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CASE REPORT / ПРИКАЗ БОЛЕСНИКА

Surgical treatment of lung tumors with superior vena cava infiltration

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SUMMARY
Introduction Direct malignant invasion by primary lung tumors or by nodular metastases is the most frequent indication for superior vena cava resection and reconstruction.
The aim of our work is to underline the importance of good evaluation and preoperative workup from the standpoint of the overall survival.
Case outline A male patient, aged 61 years, was admitted for the surgical treatment of adenocarcinoma of the right lung upper lobe. The proposed protocol for the treatment of our patient comprised radiological verification, biopsy with histopathology analysis, standard upper lobectomy with mediastinal lymphadenectomy and with resection of the superior vena cava in a length of about 30 mm. Reconstruction of the superior vena cava was done by implanting a 16 mm INTERGARD vascular graft, using the running suture. In our patient, grafting and bridging the superior vena cava structure prevented the development of postoperative vascular complications and improved survival from the beginning of the treatment.
Conclusion Mixed thoracic and vascular surgical treatment reduces postoperative complications and improves survival.
Keywords: surgical treatment; lung tumor; superior vena cava

INTRODUCTION

Surgical resection is controversial for patients with lung cancer infiltrating a great vessel because of its poor prognosis, although it can be an oncologic emergency leading to circulation and airway compromises.

Superior vena cava (SVC) infiltration represents a complex diagnosis confirmed with imaging studies. Initial evaluation includes a detailed lung cancer history and physical examination. Using chest radiography, a growing right-sided mediastinal or hilar mass is seen in most lung cancer patients. Some authors suggest perfusion lung scintigraphy as a complement to morphological diagnosis as part of the preoperative evaluation of patients [1, 2, 3]. Based on the above, it could be said that perfusion scintigraphy has its place in the diagnostic algorithm as part of the assessment of functional operability. Contrast-enhanced computed tomography can further delineate the point of infiltration and the size and character of the infiltrating mass (tumor or nodal involvement), as well as evaluate any additional structures the tumor has invaded.

Dartevelle et al. [4] and others recommend the radical approach by using combined surgical technique that improves the five-year survival rate [5]. Some other authors prefer sparing surgery, especially when the advanced tumor growth with the invasion of the SVC or IVC is a limiting factor [6].

The aim of this case report is to underline the importance of good preoperative evaluation and preparation for the operative mortality and overall survival in patients with lung cancer infiltrating a great vessel that underwent a radical resection for primary lung cancer and an infiltrated great vessel.

CASE REPORT

A male patient, aged 61 years, was admitted for the surgical treatment of adenocarcinoma of the upper lobe of the right lung. Medical history revealed that the dyspnoea symptoms occurred six months earlier, with pain in the right hemithorax that occurred after a trauma. Clinically, there were no conspicuous findings, while biochemically increased inflammation factors, with normocytic normochromic anemia, were demonstrated.

Radiological findings in lung posteroanterior projection verified a tumor shadow in the upper right lobe (Figure 1).

The patient was pulmonary fully processed, with spirometry in terms of obstruction and FEV1: 1.87 (61%). He also underwent bronchoscopy, by which subsegmental bronchus closed with white tumor mass patches was verified and then bronchobiopsy proved adenocarcinoma (histopathologic findings: adenocarcinoma pulmonis G3). Multislice computed tomography (MSCT) of the chest

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Figure 1. Conventional chest radiography in the posteroanterior projection: shading in the upper right lobe

