

# Worsening cardiac tamponade after pericardiocentesis in a patient with anterior mediastinum mass: a case report

Osman Adi <sup>1\*</sup>, Chan Pei Fong <sup>1</sup>, Azma Haryaty Ahmad <sup>1</sup>, and Nova Panebianco<sup>2</sup>

<sup>1</sup>Department, Hospital Raja Permaisuri Bainun, Ipoh, PRK, Malaysia; and <sup>2</sup>Department of Emergency Medicine, Hospital of the University of Pennsylvania, Philadelphia, PA, USA

Received 1 November 2021; first decision 25 January 2022; accepted 4 August 2022; online publish-ahead-of-print 5 August 2022

## Background

Mediastinal mass is an entity with variable pathology and clinical spectrum. Anterior mediastinal mass can result in severe symptoms due to involvement of surrounding vital structures such as the great vessels, trachea-bronchial tree, and heart. We highlight a case of cardiac tamponade in a patient with an anterior mediastinal mass that was paradoxically worsened after decompressive pericardiocentesis.

## Case summary

A 21-year-old male presented to the emergency department (ED) with breathlessness and hypotension. Bedside focused cardiac ultrasound revealed cardiac tamponade which was made worse with an anterior mediastinal mass compressing the right heart chambers. The patient was intubated for respiratory failure, following which an ultrasound-guided pericardiocentesis was performed. Unexpectedly, his hemodynamic status worsened after aspiration of 1000 mL of pericardial fluid. A repeat focused cardiac ultrasound showed reduced pericardial effusion, but worsening of right heart chambers compression by the mediastinal mass. Re-expansion of the pericardium space with 600 mL of normal saline improved the patient's vital signs, and reduced the right heart compression. Computed tomography was deferred due to the patient's hemodynamic instability. Despite resuscitation with fluids and initiation of vasopressor, the patient's condition deteriorated. He succumbed to his illness due to obstructive shock causing multi-organ failure. The autopsy showed a large anterior mediastinal mass, and histopathological examination confirmed the diagnosis of lymphoma.

## Discussion

This case demonstrated the therapeutic challenges of managing a shock patient with anterior mediastinal mass, and massive pericardial effusion causing cardiac tamponade.

## Keywords

Case report • Anterior mediastinal mass • Cardiac tamponade • Pericardiocentesis

## ESC curriculum

2.1 Imaging modalities • 2.2 Echocardiography • 6.8 Cardiac tumours

## Learning points

- Clinicians should be alerted to the therapeutic challenges in patient presenting with anterior mediastinal mass.
- When dealing with massive pericardial effusion with compression from the anterior mediastinal mass, overzealous pericardiocentesis can exacerbate the compressive effect of the mediastinal mass due to loss of protective effect of the pericardial effusion.
- If pericardiocentesis is indicated, a controlled release of the pericardial effusion should be done to avoid paradoxical worsening of patient's hemodynamics.

\* Corresponding author. Email: [osman.adi@gmail.com](mailto:osman.adi@gmail.com)

Handling Editor: Suzan Hatipoglu

Peer-reviewers: Andriana Anagnostopoulou; Zain Ul Abideen Asad; Jagjit Khosla

Compliance Editor: Gal Tsaban

Supplementary Material Editor: Jonathan Senior

© The Author(s) 2022. Published by Oxford University Press on behalf of the European Society of Cardiology.

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial License (<https://creativecommons.org/licenses/by-nc/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited. For commercial re-use, please contact [journals.permissions@oup.com](mailto:journals.permissions@oup.com)

