Transcaval invasion of right atrium by thymoma: resection via transient cava-pulmonary shunt

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Abstract

Transcaval extension of the thymoma to the right atrium has very rarely been reported, and cardiopulmonary bypass is recommended for successful resection. An invasive thymoma with intravascular invasion of the superior vena cava, and the left innominate vein extending into the right atrium was presented. Intra-atrial extension was resected through a transient external shunt from the inferior vena cava to the main pulmonary artery. We discussed the feasibility of this surgical technique and possible advantages of cardiopulmonary bypass avoidance.

Keywords: Mediastinal tumour • Thymoma • Shunt (cava-pulmonary)

INTRODUCTION

Although an invasive thymoma commonly infiltrates mediastinal vascular structures, intracardiac extension from an intracaval growth is rare. This metastatic route is called 'transvenous' cardiac metastasis and few case reports have been reported in the literature [1–3]. We have previously reported the magnetic resonance imaging findings of cardiac metastasis in an invasive thymoma into the right atrium via the superior vena cava [4]. The recommended treatment is excision on cardiopulmonary bypass and reconstruction of the superior vena cava [2, 5].

We present a case of invasive thymoma with intravascular invasion of the superior vena cava and left innominate vein extending into the right atrium. Intra-atrial extension was resected using a transient external shunt from the inferior vena cava to the main pulmonary artery. In this case report, we have discussed the feasibility of the surgical technique and possible advantages of cardiopulmonary bypass avoidance.

CASE REPORT

A 53-year old female patient was admitted to our department with superior vena cava syndrome due to an invasive thymoma, which was diagnosed with fine needle aspiration biopsy. Chest computerized tomography revealed an 8-cm mediastinal mass invading the superior vena cava and extending into the right atrium, which was filled with a mass of 2.8 × 3.9 cm (Fig. 1a–d). Echocardiographic evaluation demonstrated an intra-atrial mass with an insufficient large tricuspid valve and pulmonary hypertension (>40 mmHg) (Supplementary Video 1). Tumour markers (beta HCG, alfa FP, LDH and CEA) were in the normal range. Pulmonary function tests did not show any abnormalities.

All venous lines were prepared from both the inferior extremities including the central venous line from the femoral vein. Median sternotomy was performed. After the resectability of the mass was confirmed, purse string sutures were placed on the anterior surface of the inferior vena cava and on the main pulmonary artery. After administration of 5000 IU heparin, both inferior vena cava and main pulmonary artery were cannulated with 28 F arterial-32 F venous cannulas and connected to each other with the aid of a Y-connector and air was removed. Resection of the left and right innominate veins was performed with two vascular staplers (TA 30 V3 Covidien, Norwalk, CT, USA). The patient was kept in the Trendelenburg position and the clamp was removed from the transient external shunt. Blood coming from the inferior vena cava was directed to the main pulmonary artery by squeezing the vessel loop around the inferior vena cava cannula. The mass was resected en bloc with superior vena cava and proximal parts of innominate veins, pericardium and a part of the right atrium. The right atrium was closed by placing a pericardial patch. Total shunt time was 14 min. Both cannulas were removed. A ringed Gore-Tex (W. L. Gore and Associates, Flagstaff, AZ, USA) vascular synthetic graft of 14 mm was interposed between the right atrium and the right innominate vein (Fig. 2a–d). Right diaphragmatic plication was performed due to resection of the right phrenic nerve. The patient was discharged on postoperative Day 18 due to respiratory
complications, left arm oedema and haematoma. After coumadinization of the patient, left arm oedema disappeared. She was referred to the oncology department to have adjuvant chemotherapy and radiotherapy.

**DISCUSSION**

Tumours may invade the heart by one of the four mechanisms: lymphatic extension, haematogenous metastasis, direct invasion or transvenous extension. The transvenous route of tumour spread relies on the extension of tumour thrombus into the right atrium via the superior vena cava in the case of lung cancer or via the inferior vena cava in case of primary renal or hepatic tumours [6]. This pathway is common to surgeons who deal with renal cell carcinoma [7]. Although cardiopulmonary bypass is recommended in patients with right atrial invasion through the transcaval route [2, 5], there may be concerns about full heparinization and postoperative bleeding due to invasion of the mediastinal mass to adjacent organs.

The transient cava-pulmonary shunt technique for a bidirectional cava-pulmonary shunt operation was used and described...
in patients with functional single ventricular physiology by one of us (E.T.) [8]. Transient shunts were performed from the superior vena cava to the right atrium or left pulmonary artery, and the results demonstrated that this technique is feasible and safe. Thus, resection of thymoma, the infiltrated part of the superior vena cava and the right atrial mass were considered to be performed via cava-pulmonary shunt, through the inferior vena cava and the main pulmonary artery. Since the right atrium was filled with mass, inferior vena cava cannulation was performed under transoesophageal control over the anterior surface of the vein (Supplementary Video 1). After the main pulmonary arterial cannulation was performed with standard techniques, air was removed and the patient was kept in the Trandelenburg position for maintaining the flow from the inferior vena cava to the pulmonary artery. There was no problem with the flow due to all venous access coming from the inferior part of the body. Haemodynamic deterioration and hypoxemia were not experienced during the shunt period.

Avoidance of cardiopulmonary bypass for the thoracic malignancy resections may help in decreasing postoperative bleeding due to systemic heparinization, and thereby, causing a decrease in the amount of transfusion, requirement of inotropic agents, and pleural effusions and may help in early extubation. Moreover, concerns about the potential systemic side effects of cardiopulmonary bypass on thoracic malignancy patients can be avoided.

This case report was presented to demonstrate an alternative technique to cardiopulmonary by pass for resection of tumours that have intra-atrial extension.

**SUPPLEMENTARY MATERIAL**

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

Conflict of interest: none declared.

**REFERENCES**


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**EDITORIAL COMMENT**

**Superior vena cava resection and reconstruction**

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Stage III thymic tumours often represent a major challenge; however, if complete resection is accomplished, long-term survival can be comparable with that of patients with stage I and II disease [1]. Induction and adjuvant regimens may help us to achieve these results [2]. The left brachiocephalic vein, superior vena cava (SVC), right atrium, pericardium, lung and diaphragm can be safely resected with or without reconstruction. Also, resection of one phrenic nerve or reconstruction of the ascending aorta and main pulmonary artery may be required to achieve complete resection; on the other hand, invasion through the pericardium into the myocardium usually precludes resection.