

Review

Psychological health management in breast cancer patients: A review of treatment side effects and intervention strategies

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Abstract: Breast cancer is the most common malignancy among women globally, with rising incidence and mortality. While advances in treatment have improved survival rates, psychological challenges such as anxiety, depression, body image disturbances, and cognitive dysfunction remain prevalent. These effects are exacerbated by treatment-related physical side effects like fatigue and pain. This review examines the psychological effects of breast cancer treatments, relevant biological mechanisms, and helpful intervention strategies. Psychological interventions, like cognitive-behavioral therapy, peer support, and physical activity, can reduce these issues. Personalized care is essential for improving patients' quality of life and clinical results. Future research should focus on refining intervention strategies to better integrate psychological support into comprehensive breast cancer care, with a particular emphasis on long-term psychological impacts such as post-traumatic stress disorder (PTSD) and survivorship anxiety, which are prevalent among long-term breast cancer survivors.

Keywords: Breast cancer; Anxiety; Depression; Quality of life; Survivorship

1. Introduction

1.1. Global breast cancer context

Breast cancer is the most common malignant tumor among women worldwide, and its incidence continues to rise, posing a significant threat to women's health [1]. According to statistical data, breast cancer has the highest incidence rate among female cancers. In 2012, approximately 1.7 million new cases of breast cancer were diagnosed globally, with related mortality reaching 522,000, highlighting the rising trends in both incidence and mortality rates [2]. By 2020, 2.26 million new breast cancer cases were diagnosed, surpassing lung cancer to become the most common cancer worldwide [3,4]. It is estimated that by 2050, the annual incidence of breast cancer in women globally will reach approximately 3.2 million. This trend reflects the severity of breast cancer and its profound social impact, underscoring the urgent need for effective preventive and therapeutic measures [5,6].

This review aims to explore the psychological impact of breast cancer treatments and to evaluate intervention strategies that manage these effects. Specifically, it addresses critical research gaps in understanding how treatment-related side effects contribute to mental health challenges and in assessing personalized approaches to enhance quality of life for breast cancer patients.

Breast cancer's pathological traits are highly varied. Some cases grow slowly and have a good prognosis, while others are very aggressive [7]. Despite advances in medicine and healthcare technologies enabling early detection and treatment, many questions remain unanswered, particularly concerning the invasive molecular

mechanisms of certain breast cancer subtypes [8]. Epidemiological studies suggest that addressing socioeconomic issues is crucial to ensuring equitable access to healthcare services, from screening to advanced treatment, for all women. Such decisive actions would help reduce the global burden of breast cancer [9].

In recent years, immunotherapy has shown unique value in treating patients with metastatic breast cancer, offering new options to improve efficacy and prolong survival [10]. With ongoing clinical trials, emerging therapies such as tumor vaccines and monoclonal antibodies present new possibilities for personalized breast cancer treatment [11]. Additionally, the predictive value of tumor mutation burden (TMB) in breast cancer immunotherapy is gaining attention, providing important directions for future research. Given the rising incidence and diverse pathology of breast cancer, treatment approaches have evolved in complexity to address these unique challenges. The following section will discuss the multifaceted nature of breast cancer treatment and its implications for patient well-being.

1.2. Complexity and challenges in breast cancer treatment

Breast cancer treatment is complex and diverse, including methods such as surgery, chemotherapy, and radiotherapy. While these treatments have improved survival rates, they also pose several challenges [12]. For instance, the treatment of metastatic breast cancer (MBC) often requires a combination of surgery, radiotherapy, hormone therapy, chemotherapy, or immunotherapy and in some cases, supportive TCM interventions [13,14]. Biological drugs, targeted therapies, and gene therapies can reduce mortality and improve quality of life for patients. However, triple-negative breast cancer (TNBC), which accounts for approximately 10%–20% of all breast cancer cases, expresses low levels of progesterone receptor (PR), estrogen receptor (ER), and human epidermal growth factor receptor 2 (HER2), limiting the efficacy of conventional targeted therapies and necessitating special treatment strategies [15].

