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## THERAPEUTIC APPROACHES IN LUNG CANCER

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**Abstract:** Lung cancer is one of the leading causes of cancer death worldwide, and its treatment requires a multidisciplinary approach, taking into account factors such as the stage of the disease, the histology of the tumor and the genetic characteristics of the patient. The main therapeutic modalities include surgery, chemotherapy, radiotherapy, immunotherapy and targeted molecular therapies, with the treatment being chosen based on the clinical conditions and characteristics of the tumor. In the early stages, surgery is the main option, with adjuvant chemotherapy being used to reduce the risk of recurrence. In more advanced stages, the combination of chemotherapy and immunotherapy has shown promising results. Advances in radiotherapy technologies have enabled more precise and effective treatments, while targeted molecular therapies are increasingly being investigated to improve therapeutic response. This paper discusses the latest therapeutic approaches in the treatment of lung cancer, highlighting the advances and challenges in the management of this disease.

**Keywords:** Lung cancer, treatment, chemotherapy, radiotherapy, immunotherapy, molecular therapies, surgery, therapeutic approaches.

## INTRODUCTION

The last decade has seen remarkable advances in the treatment of lung cancer, particularly non-small cell lung cancer (NSCLC). These advances cover crucial areas such as screening, diagnosis and treatments, being driven mainly by the development of molecularly targeted therapeutics, immune checkpoint inhibitors and anti-angiogenic agents. These advances have shown significantly better outcomes for patients, transforming the lung cancer treatment landscape. In addition, increased understanding of specific genetic mutations, such as EGFR, ALK, ROS1, RET, BRAF V600E and eNTRK sensitizations, has

contributed to the personalization of treatment, optimizing targeted therapies for specific subgroups of patients. (ALEXANDER; KIM; CHENG, 2020)

Lung cancer continues to be one of the leading causes of mortality worldwide, with a high incidence and mortality rate in several regions. In India, for example, lung cancer accounts for a large proportion of cancer-related deaths, with an alarming rate of 63,475 deaths recorded in 2018, according to the GLOBOCAN report. The lack of comprehensive data on lung cancer in this country makes it difficult to implement effective treatment strategies. However, advances in molecular diagnostics, including tests for biomarkers such as EGFR, ALK and PDL1, have shown promising therapeutic results, especially in patients with NSCLC. The combination of surgery, radiotherapy, systemic chemotherapy and personalized molecular therapies has provided a significant increase in the overall survival of patients. Immunotherapy, in particular, is emerging as a relevant alternative, especially for those who do not have driver mutations and still need prolonged disease control. (DESHPAND; CHANDRA; RAUTHAN, 2022)

Radiotherapy, in turn, plays an essential role in the treatment of lung cancer, being indicated for up to 77% of patients with this condition. Although it is a widely recommended approach, radiotherapy is still underused in many cases. Technological advances have made it possible to target radiotherapy more precisely, reducing irradiation of surrounding normal tissues and broadening its indications. These innovations have contributed to improving survival and reducing the toxicity associated with treatment, making it an important modality in both early and advanced stages of the disease. (VINOD; HAU, 2020)

Although conventional treatments, such as chemotherapy, and recent advances in targeted therapies and immunotherapy have promoted a significant improvement in clinical results, the recurrence of the disease and the appearance of distant metastases are still significant challenges. In order to optimize the management of patients with NSCLC, it is essential to personalize treatment based on individual characteristics and an accurate classification of the disease, following World Health Organization standards. In this context, aspects such as the patient's nutritional status can also influence tolerance to therapies and quality of life, complementing medical strategies. With continued advances in precision medicine, lung cancer treatment is moving towards a scenario where more effective and personalized strategies can offer a more promising outlook for patients. (ALDUAIS et al., 2023).

