analysis of real-world evidence

Hsuan-Wen Lai, MS[a], Yu-An Chen, MS[a], Ka-Wai Tam, MD, PhD[b,c,d,*]

[a] School of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan
[b] Cochrane Taiwan, Taipei Medical University, Taipei, Taiwan
[c] Division of General Surgery, Department of Surgery, School of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan
[d] Division of General Surgery, Department of Surgery, Shuang Ho Hospital, Taipei Medical University, New Taipei City, Taiwan

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ABSTRACT

Background: Older patients with breast cancer are often underrepresented in clinical trials, leading to a lack of evidence-based guidelines for surgical treatment in this cohort. Consequently, synthesizing real-world data is crucial for determining the optimal surgical management of geriatric patients with breast cancer.

Methods: A comprehensive search was conducted of the PubMed, Embase, and Cochrane Library databases. The review included clinical studies evaluating treatments in patients aged ≥65 years with breast cancer. Comparisons were made between primary surgical treatment and endocrine therapy alone, breast-conserving surgery without radiotherapy versus mastectomy, sentinel lymph node biopsy versus omission of sentinel lymph node biopsy, and surgery plus axillary lymph node dissection versus omission of axillary lymph node dissection.

Results: A total of 44 studies were analyzed. Surgery significantly increased overall survival, breast cancer–specific survival, and recurrence-free survival compared with endocrine therapy alone. Pooled estimates revealed that mastectomy yielded significantly better prognoses than breast-conserving surgery without radiotherapy in terms of both overall survival and breast cancer–specific survival. Omitting sentinel lymph node biopsy and axillary lymph node dissection did not significantly reduce overall survival.

Conclusions: For older patients with breast cancer, primary surgical treatment significantly enhances survival and regional control compared with endocrine therapy alone without compromising quality of life. Frail patients with nonmetastatic breast cancer who are unwilling to undergo radiotherapy benefit from mastectomy, with no notable psychosocial decline compared with breast-conserving surgery alone. Sentinel lymph node biopsy omission does not increase recurrence rates or mortality, and avoiding axillary lymph node dissection may be viable for node-positive older patients due to its comparable survival outcomes.

Introduction

Breast cancer management in geriatric patients presents unique challenges and disparities. As the population ages, generally defined as those aged ≥65 years, tolerance for treatment varies because of comorbidities and frailty, often making it difficult for these patients to receive the same standard treatment protocols as their younger counterparts. Additionally, the risk of operative complications influences patients' treatment choices.[1] Because treatment decisions affect both survival and quality of life (QoL), a systematic approach is essential to balance the benefits and risks of therapies while considering the overall health of older patients with breast cancer.

Older patients with breast cancer are often denied surgery because of concerns regarding its risks, including the risks associated with anesthesia. For example, patients with hormone-positive breast cancer who do not undergo surgery are often treated with primary endocrine therapy alone. Whether avoiding surgery improves survival in older patients with breast cancer is unclear.[1]

* Corresponding author: Ka-Wai Tam, MD, PhD, Department of Surgery, Shuang Ho Hospital, Taipei Medical University, No. 291, Zhongzheng Road, Zhonghe District, New Taipei City 23561, Taiwan.
E-mail address: kelvintam@h.tmu.edu.tw (K.-W. Tam);
Twitter: @sharonlaiii, @kelvintam0203

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Additionally, concerns regarding radiotoxicity and the practical difficulties of repeated visits for radiotherapy lead some older patients to opt for breast-conserving surgery (BCS) without radiotherapy or to initially undergo mastectomy.[2] Therefore, real-world data are required to evaluate outcomes of different treatment modalities and improve doctor-patient communication regarding surgical decisions.

Sentinel lymph node biopsies (SLNBs) are essential in determining further treatment decisions, including the potential need for axillary lymph node dissection (ALND) or adjuvant therapies. Although SLNB provides essential information on nodal status, it also poses risks of complications such as lymphedema and nerve injury, particularly among older patients with prevalent comorbidities and age-related physiological changes.[3] Additionally, whether SLNB is a safe and effective procedure for elderly patients is unclear. The prognostic significance of SLNB in guiding treatment for older patients with comorbidities or limited life expectancy is unclear; therefore, a careful, balanced assessment of the risks and benefits is required.

Although ALND has been a standard practice for patients with SLNB-positive results or clinically positive lymph nodes, its necessity and therapeutic value in geriatric patients are increasingly questioned.[3] Although ALND can enhance locoregional control, it also poses the risks of arm pain, lymphedema, nerve damage, and restricted movement, which can adversely affect QoL in older patients. Therefore, its potential survival advantage requires careful evaluation.

Clinical trials and evidence on the most appropriate treatments for breast cancer in older patients are lacking. Therefore, a systematic analysis of real-world data is necessary to determine the optimal management for this population and to prevent both overtreatment and undertreatment. This review aimed to examine surgical treatment modalities for older patients with breast cancer aged ≥65 years by (1) comparing survival, regional control outcomes, and safety between patients receiving primary surgical treatment and those receiving endocrine therapy alone; (2) comparing survival outcomes and recurrence between patients undergoing mastectomy and those undergoing BCS without radiotherapy; (3) comparing survival outcomes and safety in patients with clinically negative nodes between those undergoing SLNB and those sparing SLNB; and (4) comparing survival outcomes and safety in patients with SLNB-positive results or clinically positive lymph nodes between those undergoing ALND and those not undergoing ALND.

Methods

Search strategy and selection criteria

Studies relevant to geriatric breast cancer published in or before April 2024 were identified in PubMed, Embase, and Cochrane Library databases. Duplicates and articles without full text were excluded. The following broad search terms were used: (“elderly” OR “geriatric” OR “older”) AND “breast cancer.” No language restriction, date limitation, or other filters were applied to the search. Additionally, all related references and unpublished citations were reviewed.

Randomized controlled trials (RCTs) and prospective and retrospective cohort studies evaluating surgical outcomes in patients with breast cancer aged ≥65 years were included in the analyses. Case reports, commentaries, and review articles with data already presented in original sources were excluded from the study. In cases of duplicate data, studies providing the most comprehensive baseline characteristics, comparable confounding factors, and clinical outcomes across different groups were selected. Studies involving in situ carcinoma were excluded, with only invasive breast cancer cases included. For the comparison of surgery versus endocrine therapy, articles comparing primary surgical treatment (BCS or mastectomy) with endocrine therapy alone were analyzed. In comparing BCS alone with mastectomy, we excluded studies that lacked data on cancer stage or type of surgery for each group. For the assessment of SLNB, articles evaluating patients with clinically negative nodes were included. For ALND evaluation, only studies involving patients with clinically positive nodes or SLNB-positive results were included. Studies were excluded if the clinical nodal status was unknown or if patients did not undergo SLNB prior to ALND.

All studies were screened on the basis of inclusion and exclusion criteria. Studies suitable for inclusion in our meta-analyses were reviewed by a second researcher to ensure accuracy. This analysis was registered in the PROSPERO online public database (CRD42023493652).

Data extraction

Two researchers independently reviewed the abstracts and titles of the identified studies. Inclusion and exclusion criteria were evaluated. Study design, patient characteristics, surgical interventions, and statistical outcomes were extracted and verified. Data extracted from the studies were compared, and any disagreements were resolved by a third reviewer.

Methodological quality appraisal

The quality of the studies was assessed through an examination of various aspects of research design that could potentially introduce bias. These aspects include insufficient accounting for confounding variables, measures susceptible to measurement bias, and the extent of data loss to follow-up in observational studies. To evaluate overall bias, as well as bias before, during, and after intervention, the Risk of Bias in Nonrandomized Studies of Interventions (ROBINS-I) tool was used.[4] Additionally, the quality of clinical trials was assessed using the revised Cochrane risk-of-bias tool for randomized trials (RoB 2.0),[4] with the modified Newcastle-Ottawa Scale (NOS) employed for single-armed nonrandomized studies.[5]

Outcomes

The primary outcomes of this study were the effects of surgical treatments on various aspects of survival and well-being among older patients with breast cancer, including overall survival (OS), breast-cancer-specific survival (BCSS), recurrence-free survival (RFS), recurrence rates, safety considerations, and QoL. Comparative analyses were conducted to assess the differences between surgical treatment and endocrine therapy alone, mastectomy and BCS, SLNB and SLNB omission, and ALND and ALND omission. Additionally, safety and QoL were evaluated by analyzing adverse effects and questionnaire responses.

Statistical analysis

This meta-analysis adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines.[6] Survival data extracted from the studies were pooled for meta-analysis by using Review Manager.[4] OS, BCSS, and RFS were primarily evaluated using the inverse variance method and are reported as hazard ratios (HRs). Recurrence rates, including locoregional failure and distant metastasis, were obtained using the dichotomous method and are reported as odds ratios (ORs). Effect size precision

is indicated using 95% CIs, and pooled estimates were computed using the DerSimonian and Laird random effects model.[4] Statistical heterogeneity and inconsistency in treatment effects across the included studies were assessed using Cochrane Q tests and I^2 statistics, respectively. A P value of <.1 was considered indicative of statistical significance for the Cochrane Q tests. The I^2 statistic was used to assess the degree of statistical heterogeneity, with I^2 indicating the proportion of total outcome variability attributable to inconsistency among the studies. Subgroup analyses were conducted by pooling estimates for similar patient baseline characteristics across studies.

