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SURGICAL TACTICS IN LUNG METASTASES: A COMPREHENSIVE ANALYSIS AND PERSPECTIVES FOR CLINICAL DECISION MAKING

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Abstract: **Goal:** This article proposes to analyze and summarize the different surgical strategies applied in the treatment of lung metastases originating from primary cancers. Methods: A bibliographic review was carried out in the PubMed database. The search strategy resulted in the identification of 659 articles, of which 9 were selected after applying criteria. **Discussion:** A reduction in diagnostic resections and an increase in curative resections were observed. The advancement of video-assisted thoracic surgery (VATS) and open surgery has a positive impact on the treatment of metastatic lung neoplasms. The importance of continuous adaptation of surgical practices in the face of innovations is highlighted, with a focus on less invasive approaches and personalized treatment. Both VATS and neoadjuvant therapies influence prognosis, even for tumors previously considered unresectable. In metastatic melanoma, surgical indications have evolved with systemic therapies and surgical advances, including VATS. The approach to bone metastases prioritizes specific criteria, imaging exams and minimally invasive surgery, aiming for an effective recovery. **Final considerations:** The complexity of surgical strategies for lung metastases highlights the importance of continued research and innovation.

Keywords: Lung metastases, thoracic surgery, video-assisted thoracoscopy, therapeutic innovations, patient prognosis.

INTRODUCTION

Metastasis is an intrinsic characteristic of malignant tumors, characterized by their ability to invade surrounding tissues, lymphatic and blood vessels, resulting in greater aggressiveness and dissemination beyond the primary site, being, unfortunately, the main cause of death in cancer patients (BRAZIL, 2022). It is essential to note that

different types of primary cancer demonstrate distinct genetic propensities to affect specific organs, with the lung and liver standing out as prominent targets of distant metastases (OZGUR, G. K. et al., 2023).

The relevance of this topic is further emphasized by the finding that 20% - 25% of cancer patients already manifest distant metastases at the time of diagnosis (OZGUR, G. K. et al., 2023).

The lungs and liver emerge as the most frequent sites of distant metastases in patients with primary cancer (OZGUR, G. K. et al., 2023). The formation of metastases is a complex phenomenon, related to the interaction between malignant cells, stromal cells that produce cytokines, chemokines and growth factors, together with the immune system response. This interaction favors the degradation of the extracellular matrix of the primary cancer tissue, which can culminate in the invasion of connective tissue and subsequent dissemination to secondary sites, establishing the scenario of metastasis (PALACIOS-ARREOLA, M. I. et al., 2022).

Given the complexity of managing patients with lung metastases, a variety of surgical techniques have been employed in an attempt to reverse this condition. Video-assisted thoracic surgery (VATS), originally developed for the detection and treatment of benign conditions of the lungs, pleura, diaphragm, mediastinum and upper gastrointestinal tract, is now successfully used in the treatment of primary lung cancers and lung metastases. A common feature of these metastases is their peripheral location, making them ideal candidates for VATS due to the possibility of wedge resection. However, this approach remains controversial due to the limitation in tactile detection of the nodule and therefore the possibility of incomplete resection. On the other hand, open surgery, being the most frequently used technique for pulmonary metastasectomy, allows manual palpation of the lung parenchyma, enabling the identification of occult metastases not revealed by preoperative computed tomography. This aspect is different from VATS, which depends on the location as evidenced in the preoperative image and intraoperative palpation of the instrument (CLARAMUNT, N.P, et al., 2020).

According to Claramunt N.P. et al. (2020), open surgery and VATS have similar survival benefits, with VATS exhibiting a lower risk of postoperative complications and faster recovery. However, it is worth highlighting that the selection of the surgical technique must be carried out considering diagnostic accuracy and the patient's condition.

Other surgical techniques are applied to early-stage primary lung cancer, including segmentectomy and lobectomy, which demonstrate similar postoperative complications and survival rates (GAO, X. et al., 2023). Thoracoscopic-assisted surgery demonstrates similar complications to open surgery for lobectomy in early-stage lung cancer, but has a lower pain threshold and improved quality of life (GAO, X. et al., 2023). This suggests that video-assisted thoracoscopy may be the preferred surgical approach for early-stage cancers, based on satisfactory results regarding quality of life.