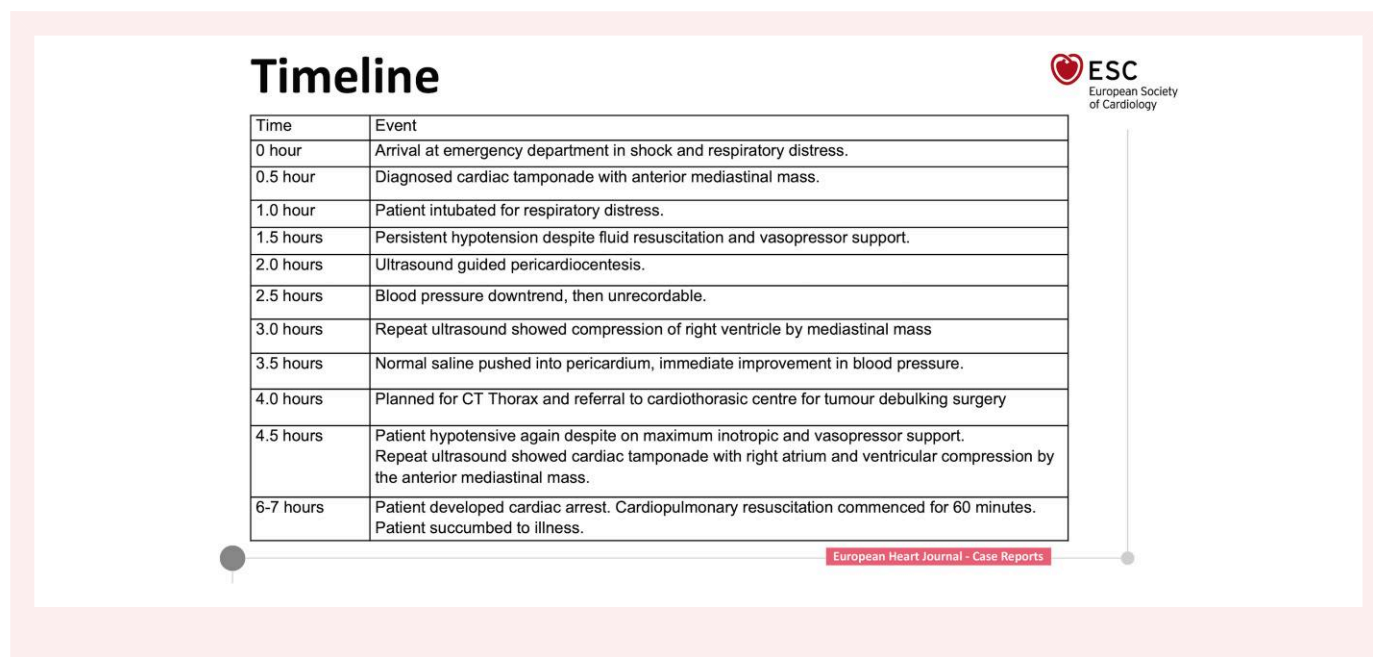
## Introduction

Cardiac tamponade is a life-threatening condition due to compression of the heart. It usually presents as an obstructive shock due to rapid accumulation of pericardial effusion which can be relieved immediately by pericardiocentesis.<sup>1,2</sup> However, intercurrent mediastinal space-occupying pathologies may also play a role in the mechanism of cardiac tamponade.<sup>3,4</sup> The management of such patients with overlapping conditions remains debatable, and the literature are limited to case reports.<sup>5,6,7,8</sup>

Mediastinal masses have variable clinical presentations, and 40% of the patients are asymptomatic.<sup>9,10</sup> Depending on the type of tumour and stage of presentation, definite management of mediastinal mass requires careful planning with multidisciplinary team approach.<sup>11,12,13</sup> The true incidence and prognosis of this condition is unknown, as some patients present with hemodynamic instability, preventing proper diagnostic work-up.<sup>14</sup>

In this case report, we highlight a scenario of cardiac tamponade in a patient with an anterior mediastinal mass that paradoxically worsened with decompressive pericardiocentesis.

## Timeline



## Case summary

A 21-year-old Malay man with no medical illness, presented to the emergency department (ED) with breathlessness for 1 day. On arrival, he was drowsy with the blood pressure of 75/40 mmHg, heart rate 130 beats/min, respiratory rate 45 breaths/min, and SPO<sub>2</sub> 80% on room air. His breathing was laboured, and his jugular venous pressures were distended. Pulsus paradoxus could not be appreciated due to the weak and fast pulse. Auscultation revealed equal breath sounds bilaterally, and heart sounds were muffled. Abdomen and neurological examinations were unremarkable. An electrocardiogram showed sinus tachycardia.