Results

The study selection process is depicted in the PRISMA flow diagram (Figure 1). Following a review of titles and abstracts of articles that were manually identified in the database search, a total of 193,735 full-text entries, excluding duplicates, were retrieved, and articles unrelated to geriatric breast cancer were eliminated. A total of 758 articles underwent final evaluation, among which 44 studies meeting the inclusion criteria were selected for the meta-analysis.

The methodological quality of the included evidence varied across different outcomes. As illustrated in Supplementary Tables S1 and S2 with the majority of studies being uncontrolled cohort studies, high-quality evidence was scarce. Double-armed nonrandomized studies generally provided moderate-quality evidence, as evaluated with the ROBINS-I tool (Supplementary Table S2). For the single-armed nonrandomized study, evidence was of high quality, as assessed using the NOS (Supplementary Table S3).

Surgical treatment versus endocrine therapy alone

We retrieved 19 studies examining the effect of primary surgical treatment versus endocrine therapy alone.[1,7–24] In total, 9 were RCTs,[16–24] 2 were prospective studies,[7,8] and 8 were retrospective cohort studies.[1,9–15] Two prospective studies recruited patients from 56 UK breast units,[7,8] resulting in overlapping data; thus, only the most comprehensive data sets were used for analysis. One retrospective study collected data from the Surveillance, Epidemiology, and End Results (SEER) database,[9] whereas the others collected data from various medical centers and cancer registries.[1,10–15] Of 35,463 patients included, 23,886 underwent primary surgical treatment, and 11,577 underwent endocrine therapy alone. The majority of patients had operable early-stage breast cancer with minimal nodal involvement. Table I outlines the demographic and clinical characteristics of the patients.

Survival outcomes

The pooled analysis revealed that older patients with breast cancer who underwent surgery exhibited significantly better

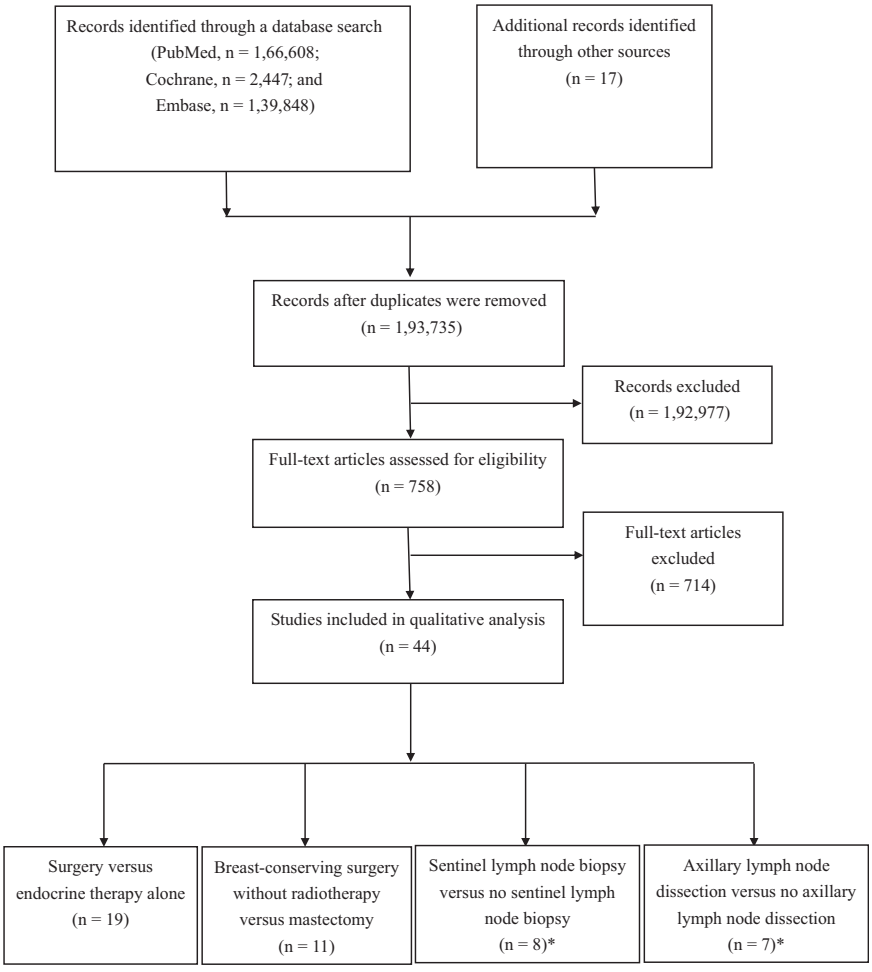

Figure 1. Study selection process. *Besic et al (2014) was included in 2 subgroups.

Table I
Characteristics of studies comparing geriatric patients with breast cancer who received surgical treatment and those who received primary endocrine therapy alone

Study (year)	Study design (country)	Patient characteristics	No. of patients	Age (yr) (mean or median)	Stage, I/II/III, *n*	Tumor stage, or size, 1/2/3/4, *n*	Charlson Comorbidity Index, 0/1/≥2, *n*	ER+/PR+/HER2+, *n*	Intervention (*n*)
Dalsen (1995)	Retrospective (Netherlands)	Age >70 yr; BC treated at Sophia Hospital between 1980 and 1992	S: 147 N: 34	S: 77* N: 83*	S: 123†/24 N: 19†/15	NR	NR	NR	S: MRM or simple mastectomy or BCS or tumor excision ± TAM N: PET (TAM alone)
Fennessy (2004) Bates (1991)	Randomized controlled trial (UK)	T1, T2, T3a, T4b N0 or N1, M0; operable primary BC; age >70 yr; treated in CRC trial (1984–1991)	S: 225 N: 230	S: 76‡ (70–90) N: 76‡ (70–87)	NR	S: 48/114/9/54 N: 38/130/16/46	NR	NR	S: BCS or mastectomy + TAM N: PET (TAM 40 mg QD)
Gazet (2011)	Randomized controlled trial (UK)	T1-T4, N0M0; operable BC; age ≥70 yr; treated in the St. Georges trial (1982–1989)	S: 100 N: 100	S: 75.4* (70–95) N: 76.9* (70–90)	NR	S: 22/48/23/7 N: 17/52/17/14	NR	200/NR/NR	S: WLE or mastectomy N: PET (TAM 20 mg QD)
Johnston§ (2012)	Randomized controlled trial (UK)	T1/2, N0/1, M0; cN− and high ER content BC; age ≥70 yr; presented to the EPSII trial (1989–1996)	S: 53 N: 100	S: 76* N: 78*	NR	All patients with tumor stage 1–2	NR	All ER histochemical scores ≥100	S: simple mastectomy + adjuvant TAM (20 mg QD) N: primary TAM (20 mg QD)
Mustacchi (2003) (2015)	Randomized controlled trial (Italy)	Operable BC; age ≥70 yr; presented to the Italian Cooperative Group, GRETA trial (1987–1992)	S: 239 N: 235	S: 76‡ (69–90) N: 77‡ (65–88)	NR	S: 135/96/2 N: 127/101/3	NR	S: 82/74/NR N: NR	S: WLE or mastectomy + TAM N: PET (TAM 160 mg on day 1, then 20 mg QD)
Nayyar‖ (2020)	Retrospective (US)	T1 or T2, N0 or N1; ER+ or PR+ BC; age ≥70 yr; diagnosed during 2008–2013; data retrieved from the SEER database	S: 8,006 N: 778	S: 77‡ (73–81) N: 80‡ (75–86)	All early stage	S: 6,044/1,962/NR/NR N: 714/64/NR/NR	S: 1¶ (0–2) N: 1¶ (0–2)	All ER+ or PR+	S: BCS or mastectomy + ET N: PET (TAM or AI)
Rao (2007)	Retrospective (UK)	Primary BC; age ≥80 yr; treated at Castle Hill Hospital between 1992 and 2002	S: 48 N: 62	80–89: 100 90–98: 10	78†/32**	NR	NR	S: 15/NR/NR N: 18/NR/NR	S: WLE or mastectomy + axillary surgery + adjuvant ET or RT N: PET (TAM or AI)
Robertson (1992) Chakrabarti (2011) Willsher (1997)	Randomized controlled trial (UK)	Operable primary invasive BC; age >70 yr; presented to Nottingham Breast Unit (1982–1987)	S: 65 N: 66	S: 76* (70–88) N: 75* (70–87)	NR	S: 18/45/20 N: 13/51/2/0	NR	NR	S: wedge mastectomy alone N: PET (TAM 20 mg BID)
Suen (2020)	Retrospective (Hongkong)	Clinical stage I–III; ER+ Chinese BC; age ≥70 yr; treated in Queen Mary Hospital between 2008 and 2017	S: 209 N: 83	S: 76.73†† ± 4.650 N: 84.17†† ± 6.152	S: 90/78/32 N: 16/54/13	S: 122/75/9/3 N: 18/46/12/7	S: 104/80/21 N: 14/24/9	S: 209/NR/34 N: 83/NR/12	S: BCS or mastectomy or MRM + adjuvant ET ± chemotherapy or RT N: PET (TAM or AI)
Syed‡‡ (2011)	Retrospective (UK)	ER-positive BC; age ≥70 yr; received diagnosis and treatment at Nottingham Breast Unit during 1973–2009	S: 616 N: 449	S: 75‡ (70–90) N: 81‡ (70–99)	652/NR/NR	S: 205/242/NR N: 156/456/NR	NR	All ER+	S: BCS or mastectomy ± ET N: PET (TAM or AI)
Traa (2011)	Retrospective (Netherlands)	BC; age ≥75 yr; treated at St. Elisabeth Hospital between 1985 and 2005	S: 233 N: 113	S: 78.6†† ± 3.3 N: 83.5†† ± 4.6	NR	S: 185§§/40‖‖ N: 65§§/23‖‖	NR	S: 162/NR/NR N: 103/NR/NR	S: BCS or total mastectomy with SLNB and/or complete ALND ± adjuvant ET N: PET (TAM alone)
Ward (2018)	Retrospective (UK)	BC; age ≥70 yr; data acquired from WMCIU, NYCRIS between 2002 and 2010	S: 10,087 N: 8,643	70–74: 6,401 75–79: 6,328 80–84: 5,513 85–89: 3,662 90–94: 1,483 ≥90: 462	NR	5,142/8,445/1,872/1,511	16,688/1,882/1,529	18,730/NR/850	S: surgery + adjuvant ET N: PET

