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Effect of Baduanjin on postoperative activity tolerance, lung function and negative emotions in patients with lung cancer: a protocol for systematic review and meta-analysis

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ABSTRACT

Introduction Patients who have undergone lung cancer surgery often experience reduced exercise tolerance, impaired lung function and increased negative emotions such as anxiety and depression. Baduanjin, a traditional Chinese mind-body exercise, has shown benefits in improving exercise tolerance and lung function in populations with chronic diseases. However, evidence on the effectiveness of Baduanjin for post-lung cancer surgery patients remains limited. This study aims to systematically assess the impact of Baduanjin on exercise tolerance, lung function and emotional well-being in these patients.

Methods and analysis We will conduct a comprehensive search of PubMed, the Cochrane Library, China National Knowledge Infrastructure, Chinese Biomedical Literatures database, Wangfang database and China Science and Technology Journal Database (VIP) to identify randomised controlled trials (RCTs) assessing Baduanjin in postoperative lung cancer patients. The primary outcome measure will be the 6-minute walk test distance. We will assess the risk of bias in included RCTs using the bias risk assessment form from the Cochrane Collaboration Handbook. This protocol follows the Preferred Reporting Items for Systematic Reviews and Meta-analyses Protocols 2015 guidelines.

Ethics and dissemination Ethical approval is not required as no primary data are collected. The results will be presented at scientific conferences or submitted to a peer-reviewed scientific journal.

PROSPERO registration number CRD42024570196.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study will strictly adhere to the Preferred Reporting Items for Systematic Reviews and Meta-analyses-2020 guidelines.
⇒ Only randomised controlled trials will be included, which are more likely to provide unbiased information than other study designs.
⇒ This study will employ the Grading of Recommendations Assessment, Development and Evaluation methodology for evidence grading.
⇒ This study could be limited by the quality of available studies, insufficient methodological rigour and statistical heterogeneity.
⇒ Whether the exercise of Baduanjin meets the standards may be another limitation to the quality of evidence of this study.

BACKGROUND

Description of the condition

Lung cancer has the highest incidence and mortality rates of all malignant tumours worldwide. Surgical resection is the most effective treatment, with approximately 40% of patients eligible for the procedure.[1] Although radical resection improves survival rates, it also causes side effects such as pain, fatigue, shortness of breath, reduced lung function and physical activity and negative emotions like anxiety and depression, all of which significantly affect patients' quality of life.[2–6]

Operable lung cancer patients often view physical weakness as a more unacceptable outcome than complications like atelectasis and pneumonia.[7] Research indicates that patients' ability to perform moderate and high-intensity exercises gradually improves over time after pneumonectomy.[8] The study categorises postsurgery patients into three groups: sedentary, low activity and meet guidelines (defined as engaging in at least 150 min of moderate-intensity activity per week or 60 min of vigorous activity per week). Individuals adhering to exercise guidelines report a better quality of life—improved physical functioning, fewer role limitations due to physical problems, better general health perceptions and increased vitality—compared with those with lower activity levels. This suggests that while physical ability gradually improves,

varying exercise intensity impacts quality of life. Many lung cancer patients experience poor exercise tolerance and reduced lung function due to their primary disease or a history of respiratory conditions (such as chronic bronchitis and chronic obstructive pulmonary disease). Surgery can worsen these issues. Studies show that forced expiratory volume in 1 second (FEV_1) decreases by 11% and 36% at 6 months after lobectomy and pneumonectomy, respectively, while peak oxygen consumption (VO_2peak) decreases by 13% and 28%,[9] resulting in a 40% reduction compared with age-matched healthy individuals.[5 10]

Lung cancer patients also face significant emotional challenges. Research shows that anxiety and depression rates after surgery are much higher compared with the general population (anxiety: 49.6% vs 13.8%, depression: 38.3% vs 10.0%).[11] Preoperative anxiety and depression rates are 8% and 12%, respectively, which increase to 9% and 19% after surgery. Risk factors for postoperative depression include thoracotomy, postoperative shortness of breath, severe pain and diabetes. Residual symptoms after surgery can worsen postoperative anxiety and depression.[12]

