



Resection and a Rare Type of Reconstruction of the Superior Vena Cava with the Left Brachiocephalic Vein

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Abstract

Resection and reconstruction of the superior vena cava (SVC) are required in a selected group of patients with anterior mediastinal tumors and lung neoplasms. We present the case of a 63-year-old woman who underwent invasive type B2 thymoma resection and a rare type of reconstruction of the superior vena cava using a patch of the left brachiocephalic vein (LBV). The various types of reconstruction of the superior vena cava are discussed.

Keywords

brachiocephalic vein, patch reconstruction, resection, superior cava vein

INTRODUCTION

Resection and reconstruction of the superior vena cava to remove anterior mediastinal and lung tumors are still difficult procedures. Several techniques, as well as biological and synthetic materials for reconstruction, have been described. We present the case of a 63-year-old woman who underwent resection of an invasive type B2 thymoma and a rare type of reconstruction of the superior vena cava with a patch from the left brachiocephalic vein (LBV). The various types of SVC reconstruction are discussed.

CASE REPORT

A 63-year-old woman was admitted to the Department of Thoracic Surgery for surgical treatment due to an anterior mediastinal mass. The CT showed a lobulated mass

(40×35 mm) in the upper anterior mediastinum, granular structure, and central calcification (**Fig. 1**). The dorsal surface of the lesion lay intimately on the anterior circumference of the ascending aorta and the SVC but without convincing evidence of SVC infiltration because a prevascular adipose tissue was erased.

A median sternotomy was performed. The two pleural cavities were explored and no pleural changes were found. Two visibly unaltered aortopulmonary lymph nodes were removed. An anterior mediastinal lesion about 40 mm in diameter was found. At the beginning of sharp dissection and mobilization of the lesion, infiltration in the area of the confluence of the left brachiocephalic vein and SVC was established. Intravenous heparin was administered and the two brachiocephalic veins, the SVC, and the ascending aorta were dissected and taken on the vessel loops. A side-biting Satinsky vascular clamp was placed on the SVC and a bulldog forceps clamp was placed in the area of the initial part of the left bra-