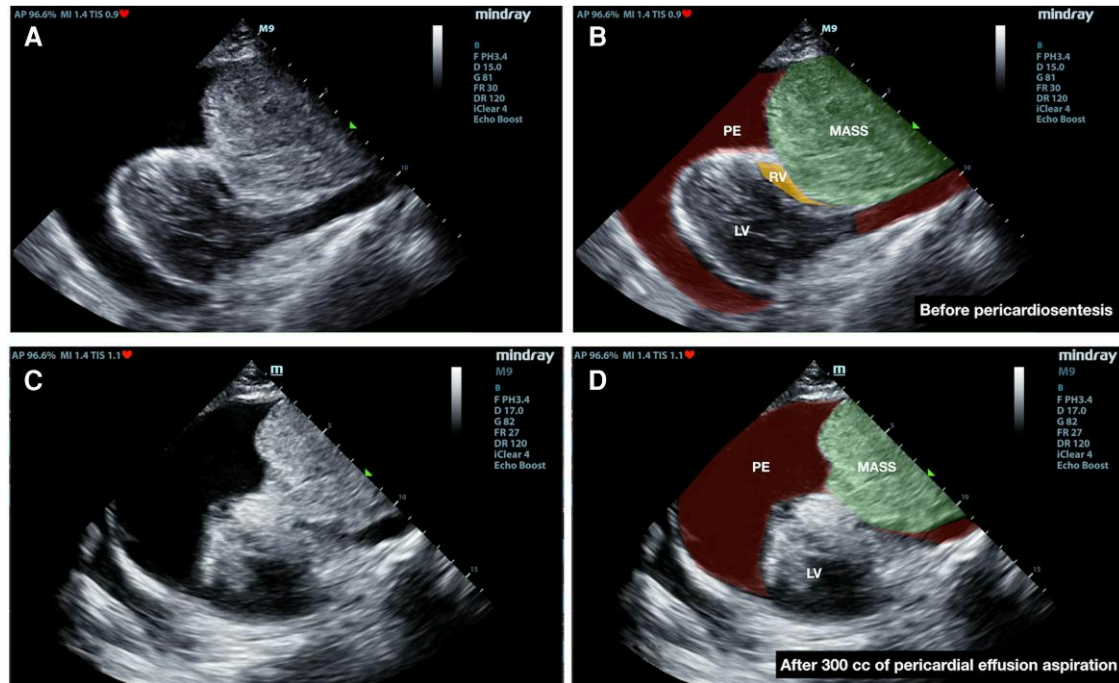
Based on the clinical presentation, the differential diagnosis included right heart failure, tricuspid valve pathology, pulmonary vascular problems, superior vena cava obstruction, and pericardial diseases. In

view of the severity of the patient's condition, a bedside point of care ultrasound was performed immediately to search for the cause. Ultrasound revealed a large anterior mediastinal mass compressing on the right atrium (RA) and right ventricle (RV) (*Figure 1A and B*). The surrounding massive pericardial effusion contributed to the cardiac tamponade. The patient's chest X-ray showed cardiomegaly with widening of the mediastinum (*Figure 2*).

The patient was resuscitated with 1 L of intravenous normal saline. One hour later, he was intubated for respiratory failure. He received intravenous fentanyl 100 mcg, intravenous midazolam 5 mg, and intravenous rocuronium 50 mg for induction. The ventilator setting was set at synchronized intermittent mandatory volume (SIMV) mode with a fraction of oxygen of 1.0, tidal volume 450 mL, respiratory rate 18/min, and positive end-expiratory pressure (PEEP) of 5 cm H<sub>2</sub>O. Post intubation, he remained hypotensive despite fluid resuscitation, which led to the initiation of intravenous infusion noradrenaline 0.8 mcg/kg/min. While waiting for an urgent computed tomography (CT) examination, the patient's condition deteriorated further to a blood pressure of 80/40 mmHg. The diagnosis of obstructive shock secondary to cardiac tamponade was deemed to be life-threatening. The anaesthetist, cardiologist, and general surgeon were consulted at this point, which advised emergency pericardiocentesis for stabilization of the patient, before transfer to a centre with cardiothoracic facilities.

Ultrasound-guided pericardiocentesis using the parasternal approach was performed at the bedside. One-thousand millilitre of serosanguinous fluid was drained, which was later found to be exudative, but did not yield any tumour cells. Post pericardiocentesis, the patient's haemodynamics worsened, and the blood pressure was unrecordable. Fluid resuscitation continued with another 1 L of normal saline. However, focused cardiac ultrasound showed worsening RV and RA compression by the anterior mediastinal mass (*Figure 1C and D*).

Our in-house cardiologist was consulted, and a trial of expansion of pericardium with 600 mL of normal saline into the pericardial space via pigtail catheter was performed. Post pericardial re-expansion, the blood pressure was 90/45 mmHg. Focused cardiac ultrasound still revealed right heart chambers compression (see [Supplementary](#)



**Figure 1** (A and B) Bedside focused cardiac ultrasound revealed a massive pericardial effusion with right atrium and right ventricle compression by an anterior mediastinal mass. (C and D) Focused cardiac ultrasound showed worsening right ventricle and right atrium compression by the anterior mediastinal mass after needle pericardiocentesis.