Despite the landmark introduction of anti-PD-L1 antibody atezolizumab in combination with chemotherapy for the treatment of metastatic TNBC, the success of immunotherapy is still restricted by various factors [16]. Single-cell RNA sequencing offers new ways to study breast cancer by analyzing cellular differences in phenotype and gene expression. This technique has revealed heterogeneity, dynamic growth, and differentiation processes within cells [17]. Its application in breast cancer research, particularly in the areas of cell heterogeneity, cancer metastasis, drug resistance, and prognosis, has shown great promise [17]. While these treatment modalities have improved survival rates, they also present a range of physical and psychological challenges. The following section will delve into the mental health impacts of breast cancer treatment, highlighting the emotional burdens patients often face throughout their treatment journey.

1.3. Impact of breast cancer treatment on mental health

During the course of breast cancer treatment, physical side effects are often accompanied by emotional fluctuations, anxiety, and depression, which can affect patients' daily lives and recovery. However, beyond the immediate treatment phase, many survivors experience long-term psychological impacts, including post-traumatic stress disorder (PTSD) and survivorship anxiety, which can persist for years and significantly impact their quality of life [18]. Studies show that breast cancer patients often face major changes in self-image during treatment. These changes can cause deep emotional distress [19]. Moreover, depression is one of the most common psychological disorders among breast cancer patients, with many showing

marked depressive symptoms during treatment, which are closely associated with demographic factors such as education level and marital status [20]. Therefore, psychological interventions targeting breast cancer patients are particularly important for improving their resilience and coping abilities [21].

A breast cancer diagnosis creates physical challenges and adds psychological stress. Treatment side effects also disrupt patients' daily lives [22]. In this context, psychological interventions have been identified as an important strategy for alleviating depressive symptoms in patients, particularly in those with advanced cancer, where psychological interventions have shown significant effectiveness [23,24]. Consequently, designing patient-centered treatment plans that address their psychosocial needs is crucial for improving the overall quality of life for breast cancer patients [15]. Given the significant psychological burden associated with breast cancer treatment, targeted psychosocial interventions are essential to bolster patients' resilience and improve their quality of life. The following sections will examine specific intervention strategies aimed at mitigating these psychological challenges.

New psychosocial interventions, like art therapy and online support, provide more ways to address breast cancer patients' psychological challenges. Art therapy, for instance, enables patients to express emotions and manage symptoms of anxiety and depression through creative processes such as painting or drawing, leading to improvements in quality of life and emotional resilience [25]. Specifically, recent studies indicate that art therapy can reduce anxiety by 8% to 64% and depressive symptoms by 6% to 72% among cancer patients, though variations in therapist expertise and patient engagement may impact effectiveness. The relatively small sample sizes and short durations in these studies also suggest the need for standardized protocols to ensure consistent outcomes in broader clinical settings [25].

Online support platforms provide continuous emotional support and foster a sense of community, which can be particularly beneficial for isolated or underserved populations. These platforms offer patients an accessible space to share experiences and receive emotional encouragement, especially valuable for those with limited in-person support options [26]. However, patient adherence and engagement vary widely, and factors such as age and digital literacy can influence effectiveness, highlighting the importance of tailored approaches in implementing these interventions.

2. Impact of breast cancer treatment side effects on psychological and emotional disorders

2.1. Psychological impact

Surgical treatment, including mastectomy and reconstruction, directly affects patients' self-image and gender identity, particularly in younger patients, potentially leading to severe emotional distress. Studies have shown that postoperative patients frequently face body image changes and gender identity crises, most notably in women undergoing mastectomy [27]. Many women perceive the loss of their breasts as a threat to their feminine identity, with some even viewing surgery as a loss of self-identity [28]. Additionally, surgery-related lymphedema can exacerbate these psychological issues, affecting sexual function and partner relationships [29]. The psychological effects of surgery are not limited to changes in appearance but also include sexual dysfunction. Research indicates that patients often feel isolated and helpless after surgery due to their reluctance to discuss sexual issues with medical professionals. Hence, psychological health must be prioritized when developing

treatment plans, providing both pre- and postoperative psychological support and counseling to help patients better cope with these changes.

2.2. Role and limitations of breast reconstruction

Breast reconstruction can help some patients regain their external appearance, but it does not entirely resolve psychological issues, especially in cases of surgical complications or poor recovery outcomes. Studies have found that anxiety and cancer-related distress may be alleviated after breast reconstruction; however, the occurrence of complications significantly increases the risk of depression and anxiety [30]. Moreover, the diagnosis and treatment of breast cancer have a profound impact on patients' mental health, which necessitates consideration of their psychosocial needs when developing treatment plans [31]. Personalized psychological interventions are essential for enhancing patients' psychological adaptation and overall mental health [32].

