Ultrasound-guided intraoperative trans-epicardial needle biopsy of an intracardiac tumor

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ABSTRACT

We describe the use of a novel interventional approach to the histopathologic diagnosis of a ventricular septal tumor using intraoperative ultrasound-guided trans-epicardial biopsy without the need for cardiopulmonary bypass in a 2-year-old child. This novel approach has not been previously reported. Multidisciplinary collaboration between cardiothoracic surgery, cardiology, cardiac imaging, and interventional radiology provided the ability to perform cardiac biopsy. This technique may be used in specific cases of cardiac tumors where tissue diagnosis is important, but surgical resection is deemed excessively risky or impossible.

Keywords: Biopsy, cystic, intracardiac, teratoma

INTRODUCTION

Cardiac tumors are most commonly diagnosed by imaging modalities such as an echocardiogram or cardiac magnetic resonance imaging (MRI). In rare instances, the diagnosis can be elusive and histopathology is required to determine tumor type. In this case report, we describe the use of a novel approach for the histopathologic diagnosis of the tumor using ultrasound-guided intraoperative biopsy of a cardiac interventricular septal tumor without the need for cardiopulmonary bypass.

CASE REPORT

Our patient was a 25 month old prenatally diagnosed with an interventricular septal mass. Postnatally, the mass was noted to encompass the entire venticular septum without inflow or outflow tract obstruction. Imaging with echocardiography and cardiac MRI [Figure 1] could not delineate a definitive diagnosis. Although tissue typing was recommended for diagnosis, an open surgical biopsy and/or resection of the mass was deferred because the mass was deemed unresectable due to the size and location of the tumor occupying the entire interventricular septum.

Over two years the tumor had slowly increased in size and the patient developed progressive conduction delay (QRS duration increased from 78 to 138 ms) [Figure 1] with a left anterior hemiblock and development of a complete right bundle branch block. There was mild right ventricular outflow tract obstruction. If the tumor was to continue to increase in size and cause hemodynamically significant adverse effects such as outflow or inflow obstruction, complete heart block or cardiac dysfunction, treatment options were limited by a lack of definitive tumor diagnosis. From a surgical standpoint, the tumor was inoperable. Heart transplant was not an option without a specific tumor diagnosis. Due to concern for the progressive increase in the size of the tumor causing possible invasion of

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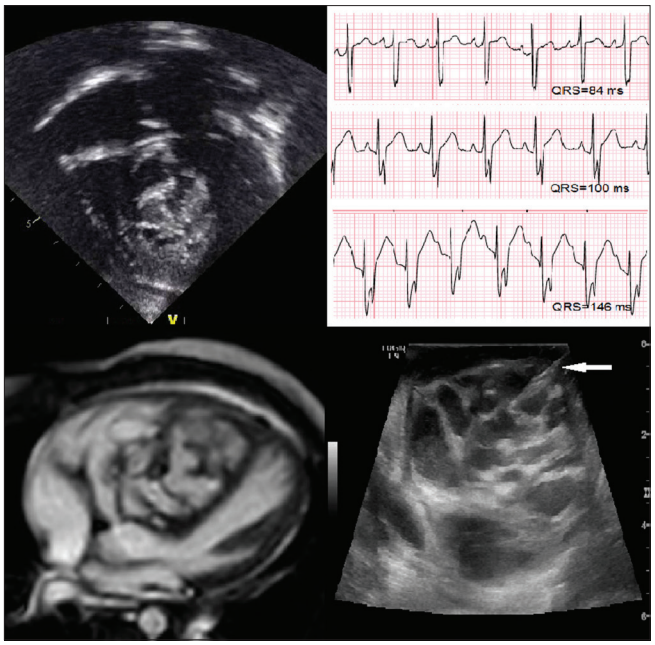

Figure 1: Echocardiogram showing a large interventricular septal tumor (left upper panel), magnetic resonance imaging showing interventricular tumor nearly occupying the entire septum (left Lower Panel), epicardial ultrasonography showing cystic lobulated tumor mass in the right ventricle and septum with a needle inside the tumor and echocardiogram changes (Right Lower Panel). QRS duration prolongation over time (Right upper panel)

the tumor into His-bundle system leading to complete heart block, the decision was made to obtain a biopsy of the tumor to rule out malignancy and to implant a pacemaker during the thoracotomy.