[material online, Video S1](#)). The patient was planned for CT Thorax and urgent surgical decompression.

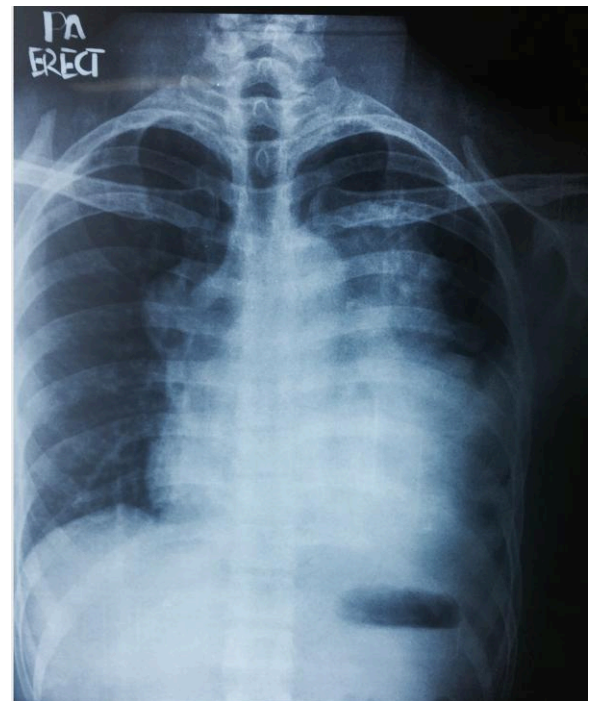
Unfortunately, the patient became more hypotensive despite on maximum vasopressor support and succumbed to his illness at around 7 h after admission. The autopsy showed a large anterior mediastinal mass that invaded into the pericardium, and histopathological examination confirmed lymphoma.

## Discussion

This article highlights the therapeutic challenges of managing a patient with cardiac tamponade exacerbated by an anterior mediastinal mass. While convention should dictate that draining a pericardial effusion causing RA and RV collapse would improve shock hemodynamics,<sup>2</sup> the opposite occurred in this patient because of the unrecognized benefit that the pericardial effusion was providing by inhibiting the compressive mass effect of the tumour.

The acute presentation of respiratory failure and shock in this patient could be due to many possibilities. The presence of distended neck veins with normal lung findings narrowed down the differential diagnosis to right heart pathology or obstruction of forward flow to the left heart.<sup>15</sup> The point of care ultrasound proved to be the best tool to investigate this patient who was critically ill.<sup>16,17</sup> Ultrasound revealed that the patient had cardiac tamponade, and an anterior mediastinal mass compressing on the right heart chambers.

After the airway was secured, the patient had refractory shock that was not responsive to fluids or vasopressor. One concern was that he had developed mediastinal mass syndrome, an acute respiratory or hemodynamic compromise due to intubation, triggered by supine



**Figure 2** Chest x-ray showed presence of a large anterior mediastinal mass with cardiomegaly.

position, administration of induction agents, and positive pressure ventilation.<sup>3,18</sup> There was no issue with the ventilation post-intubation, thus excluding airway compression from the tumour.<sup>7</sup> The positive pressure ventilation possibly worsened the shock by increasing intrathoracic pressure, which further impeded the venous return.<sup>3,18</sup>

The patient had a life-threatening obstructive shock due to cardiac tamponade, that was caused by an anterior mediastinal mass, and he needed urgent intervention.<sup>5,8</sup> Management of this complex condition involved a multidisciplinary joint decision-making between the anaesthetist, cardiologist, general surgeon, and emergency physician.<sup>12,13</sup>

Surgical intervention such as tumour resection or debulking would be the best option for this patient.<sup>6,12,13</sup> A pericardiectomy could be performed to evacuate the pericardial effusion, and a tissue biopsy obtained at the same setting.<sup>19</sup> However, this was not feasible in this case, due to the unavailability of cardiothoracic surgeon in our hospital. The second option was to treat the lymphoma with chemotherapy, provided the tissue diagnosis was obtained earlier.<sup>20</sup>

Persistent shock led to the decision for emergency pericardiocentesis. Unfortunately, the patient took a turn for the worse after the procedure, and the blood pressure was not recordable. He could have developed complications such as cardiac perforation, vessel injury, and pneumothorax.<sup>21</sup> Another possibility would be the development of pericardial decompression syndrome (PDS), a paradoxical worsening of vital signs after rapid decompression of the pericardium. PDS could happen due to myocardial ischaemia, over-expansion of the right heart, or autonomic imbalance from sudden removal of sympathetic stimulation.<sup>22</sup> Usually in PDS, rapid decompression will cause the right heart to expand with increase in venous return. However, in this case, a repeat ultrasound showed worsening RA and RV compression by the anterior mediastinal mass instead.

