Case Report

Cardiac metastasis of acute lymphoblastic leukemia among adult patients

Nattiya Teawtrakul[1], Kanchana Chansung[1], Chittima Sirijerachai[1], Orathai Pacheerat[2] and Burabha Pussadhamma[2]

[1]Division of Hematology; [2]Division of Cardiology, Department of Internal Medicine, Srinagarind Hospital, Faculty of Medicine, Khon Kaen University

Abstract:

Cardiac metastasis is an uncommon clinical complication of acute lymphoblastic leukemia (ALL). We reported two new cases of T-cell and B-cell ALL who presented with different clinical manifestations of cardiac leukemia at the time of initial diagnosis. We also demonstrated the advantage of echocardiography and computed tomography scan in the diagnosis and follow-up of patients. The cardiac involvements improved after the treatment of acute leukemia by chemotherapy and radiotherapy.

Keywords : ● *Cardiac involvement* ● *Acute lymphoblastic leukemia*

J Hematol Transfus Med. 2019;29:363-8.

Received 10 September 2019 Corrected 29 October 2019 Accepted 13 November 2019

Correspondence should be addressed to Teawtrakul N, Department of Internal Medicine, Faculty of Medicine, Khon Kaen University 40002

E-mail: nattiya@kku.ac.th

รายงานผู้ป่วย

การแพร่กระจายไปที่หัวใจของมะเร็งเม็ดเลือดขาวแบบเฉียบพลันชนิดลิมฟอยด์ในผู้ป่วยผู้ใหญ่

ณัฐติยา เตียวตระกูล กาญจนา จันทร์สูง จิตติมา ศิริจีระชัย อรทัย พาชีรัตน์ และ บูรพา ปุสธรรม

บทคัดย่อ

การแพร่กระจายของมะเร็งเม็ดเลือดขาวไปที่หัวใจเป็นภาวะแทรกซ้อนที่พบได้ไม่บ่อยในโรคมะเร็งเม็ดเลือดขาวแบบเฉียบพลันชนิดลิมฟอยด์ ผู้วิจัยได้รายงานผู้ป่วยโรคมะเร็งเม็ดเลือดขาวแบบเฉียบพลันรายใหม่จำนวน 2 ราย โดยเป็นมะเร็งเม็ดเลือดขาวแบบเฉียบพลันชนิดลิมฟอยด์บี-เซลล์ และ มะเร็งเม็ดเลือดขาวแบบเฉียบพลันชนิดลิมฟอยด์ที-เซลล์ ที่มีอาการแสดงทางคลินิกของการแพร่กระจายของมะเร็งเม็ดเลือดขาวไปที่หัวใจแตกต่างกันในช่วงเวลาของการวินิจฉัยครั้งแรก นอกจากนี้ผู้วิจัยยังแสดงให้เห็นถึงประโยชน์ของการตรวจคลื่นเสียงสะท้อนหัวใจและการตรวจเอกซเรย์คอมพิวเตอร์ในการวินิจฉัยและการติดตามผู้ป่วย การแพร่กระจายของมะเร็งเม็ดเลือดขาวไปที่หัวใจดีขึ้นหลังจากการรักษาโรคมะเร็งเม็ดเลือดขาวเฉียบพลันด้วยยาเคมีบำบัดและรังสีรักษา

คำสำคัญ : ● *การแพร่กระจายไปที่หัวใจ* ● *มะเร็งเม็ดเลือดขาวแบบเฉียบพลันชนิดลิมฟอยด์*

วารสารโลหิตวิทยาและเวชศาสตร์บริการโลหิต. 2562;29:363-8.

Introduction

Cardiac metastasis is a rare clinical complication in acute leukemia. Microscopic postmortem cardiac leukemia has been reported about 30 to 45% in a few necropsy and autopsy case series.[1,2] Antemortem gross cardiac involvement is less common.

The cardiac involvement of acute leukemia were found in both acute lymphoblastic leukemia (ALL)[3-7] and acute myeloblastic leukemia (AML).[8-10] Among adult patients, cardiac involvement is more common in AML. Most cases with acute leukemia presenting cardiac metastases are frequently associated with advanced conditions, for example, relapse after allogeneic stem cell transplantation.[4-8] Moreover, this condition is rarely found at the time of leukemia diagnosis.[3,9,10]

We demonstrate two cases of T-ALL and B-ALL who had cardiac involvement at initial diagnosis with distinct clinical presentations.

