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SYSTEMATIC REVIEW

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Effect of breast cancer surgery on levels of depression and anxiety: a systematic review and meta-analysis

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Abstract

Background Breast cancer surgery is a critical intervention with potentially significant psychological impacts. This systematic review and meta-analysis investigate the effect of different surgical approaches on levels of depression and anxiety in breast cancer patients.

Methods Following the PRISMA 2020 guidelines, we conducted a comprehensive search of international bibliometric databases including PubMed, Scopus, Web of Science, and Embase, up to March 21, 2024.

Results From 1576 identified articles, 13 studies were included after screening and eligibility assessments. Meta-analysis results indicated a significant reduction in depression (SMD: -0.14; 95% CI: -0.25 to -0.02) and anxiety (SMD: -0.42; 95% CI: -0.56 to -0.28) following breast cancer surgery. Subgroup analysis revealed that mastectomy patients experienced a notable decrease in both depression and anxiety, while results for breast-conserving surgery and reconstruction were more varied.

Conclusions Breast cancer surgery is associated with a decrease in depression and anxiety, particularly following mastectomy. Further research should focus on long-term psychological effects and the development of tailored interventions for different surgical types.

Keywords Depression, Mastectomy, Breast cancer, Anxiety

Introduction

The incidence of breast cancer is increasing worldwide. According to the World Health Organization in 2022, an estimated 2.3 million individuals globally were affected by this disease, resulting in an estimated 670,000 deaths [1]. Family history, genetic mutations, race/ethnicity, older age, reproductive history, and physical activity are some of the known risk factors for breast cancer [2]. Experimental studies have demonstrated that the prevalence of mental disorders is higher in breast cancer patients compared to the general population, with anxiety and depression being the two most common psychological issues. Previous meta-analyses have revealed that the prevalence

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of anxiety and depression among breast cancer patients can be as high as 41.9% and 32.2%, respectively [3, 4].

Breast cancer diagnosis and treatment often result in variations in physical status and function, a decline in quality of life, impaired social relationships, and other adverse side effects [5, 6].

The management of breast cancer depends on the extent of its spread to lymph nodes (stage II or III) or other parts of the body (stage IV) and the subtype of cancer [7].

Over the years, surgical treatment for breast cancer has evolved significantly. Current surgical methods to reduce recurrence risk and treat breast tumors include breast-conserving therapy (BCT), mastectomy alone, or mastectomy with primary or delayed reconstruction [8].

A wide range of complications have been reported following breast surgical procedures. Numerous complications have been reported following these surgical procedures, including postoperative issues such as infection, seroma, and necrosis [9]. Additionally, many individuals who undergo these surgeries may experience other complications, such as psychological and sexual dysfunctions [10]. Women who underwent mastectomy surgery reported significantly greater difficulties with sexual desire, arousal, orgasmic ability, and orgasm intensity [11, 12]. The psychiatric symptoms of such surgeries can also be remarkable [13]. On the other hand, some studies suggest that depression and anxiety do not have a significant relationship with breast cancer surgery [14–16] Previous studies have demonstrated that depression and anxiety are related to non-compliance to treatment in oncology patients and poorer prognosis [17]; moreover, longer hospitalization and impaired social and physical functioning are also associated with these two treatable disorders [18].

Given that mental health plays a critical role in the overall well-being and recovery of breast cancer patients, it is essential to understand the impact of surgical treatment on psychological outcomes. This systematic review and meta-analysis aim to collect and analyze the available evidence on depression and anxiety levels in breast cancer patients undergoing surgery. By reviewing and statistically synthesizing data from various studies, this study seeks to clarify the extent of these psychological effects and identify potential moderating factors such as type of surgery, demographic variables, and time since surgery. The results of this review are expected to provide valuable information to healthcare professionals, enabling more informed decisions about patient care. Additionally, it aims to highlight the need for integrated psychological support in the treatment methods for breast cancer patients. Understanding the evolution of mental health after surgery can help develop targeted interventions to alleviate depression and anxiety, ultimately improving the overall care and quality of life of breast cancer survivors.

Methods

This study was performed based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) [19]. The protocol of this study was registered in PROSPERO with the following registration number: CRD420251037946.

Search strategy

A comprehensive search was conducted in international bibliometric databases, including PubMed, Scopus, Web of Science, and Embase, to identify any relevant studies that evaluated depression and anxiety before and after mastectomy and breast conservative surgery, from the inception to March 21st, 2024. The search keywords were categorized into two groups: Depression/Anxiety group and the Breast surgery group. In the Depression/anxiety group, we used any possible keyword, such as depression, depressive, anxiety, etc. In the Breast surgery group, we used all possible keywords, including mastectomy, breast resection, breast amputation, breast reconstruction, mammoplasty, etc. The keywords were combined with "OR" between the keywords of each group, and with "AND" between the groups. A second search was conducted one week before the submission of the manuscript, to retrieve any newly published article which was related to the topic of this systematic review and meta-analysis.

