Primary pulmonary artery sarcoma: a new surgical technique for pulmonary artery reconstruction using a self-made stapled bovine pericardial graft conduit

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Abstract

Primary pulmonary artery sarcoma is an uncommon neoplasm with a grim prognosis. Complete resection is the only treatment that can improve the patient’s survival. The role of multimodality treatment is still controversial, although adjuvant chemotherapy possibly could improve outcomes of these patients. Several pulmonary artery reconstructive techniques have been reported in the scientific literature, such as patch reconstruction, end-to-end anastomosis, synthetic prosthesis or biological grafts. In this article, we propose a new surgical option for pulmonary artery reconstruction after radical tumour resection using a self-made stapled bovine pericardial graft conduit in a patient with a mass in the pulmonary trunk and right pulmonary artery. We believe that the use of this technique adds safety and effectiveness, and reduces the surgical time.

Keywords: Bioprosthesis • Graft • Pulmonary artery • Sarcoma • Surgery

INTRODUCTION

Primary pulmonary artery sarcoma (PPAS) is a rare neoplasm with a poor prognosis. Early detection is essential in order to make a prompt treatment and improve the prognosis. Surgery remains the treatment of choice [1, 2]. Nowadays, radical tumour resection and pulmonary artery reconstruction is the most promising treatment for PPAS. The role of multimodality treatment is still controversial, although adjuvant chemotherapy possibly could improve outcomes of these patients.

To date, different pulmonary artery reconstructive techniques have been reported. Here, we have drawn on a previously published technique for replacement of the superior vena cava [3] and we have adapted this technique for pulmonary artery reconstruction after radical tumour resection, using a self-made stapled bovine pericardial graft conduit.

TECHNIQUE

A 45-year old woman with a mass in the pulmonary trunk and right pulmonary artery (Fig. 1) was referred to our institution for surgery. Standard cardiopulmonary bypass was established through a median sternotomy; ventilation was interrupted and myocardial protection was achieved using intermittent retrograde cold-blood cardioplegia. First, the superior vena cava and the ascending aorta were transected to facilitate right pulmonary artery exposure. Then, the pulmonary artery was sectioned, proximally at the trunk portion in the supravalvular area and distally at the left pulmonary artery 2 cm from its beginning. Once done, we proceeded to perform a right pneumonectomy (Fig. 2). Intraoperative pathological analysis revealed that surgical margins were free of disease.

For the pulmonary artery reconstruction we used a bovine pericardial patch (Sheldhigh No-React Pericardial Patch, Millburn, NJ, USA; original size 10 × 20 cm). We created a heterologous pericardial tube using a Hegar dilator (21 mm) as a mould (Supplementary Video 1). Instead of hand-stitching, we decided to longitudinally seal this conduit with a vascular Endo-Gia stapler (Endo GIA™ Ultra Universal Stapler, Covidien®). The tube was cut depending on the length we needed. Subsequently, we performed an end-to-end anastomosis between the conduit and the proximal and distal pulmonary artery cuffs using a continuous running suture with Prolene 5-0.

Finally, the superior vena cava and the aorta were re-anastomosed and decannulation was performed when complete haemodynamic stability was achieved. After an exhaustive haemostasis, the sternotomy was closed. The total cardiopulmonary bypass time was 204 min with an aortic cross-clamp time of 167 min.

The postoperative course was uneventful and the patient was discharged from the hospital on the sixth postoperative day. The patient was referred to the local Oncology Service for further
chemotherapy treatment with Adriamycin and Ifosfamide. Currently, she is alive and free of disease 2 years after surgery.

DISCUSSION

PPAS is an uncommon neoplasm with a high mortality rate. Surgical resection remains the mainstay of treatment. Complete resection is essential to improve survival of patients diagnosed with PPAS. Blackmon et al. [4] reported that the median and 5-year survival were, respectively, 36.5 ± 20.2 months and 49.2% for patients undergoing a curative resection attempt compared with 11 ± 3 months and 0% for those undergoing exploration, tumour debulking, palliative pneumonectomy or thromboendarterectomy. For this reason, early diagnosis is crucial in order to provide a prompt treatment. Furthermore, some authors have suggested that multimodal treatment could also increase survival rates [5, 6]. However, future studies will be required in order to establish the role of induction and adjuvant therapies in these patients.

Tumour resection and pulmonary artery reconstruction is currently the most hopeful treatment for PPAS. The breadth of resection depends on tumoural extension. Sometimes, it is necessary to remove vital structures such as the pulmonary valve or the right ventricular outflow tract. Complete resection (R0) is the most significant prognostic factor. Hence, frozen specimen analysis is essential in order to determine the completeness of resection margins.

Several pulmonary artery reconstructive techniques have been described such as patch reconstruction, end-to-end anastomosis, synthetic prosthesis (Dacron, PTFE) and biological heterologous (bovine pericardium) or homologous (azygous vein, pulmonary vein and pericardium) grafts. Autologous and heterologous pericardium represent ideal materials for prosthetic reconstruction of the pulmonary artery. The pericardial conduit has lower risks of infection and thrombosis when compared with synthetic materials and does not require long-term anticoagulation [7]. In our case, we prefer to use bovine pericardium because the autologous pericardium was needed for posterior mediastinal stability. Furthermore, it is absolutely biocompatible and stiff, it does not shrink and its patency remains satisfactory over time [8].

In this article, we present the first case report in the literature of PPAS radical resection and pulmonary arterial reconstruction using a self-made stapled bovine pericardial conduit. Based on the surgical technique described by D’Andrilli et al. [3] in 2006 for reconstruction of the superior vena cava, Gonzalo Pradas Montilla constructed a pericardial conduit using a Hegar dilator as a mould, and performed the longitudinal suture with a linear reloadable stapler. The use of this mechanical suture for the longitudinal closure of the tube adds safety, enhances sealing and reduces the surgical time, especially the total myocardial ischaemic time.

In conclusion, we suggest that pulmonary arterial reconstruction using a self-made stapled bovine pericardial graft conduit is a safe and useful technique. We believe that knowledge of this new option will help physicians to improve the surgical treatment of PPAS.

Figure 1: (A) Axial thoracic computed tomography image showing an intravascular mass (black arrow) extending on the pulmonary trunk and right pulmonary artery. (B) Positron emission tomography scan revealed an increased fluorodeoxyglucose uptake (SUV 8.7 g/ml) in the pulmonary artery (arrowheads).

Figure 2: Right pneumonectomy. Macroscopic appearance of pulmonary artery sarcoma.
**SUPPLEMENTARY MATERIAL**

Supplementary material (Video 1) is available at EJCTS online.

Video 1: This video shows a new surgical technique for pulmonary artery reconstruction. We created a heterologous pericardial tube using a Hegar dilator as a mold. We decided to seal longitudinally this conduit with a vascular Endo-Gia stapler. Then, we cut the conduit according our needs.

**Conflict of interest:** none declared.

**REFERENCES**