2.3. Chemotherapy-related side effects

Cognitive Impairment and Fatigue:

Chemotherapy often results in cognitive decline, such as “chemo brain,” and severe fatigue, which are closely related to emotional disorders and significantly affect patients' daily lives [33]. Research indicates that many patients undergoing chemotherapy experience chemotherapy-induced cognitive impairment (CICI), with varying degrees, onset times, and durations, all of which have profound effects on quality of life [34]. Furthermore, chemotherapy agents such as anthracyclines, taxanes, and platinum derivatives have been shown to induce oxidative stress, which not only affects the bloodstream but also the brain, leading to cognitive decline [35]. Fatigue is often considered a key predictor of cognitive impairment, with cumulative chemotherapy cycles and older age being major factors influencing objective cognitive deficits [36]. Therefore, chemotherapy-induced cognitive impairment and fatigue present not only physiological challenges but also have profound implications for patients' mental health and quality of life.

2.4. Radiotherapy-related side effects

Fatigue and Anxiety:

Radiotherapy can cause severe physical fatigue, and patients must also cope with persistent anxiety induced by radiation treatment. Studies have shown that cancer patients frequently experience cancer-related fatigue (CRF) during and after radiotherapy, affecting their physical, psychological, and social functioning [37]. In pediatric patients undergoing radiotherapy, anxiety and psychological stress significantly impact their treatment experience, prompting radiation oncology teams to develop strategies to mitigate these negative effects [38]. In nasopharyngeal carcinoma patients, a correlation between nutritional status and fatigue was observed, suggesting that overall health status influences the perception of fatigue during radiotherapy [39]. Moreover, breast cancer patients receiving adjuvant radiotherapy demonstrated significant improvements in fatigue, sleep quality, and quality of life through reflexology, offering new insights into managing radiotherapy side effects [40]. Considering patients' nutritional status, psychological support, and the use of complementary therapies may help enhance the overall treatment experience and quality of life. To better understand the underlying causes of these psychological issues, it is crucial to examine the biological mechanisms involved. The next section will discuss the imbalance between stress response and psychological regulation during breast cancer treatment.

3. Biological mechanisms of psychological and emotional disorders

3.1. Stress response and imbalance in psychological regulation

The imbalance between stress response and psychological regulation during breast cancer treatment is a significant health concern. The stress induced by treatment activates the hypothalamic-pituitary-adrenal (HPA) axis, leading to elevated cortisol levels, which in turn triggers emotional disturbances [41]. The accumulation of chronic stress is often accompanied by psychological issues such as depression and anxiety [42]. Although the hypothesis that psychosocial stress may be a potential trigger for breast cancer remains controversial, its prevalence among patients cannot be ignored [43]. The abnormal activation of the HPA axis not only affects emotional stability but also exacerbates the condition of breast cancer patients by reducing immune function and increasing chemotherapy resistance (**Figure 1**). Therefore, understanding the interplay between stress response and psychological regulation is crucial for improving patient outcomes and quality of life [44].