Description of the intervention

Patients who undergo lung resection often receive rehabilitation therapy to support physical recovery.[13–15] A 2021 meta-analysis found that preoperative respiratory training can shorten hospital stays, reduce pulmonary complications and improve the 6-minute walk test distance (6MWD) in lung cancer patients undergoing resection, though it has no significant effect on FEV_1 or quality of life.[16] A 2019 meta-analysis showed that exercise training can increase exercise capacity (measured by VO_2peak) and 6MWD in non-small cell lung cancer patients after lung resection.[17] A 2020 systematic review indicated that preoperative exercise interventions positively affect physical and lung function. Even brief interventions (1–2 weeks before surgery) can improve lung function, shorten hospital stays, reduce surgical complications and speed up recovery.[18] A study found that patients meeting exercise guidelines postoperatively had significantly fewer depressive symptoms than those who were sedentary or engaged in low-intensity exercise, although anxiety symptoms did not differ significantly.[8] In conclusion, preoperative and postoperative rehabilitation training can enhance activity endurance (measured by 6MWD) and reduce pulmonary complications in patients after lung cancer surgery. However, its effects on lung function and quality of life remain controversial.

Baduanjin (eight-section brocades) is an ancient Chinese exercise routine from the Northern Song Dynasty with a history of over 800 years. It is a traditional health-preserving method that is easy to practice and has gained popularity as a form of exercise.[19] Unlike running or ball sports, Baduanjin is a gentle and moderate exercise focusing on movement and breathing coordination. It may be particularly beneficial for individuals with physical or cognitive impairments, helping improve their physical function and mental health. The exercise includes eight continuous movements: supporting heaven with both hands, dragon spraying water, big bird spreading its wings, lifting a window to view the moon on the left, descending to earth, beautiful maiden twisting her waist to the right, extending shoulders to bring hands together and dragon claws to the left.[20] While Baduanjin originated as a Chinese practice, deep knowledge of traditional Chinese culture is not required to learn this exercise. For international learners, it is feasible to master the core techniques of Baduanjin by following instructional videos. A randomised controlled trial (RCT) has shown that Baduanjin exercise offers benefits over regular exercise in improving cardiorespiratory endurance, lower limb proprioception and attention among college students.[21] Meta-analyses suggest that Baduanjin can improve cardiorespiratory endurance by lowering resting heart rate, increase lung capacity and enhance overall quality of life.[22] It has also been found to alleviate depressive symptoms in women with chronic fatigue syndrome-like conditions, possibly by raising adiponectin levels.[23] Additionally, multiple studies indicate that Baduanjin can enhance lung function, increase 6MWD and reduce negative emotions like anxiety and depression in lung cancer surgery patients, with a favourable safety profile.[24]

The importance of this review

A meta-analysis published in July 2024 explored Baduanjin's rehabilitative effects on postsurgery lung cancer patients. It concluded that Baduanjin exercise can enhance exercise endurance, pulmonary function and quality of life and alleviate anxiety and depression.[25] The analysis covered studies up to April 2023 and included comprehensive therapies with oral medicines. Distinguished from it, our research has a longer retrieval period, possibly incorporating more literature for higher-credibility conclusions. Focusing on non-drug therapies' impact on postsurgery lung cancer patients, our study aims to offer a feasible home-based non-drug rehabilitation approach to promote their recovery.

Objectives

This study aims to systematically summarise RCTs that assess the effects of Baduanjin on exercise tolerance, lung function and negative emotions in patients after lung cancer surgery. We will compare Baduanjin with other physical rehabilitation methods, routine care or no intervention to provide a convenient, effective and safe rehabilitation alternative for this patient population.

METHODS

This protocol will be developed following the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) Protocols 2015.[26]

Eligibility criteria

Types of studies

We will include studies published in Chinese or English from database inception to 1 July 2024. The rationale for

setting 1 July 2024 as the literature search cut-off date was because it aligns with our submission of the study protocol to PROSPERO in July 2024.

Types of participants

We will include lung cancer patients aged 18 years and older who have undergone lung resection surgery, regardless of whether they received radiotherapy or chemotherapy. The type of surgical approach is not restricted. Video-assisted thoracoscopic surgery and traditional open thoracotomy have similar rates of short-term mortality, wound infection and pulmonary complications.[27] All patients must have a confirmed diagnosis of lung cancer through pathology or cytology. Patients found to have non-malignant tumours on postoperative pathology examination will be excluded.

Types of interventions

Experimental interventions

We will include rehabilitation training focusing on Baduanjin, either as a sole intervention or combined with control group interventions. There are no restrictions on the training duration, but details such as training time, frequency and supervision methods will be recorded.