Eligibility criteria

The population of interest comprises adult women (aged 18 years and older) diagnosed with breast cancer who have undergone any form of surgical treatment, including mastectomy, lumpectomy, or breast-conserving surgery, regardless of the stage of cancer. The intervention is defined as breast cancer surgery, while comparisons may include pre-surgical psychological status (baseline depression and anxiety levels). The primary outcomes are changes in depression and/or anxiety levels, assessed using validated psychological scales such as the Hospital Anxiety and Depression Scale (HADS), and Beck Depression Inventory (BDI). Eligible studies include observational designs (e.g., cohort, case-control, cross-sectional) that report quantitative data on depression and/or anxiety in the context of breast cancer surgery. The exclusion criteria were as follows: (a) review articles, (b) meta-analyses, (c) case reports, (d) letter to the editors, (e) animal studies, and (f) studies that did not compare the anxiety or depression before and after the surgery. No limitation was imposed on the original language of the identified articles, sample sizes, or characteristics of the patients.

Data extraction and quality assessment

The initial screening of the identified studies was performed by two independent reviewers, based on their titles and abstracts to exclude irrelevant studies. The full text of related articles was reviewed by two reviewers for the confirmation of meeting inclusion criteria. Then, an Excel-based sheet was used to extract the data of the included studies. The data sheet included the names of the first authors, year of publication, study design, country of origin, population type, age of the participants, sample sizes, depression or anxiety assessment scale, and anxiety or depression scores. The methodological quality of the studies was assessed by two reviewers, independently using the Newcastle-Ottawa Scale (NOS).

Statistical analysis

A random effect model meta-analysis was used due to the high amount of heterogeneity among the characteristics and demographics between the studies, to pool the data regarding anxiety and depression changes after the mastectomy. We calculated standardized mean differences (SMD) with 95% confidence intervals (CI) to estimate the effect of breast cancer surgery on depression and anxiety levels. The heterogeneity between the studies was calculated using I^2 and Chi-square statistics. Low heterogeneity was considered when I^2 was less than 25%. Moderate heterogeneity was considered when I^2 was between 26 and 75%. Finally, high heterogeneity was considered when I^2 was more than 75%. The publication bias among the included studies was assessed using Egger's test and funnel plot visualization. A p-value less than 0.05 was considered statistically significant. All statistical analyses were conducted using R (version 4.1.3, R Core team, 2020) and the meta package (version 5.5).

Results

Characteristics of the included studies

Our systematic search identified 1576 articles. After removing duplicate articles, a total of 1128 articles were enrolled for initial screening, based on their titles and abstracts. Then, 68 full-texts were reviewed and 13 studies were included in our systematic review and meta-analysis [11, 15, 16, 20–29] (Fig. 1). The systematic review included 13 studies published between 2003 and 2023, conducted across a range of countries including Belgium, Sweden, the Netherlands, Pakistan, England, Germany, Canada, Italy, and Iran. The mean or median ages of participants varied across studies, generally ranging from the late 30s to mid-50s. Study populations consisted of women diagnosed with early-stage breast cancer, high-risk individuals undergoing prophylactic mastectomy, and those receiving reconstructive surgery post-mastectomy. Various types of surgeries were examined, including mastectomy, breast-conserving surgery, prophylactic mastectomy, and different forms of breast reconstruction (immediate, delayed, implant-based, or autologous reconstruction such as DIEP flap). Depression and anxiety were assessed using a variety of validated instruments, most commonly the Hospital Anxiety and Depression Scale (HADS), followed by the Beck Depression Inventory (BDI), Brief Symptom Inventory (BSI), State-Trait Anxiety Inventory (STAI), and other context-specific scales such as the Cognitive-Somatic Anxiety Questionnaire (CSAQ). Quality scores of the included studies ranged from 6 to 9 (out of 10), indicating a generally moderate to high methodological quality, with most studies scoring 7 or 8. One study was marked with "some concerns" regarding quality, suggesting a need for cautious interpretation of its results. Overall, the studies provide a diverse and comprehensive overview of the psychological impact of different types of breast cancer surgery on depression and anxiety outcomes. (Supplementary Tables 1 and Table 2).

Meta-analysis

Depression

A total of nine studies reported sufficient data for performing a meta-analysis on depression in patients who underwent breast surgery [11, 15, 16, 20–24, 26]. The results revealed that depression among patients who underwent breast surgery significantly decreased after the surgery (SMD: -0.14; 95% CI: -0.25 to -0.02; I^2: 50%) (Fig. 2). In the subgroup analysis, the patients who underwent mastectomy had significantly decreased depression (SMD: -0.17; 95% CI: -0.32 - -0.02); however, the depression among patients who underwent breast-conserving surgery (SMD: -0.11; 95% CI: -0.29–0.08) and breast reconstruction (SMD: -0.16; 95% CI: -0.47–0.15) was not reduced significantly (Fig. 3). The visual inspection of the funnel plot revealed no publication bias (Fig. 4).

