

Quality of Life and Pulmonary Function after Lung Cancer Treatment: Systematic Review

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ABSTRACT

Introduction: Lung cancer is the leading cause of cancer-related death worldwide. Its treatment has a significant impact on the physical and psychological well-being of patients, resulting in a reduction in health-related quality of life (HRQoL) and pulmonary function.

Objective: To provide a detailed assessment of the available literature on the impact of lung cancer treatment on the quality of life and functioning of patients.

Methods: A systematic review was conducted using advanced searches in the databases The Cochrane Library Plus, PubMed, and Science Direct. The selected publications were thoroughly analyzed, and the PRISMA scale (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) was used to display the selection process.

Results: A total of 51 articles were identified. Studies involving cancers other than lung cancer, or those that did not include questionnaires, spirometry tests, or the effects of physical exercise on patient outcomes, were subsequently excluded. After a full-text review, 11 articles met the previously defined criteria.

This literature review reveals that, in most of the studies examined, the quality of life of lung cancer patients tends to decline after treatment, reflecting the physical, emotional, and social challenges they face throughout the process.

Regarding lung function, the reviewed studies show that it deteriorates following treatment, resulting in a reduction in the patients' respiratory capacity.

Conclusion: Although the results provide evidence of the impact of lung cancer and its treatment on various aspects of life, further research with larger sample sizes is necessary to validate these findings.

KEYWORDS: Lung cancer; quality of life; pulmonary function; survivorship; cancer treatment.

ARTICLE DETAILS

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I. INTRODUCTION

Lung cancer is the leading cause of cancer-related death worldwide. Its treatment has a significant impact on the physical and psychological well-being of patients, resulting in a reduction in health-related quality of life (HRQoL). The World Health Organization (WHO) defines quality of life as "an individual's perception of their position in life within the context of the culture and value systems in which they live," which can simply be expressed as a person's daily response

to the physical, mental, and social effects of disorders that influence their satisfaction in specific life conditions. (1,5)

Due to the large number of symptoms and comorbidities caused by lung cancer, the evaluation of HRQoL has become an essential component in cancer management and should be incorporated routinely to facilitate comparisons between different therapeutic approaches and consequently, help select the most appropriate treatment modality. (2)

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Exercise training is gaining an increasingly important role in lung cancer care. The past decade has seen an exponential increase in evidence (of varying levels of certainty) showing that exercise training is safe, feasible, and effective in improving several outcomes for individuals with lung cancer.

(3)

The eighth edition of the TNM classification for lung cancer reported overall survival (OS) rates at 24 and 60 months ranging from 97% and 92% for patients in stage I to 10% and 0% for those in stage IVB. Lung cancer remains associated with physical, psychological, and social challenges that negatively affect patients' quality of life.

(4)
Chemoradiotherapy is applied in cases of limited-stage cancers, while chemotherapy alone is used for more advanced stages. Lung carcinoma affects regional ventilation and/or perfusion due to atelectasis or pressure on major vessels caused by bronchial obstruction. Thoracic radiotherapy (RT) can improve ventilation-perfusion by reducing tumor size, but it also reduces pulmonary function as a result of lung damage.

(5)
Another treatment for lung cancer is immunotherapy, whose effectiveness has been increasingly studied over time.

Surgical treatment is the best option for managing many pulmonary diseases, including potentially curable ones such as bronchopulmonary carcinoma. The surgeon's goal during resection is to remove the tumor while preserving as much functional lung tissue as possible. The functional loss resulting from pulmonary resection depends on the extent of the resection, the relative functional status of the removed tissue compared to the remaining tissue, and the degree of lung function impairment before surgery.

(6)
This review describes the impact of lung cancer and its treatment on patient health outcomes, including quality of life and pulmonary function after undergoing treatment.