(*continued on next page*)

Table I (*continued*)

Study (year)	Study design (country)	Patient characteristics	No. of patients	Age (yr) (mean or median)	Stage, I/II/III, *n*	Tumor stage, or size, 1/2/3/4, *n*	Charlson Comorbidity Index, 0/1/≥2, *n*	ER+/PR+/HER2+, *n*	Intervention (*n*)
Wink (2012)	Retrospective (Netherlands)	Age ≥75 yr; BC received diagnosis in 2001–2008 in the ECR	S: 1,504 N: 184	84* (75–89) S: 80.2* N: 83.8*	NR	55/94/3/27	S: 325/448/574 N: 16/51/107	145/117/4	S: surgery ± ET N: PET (TAM or AI)
Wyld¶¶ (2021) Morgan (2020)	Prospective (UK)	T1-3, N0-2, M0; operable invasive BC; age ≥70 yr; recruited from 56 UK breast units during 2013–2018	S: 2,354 N: 500	S: 76.4†† ± 5.1 N: 83.5†† ± 6.5	NR	S: 1.92*** ± 1.23 N: 2.39*** ± 1.2	S: 4.3†† ± 1.4 N: 5.8†† ± 2.0	S: 2,354/NR/200 N: 500/NR/34	S: BCS or mastectomy + ET N: PET (TAM or AI)

AI, aromatase inhibitor; *ALND*, axillary lymph node dissection; *BC*, breast cancer; *BCS*, breast-conserving surgery; *BID*, twice daily; *cN*, clinically node; *CRC*, Cancer Research Campaign; *ECR*, Eindhoven Cancer Registry; *ER*, estrogen receptor; *ET*, endocrine therapy; *HER2*, human epidermal growth factor receptor 2; *MRM*, modified radical mastectomy; *N*, no surgery group; *NR*, not reported; *NYCRIS*, Northern and Yorkshire Cancer Registry and Information Service; *PET*, primary endocrine therapy; *PR*, progesterone receptor; *QD*, once daily; *S*, surgery group; *SEER*, Surveillance, Epidemiology, and End Results database; *SLNB*, sentinel lymph node biopsy; *TAM*, tamoxifen; *VdUH*, Vall d'Hebron University Hospital; *WLE*, wide local excision; *WMCIU*, West Midlands cancer intelligence unit.

* Mean (range).
† Stage I–II.
‡ Median (range).
§ Older women aged ≥70 y with node-negative primary invasive breast carcinoma <5 cm with high ER content [histochemical (H) score ≥100].
‖ Women aged ≥70 years who received a diagnosis of early-stage invasive breast cancer between 2008 and 2013 with tumor size T1 or T2, minimal nodal involvement (N0 and N1), and ER and/or PR positivity who started ET within a year of diagnosis.
¶ Median (IQR).
** Stage III–IV.
†† Mean ± SD.
‡‡ Women aged ≥70 years with either ductal carcinoma in situ or invasive early operable primary breast cancer with clinical size ≤5 cm with no evidence of metastases.
§§ Tumor stage I–II.
‖‖ Tumor stage III–IV.
¶¶ Women aged ≥70 years at the time of breast cancer diagnosed with primary unilateral or bilateral operable invasive breast cancer (TNM stages: T1–3 and some T4b, N0–2, M0).
*** Tumor size, mean (±SD).

prognoses than did those receiving endocrine therapy alone. This was evident in terms of OS (HR = 0.77, 95% CI: 0.60–0.98; Figure 2, *A*), BCSS (HR = 0.66, 95% CI: 0.45–0.97; Figure 2, *B*), RFS (HR = 0.40, 95% CI: 0.22–0.74; Figure 2, *C*), and 5- and 10-year OS (at 5 years: OR = 0.50, 95% CI: 0.35–0.70; at 10 years: OR = 0.43, 95% CI: 0.20–0.96; Supplementary Figure S1, *A* and *B*). Notably, one study that was not included in the meta-analysis and had a follow-up duration of up to 28 years[21] suggested that individuals undergoing surgery exhibited an average increase in all-cause survival of up to 2 years compared with those primarily treated with endocrine therapy.

Locoregional failure

Five studies evaluated the locoregional failure rate.[7,10,16,22,24] Our meta-analysis revealed that surgical treatment significantly reduced the overall locoregional failure rate (OR = 0.23, 95% CI: 0.12–0.46; Figure 2, *D*). In the surgery group, a significant decrease in the 5- and 10-year locoregional failure rates (at 5 years: OR = 0.22, 95% CI: 0.09–0.52; at 10 years: OR = 0.12, 95% CI: 0.06–0.25) was observed. However, one study reported a different trend for the 2-year locoregional failure rate,[10] favoring endocrine therapy (at 2 years: OR = 1.84, 95% CI: 0.39–8.62).

Distant metastasis rate

Six studies evaluated the distant metastasis rate.[7,10,16,19,22,24] The overall distant metastasis rate differed nonsignificantly between the 2 groups (OR = 0.77, 95% CI: 0.49–1.20; Figure 2, *E*). An insignificant trend toward a lower incidence of distant metastasis was observed in the surgery group at 2-year, 5-year, and 10-year follow-ups. However, at follow-ups exceeding 10 years, the trend insignificantly favored the endocrine therapy alone group (at 2 years: OR = 0.32, 95% CI: 0.17–0.60; at 5 years: OR = 0.77, 95% CI: 0.48–1.25; at 10 years: OR = 0.58, 95% CI: 0.07–5.04; at >10 years: OR = 1.26, 95% CI: 0.87–1.82).

QoL

Three studies examined QoL,[7,8,23] evaluating the physical and mental health status of geriatric individuals affected by breast cancer– or treatment-related side effects. One study reported no significant difference between the surgery group and endocrine therapy alone group in their ability to manage household tasks at a median follow-up of 34 months.[23] Psychosocial morbidity, including physical malaise, social dysfunction, depression, and anxiety, assessed through the General Health Questionnaire 28 items (GHQ-28), also demonstrated no significant difference. Two other studies employed the European Organization for Research and Treatment of Cancer QLQ-ELD15 and EuroQol Five Dimensions Five Level (EQ-5D-5L) questionnaires.[7,8] Although they noted burden of illness, mobility problems, and joint stiffness, they reported no significant differences between the 2 groups.

Safety

Three studies assessed safety by examining treatment-related morbidity, side effects, and mortality.[7,20,21] One study revealed that 19% of patients in the surgery group experienced complications such as seroma, hematoma, and infection, whereas 2.1% experienced cardiorespiratory or thrombotic events.[7] Another study revealed no difference in toxicity and mortality unrelated to breast cancer between the 2 groups, with no operative mortality observed in the surgery group.[19] Additionally, 1 study reported occurrences of mild rash and hot flushes associated with tamoxifen.[21]

