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Effects of Aerobic Exercise on Sleep Disorder of Breast Cancer Patients: A Systemic Review

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Abstract: *In recent decades, the problem of sleep disorders in patients with breast cancer has not been well addressed. Aerobic exercise, regarded as a new non-drug treatment, is currently being widely studied. The purpose of this study is to determine the effect of aerobic exercise on postoperative sleep disorders in patients with breast cancer. Research shows that aerobic exercise can alleviate sleep problems by improving patients' moods and stimulating blood circulation. In addition, this essay also discusses the specific influence mechanism of aerobic exercise. This article concludes that aerobic exercise can promote metabolism, and blood circulation and stimulate the pituitary to secrete an exciting hormone dopamine. Using such treatment methods can achieve the purpose of improving sleep quality by alleviating pain, relieving mood, and improving immune function. However, whether the mechanism of aerobic exercise is related to other signal transduction pathways or hormones in the human body is still unknown, and the specific treatment scheme has not been determined, so further research is needed.*

Keywords: *Aerobic exercise; Breast cancer; Sleep disorder*

1. Introduction

Breast cancer has been identified as one of the most widespread cancers among women worldwide [1] and the second leading cause of cancer-related death. The last decades have seen a substantial decline in the mortality rate of breast cancer[2, 3]; however, the postoperative sleep disorder problem is still increasing. Sleep disorders are common symptoms in breast cancer patients[4]. Studies have shown that the incidence of sleep disorders in breast cancer patients after surgery is as high as 90%[5]. Sleep can maintain the body's normal immune and endocrine functions[6] and plays a crucial role in emotion and cognitive behavior[7]. Therefore, the decline in sleep quality will not only bring physiological discomfort to patients but also cause certain psychological disorders, such as anxiety and depression. That is to say, postoperative sleep disorders can cause damage to a patient's immune system, lead to different degrees of sleep disorders, and even affect the clinical treatment effect.

With the increasing popularity of non-drug treatment, the research on aerobic exercise in the treatment of sleep disorders has surged. A large amount of literature has studied the role of aerobic exercise in breast cancer treatment and rehabilitation, and the results are satisfactory. Aerobic exercise has been shown to effectively alleviate physical and psychological disorders and improve sleep disorders after breast cancer surgery by improving mood, and cardiopulmonary function, promoting blood circulation, and improving body composition[8-10]. However, in the discussion of how to treat postoperative sleep disorders of patients with breast cancer, one controversial issue is whether we can use aerobic exercise treatment to replace traditional drug treatments. Some argue that medical treatment is more effective. While others focus on the risks of these drugs and maintain that aerobic exercise treatment is a long-term solution. When it comes to the topic of aerobic exercise and its medical application for breast cancer patients, most of us will readily agree that it can promote metabolism and improve body function. These benefits include a reduction in anxiety, depression, and fatigue as well as an improvement in sleep and immune system. Indeed, our understanding of the application of aerobic exercise to medical treatments remains incomplete because previous work has not thoroughly investigated its specific effect on

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postoperative sleep disorder problems. Hence, by synthesizing the existing literature, this review analyzes and summarizes the influencing factors of sleep disorders in breast cancer patients, and summarizes effective aerobic exercise treatment programs, in order to provide a theoretical basis for clinical practice.

2. Methods

A comprehensive search of Pubmed and Web of Science databases using predefined terms was conducted from their inception to April 4, 2024. Original articles, RCTs, systematic reviews and meta-analyses were included. The search keywords related to “breast cancer”, “sleep disorder” and “aerobic exercise”. Articles not published in English and without full text were excluded.

3. Results

A total of 114 articles were obtained through the search. 93 articles were obtained after preliminary weight removal by endnote. Literature screening and assessment were performed independently by two researchers. The selection process and results of articles are shown in Figure 1. A total of 14 articles were selected for this review, including 5 RCTs, 4 systemic reviews and meta-analyses and 5 original articles[9, 11-23].