II. MATERIALS AND METHODS

A systematic review was conducted using advanced searches in the databases The Cochrane Library Plus, PubMed, and Science Direct. The following MeSH descriptors were used: Lung cancer, quality of life, pulmonary function, survivorship, cancer treatment. No chronological restrictions were applied, and additional physical reference searches were performed to complement the studies not identified through the electronic search. The selection of articles began with the review of their titles and abstracts. A full-text review was also carried out for studies with inconclusive abstracts. The selected publications were thoroughly analyzed, and the PRISMA scale (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) was used to display the selection process.

The evaluation and selection of studies were conducted by three independent reviewers, following a standardized and non-blinded process. Any disagreements among the reviewers were resolved through consensus. The following inclusion and exclusion criteria were applied: studies that

evaluated the effect of lung cancer and its treatment (chemotherapy, radiotherapy, or surgery) on quality of life and pulmonary function were included, provided they also incorporated assessments such as the Quality-of-Life Questionnaire-Core 30 (EORTC QLQ-C30), Lung Cancer Module (LC13), Nottingham Health Profile (NHP), exercise training programs, and pulmonary function tests, such as forced expiratory volume in 1 second (FEV1) and the ratio of FEV1 to vital capacity (FEV1/VC).

Case reports, letters, and other articles without original data were excluded, as were animal studies and those published in languages other than English, Portuguese or Spanish. A total of 51 articles were identified. Studies involving cancers other than lung cancer, or those that did not include questionnaires, spirometry tests, or the effects of physical exercise on patient outcomes, were subsequently excluded. After a full-text review, 11 articles met the previously defined criteria.

Figure 1 provides a flow diagram used to identify relevant articles for the study, specifying the reasons for exclusion, such as lack of relevance to the study objectives, duplication, failure to meet inclusion criteria, or lack of access to the full text.

III. RESULTS

The results are summarized in Table 1, which includes the authors of each study and the year of publication, as well as the title, sample size, study type, and the conclusions reached by the studies.

Seven of the studies presented focus on the quality of life of patients who underwent some form of treatment to cure lung cancer, including immunotherapy, chemotherapy, radiation, and surgery. Several factors related to quality of life were also examined, such as physical activity, sleep, and mental health. Three of these studies (2,9,10) reported favorable outcomes in patients' quality of life after treatment, while three others (1,7,8) found no significant changes. Ha et al. (11) highlighted modifiable factors associated with the quality of life of lung cancer survivors that could be adjusted to achieve improvement.

Regarding pulmonary function after lung cancer treatment, four studies were analyzed. Two of them (13,15) showed a decline in pulmonary function following treatment. Yokoba et al. (12) noted that pulmonary function varies depending on the location of the lesion, and Okamoto et al. (14) reported that pulmonary function gradually improved in the months following surgery.

IV. DISCUSSION

The aim of this review was to analyze the impact on quality of life and lung function in patients with lung cancer undergoing various treatments. In general, the studies reviewed show that lung cancer treatment affects patients' quality of life and lung function, either positively or negatively. Many of the studies focus on examining different

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factors related to quality of life and their impact across the available treatments.

One study on quality of life in relation to age found that the older a patient is at diagnosis and treatment, the greater

the decline in quality of life, including physical activity, cognition, symptoms, and financial difficulties (1).

Poghosyan et al. (7) found that mental health deteriorated six months after surgery compared to pre-surgery levels,