Case 1

A 24-year-old man was evaluated due to prolonged fever with no symptoms of specific organ involvement. Physical examination revealed unremarkable changes except for mild pallor. The complete blood counts were as follows: hemoglobin, 9.3 g/dL; white blood cell count, 10.8×10^9/L; differentiation: neutrophils 3%, lymphocytes, 22%, lymphoblasts, 75% and platelet count, 63×10^9/L. Bone marrow smears showed increased cellularity with lymphoblasts of 95%. Flow cytometry revealed the following T-cell lineage: CD2+, cytoCD3+, CD7+, CD34+, TdT+, CD4-, CD8- and CD19-. A summary of laboratory data are shown in Table 1. After T-cell ALL was diagnosed, he underwent echocardiography before anthracycline-based chemotherapy administration which unexpectedly revealed a right ventricular mass. (Figure 1) Based on

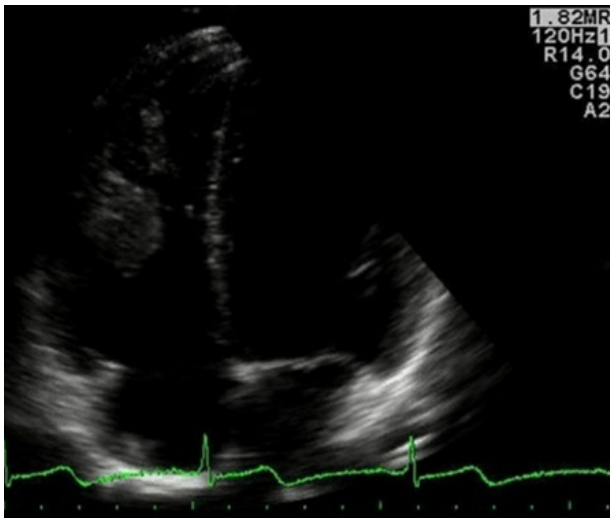

Figure 1 Pre-chemotherapy transthoracic echocardiography: showed right ventricular mass. The mass is attached to the free wall of the right ventricle.

Table 1. Summary of clinical characteristic and laboratory data of patients

Clinical characteristic and laboratory data	Patient 1	Patient 2
Age (year)	24	21
Diagnosis	Precursor T-ALL	Precursor B-ALL
Clinical presentation	Prolonged fever	Heart failure
WBC ($x10^9$/L)	10.8	56.5
Peripheral blast (%)	75	95
Hb (g/dL) / Hct (%)	9.3/26	6.8/22
Platelet ($x10^9$/L)	63	74
Cardiac involvement	Right ventricular mass	Infiltrative cardiomyopathy
Flow cytometry	CD2+, cytoCD3+, CD7+,CD34+ TdT+, CD4-, CD8-, CD19-	CD19+, CD34+, HLA-DR+, TdT+, CD10-, CD3-, CD4-
Cytogenetic study	46XY	46XY
Treatment	Chemotherapy	Chemotherapy+ radiation

cytoCD3, cytoplasmic CD3; TdT, terminal deoxynucleotidyl transferase

the patient, leukemic mass, thrombosis and vegetation comprised differential diagnoses. Cardiac mass was confirmed by the computed tomography scan of the heart and presented a well-defined hypodensity non-enhancing lesion at the anterior aspect of the right ventricle and by the evidence of attachment to chordae tendinae and nondependent part location, right ventricular mass from leukemic infiltration was the most likely diagnosis (Figure 2). He then received multi-agent chemotherapy protocol for ALL. Subsequent echocardiographic evaluation after one month of chemotherapy showed a decrease in the size of the cardiac mass. (Figure 3) The course in the hospital was complicated by febrile neutropenia, for which the patient refused the treatment and then was lost to follow-up.

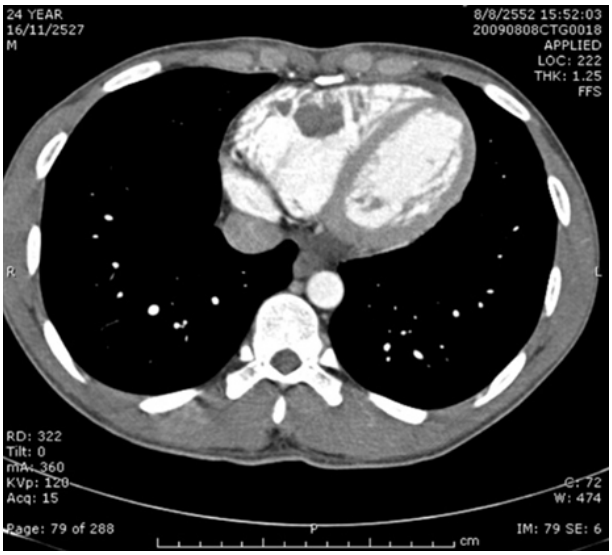

Figure 2 Computed tomography scan of the heart (arterial phase): revealed a well-defined hypodensity non-enhancing lesion with evidence of filling defect at the anterior aspect of the right ventricle, measuring about 1.8 x 2.6 x 1.4 cm in size. The mass is attached to the chordae tendinae.