Anxiety

A total of nine studies reported sufficient data for performing a meta-analysis on anxiety in patients who underwent breast surgery [15, 16, 20–26]. The results revealed that the anxiety among patients who underwent mastectomy significantly decreased after the surgery (SMD: -0.42; 95% CI: -0.56 - -0.28; I^2: 60%) (Fig. 5). In the subgroup analysis, the patients who underwent mastectomy had significantly decreased anxiety (SMD: -0.49; 95% CI: -0.71 - -0.28). Also, the anxiety among patients who underwent breast reconstruction was significantly decreased (SMD: -0.27; 95% CI: -0.44 - -0.10) (Fig. 6). The visual inspection of the funnel plot revealed no publication bias (Fig. 7).

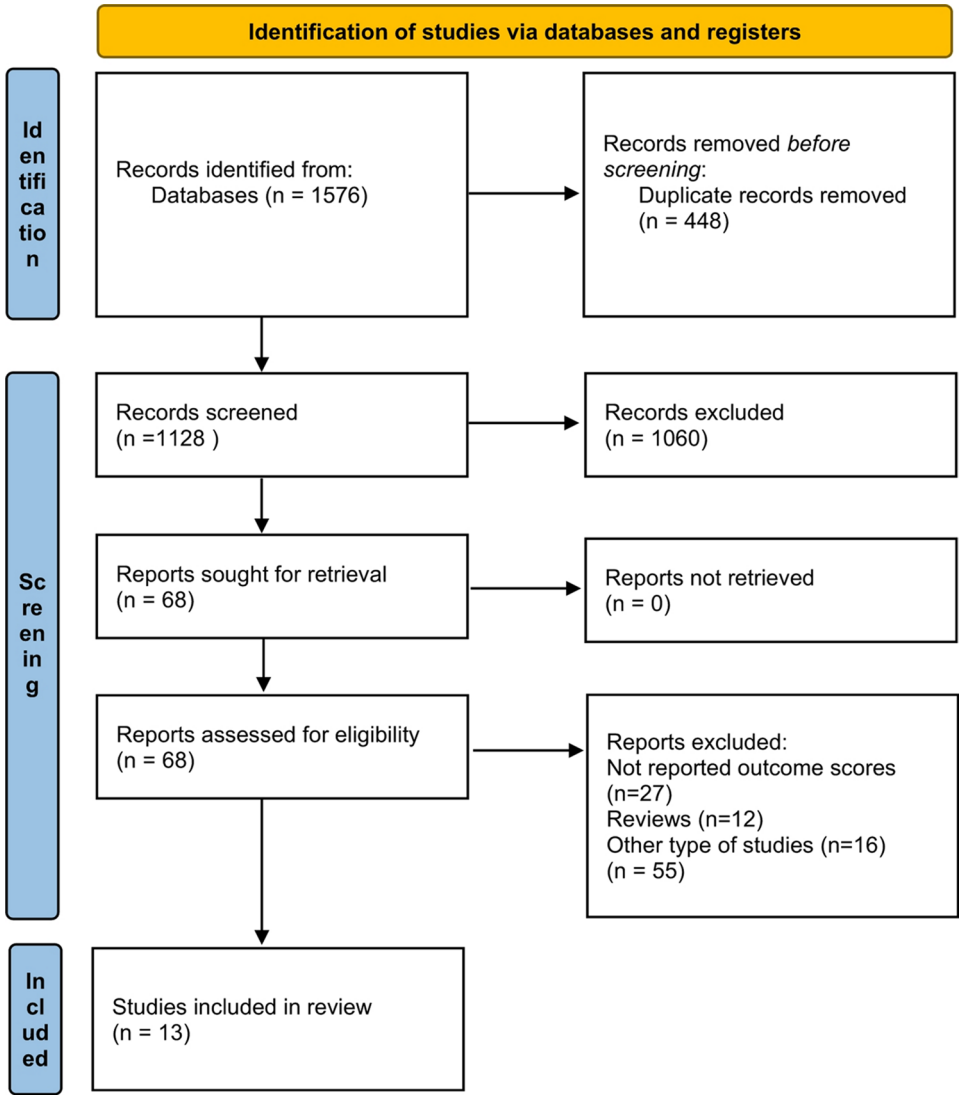

Fig. 1 PRISMA flowchart of the literature search and selection of the articles

Discussion

Breast cancer is the most commonly diagnosed malignant tumor in women worldwide [30]. one of the primary treatments for this cancer is surgical intervention, which entails numerous consequences [8]. The results of this meta-analysis suggest that breast cancer surgery, particularly mastectomy, is associated with a significant reduction in both depression and anxiety. These findings challenge the common perception that breast cancer surgery predominantly increases psychological distress [31]. Instead, the data indicate that surgical intervention may alleviate some aspects of the psychological burden, possibly due to the removal of the cancerous tissue and decrease in cancer-related distress [24] and the subsequent perceived reduction in the immediate threat posed by the disease. As it has been shown, women at high risk of breast cancer experienced significantly lower anxiety after surgery [32], whereas women who did not have surgery showed no such improvement [33]. Moreover, among women already diagnosed with breast cancer, anxiety often peaks around diagnosis and before treatment, then diminishes once the primary tumor is surgically removed. A 2020 prospective study of breast cancer patients showed that 44.5% had clinically high anxiety pre-surgery, which dropped significantly after surgery and remained low for months [34] In addition, qualitative research confirms that fear of recurrence is a major driver in women's decision to opt for mastectomy over less extensive treatments [35]. This suggests that mastectomy provides psychological comfort by empowering patients to remove the cancer and reduce future risk actively.

Result of the meta-analysis and systematic review conducted by Carreira. H et al. [36] revealed a bigger risk of