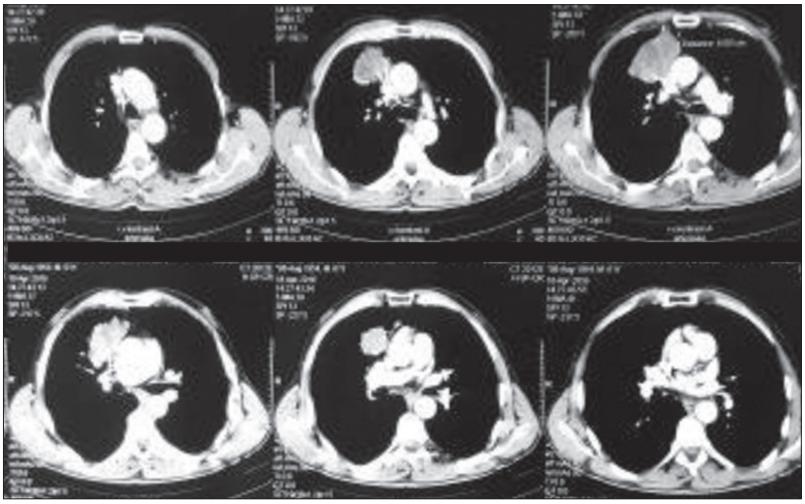

Figure 2. Multislice computed tomography of the chest: tumor's change, diameter up to 70 mm in the anterior segment of the upper lobe, the superior vena cava not invaded

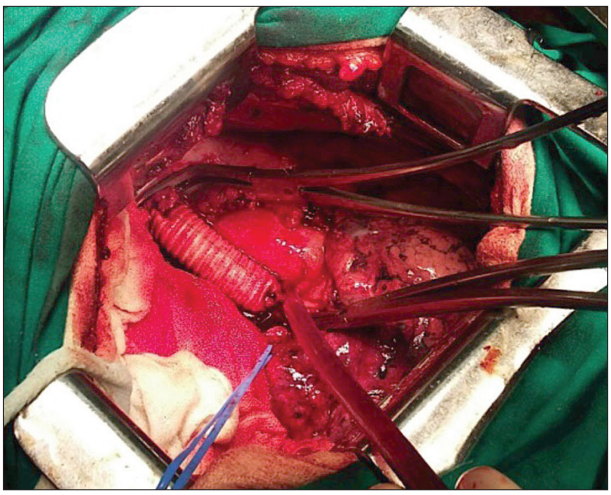

Figure 3. Implantation of the graft at the site of the resected part of the superior vena cava

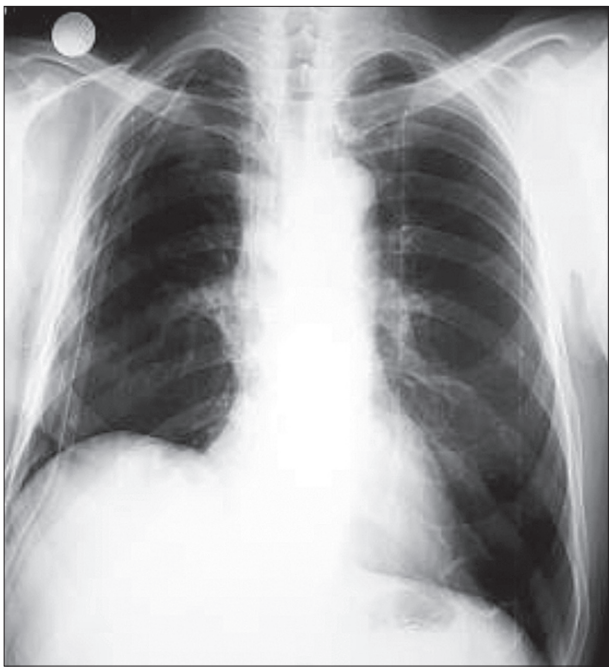

Figure 4. Control radiography: lungs expanded, neat transparency, without pleural effusion, drain in a good position, elevation of the right hemidiaphragm (after ligation of the phrenic nerve)