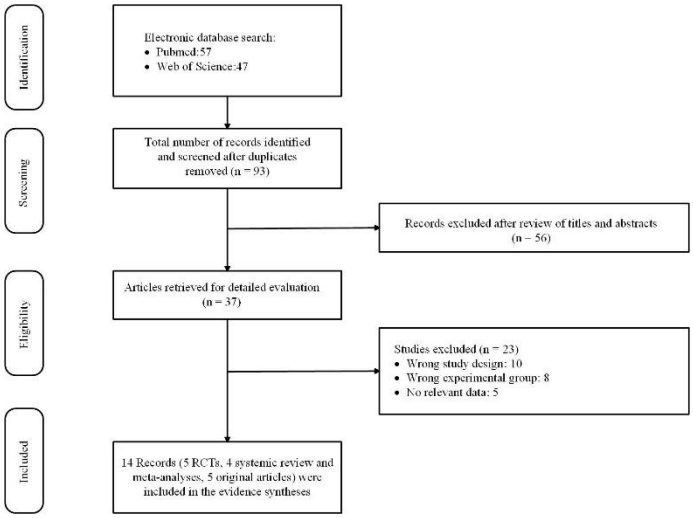

Figure 1: PRISMA Flow Chart. Schematic representation of the identification process for retrieval and screening studies.

3.1 Influencing factors of sleep disorders in breast cancer

Sleep disorders are symptoms used to describe perceived or actual changes in the way one sleeps. Based on the 3rd edition of the International Classification of Sleep Disorders, insomnia is the most common symptom of sleep disorders, which is characterized by difficulty falling asleep (time to fall asleep >30min), short sleep maintenance (≥2 nocturnal awakenings), decreased quality of sleep, and short total sleep time (usually <6h), accompanied by daytime dysfunction such as fatigue and depressed mood[24, 25]. The main factors associated with the occurrence of sleep disorders in postoperative breast cancer patients can be categorized into physiological, pathological, environmental, psychological and other factors. Among physiologic factors, age factor is the main one, and young and middle-aged female patients under 40 years old are more likely to have sleep disorders. Among the pathological factors, patients with incision pain on the affected side, limb movement disorder, sequelae of radiotherapy, endocrine disorders, chronic neuropathic pain, and cancer-caused fatigue were positively correlated with sleep disorders. Among the environmental factors, sleep environment change and forced position were the main factors. Among the psychological factors, sleep disorder was strongly correlated with the patients' bad mood, and the degree of relatives' companionship and care, economic and cultural status were negatively correlated with the occurrence of sleep disorder; in addition, the type of breast cancer patients suffered from, the means of treatment, and the drugs they used were also correlated with the degree of sleep disorder[26, 27].

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3.2 Methods for assessing sleep disorders in breast cancer

The assessment of sleep disorders in breast cancer patients is mainly through patients' self-administered questionnaires, self-report measures, sleep quality assessment forms, and self-sleep diaries, with the Pittsburgh Sleep Quality Index Scale as the main basis. Healthcare professionals should have a detailed understanding of the patient's disease history, treatment history, and previous sleep, and assess the patient's sleep disorders with scientific and comprehensive evaluation and inclusion criteria[28, 29].

3.3 Literature Review

According to the latest statistics, the main reasons why patients with breast cancer suffer from sleep disorders are as follows: pain, psychological problems, low immunity, adverse reactions, and pressures. In addressing the question of how aerobic exercise improves these factors, researchers have considered several explanations. Rogers argued that aerobic exercise can reduce anxiety, depression, pain, and fatigue in breast cancer patients, and can effectively prolong sleep time and improve sleep disorders. This study concluded that aerobic exercise can significantly reduce the perceived sleep disorder of breast cancer patients [9]. A related investigation by Matthews has presented convincing evidence through randomized experiments. According to this study, aerobic exercises such as yoga, qigong, dancing, and walking can notably improve postoperative sleep disorders in breast cancer patients because they can alleviate patients' psychological problems and reduce adverse reactions [19]. Research by Yang indicated that aerobic exercise improves sleep quality by promoting dopamine secretion and improving the immune system[13]. Overall, a study of existing research on this issue reveals that aerobic exercise can assist in correcting sleep disorders for these patients by promoting dopamine secretion, improving mood, promoting blood circulation, and activating the immune system of the body[30].