Comparator interventions

Comparator interventions include routine care, active lung rehabilitation (such as health education, respiratory training and exercise training) or observation only.

Types of outcome measure

Primary outcome

The primary outcome measure will be activity tolerance, assessed by the 6MWD.

Secondary outcome

Secondary outcome measures will include lung function indicators, such as $FEV_1$and forced vital capacity (FVC), anxiety and depression scores assessed by the self-rating anxiety scale (SAS) and self-rating depression scale (SDS), and quality of life measured using the functional assessment of cancer therapy-lung cancer (FACT-L). Adverse events will also be analyzed to evaluate the safety of Baduanjin.

Exclusion criteria

1. If multiple records describe the same patient population, the most comprehensive and recent literature will be selected for data extraction.
2. Incomplete access to the full text of literature.
3. Data with noticeable errors.

Searching strategy

Electronic searches

We will search the following databases: PubMed, Cochrane Library and four Chinese databases (CBM, CNKI, VIP and WangFang) for relevant studies from inception to 1 July 2024. The search strategy will use a combination of Medical Subject Headings (MeSH) and free-text terms. For example, the search strategy for PubMed is summarised in table 1.

Table 1 Search strategy for the Pubmed database

Number	Items
1	Lung Neoplasms(Mesh)
2	Neoplasm*, Pulmonary OR Pulmonary Neoplasm* OR Neoplasm*, Lung OR Neoplasm*, Lung OR Lung Neoplasm OR Lung Cancer* OR Cancer*, Lung OR Cancer of Lung OR Pulmonary Cancer* OR Cancer*, Pulmonary OR Cancer of the Lung
3	1 OR 2
4	Postoperative Period(Mesh)
5	Period*, Postoperative OR Postoperative Periods
6	4 OR 5
7	baduanjin OR ba duan jin OR eight section brocades
8	Physical Endurance(Mesh)
9	Physical Stamina OR Endurance, Physical OR Stamina, Physical
10	Respiratory Function Tests(Mesh)
11	Function Test*, Respiratory OR Test*, Respiratory Function OR Pulmonary Function Test* OR Function Test*, Pulmonary OR Lung Function Test* OR Function Test*, Lung OR Test*, Lung Function OR Test*, Pulmonary Function
12	Anxiety(Mesh)
13	Angst OR Nervousness OR Hypervigilance OR Social Anxiet* OR Anxiet*, Social OR Anxiousness
14	Depression(Mesh)
15	Depressive Symptom* OR Symptom, Depressive OR Emotional Depression OR Depression, Emotional
16	8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15
17	3 AND 6 AND 7 AND 16

Searching other resources

Previous reviews and meta-analyses, as well as the reference lists of selected studies, will be examined to ensure thorough coverage of the literature.

Data collection

Selection of studies

All retrieved studies will be managed using EndNote V.21. Duplicates will be removed through EndNote's deduplication feature and manual review. Irrelevant studies will be excluded based on title and abstract evaluation. Relevant studies will be selected based on predefined criteria, and full-text articles will be reviewed for eligibility as needed. Additional information will be requested from authors to resolve eligibility questions. The study selection process will be illustrated using the PRISMA flowchart (figure 1). Two researchers will independently assess eligibility in

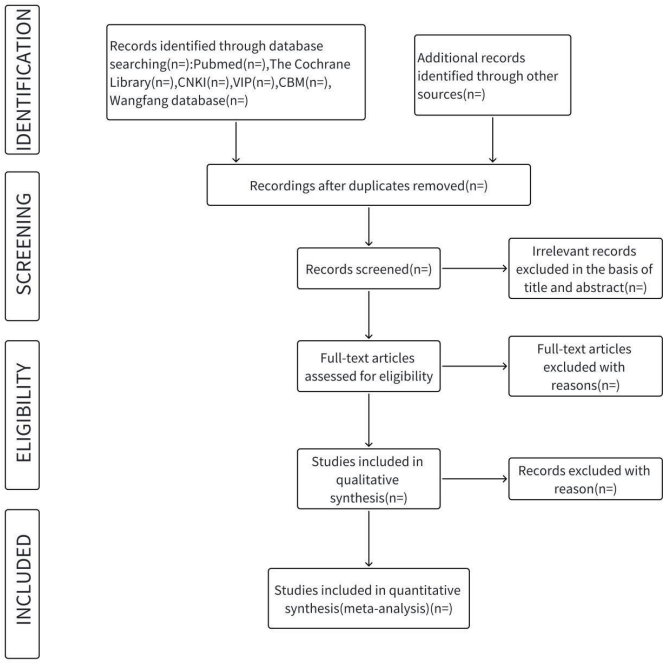

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram of identification, screening, eligibility and inclusion of studies.

an unblinded, standardised manner, with discrepancies resolved by consensus. A third researcher will be consulted if consensus cannot be reached.