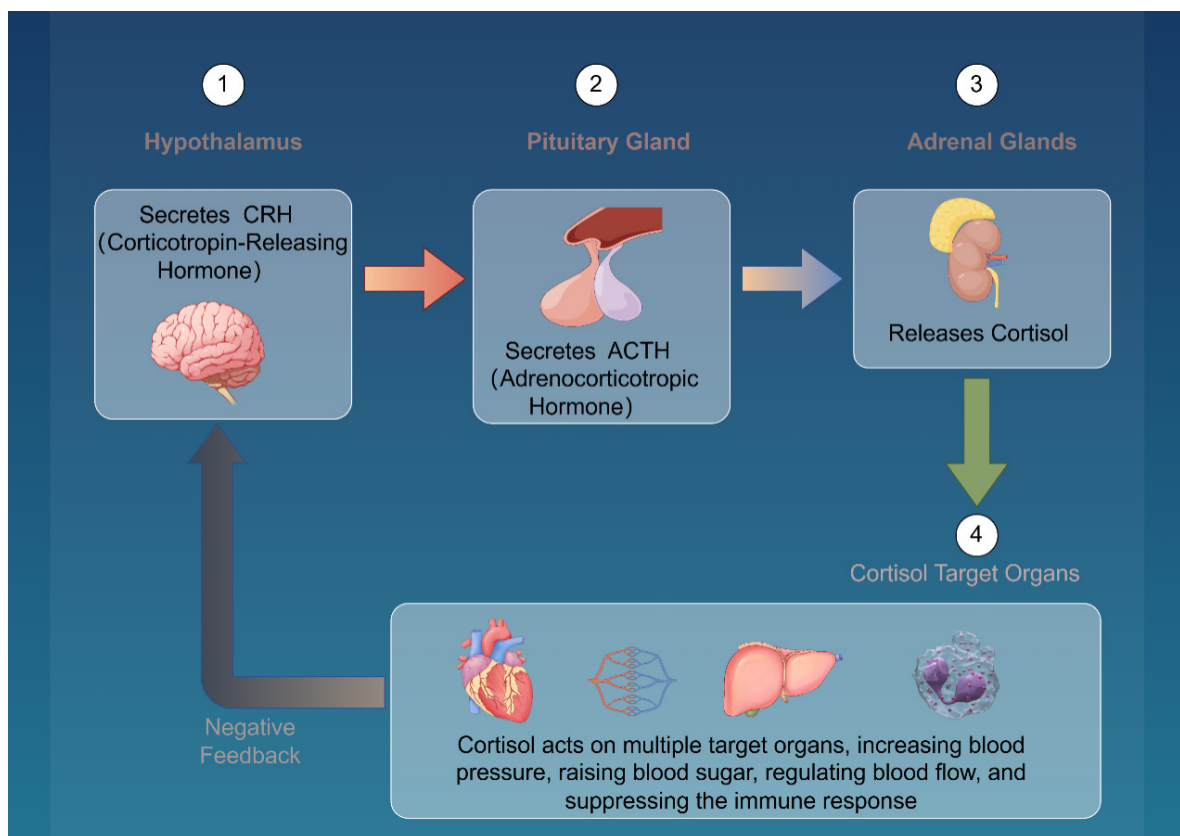


Figure 1. The Hypothalamic-Pituitary-Adrenal (HPA) Axis Stress Response.

Figure 1 provides an overview of the HPA axis, highlighting the roles of the hypothalamus, pituitary gland, and adrenal glands in regulating the stress response. This figure illustrates the hormonal signaling pathway and the feedback mechanism that modulates the response.

Additionally, the role of the MECP2 protein in stress response is worth noting. Studies have shown that MECP2 plays a key role in stress-induced epigenetic regulation, particularly in response to early-life stress [45] (**Figure 2**). The function of this protein is modulated by various post-transcriptional modifications, which affect learning, memory, and emotional regulation. Thus, targeting the mechanisms related

to the HPA axis and MECP2 could help improve the psychological health and overall prognosis of breast cancer patients [46].

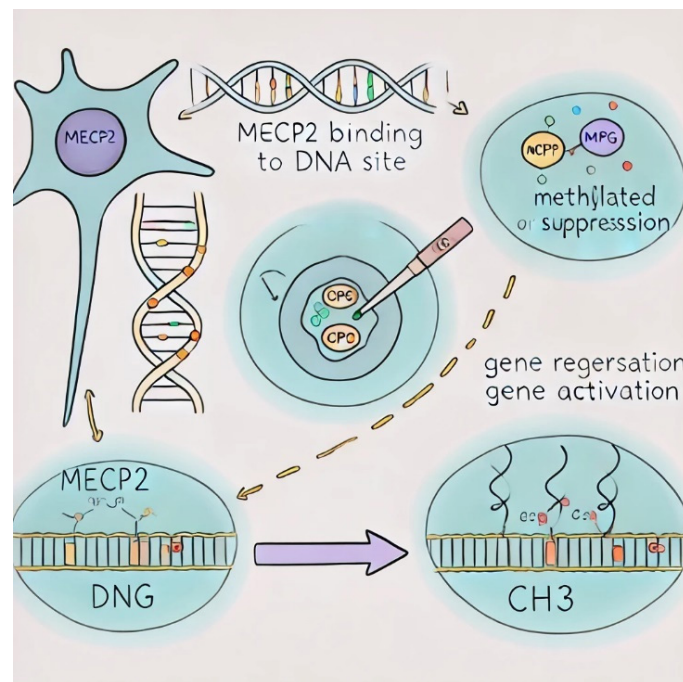


Figure 2. The MECP2 Protein: Structure and Role in Neuronal Function..

