1. Introduction

Lung cancers invading the superior vena cava (SVC) are generally considered to be a contraindication for a surgical resection, but several recent reports have shown that the patients undergoing SVC resection for lung cancers had approximately a 21–31% five-year survival rate [1]. When a small area of the SVC is invaded by the tumor, primary repair is preferred for reconstruction. If a large area of the SVC wall is resected, then patch repair with an autologous pericardium or artificial graft replacement is often performed [2]. We herein present an easy and novel method of SVC reconstruction using an azygos flap and discuss its indications.

2. Patient

A 70-year-old male patient presented with the chief complaint of cough and hemoptysis of two months’ duration. The findings of chest roentgenograms and computed tomography (CT)-scan showed a lung tumor in the right upper lobe that was suspected of invading the SVC and the pretracheal lymph node (Fig. 1). Biopsy specimens obtained via bronchoscopy revealed this tumor to be squamous cell carcinoma, and the patient was clinically diagnosed as T4N2M0. After two courses of induction chemotherapy with carboplatin and paclitaxel, the tumor shrank and a partial response was achieved. However, a combined resection of the SVC wall was still considered to be necessary.

Through a posterolateral thoracotomy in the fourth intercostal space, a mediastinal lymph node dissection was performed and the tumor was found to have spread to only a few pretracheal lymph nodes. The tumor invaded the proximal SVC below the azygos arch, which was not invaded by the tumor. The transient shunt using a 28Fr-thoracostomy tube was interposed between the distal SVC and the right atrial appendage after systemic heparinization. The SVC was partially excised with an adequate surgical margin –3.5 cm. The proximal SVC below the azygos arch, which was not invaded by the tumor was longitudinally cut-off at the level of the right superior intercostal vein, and the arch was longitudinally cut on the caudal side to cover the defect of the SVC wall (Fig. 2b). The pedicled vessel wall was trimmed for an angioplastic patch and stitched on the SVC defect with 5-0 Prolene sutures (Fig. 2c,d). A right upper sleeve lobectomy with pulmonary artery reconstruction was subsequently performed. Heparin and warfarin were postoperatively administered to the patient for preventing early thrombosis. The patient postoperatively received two additional courses of chemotherapy. The patient is currently alive with no evidence of disease, and the repaired SVC was observed to still be patent in a CT-scan taken five months after surgery (Fig. 3).

3. Comments

In SVC reconstruction, primary sutures are reported to be possible when <30 or 50% of the caval circumference is involved [1, 3, 4]. If half of the caval circumference is resected, a cross-sectional area of the repaired vascular lumen becomes less than a quarter of the preoperative one. In patients who had vessels repaired by a running suture, Spaggiari et al. demonstrated early thrombosis cases to be related to an excessive resection [5]. Although a prosthetic graft or an autologous pericardial patch is commonly used for SVC reconstruction with extensive invasion of the tumor, this novel procedure is easy to perform...
Fig. 1. Computed tomography images before induction chemotherapy showing no invasion of the azygos vein (a) and suspected invasion to the SVC and the pretracheal lymph node (b).

Fig. 2. Surgical procedure. After the SVC is clamped, it is excised with attention to the surgical margin (a). The azygos arch is longitudinally cut open on the caudal side to cover the defect of the SVC wall (b), and the defect is closed with the pedicled azygos patch (c, d).

and may prevent the vessel from becoming stenosed. If the following three conditions are met, we can utilize the azygos arch as a material for SVC reconstruction: the extent of tumor invasion is not large; the involved portion of the SVC is close to the azygos arch; and the azygos arch is free from tumor invasion. Furthermore, following SVC resection, a bronchoplastic procedure is often needed. When the airway is opened, there is an increased risk of graft infection that is inherent in all prosthetic vascular replacement. From the standpoint of infection prophylaxis, native tissue, such as the azygos arch is thus considered to be a better alternative. The azygos flap procedure may also lead to decrease the risk of thrombosis because the lumen of the reconstructed vessel is lined with the innate intima.

We performed this method for the tumor that invaded the proximal SVC below the azygos arch, but this method is also applicable to the distal invasion above the azygos level. Alternatively, the azygos arch can be utilized as a free, not pedicled, venous patch.

Our surgical concept is close to that of the subclavian flap aortoplasty (SFA) which was originally described for infant coarctation repair. SFA is used to create an aortic lumen in cases of long coarctation in which direct aortic anastomosis is impossible [6]. This concept can be applicable to several other situations, including the SVC repair as described above. We believe that not only cardiovascular surgeons, but also general thoracic surgeons, should therefore be aware of this procedure and consider it as an alternative treatment modality.

Advanced lung cancers with SVC invasion often show extensive involvement of the mediastinum, including the azygos arch. However, if the extent of the SVC invasion is small and close to intact azygos arch, then the use of the azygos flap is an easy and effective method for performing SVC reconstruction to prevent a reduction in the lumen.

References

