

Perioperative echocardiography for invasive thymoma with intracardiac invasion in a child: a case report

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In the paediatric population, thymomas are rare mediastinal tumours. Surgical management is the main treatment for these tumours. A case of an aggressive thymoma with intracardiac invasion in a child is presented. The management plan involved either resection of the mass or de-bulking of the tumour followed by radiation therapy. Anaesthetic management for this procedure is reported and the use of transthoracic and transoesophageal echocardiography during the perioperative period is described. Echocardiography adds important haemodynamic and anatomical information not obtained from traditional imaging and it is recommended that it be considered routinely in these patients.

Keywords: echocardiography, intracardiac invasion, paediatric, thymoma

Background

Thymomas are slow-growing mediastinal tumours, which can exhibit locally invasive and metastatic behaviour. In adults thymomas are a common cause of mediastinal tumours, and are often associated with myasthenia gravis. In children they are rare, accounting for 4% of mediastinal tumours, and are seldom associated with myasthenia gravis. Invasion of the pericardium is associated with a decreased survival rate.^{1,2} Surgical removal is the main treatment for thymomas, and may be followed by chemo-radiotherapy. Stage 3 and 4 tumours may be irresectable and, chemo-radiation usually precedes resection.^{1,2} These tumours can compromise respiratory and cardiovascular function due to local compressive effects or, less frequently, direct invasion of structures. Preoperative investigations may include the use of echocardiography, which can provide valuable information on the anatomy of the mass and haemodynamic changes secondary to compression.^{3,4} Previous literature has reported on the use of intraoperative transoesophageal echocardiography (TOE) in a case of a mediastinal mass in a child;⁵ however, in many centres the use of both transoesophageal and transthoracic echocardiography is not considered routine practice for thymoma resections in the paediatric population.

Case report

Informed consent to publish this case report was obtained from the mother of the patient. A 14-year-old male with mild positional dyspnoea and cough underwent computed tomography (CT) of the chest showing a large heterogeneous mass, measuring 146 x 74 x 129 mm. The mass encased mediastinal vessels and attenuated the superior vena cava (SVC), with the presence of collateral vessels. The right middle lobe; medial and lateral segmental bronchi; right lower lobe medial and posterior basal segment bronchi were infiltrated by the mass. There was encasement of the right pulmonary veins and compression of the left atrium. Type B2 thymoma was diagnosed on needle biopsy. The patient was referred to cardiothoracic surgery for resection or de-bulking prior to further therapy. Preoperative assessment established no positional symptoms and adequate effort tolerance.

On the day of surgery, preparations were made for the 'rescue position', rigid bronchoscopy was available in theatre and the cardiopulmonary bypass circuit was primed. Initial vitals were a heart rate of 110 bpm, blood pressure of 120/78 mmHg and room air saturation of 99%. An intravenous elective sequence induction was performed using 'Ketafol' with 80 mg of propofol and 40 mg of ketamine. After muscle relaxation with 30 mg of rocuronium, a size 35 Fr left double lumen endotracheal tube was sited. Maintenance of anaesthesia was achieved with sevoflurane. An increase in heart rate to 130 bpm and a reduction in blood pressure to 100/65 mmHg were considered appropriate. Oxygen saturation and end tidal carbon dioxide concentrations remained normal. During induction, a transthoracic echocardiography (TTE) probe was kept on the chest wall as an additional monitor of haemodynamic status. Minimal changes were noted. Central venous and arterial catheters were placed and an ultrasound-guided thoracic epidural was performed. The TTE performed before induction revealed marked compression of the left atrium (Figure 1A). In the transthoracic long axis view, the mass appeared to invade the left atrium (Figure 1B). There were no echocardiographic features of diminished flow across the mitral valve. During induction there was no significant reduction in transmitral or transaortic blood velocity. This was also reflected by stable blood pressure and heart rate readings throughout this period. Intraoperative TOE was used to further visualise the mass and assess the effect on cardiovascular function.