To evaluate the prognosis of patients, several factors are considered determinants, including age, sex, location of metastases, stage of primary cancer, size of metastatic nodules, presence of lymphatic metastases, neoadjuvant chemotherapy, type and number of chemotherapy sessions and surgical resection. of the tumor (OZGUR, G. K. et al., 2023). However, it is crucial to note that untreated patients have a poor prognosis, with a median survival of up to nine months. In contrast, those who receive treatment demonstrate an increase in life expectancy,

with a median survival of 20 to 22 months, resulting in a 5-year survival rate of 50% for patients with resectable lung metastases (OZGUR, G. K. et al., 2023).

This literature review article aims to carry out an in-depth analysis of the various surgical strategies used in the treatment of lung metastases from primary cancers. Furthermore, it seeks to evaluate the impact of these approaches on patients' prognosis. This review will provide valuable guidance for healthcare professionals in choosing best practices for the management of lung metastases, taking into consideration, clinical outcomes and prognosis.

METHODOLOGY

This study refers to a literature review that was conducted in accordance with the criteria of the PVO strategy, which involves the analysis of Population or Research Problem, Variables and Outcome. This methodological approach was applied to answer the following central question: "What are the most effective surgical approach strategies in the treatment of lung metastases originating from primary cancers, and what is the impact of these strategies on patients' prognosis?" In this context, the population or problem researched involves patients with lung metastases resulting from primary cancers, and the focus is on evaluating the most effective surgical approaches, as well as understanding how these strategies affect the prognosis of these patients.

The literature search was conducted in the PubMed Central (PMC) database and used the descriptors "Lung Neoplasms Secondary" and "Surgery", combined with the Boolean term "AND". This initial search resulted in a total of 659 articles, which were subsequently subjected to selection criteria. The inclusion criteria adopted covered: articles published in English and German; published between 2018 and 2023; that addressed the themes relevant to this research, including systematic reviews, cohort studies, clinical trials and original articles available in full. The exclusion criteria included articles that did not directly address the research proposal and that did not meet the other inclusion criteria. After rigorous application of these criteria, a total of 9 articles were selected from the PubMed database to compose the present study, contributing significantly to the analysis of the most effective surgical strategies in the treatment of lung metastases resulting from primary cancers and their impact on prognosis. of patients.

DISCUSSION

INDICATIONS AND MANAGEMENT OF SURGICAL INTERVENTIONS

The study highlights the importance of continuous adaptation of surgical practices in the face of therapeutic innovations. Future prospects include the search for even less invasive approaches, the individualization of treatment based on molecular characteristics, and the continued integration of systemic therapies to optimize clinical outcomes in patients with secondary lung cancer.

Lung lesions originating from primary metastases from other organs represent a significant challenge due to their unfavorable prognosis. Treatment centers on surgical resections and metastasectomy, while alternatives such as ablation and brachytherapy are considered (JONCZYK, M. et al., 2018). However, it is crucial to consider specific criteria when deciding on these treatments (ZHONG, J. et al., 2020).

The identification of potential lung metastasectomy surgeries is an important step, but it is equally vital to correlate the criteria for surgical performance, going beyond those with merely curative intent. These criteria include confirmation of the diagnosis in patients with

a history of neoplasia, presenting detectable lung nodules on follow-up CT scans, in addition to excision of residual mass after chemotherapy treatment. Obtaining adequate metastatic tissue for analysis and reducing tumor burden, especially for secretory tumors, are also essential considerations to ensure individual benefits for each patient (MOTAS, N. et al., 2023).

Ensuring an adequate prognosis requires a thorough investigation, covering detailed information about the patient, the type of lung metastasis, surgical selection parameters and the different surgical options available. Elements such as the number of metastases, primary location and extent of lymphatic excision play fundamental roles in determining survival (MOTAS, N. et al., 2023). The integration of these factors into therapeutic decisions provides a more comprehensive and personalized approach to the treatment of lung metastases, contributing to better clinical outcomes.