## METHODOLOGY

The methodology adopted for this literature review study involved searching for articles published in the last five years, using the PubMed database, with the descriptors "Lung Neoplasms" and "Treatment". The aim was to bring together the most recent therapeutic approaches in the treatment of lung cancer. The inclusion criteria were articles relevant to the topic, published between 2019 and 2024, which addressed surgical, radiotherapeutic, chemotherapeutic, immunotherapeutic and molecularly targeted treatments, according to the stage and conditions of patients with non-microcytic lung cancer (NSCLC). Studies outside the five-year period, articles not available on PubMed or which did not fit the relevance criteria were excluded. In addition, the selection was careful to ensure the reproducibility and transparency of the process, with a focus on the most up-to-date and effective therapeutic interventions, in line with contemporary disease management practices.

## RESULTS AND DISCUSSION

Lung cancer, one of the most aggressive neoplasms with high mortality rates, has a highly individualized treatment, which depends on various factors, such as the stage of the disease, the histology of the tumor, the genetic alterations present and the general condition of the patient. Therapeutic approaches include, among others, surgery, radiotherapy, chemotherapy, immunotherapy and targeted molecular therapies, either alone or in combined modalities. For patients in the early stages of lung cancer, surgical resection is one of the most recommended options, with curative intent, and is indicated mainly for those who are clinically fit. Surgical resection can be complemented by platinum-based adjuvant chemotherapy, which, although it has shown efficacy in reducing the risk of recurrence, still has high toxicity rates and limitations in terms of long-term efficacy. Molecularly targeted therapy, on the other hand, has shown significant advances in the treatment of patients with advanced disease, but there is still no robust evidence of its benefit in the early stages, which limits its applicability in these cases. In patients with locally advanced disease, chemotherapy combined with radiotherapy remains the standard of care, with immunotherapy also being introduced in some clinical scenarios. (ALDUAIS et al., 2023; ALEXANDER; KIM; CHENG, 2020; VINOD; HAU, 2020).

These therapeutic approaches are not mutually exclusive and are often strategically combined to optimize results and offer a more personalized and effective approach to lung cancer treatment. The choice of the ideal treatment should always be made by a multidisciplinary team, taking into account the characteristics of the tumor, the patient's clinical conditions and the advances in available therapies. In this context, the patient's nutritional status emerges as a determining factor for the-

therapeutic success. Malnutrition, often observed in lung cancer patients due to cachexia or the adverse effects of chemotherapy, such as nausea and loss of appetite, can limit tolerance to treatments and increase the risk of post-surgical complications. (ALDUAIS et al., 2023) In this scenario, integrating nutritionists into the multidisciplinary team can help mitigate the side effects of treatments and improve patients' quality of life. (ALEXANDER; KIM; CHENG, 2020)

Technological advances in radiotherapy, such as stereotactic body radiotherapy (SBRT) and intensity modulated radiotherapy (IMRT), have significantly improved results in the treatment of lung cancer. These new technologies allow radiation to be directed more precisely at the tumor, reducing damage to surrounding healthy tissue and, consequently, side effects. SBRT, for example, has proved particularly effective in patients with localized disease and in cases where surgery is not indicated, offering excellent local control with toxicity rates comparable to those of conventional surgery. In addition, improvements in imaging, such as four-dimensional computed tomography (4DCT), have allowed radiotherapy treatments to be more precise, adjusting to the movement of the tumor and ensuring that the prescribed dose is administered accurately. Image-guided radiotherapy (IGRT), which allows continuous monitoring of the tumor during treatment, has also been an important addition to clinical practice, improving overall results and patient safety. Despite these innovations, side effects such as esophageal mucositis and fatigue persist in some cases, impacting food intake and nutritional status, which can affect quality of life during treatment. (DESHPAND; CHANDRA; RAUTHAN, 2022; VINOD; HAU, 2020)

SBRT can be used mainly to treat peripherally located NSCLC at stage I-IIA in clinically inoperable cases or those who refuse surgery. It has been shown to have reduced toxicity and improved quality of life for patients, as well as having a more convenient schedule, especially for elderly patients with comorbidities, increasing its rate of use. However, mortality related to the treatment of centrally located tumors is higher (3.7-8.5%) compared to those located peripherally, although there are studies that manage to maintain low toxicity and mortality, and more studies can be done on the subject (VINOD; HAU, 2020).