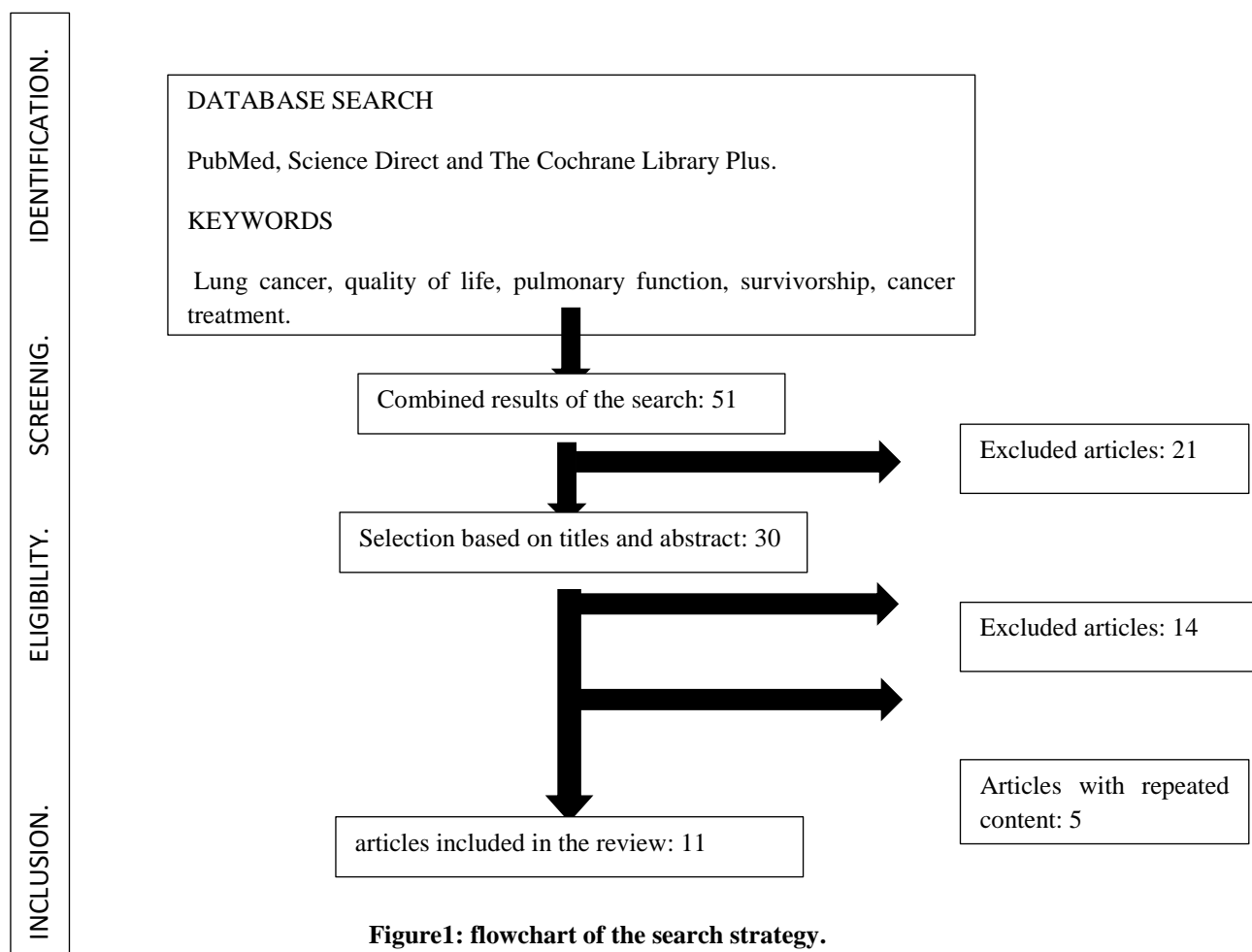


Figure 1: flowchart of the search strategy.

likely due to a decline in physical function, pain, and respiratory symptoms following the procedure.

Montazeri et al. (8) reported in their study on quality of life that patients experienced only slight improvement in sleep difficulties after treatment. These findings highlight the need to assess the quality of life of patients undergoing treatment for lung cancer to minimize any post-treatment deterioration in their well-being.

Three studies (2, 9, 10) showed improvements in quality of life after lung cancer treatment, particularly in areas such as physical activity (exercise), dyspnea, coughing, sleep, and financial difficulties. Leach et al. (10) emphasized the importance of considering patients' exercise preferences.