pointed out a tumor with a diameter of 70 mm in the anterior segment of the upper lobe, limited by medial mediastinal pleura, which reaches the ascending aorta and the SVC (Figure 2). Pathologically altered mediastinal or hilar lymph nodes were not seen. In the case of our patient, using visual method (MSCT of the chest), invasion of the SVC was not verified, which was proved intraoperatively and resolved, while the functional diagnostics were never done. Perfusion scintigraphy detected T4N2M0 carcinoma of the right lung – clinical stage IIIB (perfusion scintigraphy: perfusion defect in the first, second, and partially in the sixth segment of the right lung; disturbed perfusion in polycyclic restricted zones in both hili; mediastinum was widened, predominantly at the expense of the anterior mediastinum; the perfusion index: 45.5% of the right lung, 54.5% of the left lung).

Complete preoperative examination authenticated the existence of bronchogenic adenocarcinoma of the bronchus of the upper lobe, 70 mm in diameter, without mediastinal and hilar lymphadenopathy and with no metastatic changes. Good general condition of the patient, preserved pulmonary function, the absence of co-morbidities and local resectability of the tumor were taken into account when deciding on surgical treatment. According to the TNM classification, the tumor was estimated as T2b, N0, M0, the disease stage IIA. The thoracotomy was performed by the access through the fourth intercostal space, with separate ventilation. Intraoperatively, the existence of tumor in the upper lobe was verified; the tumor directly invaded the SVC in the length of about 2 cm extrapericardially, without involving the hilar elements. The patient underwent a standard upper lobectomy with mediastinal lymphadenectomy with resection of the SVC, in the length of about 30 mm. The SVC reconstruction was performed by implanting a 16 mm INTERGARD vascular graft, using the running suture. The time for SVC clamping was about 15 minutes. The postoperative care was uneventful, with

no significant bleeding and with the usual aerostasis duration. The pathohistological findings confirmed transmural tumor expansion in the SVC segment, 20 × 25 mm in size, with no pathologically altered hilar and mediastinal lymph nodes. By using TNM classification, the tumor was revised as T4 N0 M0, stage IIIA.

The combination of vascular and thoracic surgical techniques provided a complete tumor resection, resection of the SVC with the implantation of the graft, and right upper lobectomy (Figure 3). After the intervention, a control radiography was performed (Figure 4).

DISCUSSION

Although many authors have reported favorable results of surgical operations for a T4 NSCLC infiltrating a great vessel, surgical indications for a combined resection of a great vessel remain controversial [7]. Direct malignant invasion by primary lung tumors or by nodular metastases is the most frequent indication for the SVC resection and reconstruction. The reason for the vulnerability of the SVC to tumors arising both in the lung and anterior mediastinum is its anatomy. Primary tumors of the SVC, saccular aneurysms or primary malformations and traumatic lesions (iatrogenic, blunt, or penetrating injuries) are infrequent indications [8]. Contraindication to surgical resection and replacement is the presence of SVC syndrome related to unresectable tumors. Kuehnl et al. [6] point out that advanced tumor growth with the invasion of the SVC or IVC is generally considered a contraindication for surgery. Other frequent contraindications are completely obstructed SVC with rich collateral vein circulation and abnormal walls of the proximal veins. Particular attention is demanded for patients undergoing induction chemoradiotherapy [8, 9].

Some data suggest that radical resection of lung cancer involving the SVC may result in a permanent cure in carefully selected patients [7]. Good preoperative evaluation and preparation are considered to be very important for the operative mortality and overall survival. Very few studies have dealt with prognostic factors that would be useful in the selection of patients of the SVC resection for lung cancer. A follow-up study with 109 participants recorded that both pneumonectomy and complete resection of the SVC with prosthetic replacement were associated with an increased risk of death [10]. Also, an almost six times higher five-year survival rate was found among patients with SVC invasion by metastatic nodes compared to those with SVC invasion by a direct tumor extension (6.6% versus 36%) [10]. The pattern of SVC invasion, as a significant prognostic factor, should also be taken into consideration for therapeutic decision.

