**Prosthetic azygo-atrial bypass for palliation of superior vena cava syndrome**

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**Abstract**

We report a case of locally advanced excavated non-small cell lung cancer with superior vena cava (SVC) syndrome that underwent four cycles of induction chemotherapy. Due to early treatment failure and the impossibility applying radical radiotherapy, a decision was made to perform surgery. The patient underwent right intrapericardial pneumonectomy with en-bloc resection of the SVC, azygos vein and mediastinal lymph nodes. Prosthetic azygo-atrial bypass was then performed. The patient enjoys one year progression-free survival with patent graft and symptomatic relief of SVC syndrome.

**Keywords:** Lung cancer surgery · Venous disease · Thrombosis

**INTRODUCTION**

Superior vena cava (SVC) reconstruction is contraindicated in at least two oncological circumstances: in the presence of extensive thrombosis involving subclavian veins, and in the presence of well-developed collateral circulation. After SVC resection in such situations simple ligation usually suffices [1]. We propose a step forward in the case of a complete resection of SVC, i.e. prosthetic azygo-atrial bypass aiming at palliation of SVC syndrome.

**CASE REPORT**

A 63-year old Caucasian male complained of face and neck oedema, and productive coughing in September 2009. Contrast-enhanced computed tomography (CT) of the chest demonstrated an excavated pulmonary mass measuring 5 cm with speculated margins situated in the third segment of the right lung accompanied by mediastinal lymphadenopathy (Fig. 1a). In addition, thrombosis of the left jugular vein extending to the confluence with right brachiocephalic vein was described. Transbronchial needle aspiration biopsy was diagnostic of poorly differentiated non-small cell lung cancer (NSCLC) and positive for metastatic disease in station 4R. CT of the brain and abdomen, and bone scan were negative. Color-Doppler examination of circromediastinal vessels revealed distension of both jugular veins with thickened walls towards mediastinal side. Positron emission tomography (PET) imaging done in November showed the pathological uptake in the area of tumour and nodal stations 7 and 4R. The patient underwent four cycles of chemotherapy. Control PET–CT done in April 2010 was positive in the region of primary tumour and lymph node stations 4R and 7 with standardized uptake value max values of 16.61, 8.74, and 6.5, respectively. The tumour diameter remained unchanged.

The patient was then brought to our attention. Because of tumour excavation, a decision was made not to employ radical radiotherapy. We performed a full functional evaluation. The patient was deemed operable with a predicted postoperative forced expiratory volume (ppoFEV1) of 40% and plots of predicted and observed diffusion capacity of the lung for carbon monoxide (ppoDLCO) of 37%. A preoperative CT scan of the chest done in mid-June revealed an increase in the pulmonary mass that now measured 6 cm. The SVC was totally occluded with well-developed collateral circulation. The diameter of azygos vein was prominent (Fig. 1b).

After careful consideration of perioperative risks and long-term prognosis a decision was made with the full participation of the patient to perform surgical intervention with azygo-atrial prosthetic bypass.

We found intraoperatively complete thrombosis of SVC and azygos vein at its confluence and tumour mass that was adherent to the chest wall (Fig. 1b). The dissection of the tumour was first performed in the extrapleural plane. Intrapericardial pneumonectomy was performed en-bloc with SVC down to cava–atrial junction, segment of azygos vein at its confluence with the former and surrounding lymph nodes. Bypass was then performed using 16 mm Gore-tex armoured graft between azygos vein and right atrium. The patient made an uneventful recovery. Soon after the operation the symptoms and signs of SVC syndrome disappeared. Final pathological report revealed adenocarcinoma that had infiltrated directly mediastinal fat with positive lymph node stations 4R and 7, and infiltration of SVC from extranodal cancer growth. The patient’s final stage was ypT4N2M0. Postoperative radiotherapy of 54 Gy was delivered to the patient’s mediastinum.
Currently, the patient enjoys a good quality of life and one year progression-free survival. Contrast-enhanced CT revealed a functional graft between azygos vein and right atrium without signs of loco-regional recurrence (Figs. 1c and 2).

DISCUSSION

Salvage surgery has been described in the setting of locally advanced NSCLC after failure of definitive radiotherapy [2]. In this case series, 22 out of 24 patients underwent concurrent chemotherapy. The time from termination of primary therapy to salvage surgery ranged from 5.4 to 93.7 weeks. Overall, salvage surgery turned out to be feasible and safe [2].

Our patient could not have been subjected to radical radiotherapy because of tumour excavation. In this setting, the only alternative loco-regional form of treatment was surgery. The decision to employ it in this clinical scenario was made for a highly selected patient with excellent performance status and still technically resectable disease.

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The most interesting aspect of this clinical case, however, was the decision to perform azygo-atrial bypass. Using a classification system and treatment algorithm for management of SVC syndrome for malignant causes as suggested by Detterbeck et al. [3], we will discuss therapeutic alternatives and then assess the treatment efficacy.

We excluded the use of second line chemotherapy due to the fear that the disease could become technically irresectable and the planned surgical intervention precluded the possible use of intravascular stent. Preoperative imaging findings of well-developed collateral circulation and thickened walls of the jugular veins contraindicated the attempt to reconstruct SVC [1]. We thought that shortening the absolute distance necessary for the blood to reach the right atrium would result in venous decongestion. The finding of a prominent azygos vein evident at a preoperative chest CT scan and intraoperative confirmation of elevated blood flow oriented us to perform prosthetic venous bypass.

Our patient came to medical attention with clinical Grade 1 symptoms (Fig. 1a), progressed and stabilized preoperatively at Grade 2 (Fig. 1b) and then moved clinically to Grade 0 (Figs. 1c and 2) at one year time point postoperatively [3].
Surgical technique is straightforward. Both proximal and distal anastomoses are done in an end-to-end fashion using Satinsky clamps. We did not encounter any significant intraoperative difficulties. We believe that such an approach should be applied especially for oncological patients with better long-term prognosis and similar haemodynamic profile.

Retrospective literature search through Medline identified three papers that described azygo-atrial bypass for various indications [4–6].

CONCLUSION

We believe that this therapeutic approach aiming at palliation of symptoms and signs of chronic SVC syndrome should be taken seriously into consideration in the future for patients with various thoracic malignancies when SVC reconstruction after total resection is not indicated.

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REFERENCES