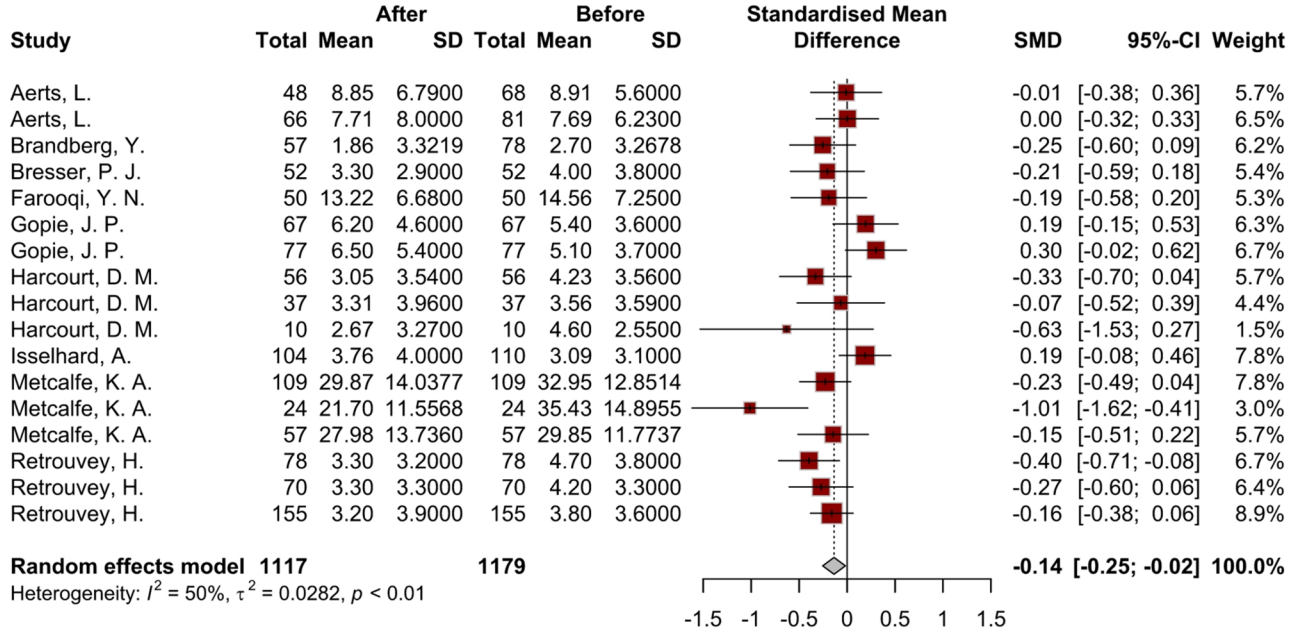

Fig. 2 Forest plot of pooled data regarding depression after breast surgery

