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CASE REPORT
Cardiac tumors

An uncommon cause of right heart failure: primary cardiac pre-B cell acute lymphoblastic leukemia (RCD code: VI-2C.1)

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Abstract

Hematological malignancies are protean in their presentations. Primary cardiac tumors are exceedingly rare, and primary cardiac leukemia presenting as an isolated mass is even rarer. Here, we present a case of a young man who presented with a history of fever and shortness of breath for the past month. His examination revealed signs of right sided heart failure. On workup he was found to have a mass in the heart on computed tomography scan of the chest, his transthoracic echocardiography showed an isolated right atrioventricular groove mass. Surgical biopsy confirmed it to be an extremely rare presentation of pre-B-cell acute lymphoblastic leukemia. The patient underwent surgical excision of the lesion. In the further course, the patient developed bone marrow leukemic involvement, confirmed by bone marrow biopsy and died of overwhelming sepsis secondary to pancytopenia. This case highlights that hematological malignancies can present as cardiac masses and should be considered during workup of patients presenting with chronic fever and right sided heart failure. JRCD 2017; 3 (4): 137–142

Key words: cardiac tumor, pre-B-cell lymphoblastic leukemia, echocardiography, rare cardiovascular disease

Background

The myocardium is a rare territory for hematological malignancies to inhabit, yet there have been reported cases in which a primary cardiac mass has shown leukemic differentiation. We present the case of a young man with right sided heart failure, who was found to have an isolated right atrioventricular mass confirmed to be a rare pre-B-cell acute lymphoblastic leukemia (ALL). Though cardiac involvement with ALL has been reported, it is extremely rare for pre-B-cell ALL to present as right sided heart failure on index presentation. This is the first case of ALL involvement of the myocardium to be reported from the subcontinent, largely because of the rare occurrence of ALL with heart involvement and also because of a lack of diagnostic advancements in the field of imaging and histopathology in this region.

Case presentation

A 40-year-old man presented with complaints of low-grade fever for one month and worsening of shortness of breath for the past 4 weeks. He was vitally stable, physical examination revealed jugular venous distention, pedal edema and a suspicion of left sided pleural effusion. Chest X-ray showed an enlarged heart with left sided pleural effusion (Figure 1). Laboratory investigations showed a normal white blood cell count and no premature cells in peripheral blood film.

Patient management and follow-up

A transthoracic two-dimensional echocardiography revealed a large echogenic density within the right atrioventricular groove and within the right atrium (RA) extending through the tricus-

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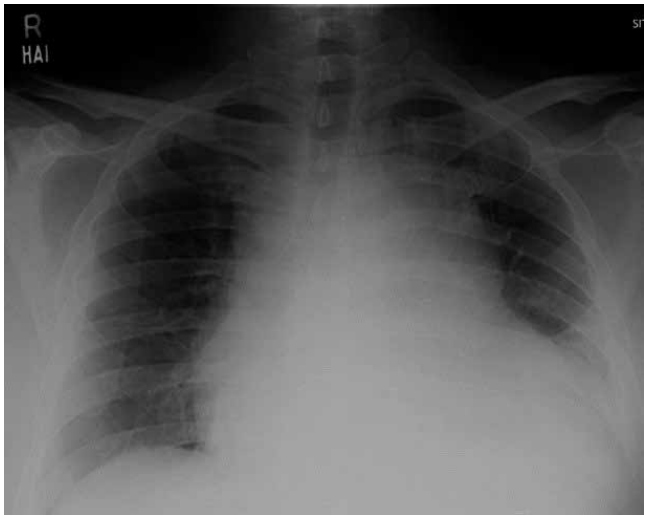