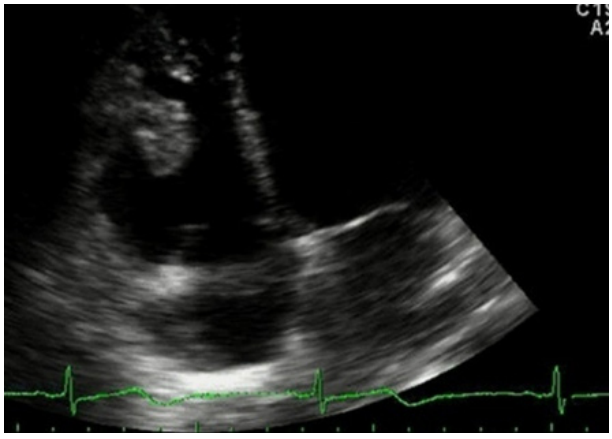

Figure 3 Post-chemotherapy transthoracic echocardiography: showed a decrease in the size of the right ventricular mass.

Case 2

A 21-year-old man presented acute heart failure, and upon physical examination revealed marked pallor, engorged jugular vein, bilateral fine crepitation at both lungs, S3 gallop and pitting edema. Echocardiography showed diffused leukemic infiltration of the heart (Figure 4) causing severe heart failure. The complete blood counts showed hemoglobin, 6.8 g/dL; white blood cell count, 56 $\times 10^9$/L; differentiation: neutrophils, 5%, lymphoblasts, 95% and platelet count, 74 $\times 10^9$/L. Bone marrow smears revealed increased cellularity with lymphoblasts of 95%. Flow cytometry results were as follows: CD19+, CD34+, HLA-DR+, TdT+, CD10-, CD3-, and CD4-. A summary of laboratory data are shown in Table 1. Bone marrow examination and flow cytometry confirmed the diagnosis of B-cell ALL. He was treated with ALL protocol and cardiac radiation. Echocardiography was performed

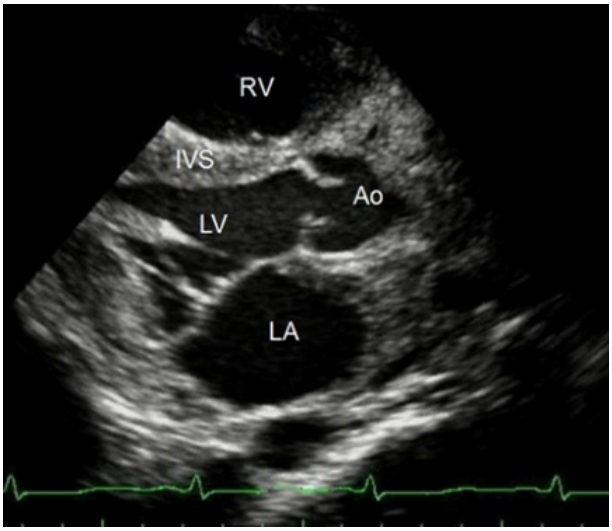

Figure 4 Pre-chemotherapy transthoracic echocardiography in parasternal long and short axes view showed diffused leukemic infiltration of the left ventricle posterior wall, interventricular septum, interatrial septum, left atrium (LA) and right atrium wall, right ventricle outflow tract, ascending aorta and main pulmonary artery wall.

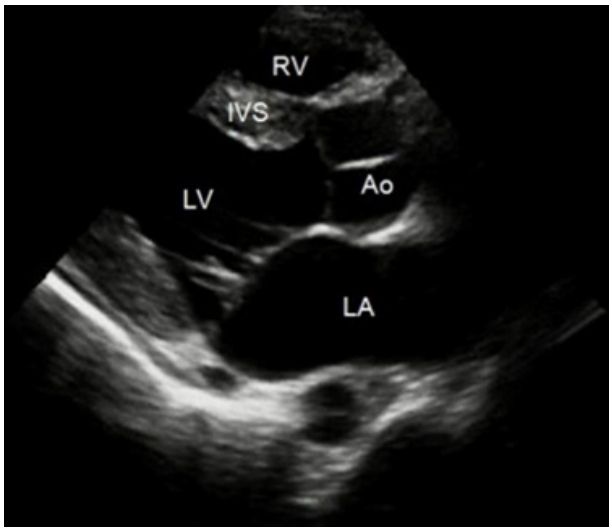

Figure 5 Post-chemotherapy transthoracic echocardiography in comparative view showed a markedly decrease in leukemic infiltration in all previous lesions.

consequently after completing the induction course of chemotherapy demonstrating markedly decreased leukemic infiltration in all previous lesions. (Figure 5) Although chemotherapy and radiation resolved his heart failure, he ultimately developed the progressive disease and died two months after the treatment.