The study by Win et al. (15) combines the results of pulmonary function tests and exercise tests in patients who underwent lobectomy and pneumonectomy, highlighting the importance of this approach since pulmonary function test results alone do not always correlate with exercise capacity, and vice versa. Exercise capacity was measured using the shuttle walk test, and pulmonary function was assessed

through spirometry, focusing on FEV1 (forced expiratory volume in one second) and FVC (forced vital capacity). Patients were evaluated at one month, three months, and six months after surgery. In the first month, there was a significant reduction in both FEV1 and exercise capacity.

Between the first and third months, improvements were observed in both pulmonary function and exercise capacity, with a more pronounced recovery in pulmonary function. However, no further improvement in pulmonary function was noted after the third month. By the sixth month, both exercise capacity and pulmonary function remained significantly below preoperative levels. Patients who underwent lobectomy showed a 15% decrease in FEV1 and a 16% reduction in exercise capacity, while those who underwent pneumonectomy experienced a 35% decline in FEV1 and a 23% reduction in exercise capacity.

Most studies related to pulmonary function have shown that lung cancer treatment has a negative impact.

Finally, because many interventions are relatively short-term and lack long-term follow-up, scientific knowledge

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regarding the benefits of quality of life improvement interventions continues to grow and spread. More cancer centers are implementing formal programs as part of an integrative psychosocial program. The growing interest in these programs will hopefully stimulate further research (16). Most studies also do not measure patients' symptoms long

after the intervention. In this context, patients would be encouraged to commit to ongoing independent practice, which may prove to be a challenge. It is also uncertain whether informal and less intensive practice would provide the same benefits as the short-term studies discussed here.

Table 1. Studies Evaluating Quality of Life and Pulmonary Function After Cancer Treatment.

Author and year	Title	N	Methods	Conclusion
Suazo-Zepeda et al. (1) 2023	Quality of life after treatment with immune checkpoint inhibitors for lung cancer; the impact of age.	151	Prospective cohort.	Show age of lung cancer patients is significantly associated with changes in Health-Related Quality-of-Life (HRQL) after immunotherapy initiation. Although this association varies depending on the HRQoL domain being considered, changes are generally less favorable for older patients.
Oliveira et al. (2) 2013	Comparison of the quality of life among person with lung cancer, before and after the chemotherapy treatment.	30	Observational and cross-sectional study.	The patients had improvement in the quality of life related to health (QLRH) and symptoms related to lung cancer after chemotherapy treatment, however, there was worsening of symptoms resulting from the toxicity of the chemotherapeutic medications.
Poghosyan et al. (7) 2013	Health-related quality of life after surgical treatment in patients with non-small cell lung cancer.	19 studies	Systematic review.	A small but substantial number of patients continue to have poor mental HRQOL following surgery highlighting the importance of screening for psychosocial distress. It appears that the majority of patients have decreased physical functioning after surgery, which can last up to two-years.
Montazeri et al. (8) 2003	How quality of life data contribute to our understanding of cancer patients' experiences? A study of patients with lung cancer.	82	Prospective study.	Comparing patients' pre-diagnosis and follow-up scores on the Nottingham Health Profile (NHP), only sleep difficulties improved slightly. Patients reported increased perceived health problems of all other characteristics studied (energy and physical mobility). Similar results were observed on the EORTC QLQ-C30 questionnaires indicating that patients' functioning and global quality of life had decreased.
Leach et al. (9) 2015	Exercise preferences, levels and quality of life in lung cancer survivors.	66	Cross-sectional, retrospective survey.	This study found that exercise (EX) after treatment was positively associated with quality of life, but that preference for EX program timing differs between patients who have had surgery and those who have not. Further studies with larger sample sizes are needed to take into account the heterogeneity of this population
Takemura et al. (10) 2014	Effectiveness of Aerobic Exercise and Tai Chi Interventions on Sleep Quality in Patients With Advanced Lung Cancer.	226	Randomized clinical trial.	In this RCT, among patients with advanced lung cancer, aerobic exercise (AE) and Tai-Chi (TC) resulted in statistically significant improvements in sleep disturbances, anxiety, depression, physical function, and circadian rhythm. Notably, participants in the TC group showed greater improvement in sleep than those in the AE group, as well as in survival compared with control group (CG).