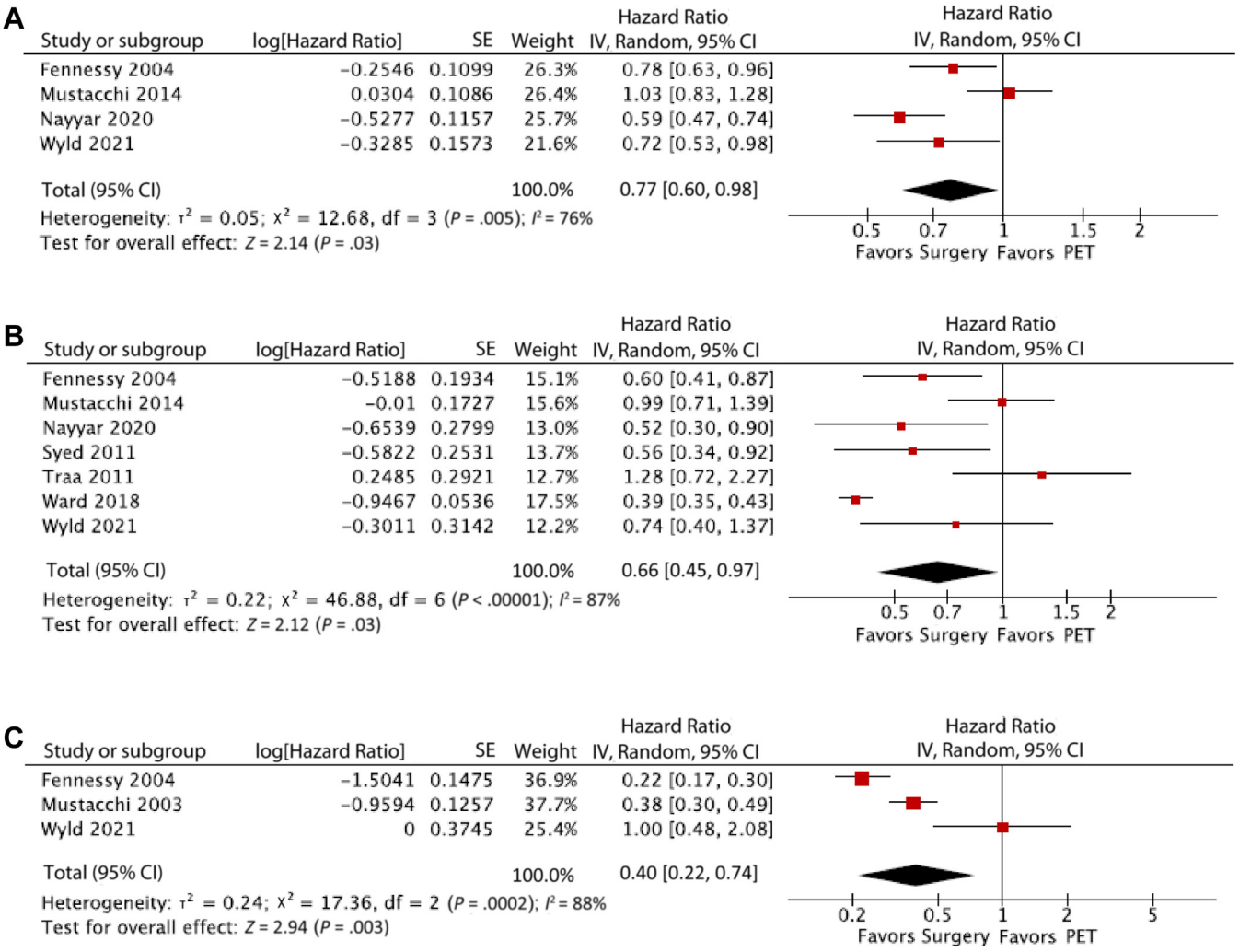

Figure 2. Outcomes of surgical treatment versus endocrine therapy alone in terms of (A) overall survival hazard ratios, (B) breast cancer–specific survival hazard ratios, (C) recurrence-free survival hazard ratios, (D) 2-year, 5-year, and 10-year locoregional failure rates, and (E) 2-year, 5-year, and 10-year distant metastasis rates. *CI*, confidence interval; *IV*, independent variable; *M-H*, Mantel-Haenszel; *PET*, primary endocrine therapy; *SE*, standard error.

Breast-conserving surgery without radiotherapy versus mastectomy

Eleven studies examined the efficacy of BCS alone without radiotherapy versus mastectomy alone.[2,25–34] Among these, 1 was a prospective study that collected data from the BOW cohort.[25] The remaining studies were retrospective.[2,26–34] Three studies were conducted at medical centers and cancer registries,[2,33,34] and the others used data from the SEER database.[26–32] Consequently, studies with the most comprehensive data sets and nonoverlapped study periods were selected for analysis. Of 28,159 patients included, 6,012 underwent BCS without radiotherapy, and 22,147 underwent mastectomy alone. All older patients included in the studies had nonmetastatic breast cancer. Details of the patients' characteristics are provided in Table II.

Survival outcomes

Five cohort studies compared the survival benefits of BCS alone with those of mastectomy alone in older patients with nonmetastatic breast cancer.[25–27,31,34] The results of the analyses revealed a significant trend favoring mastectomy in terms of both OS and BCSS (OS: HR = 0.68, 95% CI: 0.57–0.82, Figure 3, *A*; BCSS: HR = 0.68, 95% CI: 0.56–0.84, Figure 3, *B*).

Recurrence

Three studies provided data on 5- to 10-year recurrence outcomes for patients receiving BCS alone versus mastectomy alone.[2,25,33] The analysis indicated that compared with the mastectomy group, the BCS alone group exhibited a nonsignificant difference in the reduction of 5- to 10-year recurrence (OR = 0.80, 95% CI: 0.45–1.42, $P = .44$; Figure 3, *C*).

QoL

One study reported that receiving mastectomy alone did not significantly worsen cosmetic satisfaction, global health status, and psychosocial and sexual well-being compared with BCS alone, as measured using the BREAST-Q assessment tool.[34] However, a more favorable outcome in terms of physical well-being, assessed using the EQ-5D-3L global health status, was observed.

SLNB versus SLNB omission

We retrieved 8 studies that evaluated the efficacy of SLNB in older patients,[35–42] comprising 1 prospective study[42] and 7 retrospective cohort studies.[35–41] The prospective study, which was single-armed, recruited older adult patients with T1-2 N0,

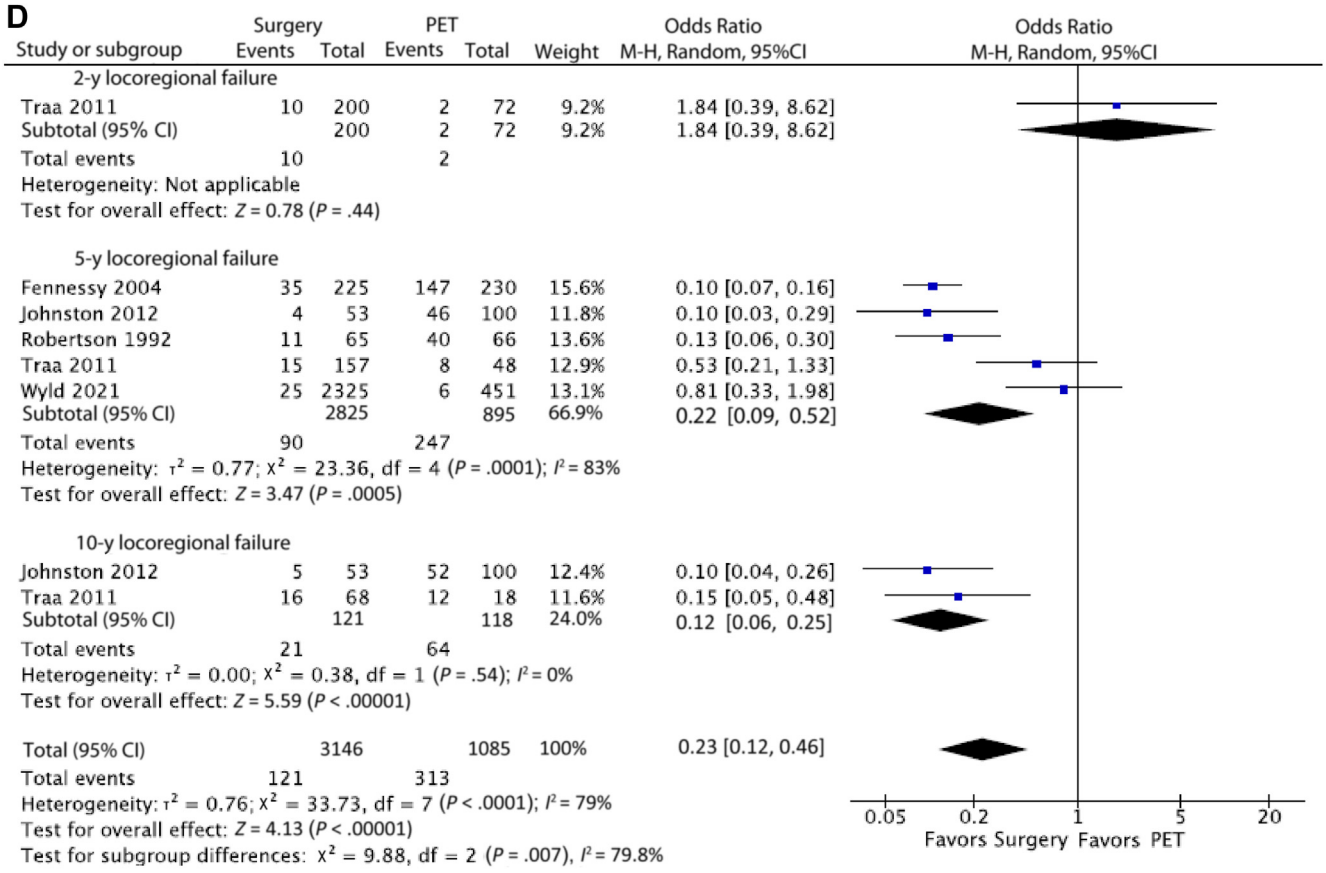

Figure 2. (*continued*).