As for chemotherapy, it is still one of the main therapeutic options, especially in patients with metastatic disease or in advanced stages. Treatment with chemotherapy, although effective in many situations, is often limited by high toxicity rates and resistance acquired over the course of treatment. Platinum-based regimens, such as the combination of cisplatin or carboplatin with agents such as paclitaxel, gemcitabine or pemetrexed, remain the first-line choice, especially for stage IV patients. However, the use of chemotherapy in combination with other therapies, such as immunotherapy and targeted molecular therapies, has been increasingly explored, with the aim of improving overall results, prolonging survival and improving patients' quality of life. Targeted therapies, in particular, have shown a considerable impact on patients with specific genetic alterations, such as mutations in EGFR, ALK and others, improving the response to treatment and reducing adverse effects compared to conventional chemotherapy. At the same time, nutritional support can help reduce the toxicity associated with chemotherapy and support immunotherapy, contributing to the physical functionality of patients during treatment (ALDUAIS et al., 2023; DESHPAND; CHANDRA; RAUTHAN, 2022) .

Another form of therapy used is encapsulated nanodrug delivery systems, due to their distinctive properties of being administered precisely to tumor sites, as well as reducing non-specific damage to the target tissue, improving the efficacy of the drug. They have several benefits, including: greater bioavailability; greater safety; and controlled release of the drug during administration, consequently improving the therapeutic effects and providing an alternative to classic treatments, with fewer side effects. (LI; YAN; HE, 2023)

One form of minimally invasive treatment is photothermal therapy, which has shown favorable results in the treatment of tumors. This therapy can combine a photothermal agent with local laser irradiation to treat tumors. It is proving to be an excellent agent when used in conjunction with nanotechnology. Immunotherapy strategies are also being used, which, when combined with other methods, have proved to be an excellent alternative for the treatment of NSCLC (LI; YAN; HE, 2023).

These therapeutic approaches are not mutually exclusive and are often strategically combined to optimize results and offer a more personalized and effective approach to lung cancer treatment. The choice of the ideal treatment should always be made by a multidisciplinary team, taking into account the characteristics of the tumor, the patient's clinical conditions and advances in available therapies. (VINOD; HAU, 2020)

## CONCLUSION

The treatment of lung cancer has evolved significantly, incorporating advances in surgery, radiotherapy, chemotherapy, immunotherapy and targeted molecular therapies. The choice of the ideal treatment depends on several factors, including the stage of the disease, the molecular characteristics of the tumor and the patient's clinical conditions. For early cases, surgery remains the main therapeutic

option, while adjuvant chemotherapy and radiotherapy complement treatment in more advanced stages. In cases of metastatic or locally advanced lung cancer, the combination of chemotherapy with immunotherapy has shown promising results, especially for patients with specific genetic mutations. In addition, advances in radiotherapy technologies, such as SBRT and IMRT, have improved local control and quality of life for patients, offering effective alternatives for those who are not candidates for surgery.

Despite these advances, challenges such as recurrence, resistance to treatment and toxicity still persist, requiring continuous medical innovation. The optimization of classic

therapies, combined with the development of new therapeutic approaches, has been key to reducing mortality and minimizing side effects. Although targeted molecular therapies are being increasingly explored, more studies are needed to evaluate their application in the early stages of the disease. In this context, the work of a multidisciplinary team is essential to improve clinical outcomes, offer comprehensive support to patients and promote an integrated and effective approach. In short, the treatment of lung cancer is increasingly personalized and guided by a multidisciplinary approach, aimed at improving patient outcomes and survival, with promising prospects for the future of oncology.

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