Cardiac fungal infections are rare and are most commonly caused by Candida albicans, Aspergillus fumigatus, and Cryptococcus. Cardiac aspergillosis often involves the endocardium and myocardium. Pericardial involvement is rare and is usually diagnosed postmortem. We report a case of an Aspergillus fumigatus pericarditis in a patient with long-term immunosuppressive therapies for seropositive erosive polyarthritis and a history of chronic lymphoblastic leukemia (CLL) with myeloproliferative syndrome.

Case
A 78-year-old female patient complaining of inspirational epigastric pain was transferred to our hospital with the suspicion of non-ST-elevation myocardial infarction. Her medical history included the following: (i) CLL associated with JAK2-positive myeloproliferative syndrome; (ii) seropositive erosive polyarthritis; and (iii) hypertension.

Received for publication March 4, 2022. Accepted April 11, 2022.

Ethics Statement: This case report has been approved by our Ethics Board Committee.

Corresponding author: Dr Samantha Guimaron, Department of Cardiac Surgery, Quebec Heart and Lung Institute, 2725 chemin Sainte Foy, Quebec, Quebec, G1V 4G5, Canada. Tel: +1-581-849-4643. E-mail: guimaron.samantha@hotmail.fr See page 664 for disclosure information.

https://doi.org/10.1016/j.cjco.2022.04.001
2589-790X/© 2022 The Authors. Published by Elsevier Inc. on behalf of the Canadian Cardiovascular Society. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
(Fig. 1A). Intravenous amiodarone was administered, and emergent pericardiacentesis was conducted, evacuating 600 mL of serous liquid, returning her to sinus rhythm. The following day, TTE showed a reduction in pericardial effusion size with fibrinous images on the LV, without cardiac compression. A contrast-enhanced body scan revealed a 27-mm pericardial fluid accumulation on the side of the LV, mild enhancement of the adjacent pericardium (Fig. 1B), stable mediastinal adenopathy, and multiple new pulmonary nodules. Pericardial fluid grew *Aspergillus fumigatus*, leading to voriconazole initiation, later confirmed by positive serology. Golimumab and methotrexate were immediately stopped, and prednisone was gradually weaned and discontinued. Recurrent symptomatic AF occurred, and repeat TTE showed increased accumulation of fibrinous deposits on the heart, in addition to cavitated areas with epicardial infiltrations. Subsequent fluorodeoxyglucose-positron emission tomography showed increased fluorodeoxyglucose uptakes of the following: (i) multiple pulmonary nodules suggestive of infectious or inflammatory lesions; (ii) mediastinal polyadenopathy secondary to either lymphoproliferative or infectious origin; (iii) the entire pericardium with an oval 30 × 45-mm focal site localized on the anterior wall of the LV; and (iv) multiple-muscle and subcutaneous focal sites (Fig. 1C), consistent with disseminated invasive aspergillosis. Because of hemodynamic consequences with recurring AF despite pericardial drainage, total pericardectomy was planned.

Surgery occurred through a median sternotomy. The pericardium was markedly thickened. Liquid and tissular collections and enlarged lymph nodes were found around the aorta and superior vena cava. Both ventricles had multiple infiltrated and cavitated areas (Fig. 1D). The pericardium was resected from one phrenic nerve to another. Unfortunately, removing all lesions was impossible, as they had completely infiltrated the myocardium. Following aggressive irrigation, the thorax was closed over 5 chest tubes. Multiple samples were sent for bacterial, fungal, and histopathologic analyses.

Postoperative TTE showed persistent circumferential epicardial tissue without fluid. Her postoperative stay was uneventful. All peri-operative and drainage system samples were positive for *Aspergillus fumigatus*. Pathology revealed multiple mycelian hyphae with 45° branching in the pericardium (Fig. 1E and F). She was discharged and closely monitored, with regular reviews. One year later, serum galactomannan assay and anti-aspergillus antibodies were both negative, her positron emission tomography scan showed no recurrence of glucose uptake in the mediastinum, her TTE was normal, and the patient was completely asymptomatic.

**Discussion**

Cardiac aspergillosis has been described with involvement of all 3 layers either isolated or as pancarditis.1,2,4,5 Risk factors for invasive aspergillosis include acquired immunodeficiency syndrome (AIDS), diabetes, severe neutropenia, hematologic disease, and immunosuppression, such as Hodgkin disease, requiring bone marrow transplant with chemotherapy,6 malignant leukemias, and solid organ transplant,7,8 and long-term steroids and/or immunosuppressive therapies.