ER-positive, and Her2-negative breast cancer who underwent BCS without SLNB.[42] Among the 7 retrospective articles, one used data from the SEER database,[35] and the others obtained data from medical centers and cancer registries.[36–41] Of 50,616 patients included in the analysis, 43,831 underwent SLNB, and 6,785 did not undergo SLNB. The majority of patients had operable early-stage breast cancer with clinically negative lymph nodes. Patient characteristics are detailed in Table III.

Survival outcomes

Five cohort studies evaluated the survival benefits of SLNB in older patients with breast cancer.[35–38,41] However, no significant findings were observed for both OS and BCSS (OS: HR = 1.41, 95% CI: 0.93–2.16; BCSS: HR = 1.34, 95% CI: 0.73–2.46; Supplementary Figure S2, *A* and *B*). One study reported that SLNBs were not associated with significantly improved regional RFS or disease-free survival (DFS) in older patients with ER-positive, clinically node-negative breast cancer.[41] Additionally, a single-armed study reported 3-year rates of OS, BCSS, RFS, and DFS to be 94.8%, 99.2%, 98.2%, and 91.2%, respectively.[42]

Recurrence

Two studies that reported 5-year-recurrence outcomes[38,42] demonstrated that the omission of SLNB was not significantly associated with an elevated recurrence rate (OR = 1.37, 95% CI: 0.90–2.08, *P* = .15, Supplementary Figure S2, *C*).

Safety

Two studies examined complication rates in patients receiving SLNB.[39,40] One of these studies demonstrated that lymphedema occurred in 4.9% of older patients receiving SLNB,[39] and the other study revealed that older patients had complication rates comparable to those of their younger counterparts (aged <70 y). An evaluation of the rates of infection (2.6%), lymphedema (2.6%), seroma (4.3%), chronic axillary or arm pain (7.7%), and mobility impairment (4.3%) revealed that both short-term and long-term complication rates after SLNB were low.[40]

ALND versus ALND omission

Seven retrospective cohort studies evaluated the effects of ALND in older patients with breast cancer with positive nodes.[3,37,43–47] One study retrospectively gathered data from the oncology institute in Ljubljana,[37] one study obtained data from the Netherlands Cancer Registry,[43] and one study retrieved data from the US National Cancer Database.[3] Three studies retrieved data from the SEER database,[44–46] 2 of which shared overlapping study periods. In such cases, the most comprehensive data sets were selected for analysis. Among 73,478 included patients, 60,240 underwent ALND, and 13,238 underwent SLNB alone without ALND. The patient characteristics are summarized in Table IV.

Survival outcomes and regional control

For node-positive patients, the 5-year OS did not differ between the 2 groups (5-year OS: OR = 0.97, 95% CI: 0.79–1.19; Supplementary Figure S3, *A*), whereas the 5-year BCSS was significantly improved in the group not receiving ALND (5-year BCSS: OR = 0.59, 95% CI: 0.42–0.82; Supplementary Figure S3, *B*). One study reported that for women aged 70–90 years with clinically positive lymph nodes who underwent upfront surgery and ALND,

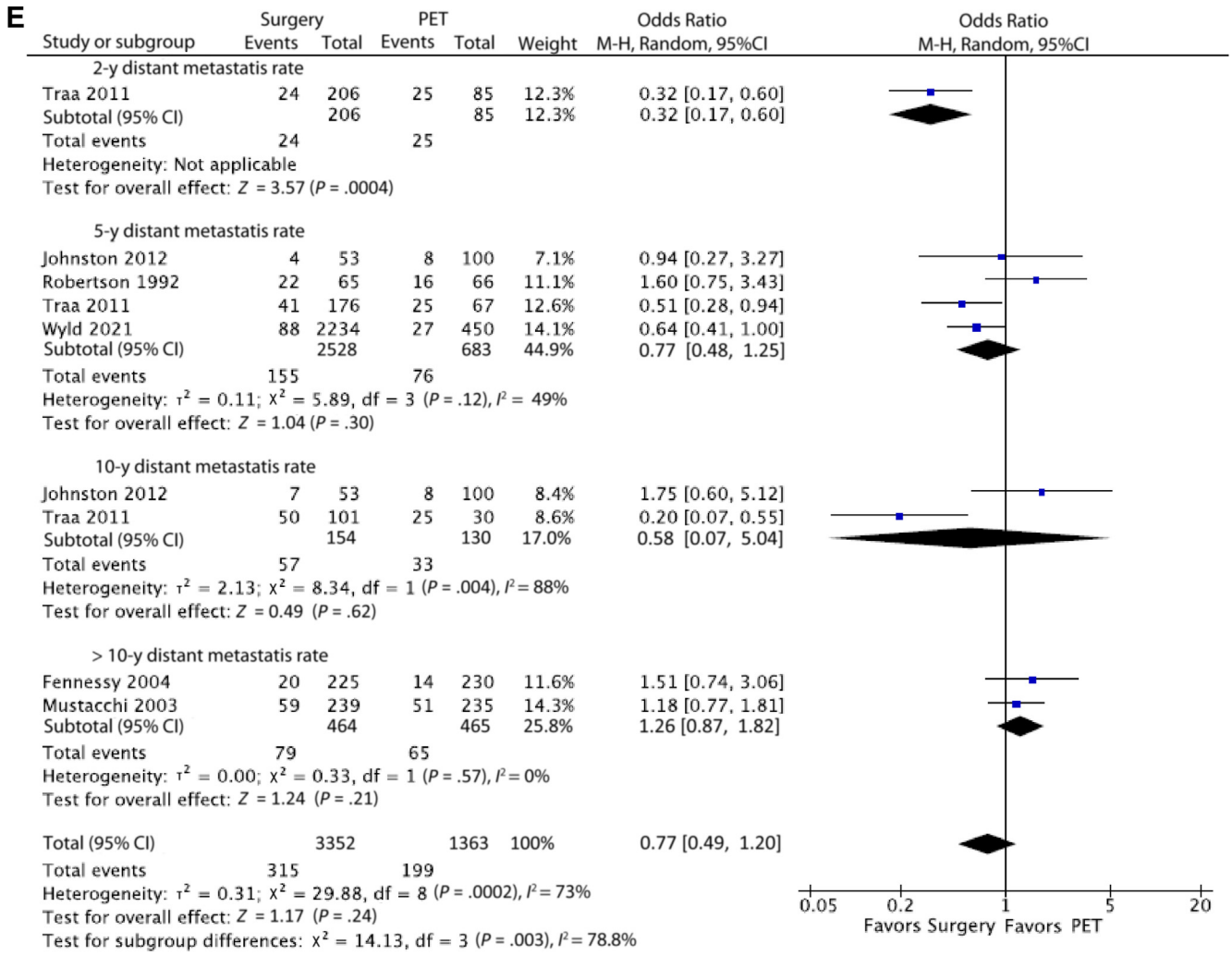

Figure 2. (*continued*).

aggressive removal of more than 12 lymph nodes was unnecessary and did not confer any survival benefits.[3] Another study demonstrated that omitting surgical axillary staging or refraining from completing ALND after positive SLNB is common among patients aged 70 years with more than 2 comorbidities; however, doing so had no discernible effect on regional control and 10-year OS.[43]

Safety

Complications associated with ALND, which included lymphedema, pain, and decreased range of motion, were considered to be balanced with the benefits of ALND. According to one study, 3.2% of women who underwent incomplete axillary staging died because of complications from breast cancer treatment.[43] Another study revealed that the estimated 5-year probability of lymphedema was 11.0% in the SLNB-only group and 14.1% in the SLNB plus ALND group, indicating an excess lymphedema probability of 3.1%.[46]

Discussion

This systematic review and meta-analysis of real-world data highlights the benefits of primary surgical interventions for older women with breast cancer. Compared with endocrine therapy alone, standard surgical interventions improved survival outcomes and prognoses in elderly patients, coupled with minimal surgical complications and low mortality rates. Importantly, the QoL among older patients undergoing surgery did not significantly decline compared with those who received endocrine therapy alone. For frail patients with nonmetastatic breast cancer who are unwilling to undergo adjuvant radiotherapy, opting for mastectomy alone represents an optimal strategy because this treatment option is associated with enhanced survival outcomes and comparable patient well-being to BCS without radiotherapy. Regarding further treatment decisions, the omission of SLNB can be considered a safe option without an increase in recurrence and mortality rates. Considering the low complication rate associated with SLNB, its performance is deemed acceptable as it provides crucial staging information and guides adjuvant therapy decisions. De-escalation of ALND represents a cautious and safe approach and may be considered for older patients, as it has a negligible impact on OS rates and regional control, while reducing complication rates, including lymphedema.