We postulated that sudden removal of pericardial fluid caused the mediastinal mass to compress the right heart chambers leading to further worsening of obstructive shock. Therefore, we attempted to infuse normal saline back into the pericardial space in the hope that the re-expansion of pericardial effusion can act as a cushion to protect the heart from the compressive effect of the mediastinal mass, akin to a water bath effect. The amount of fluid infused was stopped when hemodynamic improvement was seen indicating equalization of pressure between the right heart and pericardial space.<sup>23</sup> There is no guideline or published literature regarding this novel method of pericardial re-expansion, which was based on a joint decision between the cardiologist and emergency physician.

Emergency pericardiocentesis had always been taught to be the treatment for massive pericardial effusion with hemodynamic instability. However, in the case of cardiac tamponade with an anterior mediastinal mass, pericardiocentesis may be more detrimental than beneficial.

## Why should a clinician be aware of this?

Clinicians should be alerted to the therapeutic challenges in patient presenting with anterior mediastinal mass. When managing the airway, one should anticipate acute respiratory or hemodynamic compromise due to mediastinal mass syndrome.

When dealing with massive pericardial effusion with compression from the anterior mediastinal mass, an overzealous pericardiocentesis can exacerbate the compressive effect of the mediastinal mass, due to the loss of protective effect of the pericardial effusion. If pericardiocentesis is indicated, a controlled release of the pericardial effusion should be done, to avoid paradoxical worsening of the patient's hemodynamics.

## Lead author biography



Dr Adi Osman is currently a Senior Consultant Emergency Physician and ED Critical Care in Hospital Raja Permaisuri Bainun, Ipoh, Malaysia. Dr Adi has been a WINFOCUS board of directors and editor for The Ultrasound Journal since 2014. He is one of the appointed supervisor for European Diploma in Advanced Critical Care Echocardiography (EDEC) organized by European Society of Intensive Care Medicine (ESICM). His current research interests include non-invasive ventilation, airway ultrasound, resuscitative TEE in critical care, and ultrasound-guided procedures.

## Supplementary material

Supplementary material is available at European Heart Journal – Case Reports.

## Acknowledgements

We would like to thank Dr Asri Ranga and Ipoh Emergency Critical Care Society (IECCS) for their assistance.

**Slide sets:** A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

**Consent:** Written informed consent was obtained from the parent of the diseased patient for publication of this manuscript and the accompanying images in line with the Committee on Publication Ethics (COPE) guidelines.

## Availability of data and materials

The material available from the corresponding author on reasonable request.

## Ethics approval and consent to participate

Ethical approval and consent were taken for this study.

## Declaration

I declare that this manuscript which depicts the clinical management of patient with anterior mediastinal mass presented with cardiac tamponade. Contributions from respective authors have been explicitly mentioned in the respective segment. This work has not been submitted to any other publication for publishing.

**Conflict of interest:** None declared.

**Funding:** None declared.

## References

1. Alerhand S, Adrian RJ, Long B, Avila J. Pericardial tamponade: a comprehensive emergency medicine and echocardiography review. *Am J Emerg Med* 2022;**58**:159–174.
2. De Carlini CC, Maggolini S. Pericardiocentesis in cardiac tamponade: indications and practical aspects. *Eur Heart J* 2017;**15**.
3. Erdős G, Tzanova I. Perioperative anaesthetic management of mediastinal mass in adults. *Eur J Anaesthesiol* 2009;**26**:627–632.

