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HOW TO DO IT

Pulmonary artery reconstruction using an autologous pulmonary vein patch in pulmonary resection

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Abstract

Pulmonary artery (PA) reconstruction has been accepted to avoid pneumonectomy in locally advanced lung cancer surgery because of its satisfactory outcomes with regard to long-term survival and its low postoperative morbidity and mortality rates. Several techniques of PA reconstruction have been documented. However, the availability of PA reconstruction using an autologous pulmonary vein (PV) patch is unclear. Here, we present a patient who successfully underwent PA reconstruction using an autologous PV patch during resection of a lung adenocarcinoma (cT2aN1M0: stage IIB) in the left upper lobe with hilar extension and left main PA invasion.

Keywords Pulmonary artery reconstruction · Pulmonary vein patch · Locally advanced lung cancer

Introduction

Pneumonectomy has been reported to be associated with significantly greater morbidity and mortality rates than pulmonary lobectomy, and it has been shown to be associated with a worse quality of life [1–3]. Pulmonary artery (PA) reconstruction has gradually gained acceptance as an alternative to pneumonectomy in radical pulmonary resection for locally advanced lung cancer. Several techniques of PA reconstruction have been documented. However, the utility of PA reconstruction using an autologous pulmonary vein (PV) patch is unclear. Here, we present a patient who successfully underwent PA reconstruction using an autologous PV patch.

Case description

A 66-year-old woman having an adenocarcinoma (3.9×3.7 cm) in the superior segment (S^{1+2}) of the left upper lobe with hilar extension and left main PA invasion was admitted for surgery (Fig. 1a, b). Respiratory evaluation indicated a forced expiratory volume in 1 s of 79%, diffusing capacity of the lung for carbon monoxide/alveolar volume of 102.9% and forced vital capacity of 73.6%. Fluorodeoxyglucose positron emission tomography showed positive uptake at the tumor mass and a hilar interlobar lymph node (cT2aN1M0: stage IIB), and bronchoscopy showed no invasion of the left upper bronchus.

Surgical technique

Posterolateral left thoracotomy was performed. The superior PV was not adjacent to the tumor, and it could be exposed from the intrapericardial tract to the peripheral segmental branches. The PV was sutured intrapericardially using a linear stapler (PROXIMATE Reloadable Staplers TX, Ethicon Inc., Somerville, NJ, USA) as close as possible to the left atrium and was ligated at the level of the peripheral segmental branches distally. The length of the PV preserved for a ductal graft was 2.5 cm. The left upper bronchus was stapled before discission of the PA. The left PA was more widely infiltrated by the tumor than we expected, which spared the left upper

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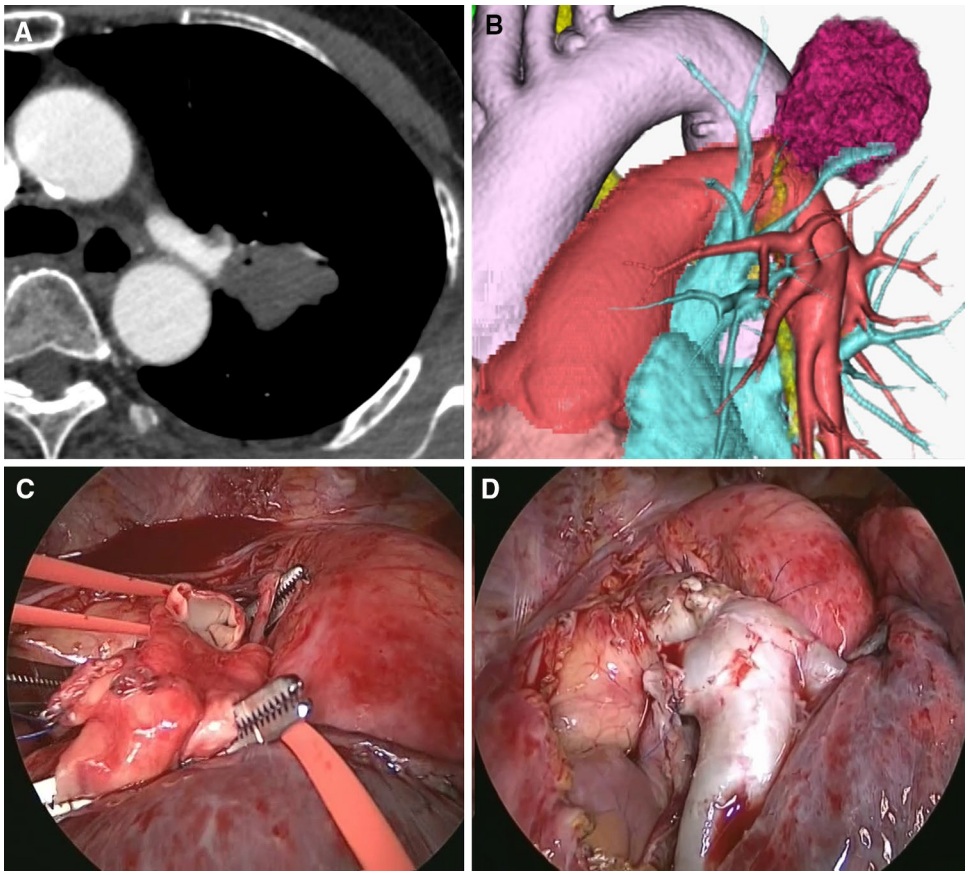