Despite constituting a significant proportion of women diagnosed with breast cancer, older individuals are often excluded from clinical trials, leading to a scarcity of RCTs to establish definitive therapeutic guidelines. Findings from a mixed-methods survey indicated that physicians were less inclined to recommend surgery to elderly individuals[48] because older patients were perceived as being fearful or incapable of actively participating in decision-making processes and coping with unfavorable prognoses. This underscores the presence of age bias among health care

Table II
Characteristics of studies comparing geriatric patients with breast cancer patients who received BCS without radiotherapy and those who received mastectomy

Study (year)	Study design (country)	Study characteristics	No. of patients	Age (y), (median or range)	Stage or grade, I/II III, n	Nodal stage, 0/1/2/3, n or no. of positive lymph nodes*, 0/1−3/4+	Tumor stage, 1/2/3/4, n or tumor size, <1/1−2/>2, cm	ER+/PR+/HER2+, n	CCI, 0/1/≥2, n or no. of comorbidities	Intervention
Bosco† (2009)	Prospective (US)	Stage I–II BC; age ≥65 yr; diagnosed between 1990 and 1996; data retrieved from the BOW cohort	B_1: 221 B_2: 639 M: 977	65–69: 626 70–74: 547 75–79: 304 ≥80: 360	All stage I–II	1,371/333/133/NR	1,135/702/NR/NR	1,538/1,538/NR	1,252/498/87	B_1: BCS alone B_2: BCS + RT M: mastectomy
Du (2008)	Retrospective (US)	Stage I–IIIA BC diagnosed between 1992 and 1999; data retrieved from the SEER database	B_1: 4,357 B_2: 12,837 M: 17,835	65–69: 8,416 70–74: 9,357 75–79: 8,026 ≥80: 9,230	All stage I–III	NR	20,616/13,307/1,106/NR	24,494‡	28,640/8,562/4,903	B_1: BCS alone B_2: BCS + RT M: mastectomy
Mburu (2022) Wu§ (2020) Tang‖ (2022) Fu¶ (2023)	Retrospective (US)	Stage I–III TNBC; age ≥65 yr; diagnosed and operated between 2010 and 2015; data retrieved from the SEER database	B_1: 402 B_2: 2,110 M_1: 1,219 M_2: 602	B_1: 66–74: 135 75–84: 139 ≥85: 128 B_2: 66–74: 1,254 75–84: 716 ≥85: 140 M_1: 66–74: 533 75–84: 474 ≥85: 212 M_2: 66–74: 348 75–84: 185 ≥85: 69	B: 199/173/30 B_2: 1,274/731/105 M_1: 428/623/168 M_2: 51/231/320	NR	B: 211/164/27/NR B_2: 1,370/665/75/NR M_1: 481/586/152/NR M_2: 120/277/205/NR	NR	B: 245/84/73 B_2:1,569/331/210 M_1: 810/203/206 M_2: 443/95/64	B_1: BCS alone B_2: BCS + RT M_1: mastectomy alone M_2: mastectomy + RT
Schonberg (2010) Mogal (2017)	Retrospective (US)	Stage I–II BC; age ≥67 yr; diagnosed between 1998 and 2010; data retrieved from the SEER database	B: 585 M: 748	67–69: 7,437 70–74: 13,774 75–79: 12,757 80–84: 8,908 85–89: 4,707 ≥90: 2,033	28,897/16,582/0	8,584*	34,529/12,698/579/NR	33,762/28 132/NR	29,832/10,257/8,317	B_1: lumpectomy alone B_2: lumpectomy + RT M: mastectomy
Swanick (2018)	Retrospective (US)	Nonmetastatic, early-stage BC; age ≥67 yr; diagnosed in 2009 in the United States; data from CMS medical claims	B_1: 108 B_2: 103 B_3: 78 M_1: 89 M_2: 111	B_1: 73** B_2: 72** B_3: 73** M_1: 72** M_2: 72**	All early stage	NR	NR	NR	B_1††: 76/32 B_2††: 73/30 B_3††: 48/30 M_1††: 63/26 M_2††: 69/42	B_1: lumpectomy+ WBI B_2: lumpectomy+ Brachy B_3: Lumpectomy alone M_1: mastectomy alone M_2: mastectomy + RT
Yood (2018)	Retrospective (US)	Stage I–II BC; age ≥65 yr; diagnosed between 1990 and 1994; data retrieved from the CRN	B_1: 221 B_2: 639 M: 977	B_1: 65–69: 35 70–74: 34 75–79: 49 ≥80: 103 B_2: 65–69: 250 70–74: 214 75–79: 101 ≥80: 74 M: 65–69: 341 70–74: 299 75–79: 154 ≥80: 183	All stage I–II	B_1*: 205/12/4 B_2*: 533/89/17 M*: 633/232/112	B_1‡‡: 96/77/48 B_2‡‡: 262/286/91 M‡‡: 208/383/386	B_1: 159‡ B_2: 504‡ M: 698‡	B: 122/83/16 B_2: 462/155/22 M: 668/260/49	B_1: BCS alone B_2: BCS + RT M: mastectomy

(*continued on next page*)

Table II (*continued*)

Study (year)	Study design (country)	Study characteristics	No. of patients	Age (y), (median or range)	Stage or grade, I/II III, n	Nodal stage, 0/1/2/3, n or no. of positive lymph nodes*, 0/1–3/4+	Tumor stage, 1/2/3/4, n or tumor size, <1/1–2/>2, cm	ER+/PR+/HER2+, n	CCI, 0/1/≥2, n or no. of comorbidities	Intervention
Zhong (2020)	Retrospective (China)	Age ≥70 yr BC; treated in PUMCH between 2010 and 2016	B: 148 M: 302	B: 70–74: 79 75–79: 54 ≥80: 15 M: 70–74: 94 75–79: 106 ≥80: 102	(Grade) B: 46/72/11 M: 53/144/60	B: 73/66/8/1 M: 193/105/4/0	B: 78/27/26/17 M: NR	B: 107‡ M: 250‡	NR	B: BCS without RT, ALND, or SLNB M: mastectomy and ALND

B, breast-conserving surgery group; *BC*, breast cancer; *BCS*, breast-conserving surgery; *Brachy*, brachytherapy; *CCCRW*, Comprehensive Cancer Center Region West; *CCI*, Charlson Comorbidity Index; *CMS*, Centers for Medicare and Medicaid Services; *cN*, clinically node; *CRN*, cancer research network; *ET*, endocrine therapy; *M*, mastectomy group; *NR*, not reported; *PR*, progesterone receptor; *RT*, radiation therapy; *SEER*, Surveillance, Epidemiology, and End Results database; *TEAM*, Tamoxifen Exemestane Adjuvant Multinational; *TNBC*, triple-negative breast cancer; *TRGH LMC*, Tumor Registry of Grant/Riverside Hospitals and Lexington Medical Center; *WBI*, whole-breast irradiation; *WLE*, wide local excision.

* No. of positive lymph nodes.
† Women aged ≥65 years who received a diagnosis of stage I–II breast cancer from 1990 to 1994 in 6 geographically diverse Cancer Research Network health-care systems.
‡ ER+ or PR+.
§ T1-2N0M0; aged ≥65 years; breast cancer diagnosed between 2010 and 2014 in SEER.
‖ T1-3N0-1M0; aged ≥70 years; TNBC diagnosed between 2010 and 2015; data retrieved from the SEER database.
¶ Stage I–II; aged ≥70 years; breast cancer diagnosed between 2010 and 2015; data retrieved from the SEER database.
** Median (range).
†† CCI score = 0/>1.
‡‡ Tumor size.

professionals specializing in breast cancer care. Consequently, we conducted a meta-analysis that incorporated real-world data alongside a limited number of RCTs, amalgamated a substantial body of evidence, and provided insights that clinicians may use to more effectively provide comprehensive evaluations of optimal surgical treatment approaches for older women with breast cancer.

Older populations are susceptible to both overtreatment and undertreatment. Typically, surgical resection (both BCS and mastectomy) with adequate surgical margins remains the cornerstone of breast cancer therapy. Concerns regarding increased frailty, higher comorbidity rates, and functional impairments among older individuals may lead clinicians to favor more conservative treatment approaches for older individuals compared with younger individuals. In such cases, solely relying on endocrine therapy serves as an alternative treatment for older women with multiple comorbidities.[21] However, recent research has suggested that relying solely on endocrine therapy may increase the risks of locoregional recurrence, reduce survival rates,[22] and contribute to numerous side effects and treatment discontinuation, ultimately negatively affecting QoL.[25] A prospective multicenter study demonstrated the safety of breast cancer surgery, reporting zero mortality within 30 days and a 19.3% adverse event rate.[8] Our results are consistent with those of contemporary studies indicating that in medically fit older patients with early-stage, nonmetastatic breast cancer, upfront definitive breast surgery can be safely conducted, offering significant survival benefits and locoregional control without significantly affecting functional independence and QoL.

The International Society of Geriatric Oncology (SIOG) and European Society of Breast Cancer Specialists (EUSOMA) have outlined that for patients older than 70 years with early-stage breast cancer, the standard surgical treatment options include either BCS combined with whole breast radiotherapy or mastectomy.[49] However, studies have indicated a lower preference for BCS among older patients,[39] possibly because of concerns regarding the potential additive toxicity from adjuvant radiotherapy. This has sparked debate surrounding the omission of radiotherapy after BCS as an alternative to mastectomy, considering the associated morbidity, cost, and time burdens. The PRIME II trial has subsequently supported the consideration of omitting radiotherapy following BCS in older patients with small, hormone receptor–positive, node-negative early breast cancer.[50] Our findings provide additional insight, suggesting that for frail patients unwilling to undergo adjuvant radiotherapy, mastectomy alone may be a more favorable strategy compared with BCS. Mastectomy alone is associated with improved survival outcomes and does not significantly compromise cosmetic satisfaction, psychosocial well-being, or overall health status.