Figure 1. Chest X-ray showing enlarged heart with left sided pleural effusion

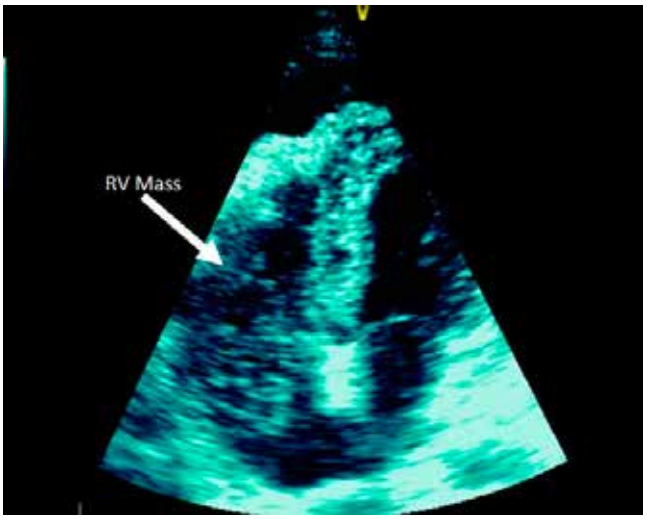

Figure 2. Transthoracic 2D echocardiography, apical 4-chamber view showing a mass in the right atrium extending into the right ventricle

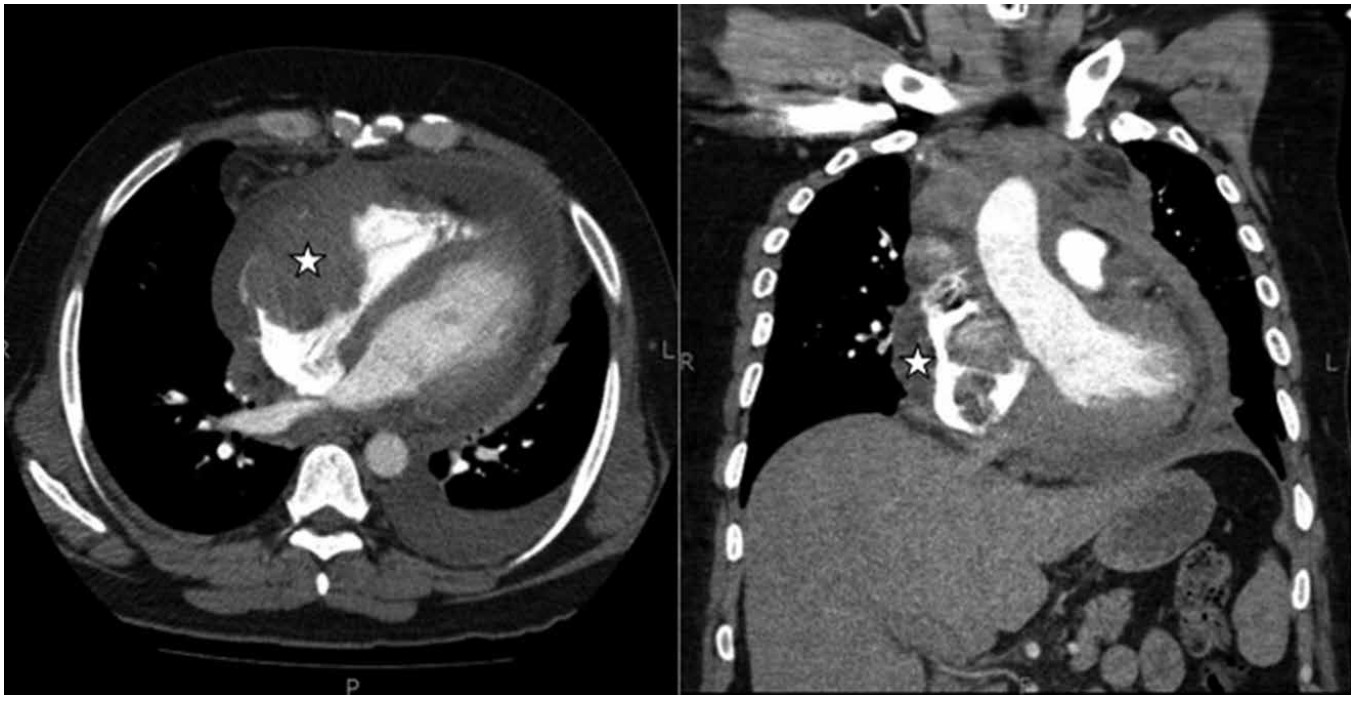

Figure 3. Chest CT scan with contrast showing intracardiac, large hypo attenuating lobulated soft tissue mass lesion 5.6 × 5.9 cm (asterisk) adherent to anterolateral wall of the right atrium, infiltrating the atrial wall, as well as atrioventricular septum