Date extraction and management

Two researchers will independently perform data extraction. Calibration exercises will be conducted before the review to ensure accuracy. Missing data will be obtained by contacting authors via email or phone. Extracted details will include: (1) basic information (title, first author, year of publication); (2) study population (age, gender, sample size); (3) intervention characteristics (measures, duration); (4) outcomes (primary and secondary). Additionally, information for assessing methodological quality and outcome indicators will be extracted.

Assessment of risk of bias

The risk of bias in included RCTs will be evaluated using the Cochrane Collaboration Handbook's Bias Risk Assessment Form. The assessment will include sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective outcome reporting and other biases. Each domain will be rated as 'high risk' or 'low risk' or 'unclear' if information is insufficient. Efforts will be made to obtain additional information from study investigators if needed. Two researchers will independently assess the risk of bias, with disagreements resolved through consensus or by consulting a third researcher. Bias risk graphs will be created using RevMan V.5.4.

Measures of Treatment Effect

Statistical analysis will be performed using RevMan V.5.4. Continuous outcomes will be assessed using mean difference (MD) or standard mean difference (SMD), with estimated values and 95% CIs. Data presented as medians and IQRs will be converted to means and SD using established protocols.[28]

Assessment of Heterogeneity

Heterogeneity among the results will be assessed using the χ^2 test and quantified with I^2. If significant statistical heterogeneity is found (I^2>50%, p≤0.1), the random effects model will be used. We will also explore sources of heterogeneity through subgroup or sensitivity analyses. If heterogeneity is not significant, the fixed effect model will be applied. If a meta-analysis cannot be conducted, we will provide a narrative summary of individual study results.

Assessment of Reporting Biases

To evaluate potential publication bias, the Egger's test, Begg test or funnel plots will be used if more than 10 studies are included in the meta-analysis.[29] If publication bias is detected, trimming and filling methods will be applied to assess the impact on the results.

Data Synthesis

Statistical analyses and forest plots will be created using RevMan V.5.4.1. Meta-analyses will include either postintervention values (with SD) or mean changes (with SD) for studies reporting MD. For studies reporting SMD, analyses will be conducted separately for those reporting postintervention values and those reporting mean changes.

Subgroup Analysis

If significant heterogeneity is present in a meta-analysis, subgroup analysis will be performed based on factors such as age and control group interventions to identify potential sources of heterogeneity.

Sensitivity Analysis

To assess the stability of the meta-analysis results, a sensitivity analysis will be conducted by systematically removing each included study one at a time to evaluate its impact on the overall effect size.

Confidence in Cumulative Estimate

The quality of evidence will be assessed using the Grading of Recommendations Assessment, Development and Evaluation framework.[30] Evidence quality will be rated as high, moderate, low or very low, based on risk of bias, consistency, directness, precision and publication bias.[31]

Amendments

Any protocol amendments will be documented with the date, a description of the changes and the rationale behind them.

Ethics and dissemination

Ethical approval was not required in this study because no data are related to an individual patient. The results will be disseminated through peer-reviewed publications.

Patient and public involvement

Existing databases will be used for the purpose of this study. Patients and the public will not be involved in the design of this study.

Contributors HC is the guarantor. DW Conceptualised the research. All authors jointly fomulated inclusion and exclusion criteria. DW, JL and YZ developed retrieval strategies. DW, ZL and YS drafted the manuscript. DW, HD, JL and HC reviewed and revised the manuscript. All authors read, provided feedback and approved the final manuscript. Since there were no native English speakers in the team, we used AI to refine the initial draft to align it better with the preferences of native English speakers. Furthermore, during the research background phase, we employed AI to assist in retrieving the literature, ensuring the inclusion of crucial references and enhancing the comprehensiveness of our research background.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. The datasets generated and/or analysed during the current study will be available from the corresponding author on reasonable request.

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