At the time of the procedure, the patient was 25 month old and weighed 13 kg. The tumor measured 44 mm × 30 mm × 32 mm by echocardiography. The patient was put under general anesthesia. A median sternotomy was performed, and the pericardium was opened. An epicardial ultrasound was used to visualize the tumor which encompassed the entire ventricular septum and consisted of multiple echolucent pockets interspersed with tissue septae [Figure 1]. The epicardial coronary arteries were located by ultrasound, and a suitable site on the right ventricular (RV) free wall was determined for the needle puncture, avoiding any coronary arteries or veins. The surgeon placed a pledgeted purse-string suture in this area for postbiopsy hemostasis, and a 16G coaxial needle was advanced through the RV free wall inside the purse-string suture, using ultrasound guidance till it reached the edge of the tumor. The tumor was very firm, and the advancement of the needle required some force. The inner component of the coaxial needle was removed, and several biopsies were performed using 6 cm and 16G Cook Quick-Core biopsy needle (Cook©, Bloomington, Indiana). In addition, aspiration using a 22G Chiba needle (Cook©, Bloomington, Indiana) from within the 16G needle was attempted, but the fluid material inside the tumor was too thick to aspirate through this small needle. The 16G needle itself was then used to aspirate the echolucent areas, and clear mucus was aspirated. After the biopsies were completed, the puncture site on the RV free wall was closed by tying down the purse-string suture. A ventricular epicardial pacemaker system was placed using a steroid-eluting bipolar lead on the right ventricle and the chest was closed [Supplemental Video].

On histopathology, heterologous elements (respiratory epithelium) and mucin were noted consistent with a benign mature cystic teratoma. Her management plan was changed to close observation because of low potential for continued tumor growth and pacemaker evaluation.

Her postoperative course was complicated by high-grade fever. During a routine blood draw from the right internal jugular line, mucoid material was aspirated concerning tumor extravasation in the bloodstream. She was treated with intravenous (IV) methylprednisolone as an anti-inflammatory agent and IV heparin to prevent intravascular thrombus formation after 5 days. She was discharged home on enoxaparin and atenolol. The enoxaparin was continued for 3 months then discontinued without complication.

DISCUSSION

This is a rare case report of an intraoperative ultrasound-guided trans-epicardial biopsy of an intracardiac tumor.

Interventricular teratomas are exceedingly rare and in prior case reports surgical resection of these tumors in neonates have resulted in cardiac dysfunction and death.[1] In one prior report, the patient died 16 h after birth due to left ventricular outflow tract obstruction.[1] In another case report, the patient underwent resection of the tumor at 2 days of life and died 15 days later.[2] The tumor size of our patient exceeded those described in prior case reports, which described successful resection of the mass, and thus the decision was made to not excise this tumor.[1,3] In this case, confirmation of the tumor type was felt to be important to establish a definitive diagnosis and to provide management options and prognosis for the family. Historically, all pediatric patients with intracardiac tumors have undergone surgical resection for antemortem histopathologic diagnosis.[1,3,4] In our patient, the tumor location was also not accessible for transcatheter endomyocardial biopsy with a bioptome due to the depth of the normal interventricular septal tissue between the RV cavity and the cystic mass. Therefore, the novel technique described here was used with multidisciplinary involvement of cardiothoracic surgery, cardiology, cardiac imaging, electrophysiology, and interventional radiology.

Intraventricular conduction delay and complete heart block have been reported with tumors of the interventricular septum.[5] There have been many reports of patients with atrioventricular nodal tumors requiring pacemakers or suffering sudden death due to suspected complete heart block. Although Cina *et al.* published three reports of sudden death with autopsy findings of intracardiac teratomas, there is no prior report of an intracardiac teratoma causing conduction delay or complete heart block like our patient.[5]

In conclusion, intracardiac teratomas may grow in size and result in conduction delays and tissue diagnosis may be required to rule out malignancy and estimate the growth potential of the tumor. Intraoperative ultrasound-guided needle biopsy of intracardiac tumors is an option in specific cases where tissue diagnosis is important but surgical resection is too risky or impossible.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Patel J, Patel S, Sheppard MN. Benign cardiac tumours associated with sudden death. Europace 2014;16:855-60.
2. Costas C, Williams RL, Fortune RL. Intracardiac teratoma in an infant. Pediatr Cardiol 1986;7:179-81.
3. Gembicki M, Hartge DR, Hoffmann U, Krapp M, Vokuhl C, Weichert J. Severe obstruction of the fetal right ventricular outflow tract due to a primary teratoma originating from the interventricular septum and resulting in neonatal death. J Ultrasound Med 2016;35:663-7.
4. Campagne G, Quereda F, Merino G, García A, Herranz Y, Frutos A, *et al.* Benign intracardiac teratoma detected prenatally. Case report and review of the literature. Eur J Obstet Gynecol Reprod Biol 1998;80:105-8.
5. Cina SJ, Smialek JE, Burke AP, Virmani R, Hutchins GM. Primary cardiac tumors causing sudden death: A review of the literature. Am J Forensic Med Pathol 1996;17:271-81.