4. Juanpere S, Cañete N, Ortuño P, Martínez S, Sanchez G, Bernado L. A diagnostic approach to the mediastinal masses. *Insights Imaging* 2013;**4**:29–52.
5. Vanneman MW, Fikry K, Quraishi SA, Schoenfeld W. A young man with a mediastinal mass and sudden cardiac arrest. *Ann Am Thorac Soc* 2015;**12**:1235–1239.
6. Palkar AV, Singh P, Hadley M, Goldman YR. Obstructive shock due to a mediastinal mass in a young male with klinefelter syndrome. *Open J Clin Med Case Rep* 2015;**10**:55.
7. Alzeer A, Al-Otair H, Mohammed M, Hajjar W, Ibraheim O. Acute hypoxaemia and right ventricular compression by A mediastinal mass. *Int J Anesthesiol* 2006;**14**.
8. Al-Sanouri I, Shaban M, Al-Shahid M, Abdulaziz S. A 21-year-old woman with mediastinal mass and cardiac arrest. *BMJ Case Rep* 2013;**2013**.
9. Hariharan U. Mediastinal masses and emergency management challenges -the great micl. *Emerg Med Inves* 2017;**12**:7.
10. Liu T, Al-Kzayer LFY, Xie X, Fan H, Sarsam SN, Nakazawa Y, et al. Mediastinal lesions across the age spectrum: a clinicopathological comparison between pediatric and adult patients. *Oncotarget* 2017;**8**:59845–59853.
11. Carter BW, Benveniste MF, Madan R, Godoy MC, de Groot PM, Truong MT, Rosado-de-Christenson ML, Marom EM. ITMIG Classification of mediastinal compartments and multidisciplinary approach to mediastinal masses. *Radiographics* 2017;**37**:413–436.
12. Li WVV, van Boven WJ, Annema JT, Eberl S, Klomp HM, de Mol BA. Management of large mediastinal masses: surgical and anesthesiological considerations. *J Thorac Dis* 2016;**8**:E175–E184.
13. Ahmad A, Sathiamurthy N, Dharmaraj B, Balasubbiah N, Chai DN, Kamil AN, Thiagarajan M. Surgery in large anterior mediastinal mass: case series of hospital Kuala Lumpur. *Curr Chall Thorac Surg* 2021;**3**.
14. Dubashi B, Cyriac S, Tenali SG. Clinicopathological analysis and outcome of primary mediastinal malignancies—A report of 91 cases from a single institute. *Ann Thorac Med* 2009;**4**:140–142.
15. Chiacio JMC, Parikh NI, Fergusson DJ. The jugular venous pressure revisited. *Cleve Clin J Med* 2013;**80**:638–644.
16. Labovitz AJ, Noble VE, Bierig M, Goldstein SA, Jones R, Kort S, et al. Focused cardiac ultrasound in the emergent setting: a consensus statement of the American society of echocardiography and American college of emergency physicians. *J Am Soc Echocardiogr* 2010;**23**:1225–1230.
17. Ghane MR, Gharib M, Ebrahimi A, Saeedi M, Akbari-Kamrani M, Rezaee M, et al. Accuracy of early rapid ultrasound in shock (RUSH) examination performed by emergency physician for diagnosis of shock etiology in critically ill patients. *J Emerg Trauma Shock* 2015;**8**:5–10.
18. Bécharde P, Létourneau L, Lacasse Y, Côté D, Bussièrès JS. Perioperative cardiorespiratory complications in adults with mediastinal mass: incidence and risk factors. *Anesthesiology* 2004;**100**:826–834.
19. Moraitis SD, Agrafiotis AC, Marinou L, Panagiotou I, Sakellaridis T, Tsakalakis C, et al. Mediastinal debulking for a T-cell leukaemia/lymphoma presenting with cardiac tamponade. *Monaldi Arch Chest Dis* 2019;**89**.
20. Harris GS, Siddiqui IA, Movahed A, Daggubati R. “Tumor and tamponade” large mediastinal lymphoma masquerading as cardiac tamponade on transthoracic echocardiogram. *J Clin Case Stu* 2016;**1**.
21. Kumar R, Sinha A, Lin MJ, Uchino R, Butryn T, O’Mara MS, et al. Complications of pericardiocentesis: A clinical synopsis. *Int J Crit Illn Inj Sci* 2015;**5**:206–212.
22. Adi O, Fong CP, Ahmad AH, Azil A, Ranga A, Panebianco N. Pericardial decompression syndrome: a complication of pericardiocentesis. *Am J Emerg Med* 2021;**45**:688.e3–688.e7.
23. Vandyke WH Jr, Cure J, Chakko CS, Gheorghiadu M. Pulmonary edema after pericardiocentesis for cardiac tamponade. *N Engl J Med* 1983 ;**309**:595–596.