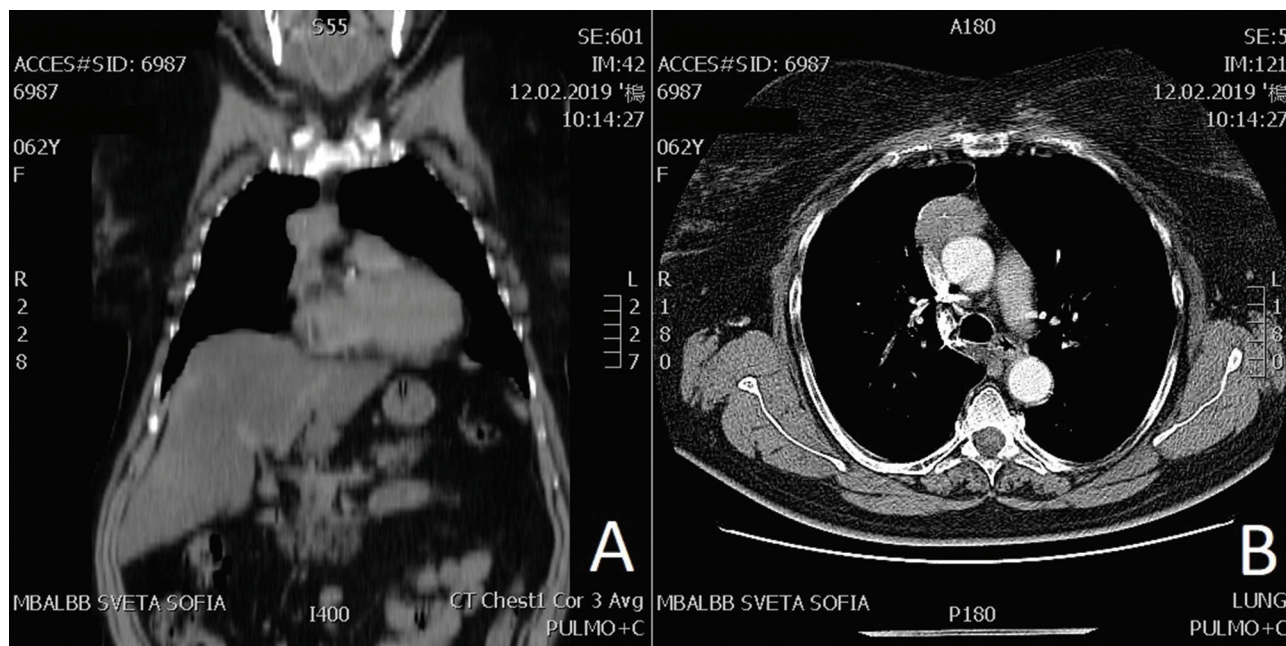


Figure 1. Chest CT on admission.

chiocephalic vein. The lesion together with the proximal antero-medial part of SVC in the confluence area with the distal antero-inferior part of the left brachiocephalic vein and the underlying anterior pericardium were resected (**Fig. 2**). The brachiocephalic vein was then ligated and transected near its origin before the junction of the left subclavian vein and the left internal jugular vein.

An elliptical patch from the intact cranial proximal part of the left brachiocephalic vein was harvested. The patch was moved clockwise, and the defect in the SVC was restored by a 6-0 running suture (**Fig. 2**). Both pleural cavities were drained and the sternotomy wound was closed.

A histological examination showed thymic epithelial neoplasm with features of type B2 thymoma and data for infiltration of the wall of the SVC. The stage of the tumor was Masaoka-Koga III. There were two aortopulmonary lymph nodes without infiltration.

A slight transient edema in the area of the left upper limb appeared on the first postoperative day and disappeared within a few days. The patient was discharged 10 days post-operatively on anticoagulant therapy and started chemotherapy and radiation therapy. At a two-year follow-up, no adverse events were reported. There was no ultrasound evidence of venous outflow disorders of the neck or upper limbs.

DISCUSSION

We present a case of an invasive B2 thymoma infiltrating the junction of the left brachiocephalic vein and SVC. We did not attempt preoperative histological verification of the lesion because it was not suitable for a transthoracic needle biopsy. Considering its small size (40 mm), we decided to perform radical extirpation. The infiltration was estab-

lished during the operation, although there were no convincing data from the preoperative CT. The obtained defect was reconstructed using a patch from the remaining proximal cranial intact part of the left brachiocephalic vein. The circumference of the veins was resected by about 40% in the area of the junction of the left brachiocephalic vein into the SVC. The blood outflow from the head and neck was redirected through the right brachiocephalic vein through the numerous head and neck venous collaterals. Except for mild transient swelling of the left upper limb during the first postoperative days, the patient experienced no complications. This rare technique was used because the infiltration was exactly in the area of the transition of the left brachiocephalic vein in the SVC. An autologous pericardium could also be used for this purpose. In cases when less than 30% of the SVC circumference is involved, resection and direct suturing of the vascular wall could be performed, as well as the use of a linear stapler. When the wall is completely involved, segmental resection of the vessel and reconstruction by interposition of a conduit from a synthetic prosthesis, pericardium, or autovenous is appropriate.

Despite the extensive experience of the pathologist, the intraoperative diagnosis of malignant thymoma was not established. The final diagnosis was made on a permanent histological preparation with immunohistochemistry. In general, the histological classification of thymic tumors is one of the most discussed and controversial topics in pathology. Sometimes well-encapsulated lesions behave as malignant and tend to become malignant. The modified Koga classification of the Masaoka staging system is currently used which divides thymomas into I, IIA, IIB, III, IVA, and IVB stages. Usually in stages I and II, when the tumor could be completely removed, surgical treatment is performed, while in the advanced stages, the management is preoperative