According to the current recommendation from the American Society of Clinical Oncology, which aligns with the Choosing Wisely statement,[38] SLNB is not deemed necessary for patients aged ≥70 years with T1cN0 invasive breast cancer who are hormone receptor–positive and HER2-negative. However, despite this recommendation, surgeons often perform SLNB in older women because of concerns regarding its effect on further treatment decisions or because of reluctance to abstain from this procedure. Several retrospective studies have also indicated that the current recommendations have not led to a decrease in the use of SLNB among older adults.[39,40] Our findings suggest that SLNB can be safely omitted for frail older patients who are unwilling to undergo further adjuvant therapy, without affecting the survival and recurrence rate. However, for individuals who are open to undergoing radiation therapy or targeted therapy, SLNB could be considered acceptable as it offers guidance for therapeutic decision making with a low risk of complications.

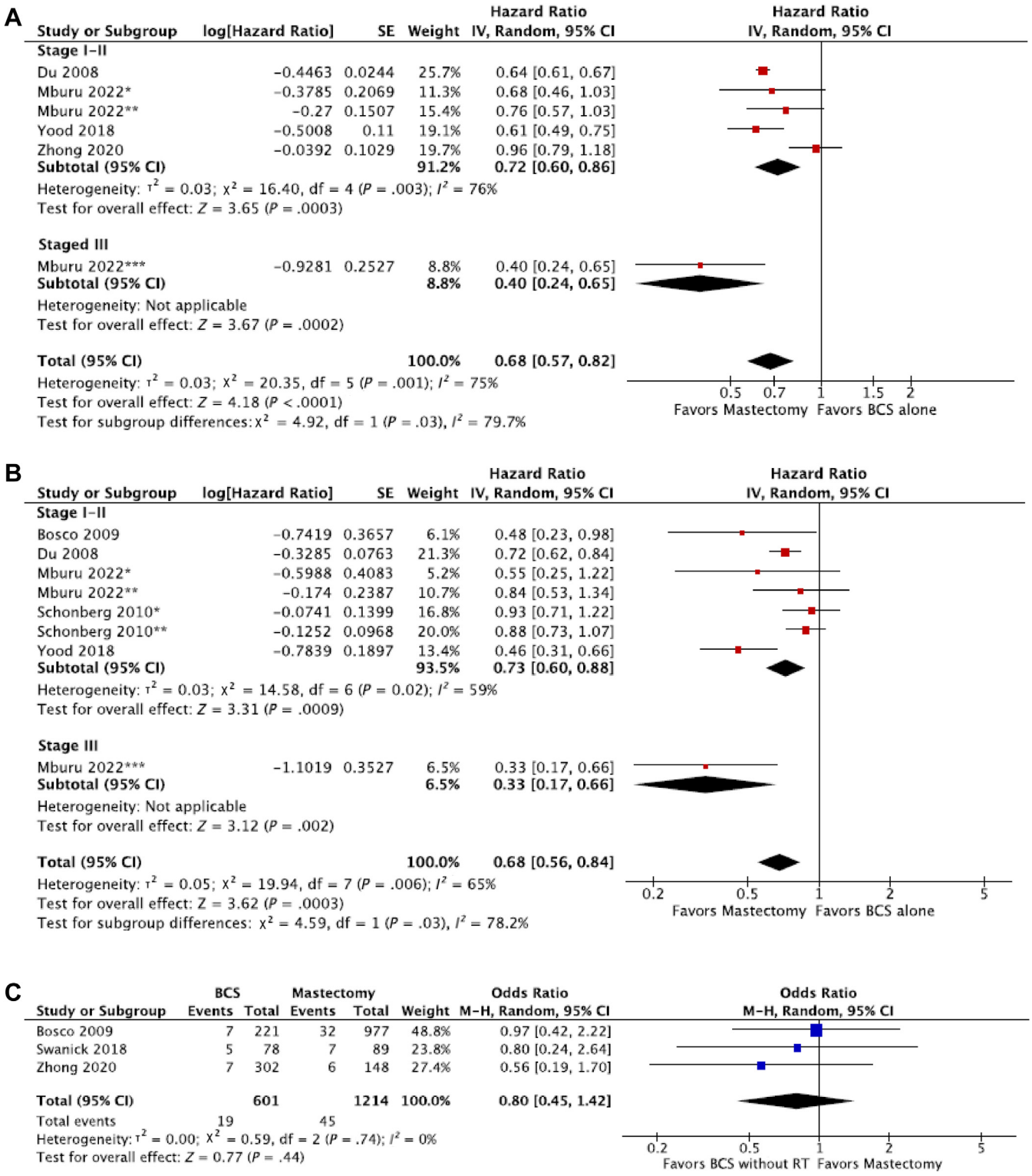

Figure 3. Outcomes of breast conservative surgery (BCS) without radiotherapy versus mastectomy in terms of (A) overall survival hazard ratio, (B) breast cancer–specific survival hazard ratios, and (C) 5- to 10-year recurrence rates. Patients with stage I*, stage II**, and stage III*** disease. *CI*, confidence interval; *IV*, independent variable; *M-H*, Mantel-Haenszel; *RT*, radiotherapy; *SE*, standard error.

Previous research on older individuals with early-stage breast cancer and clinically negative lymph nodes has indicated that surgery can be safely performed without performing ALND.[2] However, for patients with positive nodes, recent recommendations from the EUSOMA and the SIOG suggest that completing axillary therapy may not always be necessary, sparking ongoing debate.[49] Nevertheless, most studies evaluating the efficacy and QoL outcomes of axillary management in patients with clinically positive nodes or positive SLNB results have not specifically focused on the older population. Several studies comparing ALND versus

Table III
Characteristics of studies comparing geriatric patients with breast cancer who underwent and did not undergo sentinel lymph node biopsy

Study (year)	Study design (country)	Patient characteristics	No. of patients	Age, yr	Stage or grade, I/II/III, *n*	Tumor stage, 1/2/3/4, *n*	Nodal stage 0/1/2/3, n or number of positive lymph nodes*	ER+/PR+/HER2+, *n*	Intervention (*n*)
Besic (2014)	Retrospective (Slovenia)	Age ≥80 yr; Operable BC treated at Institute of Oncology, Ljubljana, during 2000 and 2008	S_1: 88 S_2: 28 N: 38	83† (80–90)	26/55/54	115‡/39§	83/71‖	134/90/7	S_1: Lymphadenectomy after SLNB S_2: SLNB only N: without LN surgery
Carleton¶ (2021)	Retrospective (US)	ER+, ERbB2−, cN− BC; Age ≥70 yr; diagnosed and treated in UPMC NCR between 2010 and 2018	S: 1,373 N: 736	S: 75.0** (72–79) N: 80.0** (74–86)	All stage I–II	S: 1,042/306/NR/NR N: 369/168/NR/NR	S: 159*	2,109/0/0	S: SLNB + RT N: without SLNB, only RT
Castelo (2023)	Retrospective (Canada)	Stage I/II BC; age ≥65 yr; data obtained from Ontario Cancer Registry between 2010 and 2016	S: 15,599 N: 1,771	S: 73.07†† ± 6.27 N: 80.12†† ± 8.13	All stage I–II	S: 9,165/6,434/NR N: 893/878/NR	NR	S: 13,833/12,416/1,139 N: 1,574/1,428/103	S: with SLNB or SLNB + ALND N: without axillary staging
Chung (2024)	Prospective (US)	T1-2 N0, ER+, Her2− invasive BC; age ≥65 yr; treated in Cedars-Sinai Medical Center during 2016 and 2022	N: 125	N: 77.0** (65–93)	All stage I–II	All stage 1/2	125/0/0/0	125/NR/0	N: BCS without SLNB + adjuvant HT ± RT
Heidinger (2023)	Retrospective (US)	Age ≥70 yr; cN− BC; treated at University Hospital, Basel, during 2011 and 2022	S: 122 N: 36	76.0‡‡ (73.0–80.5)	NR	90/54/2/3	163/0/0	142§§/10	S: SLNB N: without SLNB
Lena (2023)	Retrospective (Canada)	ER+, Her2−, cN−, Clinical stage I–II BC; age ≥70 yr; received diagnosis in McGill University Health Center between 2017 and 2019	S: 118 N: 24	S: 76.0‡‡ (72.0–82.75) N: 79.0‡‡ (74.75–83.25)	(Grade) S: 22/84/6 N: 3/14/12	S: 87/28/2 N: 17/7/0	S‖‖: 87/4/7/20 N: NR	142/112/0	S: SLNB N: without SLNB
Thompson¶¶ (2021)	Retrospective (US)	T1, ER+, HER2−, BC; age ≥70 yr; data retrieved from UMHS between 2009 and 2018	S: 414 N: 73	77** (72–82) 70–80: 155 >80: 332	(Grade) 269/189/29	487/0/0/0	487/0/0	487/NR/0	S: SLNB N: without SLNB
Xu (2020)	Retrospective (US)	T1-T2 BC; age ≥70 yr; data retrieved from the SEER database between 2010 and 2015	S: 26,089 N: 3,982	S: 70–74: 11,571 75–79: 7,778 80–84: 4,462 ≥85: 2,178 N: 70–74: 546 75–79: 707 80–84: 1,060 ≥85: 1,669	S: 18,743/7,246/NR N: 2,816/1,166/NR	S: 19,712/6,277/0/0 N: 2,828/1,154/0/0	S: 23,173/2,816/NR/NR N: 3,938/44/NR/NR	S: 23,088/20,405/2,243 N: 3,601/3,191/314	S: SLNB N: without SLNB

ALND, axillary lymph node dissection; *BC*, breast cancer; *cN*, clinically node; *HT*, hormone therapy; *LN*, lymph node; *NR*, not reported; *NS*, non-SLNB group; *PR*, progesterone receptor; *RT*, radiation therapy; *S*, SLNB group; *SEER*, Surveillance, Epidemiology, and End Results database; *SLNB*, sentinel lymph node biopsy; *UMHS*, University of Michigan Health System; *UPMC NCR*, University of Pittsburgh Medical Center Network Cancer Registry.