Figure 2 illustrates the structure and function of the MECP2 protein, emphasizing its role in gene expression regulation and neuronal development. This figure helps clarify how MECP2 influences neural plasticity and impacts psychological health.

3.2. Cognitive dysfunction and emotional disorders

Cognitive dysfunction, particularly in the form of reduced attention and memory decline, exacerbates depression and anxiety in breast cancer patients, negatively affecting their recovery [47]. Studies show that depressed patients often face cognitive impairment. This affects their daily life, social interactions, and work productivity [48]. In patients with major depressive disorder (MDD), cognitive impairment is closely associated with emotional and social factors, significantly affecting overall quality of life [49].

Notably, even when the emotional symptoms of depression improve, cognitive dysfunction may persist, indicating the need to address both emotional and cognitive recovery in depression treatment [50]. Furthermore, in neurodegenerative diseases, the onset of depressive symptoms is often accompanied by mild cognitive decline, complicating clinical diagnosis.

Therefore, early identification and comprehensive treatment of depressive symptoms are essential for improving cognitive function and overall recovery. By adopting dual treatment strategies targeting both emotional and cognitive functions, clinicians can more effectively assist patients in restoring their functional abilities and enhancing their quality of life. Having understood the biological roots of these psychological issues, we can now explore targeted social and psychological interventions aimed at alleviating these challenges. The following section will discuss various social and psychological intervention strategies and their roles in psychological recovery.

4. The role of social and psychological interventions

4.1. The role of social support in psychological recovery

Social support, including family and peer support, plays a critical role in the psychological recovery of breast cancer patients. Studies have shown that strong social support can significantly enhance emotional stability and reduce psychological stress. For instance, a randomized controlled trial found that breast cancer patients who received one-on-one peer support interventions showed marked improvements in psychological resilience and perceived social support [51]. Additionally, another study indicated a positive correlation between social support and self-care ability, with resilience and depression acting as mediators in this relationship [52]. These findings underscore the importance of social support in the recovery process of breast cancer patients, particularly in enhancing psychological resilience and quality of life [53].

In a study conducted in southern Thailand, social support for female breast cancer patients primarily came from family members and relatives, but the support received from healthcare providers was relatively limited, affecting their ability to cope with the disease. Therefore, healthcare professionals should fully understand the cultural backgrounds and challenges faced by patients when providing personalized support to help them navigate this vulnerable period more effectively [54]. Moreover, research has shown that the demand for psychosocial support among cancer patients is significantly associated with psychological stress and quality of life, further highlighting the importance of psychological support [55].

In summary, social support plays an indispensable role in the psychological recovery of breast cancer patients. Healthcare providers should recognize this and offer more comprehensive support and care to patients.

4.2. Psychological interventions

Psychological therapies like cognitive behavioral therapy (CBT) and movement therapy can effectively reduce anxiety and depression in breast cancer patients. These interventions not only help patients reconnect with their bodies and minds but also improve their overall psychological well-being. For example, one study showed that movement therapy was as effective in reducing depressive and anxiety symptoms as transdiagnostic cognitive behavioral group therapy (TCBGT) [56]. Additionally, life skills training has been found to significantly reduce depression and anxiety symptoms in breast cancer patients while improving social functioning [57]. Another study demonstrated that reflexology as an adjunctive therapy had notable effects in improving patients' psychological health and overall well-being [58]. Furthermore, mindfulness-based cancer recovery programs (MBCR) have shown good efficacy in reducing stress, depression, and anxiety in patients, with these positive effects persisting post-intervention [59]. Studies have shown that transdiagnostic cognitive behavioral therapy (TCBT) effectively reduces symptoms of anxiety and depression across a range of populations. For example, research comparing exercise and TCBT indicates that TCBT is a viable intervention with significant improvements in depression and anxiety scores, although further studies focusing on breast cancer patients specifically would help to clarify these effects in this population [60]. Research has shown that one-on-one peer support can lead to a 15% reduction in depression scores among newly diagnosed breast cancer patients. However, the reliance on self-reported measures in these studies introduces potential subjective bias, and the varying formats of peer support (e.g., in-person vs. online) complicate

direct comparisons across studies. Additionally, peer support interventions often lack standardized protocols, which can affect consistency in outcomes [51].