A summary of clinical characteristics and laboratory data of patients are shown in Table 1.

Discussion

Cardiac metastases in acute lymphoblastic leukemia have been reported with various clinical presentations including cardiac tamponade[7,10], hypertrophic cardiomyopathy[5], severe congestive heart failure[4-6,8,9] and no cardiovascular symptoms[3]. We demonstrated two interesting cases with ALL who presented different clinical characteristics. Patient 1 presented no cardiac-related symptoms, but patient 2 presented severe heart failure and had a higher leukocyte count and percentage of blasts which may have cause more severe symptoms as reported by Sumners *et al.* reporting higher peripheral leukocyte count (50 x 10^9/L or greater), which significantly correlated with more leukemic infiltration of the heart.[1]

We demonstrated the usefulness of echocardiography an effective and noninvasive procedure for diagnosis and follow-up among leukemic patients with cardiac involvement. Computed tomography scan of the heart is also an effective diagnostic modality, particularly in complicated cases.

Related reports have demonstrated the successful and effective management among patients with cardiac complication using three main treatment modalities including chemotherapy, surgery and radiation therapy. Our subjects received chemotherapy and chemotherapy plus radiation (patient 2), which rapidly resolved the cardiovascular-related symptom. The first patient finished the induction course of ALL protocol and afterward was lost to follow-up. The second patient died by the progression of disease after completing the induction course of chemotherapy.

Declaration of interest: The authors report they have no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

References

1. *Sumners JE, Johnson WW, Ainger LE. Childhood leukemic heart disease. A study of 116 hearts of children dying of leukemia. Circulation. 1969;40:575-81.*
2. *Roberts WC, Bodey GP, Wertlake PT. The heart in acute leukemia. A study of 420 autopsy cases. Am J Cardiol. 1968;21:388-412.*
3. *Barbaric D, Holley D, Lau K-C, McCowage G. It is ALL in the heart: a patient with acute lymphoblastic leukemia and cardiac infiltration at time of diagnosis. Leuk Lymphoma. 2002;43:2417-9.*
4. *Wright TL, Bardy PG, Disney P, Moore S, Horvath N. Isolated cardiac recurrence of acute lymphoblastic leukemia characterized by t(11;19) two years after unrelated allogeneic bone marrow transplantation. Cancer Genet Cytogenet. 2002;137:146-9.*
5. *Hori T, Suzuki N, Mizue N, Hatakeyama N, Takamuro M, Tsutsumi H. Relapse of T-cell all after stem cell transplant presenting as hypertrophic cardiomyopathy: the value of non-invasive diagnostic imaging in detecting cardiac leukemia. Pediatr Blood Cancer. 2006;46:108-11.*
6. *Hardikar A, Shekar P, Stubberfield J, Craddock DR, Bignold LP. Cardiac involvement in a case of acute lymphoblastic leukemia. Ann Thorac Surg. 2002;73:1310-2.*

7. *Kahwash R, Rugg SS, Smith MD. Relapsing B-cell lymphoblastic leukemia in an adult presenting as an infiltrative cardiac mass with tamponade. J Am Soc Echocardiogr. 2007;20:1319.e1-2.*
8. *Kara IO, Sahin B, Paydas S, Kara B. Granulocytic sarcoma of the heart: extramedullary relapse of acute myeloblastic leukemia after allogeneic stem cell transplantation successfully treated by chemotherapy alone. Leuk Lymphoma. 2005;46:1081-4.*
9. *Rigamonti F, Beris P, Sanchez-Pareja A, Meyer P, Ashrafpoor G, Zaza S, et al. Atypical presentation of acute myeloid leukemia: cardiac myeloid sarcoma. Int J Hematol. 2009;89:693-8.*
10. *Kozelj M, Zorman D, Mrevlje B, Cernelc P, Zver S. Cardiac granulocytic sarcoma diagnosed by intracardiac echocardiography-guided biopsy. Int J Hematol. 2008;88:101-3.*