3.4 Suggested Aerobic Exercise Prescriptions

Exercise regimens for breast cancer interventions are primarily based on the amount of exercise recommended by the U.S. Physical Activity Guidelines[31]. In conjunction with the aerobic exercise programs used in the incorporated literature, we have summarized them as follows (Table 1).

Table 1: Recommendation of Aerobic exercise Prescription in Breast cancer Patients.

Components of Exercise Prescription	
Frequency	Regular exercise 2-3 times/w Targeted exercise 3-7 times/w
Sets and Repetitions	Regular exercise 30min/time Targeted exercise 10min/time, 6 sets/d
Type	Use safe and comfortable equipment suitable for personal physical fitness
Specific actions	Regular exercise: yoga, jogging, walking, tai chi, eight-duan brocade, five-bird play Targeted exercise: hands and forearms→upper arm→forehead→cheeks→nose→jaw→neck→chest and shoulders→back→abdomen→thighs→calves→feet (Stretch and contract muscles)
Special Considerations	Frail and weak patients: ● Frequency 1–2 times a week on non-consecutive days ● 1–3 sets/d or shorten the duration of exercise

Medium-intensity aerobic exercise training can be used for strong patients, while low-intensity aerobic exercise is the mainstay for weak patients, with timely follow-up and gradual adjustment based on the patient's recovery status. Stretching, the whole body muscles gradually do tension and relaxation movements, the order of reference: hands and forearms→upper arm→forehead→ cheeks→nose→jaw→neck→chest and shoulders→back→abdomen→thighs→calves→feet [32]. Regular training is 2-3 times per week, and training for the affected side is 3-7 times per week, 30 minutes each time, which can be dynamically adjusted according to the patient's condition. Simple aerobic exercise and stretching can relax the muscles of the whole body and can also be combined with meditation and positive thinking to fully relax the body and mind to achieve the effect of sleep[33].

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4. Discussion

In reviewing the literature above, it is clear that the effect of aerobic exercise on postoperative sleep disorders is significant and should be popularized. Aerobic exercise can improve sleep disorders by improving the comprehensive functions of the body, such as circulation, immunity, hormones, etc. The findings showed that the more adequate such comprehensive intervention is used, the less the postoperative sleep disturbance of breast cancer patients is. It is important to keep in mind that aerobic exercise is a simple and safe comprehensive intervention method that has been proven at present, which can improve patients' sleep quality as well as enhance their quality of life. However, due to the lack of research on the mechanism of aerobic exercise, there is a further need for research to study the relationship between aerobic exercise and human endocrine and signal transduction pathways and formulate a clear aerobic exercise treatment plan according to American physical activity guidelines.

5. Conclusion

Given many factors of sleep disorders after breast cancer surgery, aerobic exercise can significantly improve the sleep quality of breast cancer patients in various ways. Despite the continuous progress of medical technology, breast cancer is still one of the major diseases that endangers health, and patients' sleep disorders have not yet been addressed adequately. Thus, as a safe and convenient treatment method, aerobic exercise has a broad development prospect. Our conclusion is that, compared with drug treatments, aerobic exercise intervention is a safe and effective way to intervene sleep disorders, which should interest those breast cancer patients who suffer from sleep problems. However, apart from this limited group, my argument should be meaningful for those who suffer from sleep disorders in general, because aerobic exercise is applicable to far more than breast cancer patients.

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