The prevalence of metastatic melanoma in lung tissue, approximately 40% of cases, has historically highlighted surgical interventions, particularly resection, as the main approach. However, given the advancement of systemic therapies, such as targeted therapy and immunotherapy, the analysis of neoadjuvant therapies gains relevance in recent studies, impacting surgical indications (DEBOEVER, N. et al., 2022).

According to research by Deboever N. et al. (2022), who examined data from a thoracic surgery department at the University of Texas MD Anderson Cancer Center, thoracotomy was the predominant surgical technique (73.2%), with non-anatomical sublobar resection as the most frequent type (71.6 %). Over the years, there has been a reduction in diagnostic resections and an increase in curative resections, as well as surgeries for treatment and tissue collection (DEBOEVER, N. et al., 2022).

The research pointed to a change in surgical indications for metastatic pulmonary melanoma over time, reflecting the evolution of systemic therapies and surgical techniques. Initially, diagnostic resection prevailed, but minimally invasive therapies and video-assisted thoracoscopy have gained ground. The trend shows an increase in the indication of video-assisted thoracoscopy, allowing the collection of cells to guide systemic therapies. This scenario positively influenced patients previously considered unresectable, providing optimistic perspectives.

The three-year analysis of overall survival revealed a significant increase over the period, indicating a positive correlation with changes in surgical indications. The implementation of neoadjuvant systemic therapies and improvement of surgical techniques, including video-assisted thoracoscopy, contributed to an increase in the prognosis of patients with metastatic pulmonary melanoma (DEBOEVER, N. et al., 2022).

Primary lung neoplasia frequently results in metastases in bone tissue, with the spine (50% of cases), costal arches (27.1% of cases) and sacral bone (7.1% of cases) being the most impacted sites. The preoperative approach requires care to qualify the patient for surgical intervention with curative intent. Imaging exams, such as tomography of the chest, abdomen and pelvis, magnetic resonance imaging of the skull and bone scintigraphy, are essential to identify single, well-defined metastases. Mediastinoscopy is mandatory to exclude other secondary determinations, and biopsy of the neoplastic tissue is crucial for a complete diagnostic formulation.

Surgical resection of the primary lung tumor can occur simultaneously with the resection of the metastatic bone tumor, as long as it is within oncological limits, possibly after chemotherapy sessions, depending on

the tumor location and the functionality of the bronchial tree. The option for minimally invasive surgery is viable, considering the location of the tumor, size, extension, respiratory function and general clinical picture. This approach aims to reduce postoperative pain and hospital stay, providing a faster and more satisfactory recovery. This enables subsequent discussion of metastatic treatment, whether by surgical resection or adjuvant chemotherapy (NISTOR, C.E. et al., 2022).

NEW PERSPECTIVES ON THE SURGICAL APPROACH TO METASTATIC LUNG CANCER

The lung, acting as a filter in the blood circulation, is frequently affected by metastases, with one third of patients with metastatic cancer presenting pulmonary involvement. Colorectal cancers, sarcomas, breast cancers, renal cell cancers and head and neck carcinomas are the main causes of lung metastases (MOTAS, N. et al., 2023). Recently, advances in scientific research have impacted both the diagnosis and treatment of this challenging clinical scenario.

Effective diagnosis of metastatic lung cancer depends on the accuracy of imaging tests. Initially, chest radiography offers preliminary information, while computed tomography (CT) or PET/CT is more sensitive for identifying tumors and lymph node spread. Magnetic resonance imaging (MRI) stands out in identifying infiltrations in the chest wall and mediastinum. The TNM classification is widely used to determine the extent and stage of malignant cancers, which are essential for therapeutic planning. T (size and extension of the tumor), N (lymph node involvement) and M (metastases) make up the classification criteria (WANG, X. et al., 2023).