pid valve (TV) into the right ventricle (RV), causing functional tricuspid stenosis with a peak gradient of 17 mmHg and a mean gradient of 9 mmHg (at a heart rate of 110 beats/minute). The mass appeared to be infiltrating into the wall of the RA and RV (Videos). A small mobile echogenic density was also found attached to the RA mass. RV function was reduced. Mild pericardial effusion was also noted (Figure 2).

Computed tomography (CT) scan with contrast showed a large hypoattenuating intracardiac, lobulated soft tissue mass measuring 5.6 × 5.9 cm adherent to the anterolateral wall of the RA, infiltrating the atrial wall. A moderate pericardial effusion with pericardial thickening was also seen (Figure 3).

Surgical resection of the mass was performed and the specimen was sent for histopathology analysis. A CT scan of abdomen and pelvis was performed and did not show any abdominal lymph nodes or abdominal organ involvement. Postoperative echo showed severely reduced RV systolic function. Decrease in size of the mass noted in the RA extending into the basal portion of the RV (smaller in size compared to previous echocardiogram). TV appeared thickened, with no stenosis.

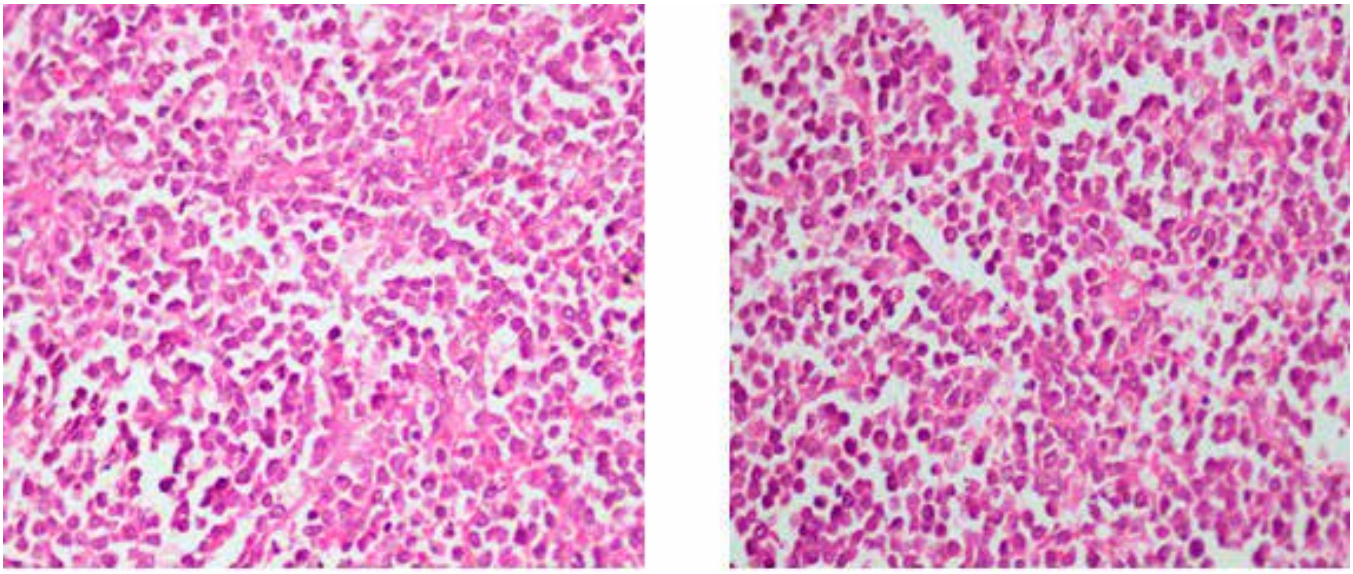

Figure 4. Hematoxylin and eosin staining shows tumor cells in form of sheets along with scattered tingible body macrophages resulting in a starry sky appearance at few places. The tumor cells have large nuclei with moderate to marked variation in size and shape. Occasional prominent nucleoli are seen