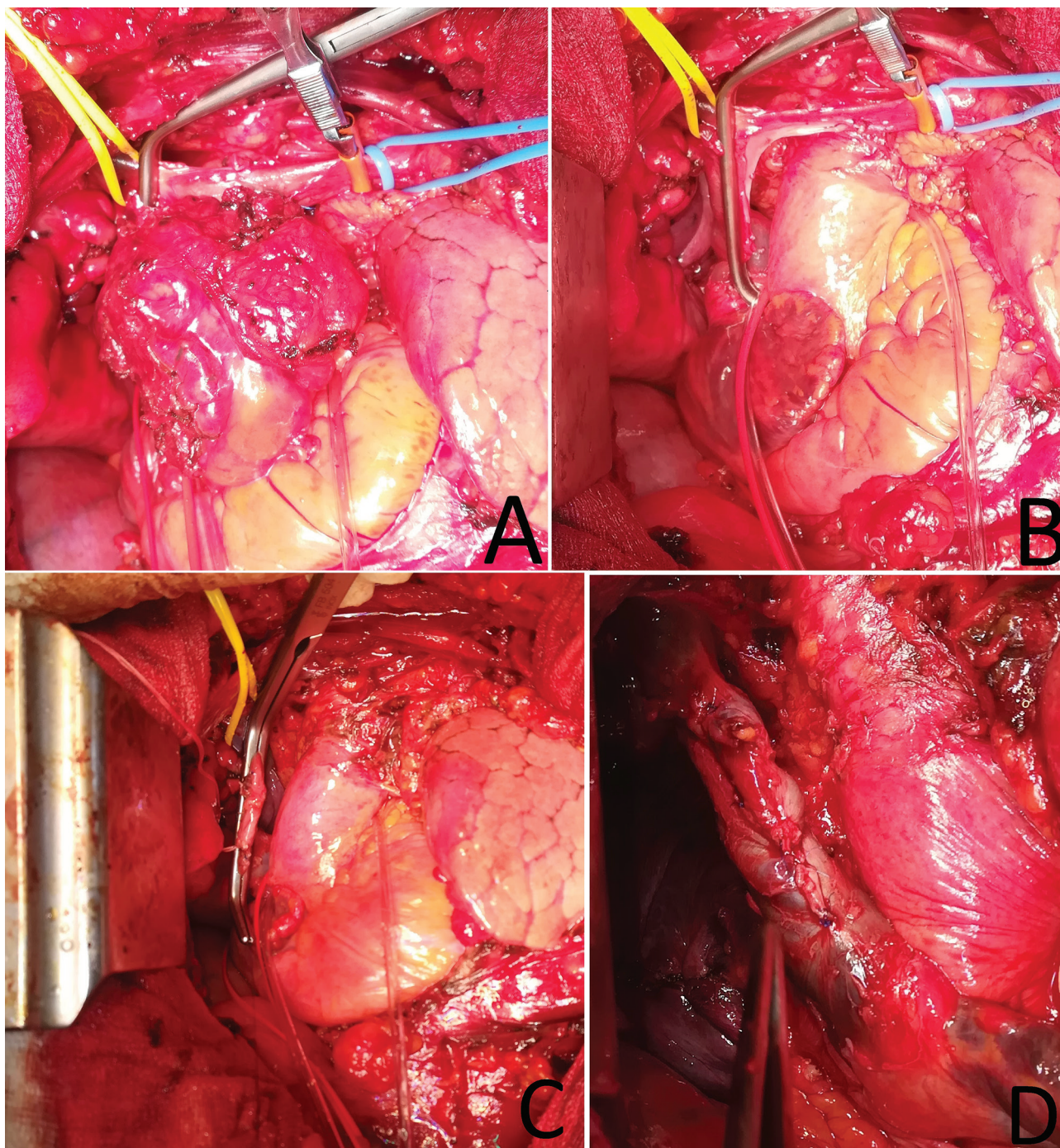


Figure 2. A. The release of the tumor together with the pericardium from the surrounding mediastinal tissues; B. A view of the superior vena cava and the left brachiocephalic vein defect after tumor removal; C. A view of the reconstructed superior vena cava before declamping; D. The same view after declamping.

chemotherapy and radiotherapy followed by surgery. In the presented case, the thymoma is type B2, stage III, and has a malignant potential. Because of the small size of the tumor and the impossibility of preoperative histology due to the extremely high risk of iatrogenic damage with a CT-guided transthoracic needle biopsy, we began with surgery.