These studies demonstrate the significant value of psychological interventions in the treatment of breast cancer patients. By integrating psychological and physical interventions, clinicians can provide more comprehensive support to patients, thereby improving their overall health and quality of life. In addition to short-term interventions, long-term psychological strategies, such as regular follow-up counseling sessions and support groups, play a crucial role in addressing PTSD and survivorship anxiety among breast cancer survivors. These interventions can include trauma-focused cognitive-behavioral therapy (CBT), mindfulness-based stress reduction (MBSR), and peer-support networks, which have been shown to reduce persistent anxiety and improve resilience over time [60].

5. Short- and long-term psychological effects of different treatment modalities

5.1. Short-term effects

Long-term psychological impacts among breast cancer survivors, particularly post-traumatic stress disorder (PTSD) and survivorship anxiety, are widely documented in clinical studies. PTSD symptoms may include persistent intrusive memories, emotional numbness, and heightened anxiety, often triggered by follow-up exams or physical sensations. Additionally, survivorship anxiety, defined as the chronic fear of cancer recurrence, can lead to sleep disturbances, avoidance behaviors, and reduced engagement in daily life. These long-term psychological sequelae underscore the importance of ongoing psychological support post-treatment, as they can significantly affect survivors' mental well-being and overall quality of life [61].

Following surgery and chemotherapy, patients often experience significant emotional fluctuations, particularly in the early postoperative phase, with anxiety and body image disturbances being especially prominent. These emotional fluctuations stem from a combination of physiological, psychological, and social factors. Studies show that postoperative depression is common among cancer patients, significantly affecting clinical treatment outcomes and quality of life [62]. Additionally, complications arising from breast reconstruction surgery can have short-term impacts on emotional health, increasing the risk of anxiety and depressive symptoms [30]. Similarly, patients undergoing weight-reduction surgery also exhibit short-term changes in anxiety and depression postoperatively, though these symptoms may improve in the long term. Therefore, timely identification and intervention for postoperative emotional fluctuations are essential for enhancing overall treatment outcomes [63].

5.2. Long-term effects

Some patients continue to grapple with persistent anxiety and emotional distress after treatment, particularly women who have undergone mastectomy, as they may struggle with long-term adaptation to changes in body image. Research indicates that women post-mastectomy faces significant challenges in self-identity and body image, with many viewing the loss of their breasts as a profound blow to their sense of identity, leading to confusion in gender identity and personal self-worth [64]. Patients who undergo breast-conserving therapy (BCT) also express concern about the long-term cosmetic outcomes, and many hope to discuss these issues during treatment and follow-up to better manage expectations and emotional responses [65].

Psychological studies suggest that restoring a satisfactory body image is critical for the long-term mental health of breast cancer patients. Thus, healthcare providers should prioritize the psychosocial needs of patients and offer ongoing support throughout the treatment process [31]. Additionally, partner support plays a key role in long-term recovery, as jointly coping with the psychological stress of cancer can significantly enhance both partners' ability to adapt and improve overall quality of life [66]. The psychological impacts observed in both the short and long term reveal the extensive mental health burden imposed by cancer treatment, underscoring directions for improving patient quality of life. The following section will discuss future research directions needed to enhance psychological interventions.

6. Future research directions and clinical recommendations

6.1. The importance of early intervention

Early psychological assessment and intervention are crucial in helping breast cancer patients better cope with the emotional challenges of treatment and improve treatment adherence. The diagnosis of breast cancer not only imposes significant psychological stress on the patient but also has profound effects on their family and social environment. Research has shown that timely psychological support and intervention can significantly improve patients' quality of life, helping them maintain a positive mindset throughout surgery and treatment [67].

Furthermore, breast cancer patients often face challenges related to gender identity and body image during treatment, which may lead to emotional withdrawal and fear of intimacy. Therefore, providing psychological interventions for both the patient and their partner is essential, as this not only improves the patient's psychological well-being but also strengthens the support and understanding between partners [66].