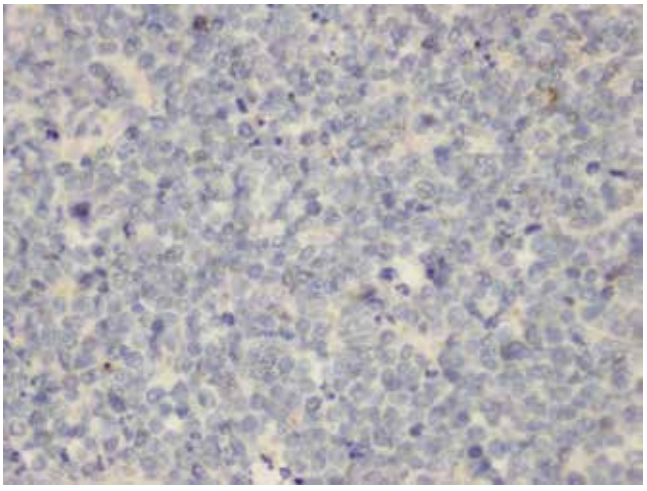

Figure 5. Immunohistochemical staining showing CD3 negative staining

Awaiting the final reports of biopsy the patient was discharged with a plan to initiate treatment once the final reports of the biopsy are available.

However, the patient was readmitted within a week, with high-grade fever and cough. His laboratory workup showed pancytopenia. Suspecting bone marrow involvement a bone marrow aspiration was performed. Due to severe sepsis secondary to respiratory tract infection he was managed with broad-spectrum antibiotics.

While he was admitted, the tissue biopsy was reported and was consistent with a high-grade B-cell leukemia (Figure 4). The immunohistochemical stains were CD79a positive, pan-T-cell marker (CD3) negative, PAX-5 positive, TdT positive, CD20 positive, CD10 positive, and BCL-2 negative (Figures 5-8).

Acute leukemia panel on bone marrow aspirate was positive for pan-B-cell markers i.e, cCD79a, CD19, CD10 and CD22, along with HLA-DR and CD45, TdT was also positive. On the basis of this analysis diagnosis of pre-B-cell ALL was made.

He was planned to be started on chemotherapy regimen comprising of vincristine, doxorubicin, cyclophosphamide, and steroids. However, despite treatment he died of overwhelming sepsis.

Review of literature

it is extremely rare for patients with leukemia to present with cardiac involvement at the time of diagnosis. The majority of available data on cardiac infiltration in leukemia originates from post-mortem analyses [1].

The cardinal manifestations of patients with leukemia are usually related to the infiltration of bone marrow with leukemic cells causing destruction of normal blood cell lineage. Rarely patients present with symptoms secondary to organ involvement. Cardiac involvement in cases of leukemia may present as cardiac rhythm disturbances, congestive cardiac failure, pericardial effusion and constrictive pericarditis. Our patient presented with symptoms of right heart failure due to tricuspid stenosis.

Sumners et al. reported microscopic myocardial involvement in 44% of autopsies of pediatric patients diagnosed with acute leukemia [1]. Yet, macroscopic involvement of the myopericardium with ALL is rare. Published literature on leukemic infiltration of the heart exists primarily as case reports, with the majority of cases being of myeloid origin [2–4]. Published cases of lymphoblastic leukemia with cardiac involvement are rare.

An electronic literature search using PubMed database with the search terms “acute lymphoblastic leukemia” and “heart” displays 9 reported cases [5–13]. Among these 3 cases are of T cell origin [5–7], 4 cases describe B-cell ALL [8–11] and in 2 case reports