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Ha et al. (11) 2022	Modifiable factors associated with health-related quality of life among lung cancer survivors following curative intent therapy.	75	Cross-sectional Observational study.	Significant modifiable factors associated with the HRQoL of disease-free, people were identified, stage I-IIIa lung cancer survivors following curative intent therapy. Interventions to improve the HRQL of these patients should aim to reduce exercise-induced dyspnea, improve role function the ability to perform work and other daily including leisure-time activities, and control insomnia.
Yokoba et al. (12) 2018	Postoperative pulmonary function changes according to the resected lobe: a 1-year follow-up study of lobectomized patients.	59	Prospective study.	Improvements in pulmonary function and symptoms varied according to the resected lobe. Some of the observed pulmonary function values were higher than the predicted postoperative values. Pulmonary function changes may be related to the location, volume, and extent of emphysematous changes.
Takemoto et al. (13) 2021	Changes in pulmonary function and their correlation with dose-volume parameters in patients undergoing stereotactic body radiotherapy for lung cancer.	70	Prospective study.	Forced vital capacity (FVC) and forced expiratory volume in 1 s (FEV1) decreased significantly after stereotactic body radiation therapy (SBRT) for lung cancer, but these changes appeared to be within previously reported ranges. Planning target volume (PTV) was associated with decreased FVC.
Okamoto et al. (14) 2021	Airway inflammation and lung function recovery after lobectomy in patients with primary lung cancer.	61	ND	Preoperative Fractional exhaled nitric oxide (FeNO) is a predictor of delayed lung function recovery 3 months after lobectomy in lung cancer patients. The impact had extended to Vital Capacity (VC) and FEV1. Although this impact is temporary, early postoperative intervention is expected to reduce the adverse effect.
Win et al. (15) 2007	The Effect of Lung Resection on Pulmonary Function and Exercise Capacity in Lung Cancer Patients.	110	Prospective study.	Lobectomy patients suffered significant reduction of functional reserve, with almost equal deterioration between lung function and exercise capacity. Pneumonectomy patients had a more substantial loss of functional reserve, and a disproportionate loss of pulmonary function relative to exercise capacity. Therefore, pulmonary function test values considered in isolation may exaggerate the loss of functional exercise capacity in pneumonectomy patients.

*ND: Nothing Described

CONCLUSIONS

This literature review shows that, in most of the analyzed studies, the quality of life of patients with lung cancer tends to deteriorate after receiving treatment, reflecting the physical, emotional, and social challenges they face throughout the process. However, some studies highlighted that the incorporation of physical activities, such as aerobic exercise or Tai Chi, can positively impact several aspects of patient well-being. Among the observed benefits are significant improvements in sleep quality, as well as in mental and physical health, suggesting that physical activity

could play a complementary role in recovery and in managing the side effects of treatment.

Regarding lung function, the analyzed studies indicate that it is negatively affected after treatment, resulting in a decrease in the respiratory capacity of patients. However, the extent of this reduction varies considerably depending on several factors, including the type of therapeutic intervention used, such as surgery, chemotherapy, radiotherapy, or combined treatments. Additionally, the adverse effects on lung function can be influenced by factors such as the extent of prior lung damage and the patient's overall health condition. Therefore, it is essential to tailor therapeutic

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strategies to each patient's individual characteristics to minimize these effects and, as much as possible, preserve functional respiratory capacity.

Although the findings provide evidence of the impact of lung cancer and its treatment on different aspects of life, further studies with larger sample sizes are needed to confirm these results.

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