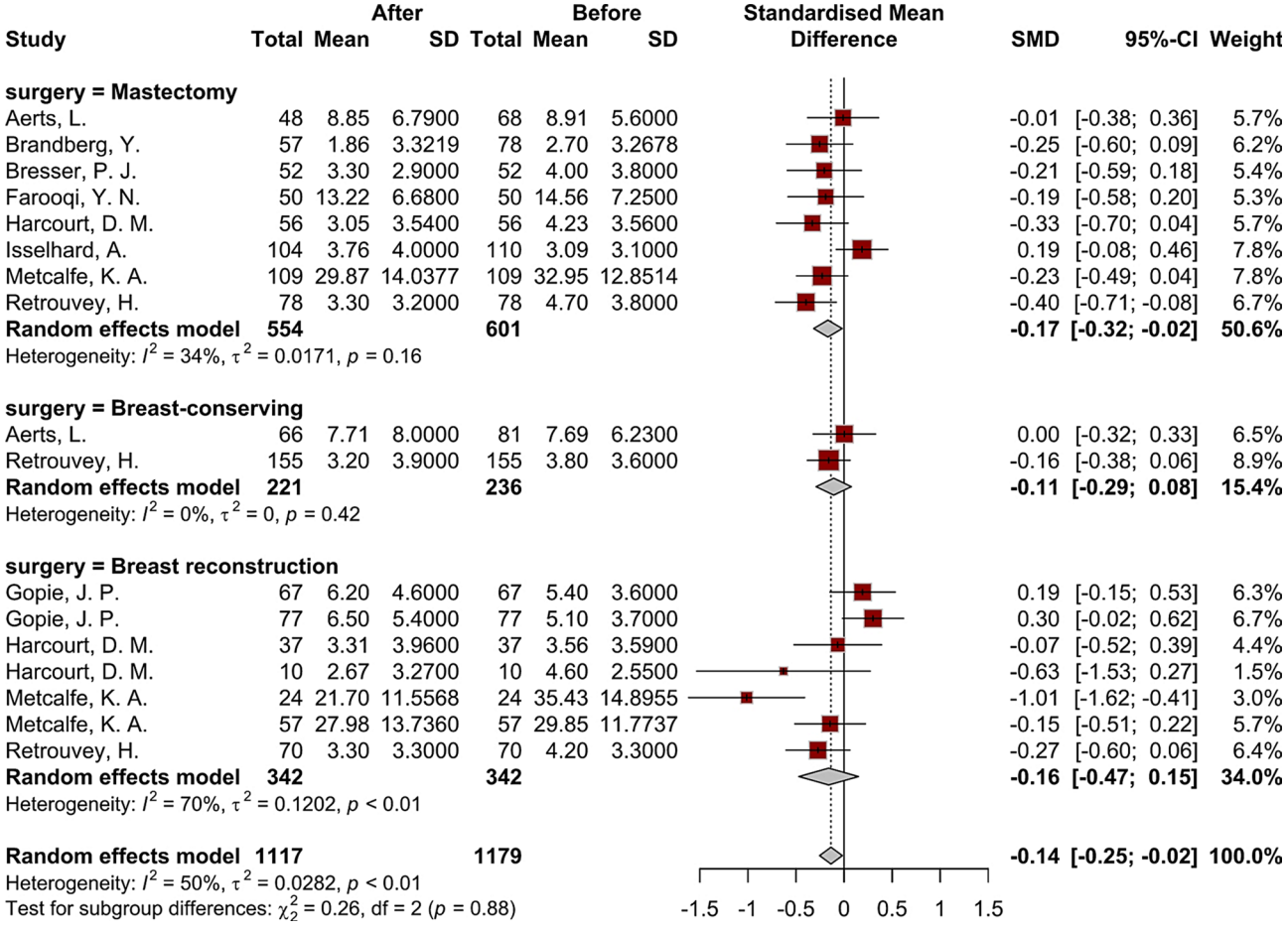

Fig. 3 Subgroup analysis based on surgery type regarding depression after breast surgery