In the study by Georgieva et al. [1], preoperative modalities as part of the treatment of lung cancer were analyzed on 25 patients, emphasizing the particular importance of ventilation and perfusion scintigraphy in the evaluation of functional operability (Figure 1). In the past years, the proposed protocol for the treatment of our patient used to comprise radiological verification, biopsy with histopathology analysis, perfusion, and only then, if scintigram is pathologically positive, video-assisted thoracoscopic surgery, mediastinoscopy, or thoracotomy [1, 2, 3].

The new recommendations involve a right thoracotomy in the fourth or fifth intercostal space for upper lobe tumors invading the SVC in selected patients. Complete median sternotomy is the standard approach for tumors of the anterior mediastinum [8]. After pneumonectomy (with or without carinal resection) or lobar resections, proposed modes for SVC resection and reconstruction are prosthetic SVC replacement, partial resection with running suture, vascular stapler, or patch [4, 8, 10].

Spaggiari et al. [10] found that the mortality rate and five-year survival rate for patients with SVC invasion were 12% and 21%, respectively. The study with T4 NSCLC recorded the thirty-day mortality of 10%, with the five-year survival rate of 24% [7, 9]. Data from the 40-year-long study emphasized that surgical treatment of lung cancer with SVC infiltration included the risk of developing postoperative complications of 30%, with the five-year survival rate of 21%. A ten-year follow-up study, as a part of the previously cited project, underlined that mixed thoracic and vascular surgical treatment reduced postoperative complications by 6%, with the five-year survival rate of 28% [4, 5].

Recommended operative mortality should be less than 10% [4, 6, 8]. A number of potential complications may be associated with resection and reconstruction of the SVC: anastomotic stenosis (proximal kinking is the most frequent cause of stenosis), graft thrombosis, and infection [4, 8]. In the study which included 35 persons, operative mortality was 65%, minor complications were developed in 35% of the patients, with 29-month overall survival. A study that was performed by Dartevelle et al. [4] recorded an excellent survival rate after radical resection of mediastinal tumors invading the SVC – five-year survival rate of 60%. Patients with lung cancer show a less favorable prognosis – about 30% at five years.

Direct malignant invasion by primary lung tumors or by nodular metastases is the most frequent indication for SVC resection and reconstruction. Despite major morbidity caused by thoracic tumors involving either the heart or great vessels, most patients are not offered surgical resection.

In our patient, grafting and bridging the SVC infested structure prevents the development of postoperative vascular complications and improves survival from the beginning of the treatment.

According to our experience, the treatment decision for palliative therapy should be based on the patient's clinical findings regardless of technical considerations, concerns regarding postoperative morbidity and mortality, or the insignificant impact on survival.

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Хируршки третман тумора плућа са инфилтрацијом горње шупље вене

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САЖЕТАК

Увод Директна малигна инвазија примарним тумором плућа или нодуларним метастазама је најчешћа индикација за ресекцију и реконструкцију горње шупље вене (ГШВ).
Циљ нашег рада је био да истакне важност добре преоперативне процене и припреме за смањење оперативног морталитета и просечно преживљавање.

Приказ болесника Мушкарац стар 61 годину примљен је ради хируршког лечења аденокарцинома горњег режња десног плућног крила. Протокол за лечење болесника је укључивао: радиолошку верификацију, биопсију са хистопатолошком анализом, стандардну горњу десну лобектомију са медијастиналном лимфаденектомијом и ресекцијом ГШВ у дужини од 30 *mm*. Реконструкција ГШВ је учињена имплантацијом васкуларног графта *INTERGARD* 16 *mm*. То је спречило развој постоперативних васкуларних компликација и побољшало преживљавање од почетка лечења.

Закључак Комбиновано васкуларно и груднохируршко лечење смањује постоперативне компликације и побољшава преживљавање.

Кључне речи: хируршки третман; тумор плућа; инфилтрација горње шупље вене