



## Lung autotransplantation for the treatment of locally advanced tumors

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### TO THE EDITOR

Since the first pneumonectomy for the treatment of lung cancer, reported by Graham in 1933, and the first sleeve lobectomy for sparing lung function in 1947, by Thomas, an important discussion has been underway regarding the extension of surgical treatment and the morbimortality inherent to pneumonectomy, and the possible complications of sleeve lobectomy for the treatment of lung cancer.<sup>(1,2)</sup>

Here we describe the case of a 66-year-old man, a heavy smoker (25 pack-years and social alcoholism) with chronic obstructive pulmonary disease, who had been receiving treatment, without exacerbations within the past year, and no other comorbidities. The patient sought medical assistance due to left chest pain. Chest computed tomography (CT) showed a contralateral central mass along the course of the fissures, measuring 5 cm in its longest axis, involving the lobar bronchus of the upper lobe and contacting the bronchus of the middle lobe. Signs of invasion of the lower lobar artery and segmental branches of the middle and upper lobe were noted, with apparent hilar lymph node enlargement, without pleural effusion or other satellite lesions. Transthoracic biopsy revealed a primary Squamous Cell Carcinoma. PET-CT showed hypermetabolism of the mass (SUVmax 15.4) and hilar node (SUVmax 5.9). Brain MRI without distant metastasis. A videomediastinoscopy was performed with sampling of lymph nodes 2R, 4R, and 7, all of which were negative. Pulmonary function test showed FVC 2.75L – 73% of the predicted value, FEV1 1.64L – 55% of the predicted value, and a 0.6 FEV1/FVC ratio – 75% of the predicted value, featuring moderate obstructive ventilatory disorder. Cardiological evaluation was within the normal range, and the 6-minute walk test was > 400 meters without desaturation.

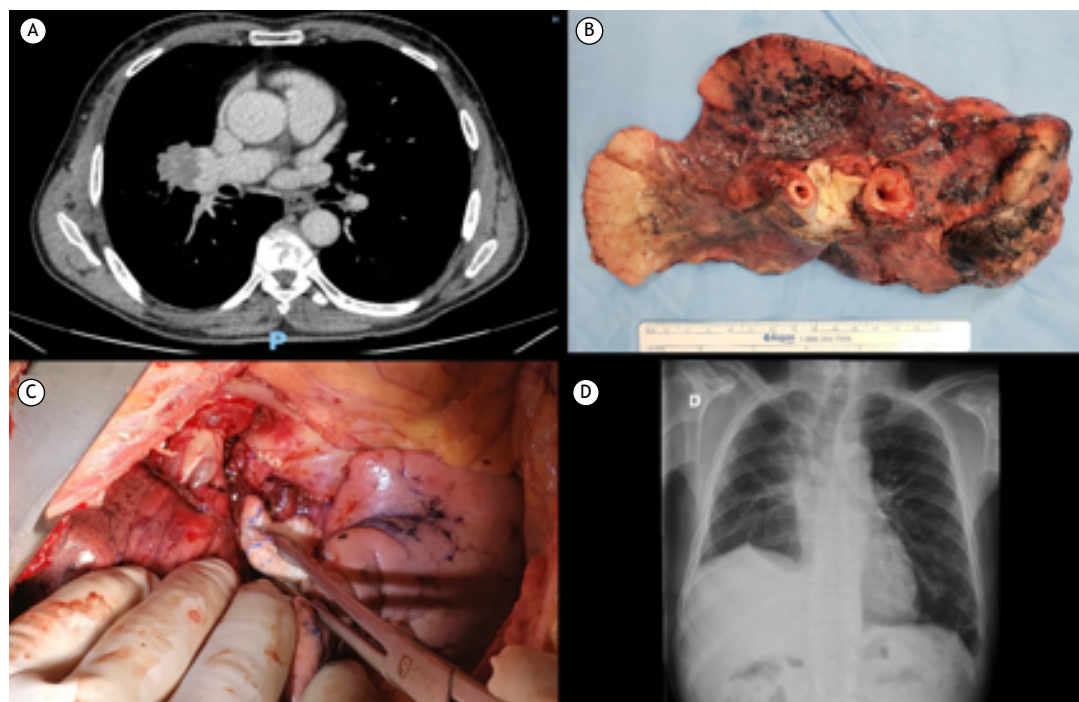
Given the extension of the tumor with bronchial invasion, the magnitude of interlobar artery involvement, and the presence of a tethering effect by the inferior pulmonary vein, double-sleeve lobectomy seemed technically unfeasible, while right pneumonectomy was a high-risk procedure due to the patient's impaired pulmonary function. We moved onto a multidisciplinary board to propose a lung autotransplant with right pneumonectomy, upper and middle lobe lobectomy, and reimplantation of the right lower lobe (RLL).