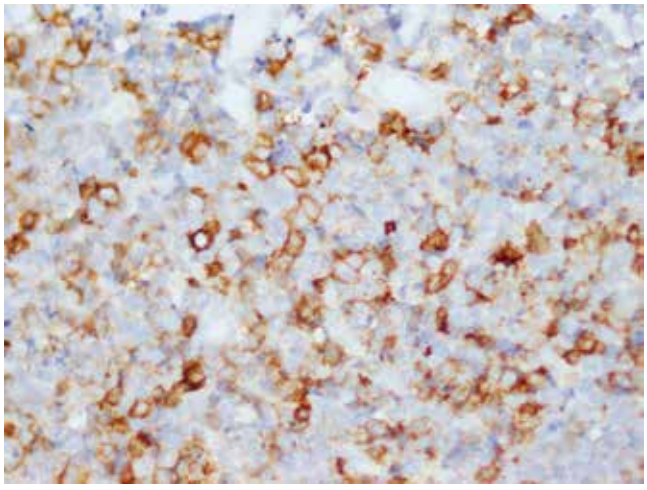

Figure 6. Immunohistochemical staining showing CD20 positive staining

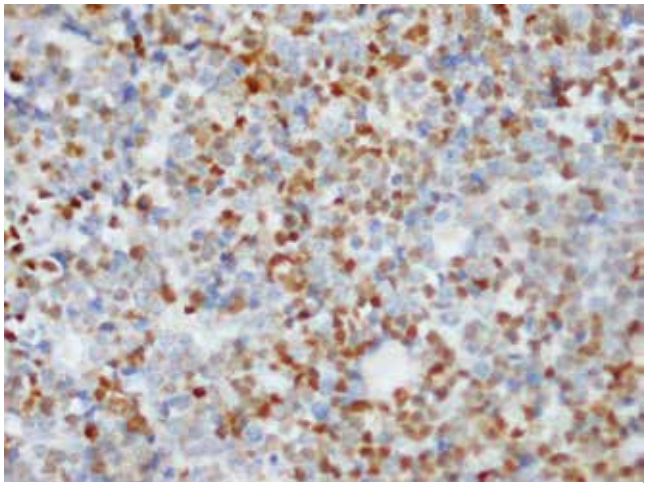

Figure 7. Immunohistochemical staining showing TdT positive staining

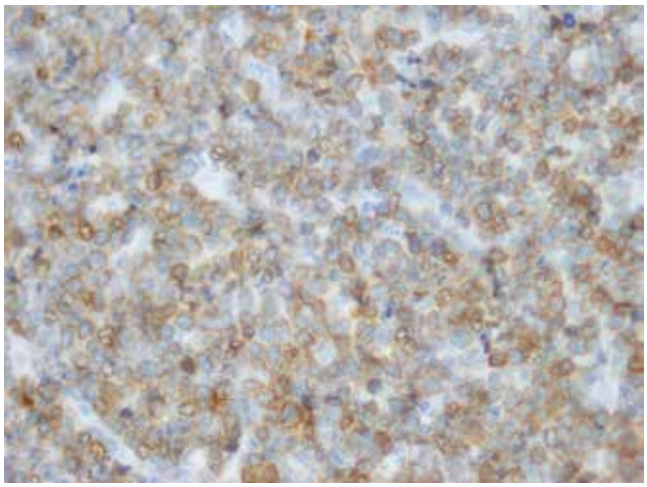

Figure 8. Immunohistochemical staining showing CD 79a positive staining

the hematopathological origin of leukemia was not mentioned [12–13]. Table 1 shows review of literature of case reports on ALL with cardiac involvement.

A review of cases of B-cell ALL with myocardial involvement [8–11] shows that three cases of B-cell ALL with myocardial infiltration report a relapse of B-cell ALL presenting as cardiac mass after chemotherapy or bone marrow transplant [8–10], whereas one case reports a right sided cardiac mass at initial presentation [7]. Our case also showed the presence of right side cardiac mass at initial presentation.

The mean age of presentation of patients presenting with myocardial involvement of B-cell ALL was 48 years. Clinical presentation of B-cell ALL in reported cases included dyspnea in 3 cases [8–10] and chest pain in one case [11]. Two patients had signs of right heart failure [8–9], one patient had cardiac tamponade [10], whereas one patient had ST-segment elevation myocardial infarction [11]. The masses were of RV origin in three cases and of pericardial origin in one patient. Chemotherapy was given in three cases and palliative radiation therapy in one case. Two patients were reported dead and one alive after treatment. Outcome in one patient was not provided. Our patient died prior to planned chemotherapy.