* Number of positive lymph nodes.
† Mean (range).
‡ Tumor stage I–II.
§ Tumor stage III–IV.
‖ cN1 or cN2 or cN3.
¶ Women aged ≥70 years with ER+, ERbB2 negative, clinically node-negative breast cancer identified during 2010–2018.
** Median (range).
†† Mean ± SD.
‡‡ Median (IQR).
§§ ER+ or PR+.
‖‖ Pathological N-stage: N0/N0(iþ)/N1mi/N1a.
¶¶ Patients aged ≥70 years treated with partial mastectomy for clinical T1, ER+, HER2−, clinically node-negative tumors.

Table IV
Characteristics of studies comparing geriatric patients with breast cancer who underwent and did not undergo axillary lymph node dissection

Study (year)	Study design (country)	Patient characteristics	No. of patients	Age (yr)	Stage or grade, I/II/III, *n*	Tumor stage, 1/2/3/4, *n*	Nodal status N0/N1/N2/N3, *n*	ER+/PR+/HER2+, *n*	Intervention (*n*)
Besic (2014)	Retrospective (Slovenia)	Operable, early-stage BC; Age ≥80 yr; treated at Institute of Oncology, Ljubljana, between 2000 and 2008	A: 88 N: 28	83* (80–90)	26/55/54	115†/39‡	83/71§	134/90/7	A: SLNB + ALND N: SLNB only
Davey (2021)	Retrospective (Ireland)	Stage I-II, ER+, Her2−, cN− BC; age ≥65 yr; treated in Galway University Hospitals between 2005 and 2015	A: 19 N: 31	73.2‖ ± 5.5	(Grade) A: 0/7/3 N: 0/11/0	A: 4/6/0/0 N: 4/7/0/0	A: ≥3 positive nodes at SLNB N: ≤3 positive nodes at SLNB	50/16/0	A: SLNB + ALND N: positive SLNB, omitting ALND
Javid¶ (2014)	Retrospective (US)	Stage I-II (T1–T2, N0) BC; age >65 yr; treated during 1998 and 2005; data retrieved from the SEER database	A: 4,586 N: 629	A: 66–70: 1,497 71–75: 1,345 76–80: 1,035 >80: 695 N: 66–70: 161 71–75: 161 76–80: 141 >80: 163	All stage I and II	A: 3,953/4,160/0/0 N: 87/58/0/0	All N0	A: 10,405/8,372/NR N: 3,329/2,664/NR	A: SLNB + ALND N: SLNB only
Luo** (2021) Yen†† (2018)	Retrospective (US)	Invasive ductal BC; Age ≥70 yr; diagnosed during 2004 and 2016; data obtained from the SEER database	A: 46,253 N: 11,351	A: 70–74: 7,412 75–79: 5,459 80–84: 3,508 ≥85: 1,967 N: 70–74: 1,586 75–79: 1,989 80–84: 2,855 ≥85: 4,921	(Grade) A: 3,158/8,071/7,117 N: 12,943/21,301/12,009	A: 9,708/7,121/840/677 N: 35,413/9,696/676/468	A: 8,807/7,939/1,539/61 N: 40,620/5,416/184/33	A: 14,516/12,297/1,401 N: 39,666/34,656/3,166	A: ALND (≥6 lymph nodes examined) N: SLNB (<6 lymph nodes examined)
Marks (2020)	Retrospective (US)	cN+ invasive BC; age 70–90 yr; diagnosed in NCDB between 2010 and 2015	A: 8,085 N: 941	A: 77‡‡ (73–82) N: 77‡‡ (71–77)	(Grade) A: 950/3,512/3,623 N: 72/329/540	A: 2,894/4,740/350/101 N: 532/343/51/15	A: 0/6,820/977/288 N: 0/732/138/71	A: 6,471§§ N: 575§§	A: Axillary surgery N: Neoadjuvant chemotherapy
Poodt (2018)	Retrospective (Netherlands)	Surgically treated primary BC; Age ≥75 yr; registered by the Netherlands Cancer Registry between 2001 and 2008	A: 1,209 N: 258	A: 80.1* 75–79: 565 80–84: 480 ≥85: 164 N: 81.7* 75–79: 37 80–84: 33 ≥85: 23	NR	A: 494/580/48/72 N: 36/44/3/7	A: 70/10/0 N: 886/225/6	A: NR N: 78§§/NR	A: SLNB only or cALND if SLN+ N: neither SLNB nor ALND; or without ALND if SLN+

A, axillary lymph node dissection group; *ALND*, axillary lymph node dissection; *BC*, breast cancer; *cALND*, complete axillary lymph node dissection; *cN*, clinically node; *ER*, estrogen receptor; *HER2*, human epidermal growth factor receptor 2; *LN*, lymph node; *NCDB*, National Cancer Database; *NR*, not reported; *PR*, progesterone receptor; *SEER*, Surveillance, Epidemiology, and End Results database; *SLNB*, sentinel lymph node biopsy.

* Mean (range).
† Tumor stage I-II.
‡ Tumor stage III-IV.
§ cN1 or cN2 or cN3.
‖ Mean ± SD.
¶ Women aged 65 years who received a diagnosis of stage I/II breast cancer between 1998 and 2005 in the SEER database.
** Women aged ≥70 years who received a diagnosis of invasive ductal breast cancer between January 2004 and 2016 in the SEER database.
†† Pathologically node-negative stage I–II invasive breast cancer diagnosed during 2008–2009 in the SEER database.
‡‡ Median (IQR).
§§ ER+ or PR+.

SLNB alone in women with early breast cancer who had positive sentinel nodes exhibited no significant differences in OS, DFS, and axillary recurrence rates.[36] Although these results were not exclusively targeted at older groups, they align with our finding that performing less aggressive axillary surgery is acceptable and does not compromise survival outcomes in older individuals with node-positive breast cancer, while also avoiding a higher risk of lymphedema.

Study limitations

This meta-analysis has several limitations that warrant acknowledgment. First, the predominance of retrospective studies in our analysis may have introduced biases such as selection bias and recall bias, potentially influencing treatment outcomes and introducing uncertainties regarding reasons for differences in treatment modalities and loss to follow-ups. Second, the overall quality of evidence was diminished by the absence of RCTs specifically focusing on geriatric breast cancer, potentially limiting the robustness of our analysis and contributing to increased heterogeneity across studies. Furthermore, the inclusion of predominantly older individuals in our study cohort poses challenges in interpreting OS rates, which may have been influenced by confounding variables, such as advanced age, comorbidities, and frailty. Last, the lack of comprehensive investigations and statistical analyses regarding treatment side effects, QoL metrics, and treatment safety represents a notable gap in our analysis, given their implications in the decision-making process for older patients. Despite these limitations, our assessment of surgical treatments provides valuable insights for oncologists, contributing to the existing evidence base and highlighting the potential roles of these treatment modalities in geriatric breast cancer care.

In conclusion, our evidence-based findings underscore the importance of proactive definitive breast surgery as the preferred approach for medically fit older patients with breast cancer, offering substantial survival benefits. For frail patients unwilling to undergo additional radiotherapy, mastectomy serves as a viable option, yielding superior survival outcomes without increasing recurrence, and without notable detriment to psychosocial well-being compared with BCS alone. Furthermore, the judicious avoidance of unnecessary axillary interventions, including SLNB and ALND, presents a safe alternative for older patients, regardless of nodal status. Despite the limited data available for older patient populations, this study leveraged real-world evidence to explore the nuances of surgical management in older patients with breast cancer, highlighting the importance of a comprehensive assessment of safety and efficacy in guiding treatment decisions. Prioritizing comprehensive geriatric assessments can help mitigate the risks of both undertreatment and overtreatment in older patients, underscoring the need for future research and additional RCTs to inform the development of robust guidelines for geriatric breast cancer care.

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Conflict of Interest/Disclosure

All authors have no conflicts of interest or financial ties to disclose.

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Ethical approval

Ethical approval is not required as our study does not include confidential participant data or interventions.

CRediT authorship contribution statement

Hsuan-Wen Lai: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation. **Yu-An Chen:** Writing – review & editing, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation. **Ka-Wai Tam:** Writing – review & editing, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [https://doi.org/10.1016/j.surg.2024.08.045].

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