Fig. 1 **a, b** Preoperative contrast-enhanced chest computed tomography scan shows main pulmonary artery invasion by the pulmonary tumor. **c, d** Intraoperative view of main left pulmonary artery reconstruction

bronchus. The PA was isolated and clamped after intravenous injection of 4000 units of heparin sodium. The proximal side of the main PA was clamped intrapericardially after discission of the ductus arteriosus. The interlobar PA was clamped distally after discission of the lingular branch. The infiltrated PA (a segment about 2.5-cm long) was resected en bloc with the left upper lobe.

We performed PV patch reconstruction for the PA defect that was larger than a quarter of the anterior artery wall because direct suturing would have resulted in narrowing of the main PA. The harvested PV ductal graft was incised longitudinally and trimmed to the size of the PA defect. A tailored PV patch was placed with running 5/0 nonabsorbable monofilament sutures (Fig. 1c, d). We thoroughly dissected surrounding tissue of PA and the total clamp time was 63 min. The operation time was 389 min and blood loss was 190 g. The pericardium was closed with interrupted sutures to prevent cardiac tamponade or herniation. The patient had an uncomplicated postoperative course and discharged on postoperative day 9.

Comments

Several techniques of PA reconstruction have been documented, including direct suturing, end-to-end anastomosis, prosthetic patch, pericardial patch and PV conduit [3, 4].

Direct suturing is suitable for small defects (less than a quarter of the anterior wall) after partial resection of the PA. Patch reconstruction is required for extended partial resection of an aspect of the vessel (less than half of the circumference). Autologous pericardium is the most widely used for PA reconstruction with a patch; however, there are technical concerns with regard to adaptation and suturing to the vascular wall due to its thinness, as it has a tendency to shrink and curl. Though prosthetic materials, such as polytetrafluoroethylene, are easy to suture, postoperative anticoagulation might be necessary to prevent thrombosis and the risk of infection could be considered [5].

A PV vein graft has suitable thickness and solid consistency as compared to pericardial patch. Therefore, a PV

graft is easy to handle during procedures, such as trimming and suturing [6]. D'Andrilli et al. reported that PA reconstruction using a PV conduit and patch is a feasible, safe, and effective option [7]. Furthermore, PV grafting has been reported to be an oncologically reliable technique when performed reasonably away from a tumor [3]. A PV patch is harvested up to the length (about 2–3 cm) and circumference (about 3–5 cm) of the PV ductal graft depending on variations in the PV branching pattern and diameter. A PV patch can shrink longitudinally but cannot shrink vertically, and it is considered useful in PA reconstruction for long slit defects.

In conclusion, an autologous PV patch technique is a useful option in PA reconstruction.

Compliance with ethical standards

Conflict of interest The authors have no conflict of interest to declare.

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