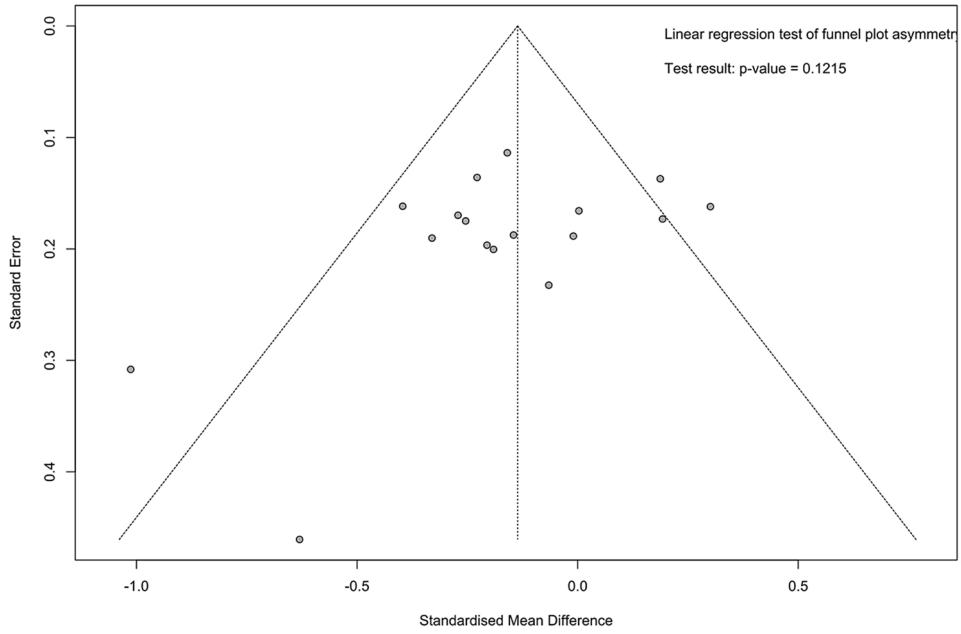

Fig. 4 Funnel plot of the studies that evaluated depression after breast surgery

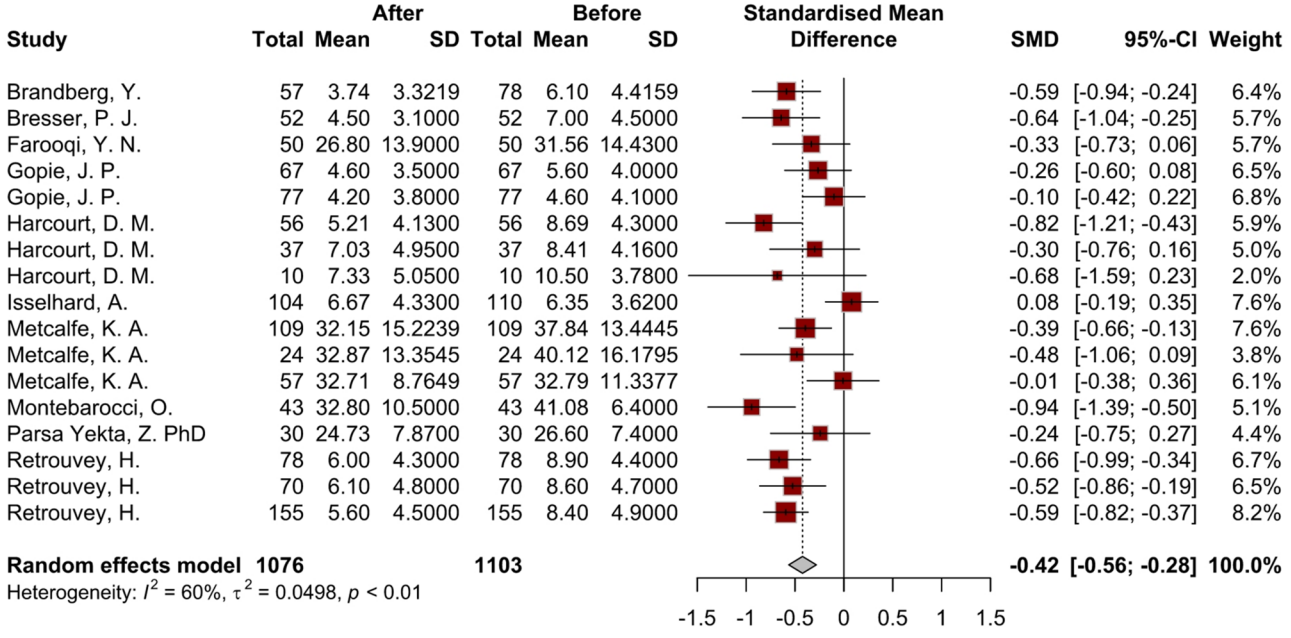

Fig. 5 Forest plot of pooled data regarding anxiety after breast surgery

suicide, neurocognitive, sexual dysfunctions, anxiety, and depression in survivors of breast cancer compared with healthy women. The results of this study show the importance of women's mental health after breast cancer surgeries. Comparison with Previous Studies Our research shows that, in general, the levels of anxiety and depression decrease after breast cancer surgery [15, 16, 20, 22, 24–29]. In the study conducted by Retrouvey et al. [26] depression, anxiety, and breast satisfaction were assessed at baseline and 6 and 12 months after three types of breast cancer surgery: breast-conserving surgery (BCS), mastectomy alone (MA), and mastectomy with immediate breast reconstruction (IBR). The results revealed that although satisfaction levels were higher after BCS, there was no significant difference in the levels of depression and anxiety after all three operations, and the level of depression significantly decreased after MA. This finding is consistent with our results. Similarly, Metcalfe et al. [24] showed that depression and anxiety levels decreased one year after mastectomy alone, mastectomy with