After providing consent, the patient underwent a right posterolateral thoracotomy with heparinization of the right pulmonary artery. A radical right pneumonectomy was

performed, taking care to keep the pulmonary vessel stump for as long as possible to allow for a secure anastomosis. Radical lymphadenectomy of stations 2R, 4R, 7, 10R, and 11R was carried out. At the back table, antegrade and retrograde flush was conducted using pulmonary preservation solution – Perfadex® (Vitrolife; Gothenburg, Sweden), maintaining constant ventilation of the RLL. Afterward, a right upper bilobectomy was performed, with safe margins and meticulous preparation of the artery, vein, and bronchus of the RLL for reimplantation. The reimplant technique involved the following procedures: end-to-end anastomosis of the right main bronchus to the graft bronchus using polypropylene 4-0, running suture at the membranous portion and simple stitches at the cartilaginous portion; right pulmonary artery anastomosis with running polypropylene 5-0, and graft of the lower vein to the upper vein with running polypropylene 5-0; total cold ischemic time of 210 minutes. The patient was extubated in the operating room and sent to the ICU. He developed hypoxemia due to pulmonary embolism, requiring anticoagulation, and was reintubated due to pneumonia on the 9<sup>th</sup> postoperative day (POD), undergoing mechanical ventilation for 8 days. After this critical initial period, he recovered and was discharged home on 34<sup>th</sup> POD. Pathology showed invasive Squamous Cell Carcinoma stage pT3pN1 (AJCC 8<sup>th</sup> edition), with tumor-free resection margins including all critical anastomoses. He received adjuvant chemotherapy, and his follow-up was uneventful 7 months later (Figure 1).

Sleeve resections have acceptable morbidity and similar survival rates to those observed in lobectomies.<sup>(3,4)</sup> However, it is also known that pneumonectomy has higher morbimortality when compared to the two procedures (5-7% vs. 1%), especially on the right side, which is 2-fold higher than on the left on account of bronchopleural fistulae.<sup>(5,6)</sup> Indeed, despite the consolidated indication of sleeve and double-sleeve resections, which may spare pulmonary function, in widespread lesions, the gap of the bronchovascular stumps precludes an unchallenging surgery due to technical issues.<sup>(7)</sup> Therefore, in order to achieve a tension-free anastomosis and reconstruction of the bronchovascular structures, a radical pneumonectomy with *ex situ* dissection and autotransplantation of the healthy graft may be the best choice. Since the 2000s, few cases have been reported, and despite the prejudgment beyond this method and its indications, it proves effective, with no extra time or cost, except for the perfusion. Regardless of no allograft rejection, with adequate perfusion and shorter ischemic time, the complication

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**Figure 1.** A: Preoperative axial tomographic section; B: Surgical resection showing intimate relationship of the tumor with the bronchovascular structures; C: Perihilar anastomosis after graft implantation; D: Late postoperative chest radiography.

of this technique is similar to double-sleeve lobectomy with lung function preservation.<sup>(8-10)</sup>

Lung sparing surgery must be a priority in locally advanced tumors and should be advocated whenever possible. However, in cases where sleeve lobectomy is impossible, lung autotransplantation is feasible and should be proposed as an alternative for patients with impaired pulmonary function. A good preoperative evaluation, surgical team expertise with stepwise meticulous preparation, and multidisciplinary approaches

are cornerstones for developing a surgical program for complex cancer cases.

#### AUTHOR CONTRIBUTIONS

JMLTB, GLA, OGJR, BJB, and MNS: conception and planning of the study; data collection and tabulation; creation of figures; drafting and revision of the manuscript; formatting of the manuscript in accordance with the JBP instructions for authors, and approval of the final version.

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