TOE images revealed invasion of the right ventricular wall and left atrium by the mass (Figure 1C and 1D). There was also evidence of main pulmonary artery compression (Figure 1D). The echogenicity of the tumour was similar to the neighbouring ventricular tissue, and the lack of visible pericardium between the mass and the heart indicated intracardiac invasion. Despite gross left atrial involvement, mitral valve gradient and left ventricular inflow velocity were normal. The tricuspid and pulmonary valve apparatus were spared (Figure 2(A) and 2(C)). The mass extended to the posterior mitral leaflet (Figure 2(B)) but this did not affect mitral valve function. The extent of invasion was confirmed by the surgical team and the procedure was abandoned after performing a tumour de-bulking and incisional biopsy.

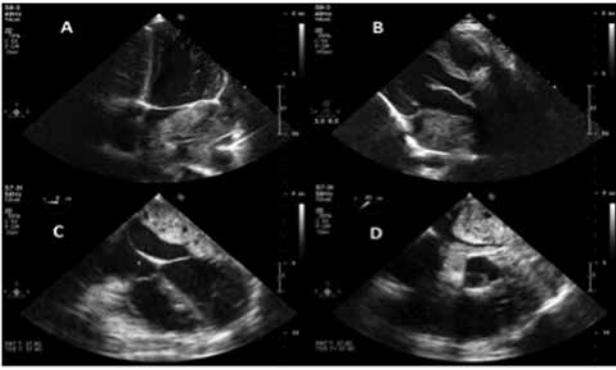


Figure 1: Transthoracic echocardiography: (A) four-chamber view showing marked left atrial compression, and (B) long axis view showing left atrial invasion. Transoesophageal echocardiography: (C) mid-oesophageal four-chamber view demonstrating left atrial and right ventricular wall invasion, and (D) mid-oesophageal right ventricular inflow-outflow view demonstrating pulmonary artery compression and left atrial invasion.

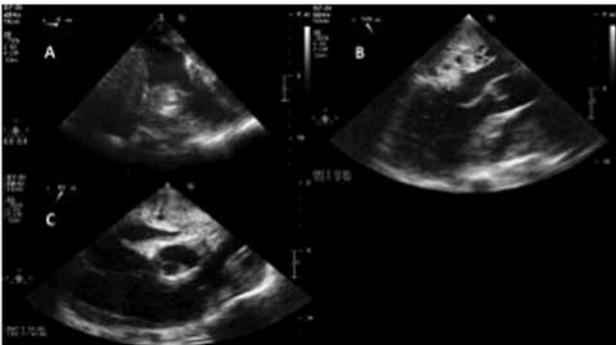


Figure 2: Transoesophageal echocardiography images demonstrating valvular anatomy: (A) mid-oesophageal four-chamber view demonstrating preserved leaflet motion of the tricuspid valve with infra-annular mass extension, (B) mid-oesophageal aortic long axis view demonstrating left atrial invasion extending to the posterior mitral leaflet, (C) mid-oesophageal right ventricular inflow-outflow view demonstrating unaffected pulmonary valve apparatus with left atrial invasion and main pulmonary trunk encasement.

The patient underwent an uneventful recovery in ICU and was referred to oncology for chemo-radiotherapy and palliative care. Subsequent histology showed Type B3 thymoma. Unfortunately, the patient died two months later.

Discussion

There are reports of thymomas invading both atria and ventricles in adults, but no reports examining the perioperative management of invasive thymomas in children could be found.^{1,6} Echocardiography is useful as a perioperative investigation for

mediastinal and paracardiac masses, and has even been suggested as an alternative to CT imaging.^{3,4} In the context of long surgical waiting lists, there may be a protracted period of time from CT scan and diagnosis to surgery. Echocardiography provides an adjunctive diagnostic modality, which could be used immediately preoperatively to confirm if the anatomy of the mass has changed markedly from previous imaging.

The literature on anaesthetic management of thymoma resection in a child is limited. The application of a TTE probe during the critical period of anaesthesia induction provided important haemodynamic information, including assessment of dynamic chamber collapse. Both TTE and TOE revealed extensive cardiac chamber invasion, which was not appreciated on the recent CT scan. We recommend that transthoracic or, in higher risk cases, transoesophageal echocardiography be considered a routine preoperative investigation for children presenting for thymoma resection.

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