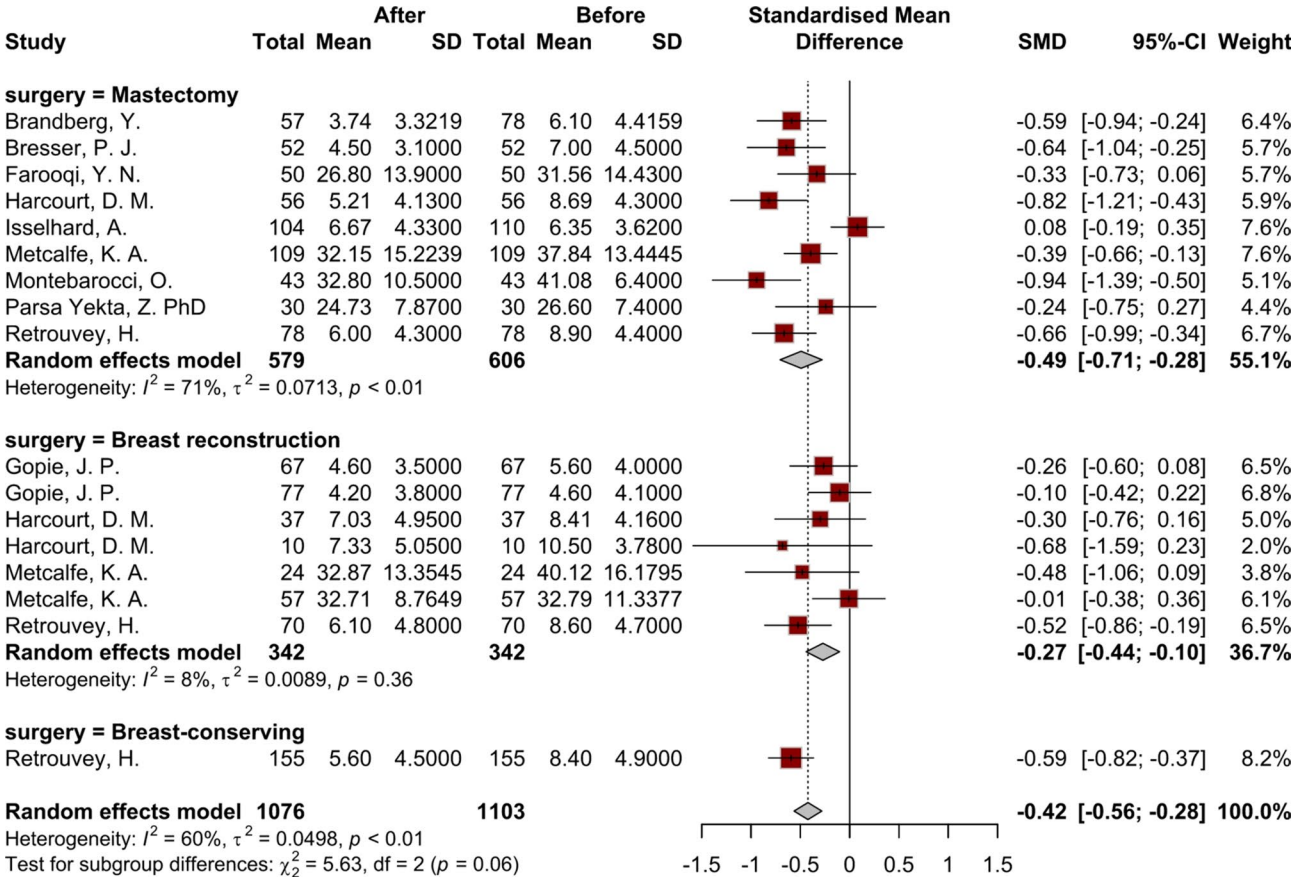

Fig. 6 Subgroup analysis based on surgery type regarding anxiety after breast surgery