Our case is interesting, as we report an early diagnosis that enabled early treatments that resulted in favorable postoperative outcomes; this outcome differs from those in previous publications. Other publications have reported either series of autopsies1,2,4,5 or case reports4,7 of diagnoses established postmortem. Cardiac fungal infections have been well described through a series of 60 autopsies from Atkinson et al.1 and 51 autopsies from Walsh et al.2 The latter study carried 13 cases of endocarditis, 34 cases of myocarditis, and 4 cases of pericarditis. These last 4 patients had a history of cytotoxic treatments, steroids, or leukemia, and combined pulmonary and cardiac lesions. The authors felt that the pericardial space was infected by either erosion of pericardial abscesses or direct contact with an infected pleural space.7

Le Moing et al.8 conducted a review of 29 cases of *Aspergillus* pericarditis. *Aspergillus fumigatus* was the most common species found (59%). Simultaneous pulmonary or pleural localization of invasive aspergillosis were present in 86% of the patients, and 34% of these patients did not receive antifungal therapy for invasive aspergillosis. All of them died, and their diagnoses were established at autopsy.9

**Conclusion**

We report the case of an immunocompromised patient with *Aspergillus* pericarditis in whom imaging revealed cardiac, pulmonary, cutaneous, and subcutaneous invasion. Rapid initiation of antifungal therapy is crucial and must be maintained on a long-term basis. Associated pericardectomy is a key aspect of the treatment of *Aspergillus* pericarditis.

**Acknowledgements**

We thank Dr Philippe Joubert, pathologist at our institution, for providing us with the histologic photography.

**Funding Sources**

The authors have no funding sources to declare.

**Disclosures**

The authors have no conflicts of interest to disclose.
Figure 1. (A) Echocardiographic 2-chamber view of left cavities showing dense tissular/fibrinous accumulation on the left ventricle (LV; red arrow). (B) Computed tomography scan transversal 4-chamber view of the heart showing circumferential pericardial effusion, with a collection on the posterior and lateral side of the LV and heterogenous pericardial thickness at the LV apex (orange arrow). (C, D) Fluorodeoxyglucose-positron emission tomography transversal 4-chamber view of the heart showing (C) increased uptake of the pericardium (green arrow), and (D) increased uptake of loculated area on the LV lateral side (green arrow). (E) Peri-operative photography of the infiltrative process with LV cavitation and abscess (yellow arrows). (F) Pathology analysis with Grocott coloration showing mycelian hyphae with 45°-branching in favor of Aspergillus organism (×400; black arrows).
References
1. Atkinson JB, Connor DH, Robinowitz M, McAllister H, Virmani R. Cardiac fungal infections: review of autopsy findings in 60 patients. Hum Pathol 1984;15:934-42.

2. Walsh TJ, Hutchins GM, Bulkley BH, Mendelson G. Fungal infections of the heart: analysis of 51 autopsy cases. Am J Cardiol 1980;45:357-66.

3. Rinaldi MG. Invasive aspergillosis. Rev Infect Dis 1983;5:1061-77.

4. Schwartz DA. Aspergillus pericarditis following bone marrow transplantation for chronic myelogenous leukemia. Chest 1989;95:1338-40.

5. Walsh TJ, Bulkley BH. Aspergillus pericarditis: clinical and pathologic features in the immunocompromised patient. Cancer 1982;49:451-60.

6. Alam M, Higgins R, Alam Z, Janakirama N, Gorman M. Aspergillus fungal mass detected by transesophageal echocardiography. J Am Soc Echocardiogr 1998;11:83-5.

7. Luce JM, Ostenson RC, Springmeyer SC, Hudson LD. Invasive aspergillosis presenting as pericarditis and cardiac tamponade. Chest 1979;76:703-5.

8. Le Moing V, Lortholary O, Timsit J-F, et al. Aspergillus pericarditis with tamponade: report of a successfully treated case and review. Clin Infect Dis 1998;26:451-60.

Supplementary Material
To access the supplementary material accompanying this article, visit CJC Open at https://www.cjcopen.ca/ and at https://doi.org/10.1016/j.cjco.2022.04.001.