Different types of techniques, as well as different biological and synthetic materials for reconstruction, are described. In locally advanced cancers of the thymus, some

factors should be considered: local involvement to large mediastinal vessels (innominate vein, SVC, and pulmonary vessels), pericardial infiltration, and distant metastases to the pleura.^[1]

Median sternotomy is the optimal approach to the anterior mediastinal mass, even in the presence of pulmonary involvement.^[2] In larger tumors, the Clamshell incision could also be used, although it is more traumatic. Numerous types of cava superior vein reconstructions using

different autologous and heterologous tissues have been described. The most common autologous ones are the femoral vein, the jugular vein, the spiral graft of the saphenous vein^[3], and the pericardium. Demirdas et al. presented a case with a vascular reconstruction alternative with patch plasty of the superior vena cava and graft interposition between the left brachiocephalic vein and the right atrium auricular.^[4] Ciccone et al. use heterologous pericardium from bovine in 15 patients and form the graft with a linear stapler.^[5] The need for SVC resection alone should not be considered a contraindication for surgery when prosthetic replacement is feasible.^[6] The most common synthetic materials for reconstruction are dacron and normal or ringed polytetrafluoroethylene graft (PTFE).

The described approach has some limitations. In general, ligation and severing of one of the two brachiocephalic veins have no lasting effects on venous drainage from the head, neck, and upper extremities because of the rich collateral venous network. Very rarely, it is possible to have transient edema of the face, neck, and upper extremities on the corresponding side, which we did not observe. This technique could only be performed with side bite clamping of the venous wall and is a good alternative to the other types of reconstructions described in the literature.

CONCLUSION

The rare technique described by us could be a good alternative for resection and reconstruction of the proximal part of the SVC in the area of the junction with the left brachiocephalic vein.

Author contributions

G.Y. and M.A. performed the procedures; G.Y., M.A., E.M., and R.P. performed the follow-up.

Ethical Approval

Ethical approval was not necessary as this is not a clinical study. The research meets all applicable standards concern-

ing the ethics of experimentation and research integrity, and the following is certified and declared true. No identifiable images or information were used.

Informed consent was obtained for all procedures as part of the patient's hospital stay.

Consent for publication

All authors read and agreed to the published version of the manuscript.

Availability of data and material

All figures and data are readily available.

Conflict of Interest

None of the authors of this paper have any financial or personal ties to other people or organizations that could improperly influence or bias the paper's content.

REFERENCES

1. Novellis P, Veronesi G, Raffeeq Z, et al. Thymoma surgery: extreme surgical indications. *J Thorac Dis* 2019; 11(7):2695–9.
2. Darteville PG, Chapelier AR, Pastorino U, et al. Long-term follow-up after prosthetic replacement of the superior vena cava combined with resection of mediastinal-pulmonary malignant tumors. *J Thorac Cardiovasc Surg* 1991; 102:259–65.
3. Doty JR, Flores JH, Doty DB. Superior vena cava obstruction: bypass using spiral vein graft. *Ann Thorac Surg* 1999; 67(4):1111–6.
4. Demirdas E, Sicim H, Kartal H, et al. Reconstruction of superior vena cava and brachiocephalic vein invasion after thymomectomy: a report of a case and surgical procedure. *EJCM* 2020; 8(1):59–62.
5. Ciccone AM, Venuta F, D'Andrilli A, et al. Long-term patency of the stapled bovine pericardial conduit for replacement of the superior vena cava. *Eur J Cardiothoracic Surg* 2011; 40(6):1487–91.
6. Spaggiari L, Leo F, Veronesi G, et al. Superior vena cava resection for lung and mediastinal malignancies: a single-center experience with 70 cases. *Ann Thorac Surg* 2007; 83:223–30.

Резекция и редкий вариант реконструкции верхней полой вены левой плечеголовной веной

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Резюме

Резекция и реконструкция верхней полой вены необходимы у избранной группы пациентов с опухолями переднего средостения и новообразованиями лёгких. Мы представляем случай 63-летней женщины, перенёвшей инвазивную резекцию тимомы типа B2 и редкий тип реконструкции верхней полой вены заплатой из левой плечеголовной вены. Обсуждаются различные виды реконструкции верхней полой вены.

Ключевые слова

плечеголовная вена, лоскутная реконструкция, резекция, верхняя полая вена