Patients' cultural background and social support systems also significantly influence their treatment choices. Personalized psychological support and educational interventions help patients better understand their diagnosis and treatment options, thereby enhancing their involvement in treatment decisions [68]. By establishing effective support networks, patients can better cope with emotional distress, which in turn improves treatment adherence and outcomes.

In conclusion, early psychological intervention not only helps breast cancer patients face emotional challenges but also promotes their active participation in treatment, thereby improving overall treatment outcomes and quality of life.

6.2. Current research gaps and future directions

Despite substantial research on breast cancer treatment side effects, gaps remain in understanding the psychological impact, highlighting the need for further exploration. Treatment often results in psychological issues like depression and anxiety, related to physical changes and future uncertainties. Clarifying these mechanisms is essential to improve quality of life and inform new therapeutic approaches. Future research should emphasize targeted interventions to better support patients' psychological resilience throughout treatment [69].

6.3. The necessity of personalized treatment

Personalized psychological interventions play a crucial role in improving the quality of life for breast cancer patients. Studies have shown that tailored psychological interventions effectively address the specific psychological needs of cancer patients, thereby enhancing their mental health and overall well-being [70].

While psychological education group interventions (PEG) and support group interventions (SG) have shown positive effects on emotional adjustment in the short term for breast cancer patients, their long-term effects are less evident [71]. Future research should focus on the individual needs of different patients to develop targeted psychological intervention strategies that enhance intervention effectiveness and improve patients' quality of life [72].

Moreover, positive psychological resources, such as resilience, hope, and self-efficacy, have been shown to be significantly positively correlated with the quality of life in cancer patients. This suggests that intervention programs should focus on strengthening these positive psychological resources to improve patients' overall well-being [73]. Additionally, research has found a positive correlation between psychological distress and the need for psychological support. Therefore, combining screening with patients' subjective needs for psychological counseling can provide more appropriate psycho-oncology support [55].

Personalized psychological interventions are indispensable for addressing the unique emotional and psychological challenges faced by breast cancer patients. By tailoring support to individual needs, these strategies contribute significantly to enhancing patients' quality of life. Future research should aim to optimize these strategies to achieve better treatment outcomes and patient satisfaction. As we gain deeper insights into the psychological needs of breast cancer patients, personalized psychological interventions are emerging as essential for enhancing patients' quality of life. The next section will discuss the role of personalized treatment strategies in addressing these specific psychological needs effectively.

Furthermore, recent research highlights the potential of e-health interventions in supporting the psychosocial well-being of breast cancer patients. Platforms like IConnecta't have demonstrated success in reducing emotional distress and improving quality of life through structured online psychosocial services. These digital interventions not only expand access to psychological support but also reduce waiting times and logistical barriers, showing promise for integration into routine care [74]. Recent reviews also emphasize the need for a multifaceted approach in addressing the diverse challenges faced by breast cancer patients. From cognitive-behavioral therapy to alternative approaches such as occupational therapy and complementary treatments, comprehensive and personalized care has proven effective in alleviating both physical and psychological symptoms [75].

In addition to conventional psychosocial interventions, emerging evidence supports the use of art therapy as an adjunct method for psychological support in cancer patients. Studies indicate that art therapy can help alleviate anxiety and depression while enhancing quality of life, although further randomized controlled trials are needed to establish its long-term efficacy. As a complementary intervention, art therapy represents a valuable addition to holistic patient care strategies.

7. Conclusion

Despite considerable advances in breast cancer survival rates, the psychological side effects of treatment continue to present substantial challenges for patients. Understanding and addressing their psychological needs is crucial to improving their overall treatment outcomes and quality of life. Future research should also prioritize the long-term psychological needs of breast cancer survivors, particularly in managing PTSD and survivorship anxiety, to ensure a sustained quality of life. By implementing tailored long-term interventions, healthcare providers can better support survivors in

their journey beyond treatment and into a psychologically healthy survivorship [76].

In conclusion, while significant progress has been made in improving survival rates for breast cancer patients, the psychological side effects of treatment remain considerable. Surgical, chemotherapy, and radiotherapy treatments can lead to a range of psychological and emotional issues, including anxiety, depression, and body image disturbances. These issues not only impact patients' daily lives but can also adversely affect overall treatment outcomes. Understanding the biological mechanisms underlying these psychological effects and addressing them through early and personalized psychological intervention strategies can effectively mitigate emotional challenges during treatment and improve patients' quality of life.

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