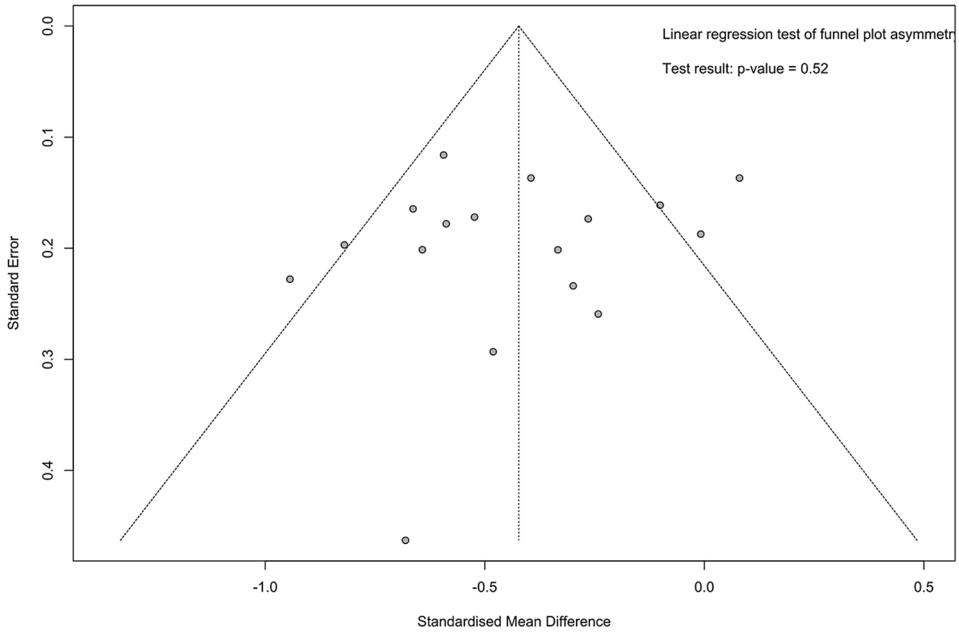

Fig. 7 Funnel plot of the studies that evaluated anxiety after breast surgery

immediate reconstruction, or delayed reconstruction. This study also indicated a significant decrease in depression and anxiety after breast reconstruction surgery.

Conversely, Gopie et al. [21] found that depression and anxiety levels increased in breast cancer patients following implant breast reconstruction and deep inferior epigastric artery perforator flap breast reconstruction. This finding contrasts with our results. Notably, Gopie's study also considered the impact of postoperative complications, finding lower depression and anxiety levels in patients without complications. Our findings diverge from those reported by Isselhard et al. [23], who noted an increase in depressive symptoms and stress after breast cancer surgery in cancer-unaffected women with a pathogenic variant in BRCA1 or BRCA2. This discrepancy could be attributed to differences in study design and patient populations.

The systematic review and meta-analysis done by Zhang C et al. [37] showed that there were no statistically significant differences in the occurrence of depression in patients with breast cancer as a consequence of breast-conserving therapy, breast reconstruction, and total mastectomy in 1-year follow-up, which is consistent with the results of our article., supporting the idea that these surgeries do not worsen the mental health of the cancerous patients.

Our meta-analysis incorporated more recent studies, reflecting advancements in surgical techniques and postoperative care, which might contribute to improved psychological outcomes. The variability in psychological impact across different types of surgeries highlights the complexity of the patient experience. While mastectomy patients showed significant improvements in both depression and anxiety, those undergoing breast-conserving surgery and breast reconstruction did not experience the same level of psychological benefit. Our analysis indicates that the reduction in depression and anxiety is more pronounced in mastectomy and reconstruction patients, suggesting that the type of surgery and the context in which it is performed play crucial roles in psychological outcomes. This finding partially contrasts with the work of Padmalatha, Sriyani [38], who found that breast reconstruction surgery was associated with lower depression levels compared to mastectomy alone. The findings suggest that providing emotional support to cancer patients may be of greater importance than prioritizing breast reconstruction surgery [24, 39].

Clinical implications

These findings underscore the importance of personalized psychological care in managing breast cancer patients. Healthcare providers should be aware of the potential for psychological improvement post-surgery, particularly for those undergoing mastectomy and reconstruction. Routine psychological assessments should be integrated into pre-operative and post-operative care to identify patients at risk of sustained psychological distress and to tailor interventions accordingly. Cognitive Behavioral Therapy (CBT) [40] and support groups have proven effective in reducing symptoms of depression and anxiety [41]. Pharmacotherapy, including antidepressants and anxiolytics, can be beneficial for patients with severe symptoms [42]. Mindfulness meditation, yoga, and progressive muscle relaxation are also recommended as complementary therapies to improve psychological well-being [43].

Limitations

While this meta-analysis provides valuable insights, several limitations must be acknowledged. The heterogeneity of the included studies, variations in the measurement of psychological outcomes, and differences in follow-up periods pose challenges to the generalizability of the findings. Future research should focus on long-term studies to understand the trajectory of psychological symptoms over time and identify factors that influence recovery. Further investigation into the effectiveness of various psychological interventions across different patient groups is also warranted. Additionally, exploring the impact of demographic variables such as age, socioeconomic status, and cultural background on psychological outcomes can provide more tailored support. Integrating biological, psychological, and social factors in research can offer a more holistic understanding of the psychological impact of breast cancer surgery.

Conclusion

Breast cancer surgery significantly affects patients' psychological well-being, with evidence suggesting a decrease in both depression and anxiety post-surgery, particularly for mastectomy and reconstructive procedures. Addressing mental health challenges is essential for improving the overall quality of life for breast cancer patients. Integrating routine psychological assessments, offering targeted interventions, and adopting a multidisciplinary approach can support patients through their recovery journey. Continued research is vital to develop effective strategies and provide comprehensive care that encompasses both physical and psychological health.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12885-025-14277-8.

Supplementary Material 1

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Author contributions
Conceptualization: AS, MD, SG; Data collection: SG, FM; Data analyzing: AS; Writing the original draft: FE, RAB; review & editing: SG, AS, FM, MD; All authors read and approve the final version of the manuscript.

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Data availability
The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethical approval
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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