Management of lung metastases requires an interdisciplinary approach, including surgery, systemic treatment, immunotherapy, and targeted therapies. Surgery remains the standard treatment, aiming at complete resection of the tumor, preserving as much lung tissue as possible. Effective alternatives include stereotactic body radiation therapy (SBRT), laser enucleation, and local ablation techniques. Less invasive options, such as VAST (videothoracoscopy) and CT-guided high dose rate brachytherapy (CT-HDRBT), are preferable (MOTAS, N. et al., 2023). The systemic approach, before or after surgery, significantly impacts patient survival. For cases of multiple metastases, systemic chemotherapy is the preferred choice. The debate about lymphadenectomy in pulmonary metastasectomy is ongoing, presenting arguments for and against. Studies indicate a significant survival advantage with systematic lymph node resection, although there is a lack of randomized studies, and the data are based on case series, making comparative survival analyzes difficult (MOTAS, N. et al., 2023; WANG, X. et al., 2023).

FINAL CONSIDERATIONS

The study highlights the challenging scenario of surgical strategies used in the treatment of lung metastases originating from primary cancers. The conventional approach through thoracotomy prevails, however, video-assisted thoracic surgery (VATS), characterized by its minimally invasive nature, emerges as an alternative that can reduce the risk of complications and accelerate postoperative recovery. Future perspectives in this scenario include the incessant search for even less invasive approaches, the personalization of treatment based on specific molecular characteristics and the synergistic integration of SYSTEMIC therapies. Recent innovations, such as video-assisted thoracoscopy and neoadjuvant therapies, demonstrate a positive impact on prognosis, even in cases previously

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considered unresectable. This study provides a comprehensive view of surgical strategies applied to lung metastases, and the clinical and prognostic implications discussed provide valuable support for decision-making by healthcare professionals. The continued importance of research and innovation in the field is highlighted, while analysis of current trends identifies specific areas that still require in-depth investigation.

REFERENCES

CLARAMUNT, N.P. et al. Incidence of ipsilateral side recurrence after open or video-assisted thoracic surgery resection of colorectal lung metastases. The Annals of thoracic surgery, v. 109, n. 5, p. 1591-1597, 2020.

DEBOEVER, N. et al. The Role of Surgery in the Treatment of Melanoma Pulmonary Metastases in the Modern Era. Journal of Surgical Research, v. 277, p. 125-130, 2022.

GAO, X. et al. Longitudinal patient-reported outcomes 1 year after thoracoscopic segmentectomy versus lobectomy for early-stage lung cancer: a multicentre, prospective cohort study protocol. BMJ open, v. 13, n. 1, p. e067841, 2023.

JONCZYK, M. et al. Primary and metastatic malignancies of the lung: Retrospective analysis of the ct-guided high-dose rate brachytherapy (ct-hdrbt) ablation in tumours< 4 cm and≥ 4 cm. European Journal of Radiology, v. 108, p. 230-235, 2018.

MOTAS, N. et al. Oncologic Outcome after Pulmonary Metastasectomy as Part of Multidisciplinary Treatment in a Tertiary Oncological Center. Diagnostics, v. 13, n. 1, p. 165, 2023.

NISTOR, C.E. et al. Management of lung cancer presenting with solitary bone metastasis. Medicina, v. 58, n. 10, p. 1463, 2022.

OZGUR, G.K. et al. The İmportance of tumor markers in patients undergoing resection for lung metastasis of colorectal carcinoma. The Clinical Respiratory Journal, v. 17, n. 5, p. 429-438, 2023.

WANG, X. et al. Outcomes and prognosis of non-small cell lung cancer patients who underwent curable surgery: a protocol for a real-world, retrospective, population-based and nationwide Chinese National Lung Cancer Cohort (CNLCC) study. BMJ open, v. 13, n. 6, p. e070188, 2023.

ZHONG, Jim et al. Long-Term Outcomes in Percutaneous Radiofrequency Ablation for Histologically Proven Colorectal Lung Metastasis. CardioVascular and Intervencional Radiology, v. 43, p. 1900-1907, 2020.