Our case highlights the unusual presentation of pre-B-cell ALL as an isolated right sided atrioventricular mass causing right heart failure due to acquired tricuspid stenosis. It is rare for ALL to present as solid masses and even rarer for B-cell ALL to present as cardiac mass on index presentation. Unfortunately, patients with pre-B-cell ALL with cardiac involvement may have extremely poor outcomes.

The mode of treatment in these cases depends upon the stage of the tumor. In case of an isolated cardiac mass the most appropriate therapy is primarily surgical resection of the mass followed by chemotherapy. However, once there is bone marrow involvement in such patients they become prone to infections due to rapidly falling leucocyte counts. The initial blood count of our patient showed normal leucocyte count, without abnormal cells on the peripheral blood film. However, post-surgery once the patient was being worked up for chemotherapy, he was found to have bone marrow involvement. His blood counts showed a falling trend and he developed pancytopenia. Table 2 shows a comparison of laboratory parameters on initial and repeat admission.

It could be speculated whether the patient had bone marrow involvement initially. The normal blood counts on initial presentation, with a normal peripheral blood film and no extracardiac involvement on initial CT scan point towards an isolated cardiac involvement of pre-B-cell ALL initially, followed by bone marrow transformation.

Our case highlights the rare occurrence of pre-B-cell ALL as a right sided cardiac mass. A diagnosis of a cardiac mass was formed and surgical resection of the lesion was performed. Despite treatment, the patient succumbed due to the malignant nature of the tumor. This is, to our knowledge, the first case of ALL involvement of the myocardium to be reported from our region.

Pre-B-cell ALL can present as a cardiac mass and should be considered during workup of patients presenting with chronic fever and right sided heart failure. Early diagnosis by a combination of imaging and biopsy followed by early initiation of treatment may alter the course of this malignant disease.

Table 1. Review of literature of case reports on Acute Lymphoblastic leukemia with cardiac involvement [5–13]

Year	Author	Age Of Patient	Gender	Location	Diagnos	Leukemia	Treatment	Outcome
2002	Barbaric D et al.	15	Male	Right ventricle	Presumed	ALL	Chemotherapy	Alive
2002	Hardikar A et al.	31	Male	Right atrium	Surgical Biopsy	T-cell ALL relapse	Surgical Excision and chemotherapy	Alive
2002	Tonya L Wright et al.	33	Male	Right atrium	Surgical Biopsy	T-cell ALL relapse	Radiotherapy	Alive
2004	Bekkers BC et al.	44	Male	Intraventricular and intra-atrial septum	Necropsy	ALL relapse	NONE	Death
2006	Tsukasa et al.	14	Female	Ventricle	Pleural Fluid Analysis	T-cell ALL relapse	Radiotherapy	Death
2007	Rami Kahwash et al.	51	Male	Pericardiac mass with tamponade	Surgical Biopsy	B-cell ALL relapse	Radiotherapy	Death
2012	Kakefuda et al.	61	Female	LV and right ventricular (RV) free wall	Surgical Biopsy	Pre B-cell ALL relapse	Chemotherapy	Alive
2016	Rudolf A. Werner et al.	38	Male	Right ventricle and right atrium	Biopsy	Pre B-cell ALL	Chemotherapy	Not provided
2016	Kiju Chang et al.	42	Male	LV and right ventricular (RV) free wall	Surgical Biopsy	B-cell ALL relapse	Chemotherapy	Death

Table 2. Comparison of laboratory parameters on initial and repeat admissions

Laboratory parameter	Initial admission (pre surgery)	Repeat admission (post surgery)
Hemoglobin	14.4 g/dl	9.4 g/dl
Blood cell count	10.2 × 109/L	1.3 × 109/L
Neutrophils	70.7%	90%
Platelet count	454 × 109/L	63,000 × 109/L
C-Reactive Protein	2.3 mg/dl	1.4 mg/dl
NT-proBNP	2145	1747

NT-proBNP – N-terminal pro brain natriuretic peptide

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