Case Report

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Successful Computed Tomography-guided Pericardiocentesis After Performing a Failed Conventional Transthoracic Echocardiography-guided Approach: A Case Report

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Abstract

İntroduction: Computed tomography-guided pericardiocentesis has been shown to be technically feasible and safe for treating pericardial effusion. However, no recommendations for computed tomography-guided pericardiocentesis have been made and standardized among the established guidelines by the European Society of Cardiology or the Japanese Circulation Society. We report on a case of successful computed tomography-guided pericardiocentesis after performing a failed conventional transthoracic echocardiography-guided approach in a patient with cardiac tamponade.

Case Report: A 71-year-old man was admitted to our hospital with progressive chest discomfort and cardiac tamponade. Transthoracic echocardiography-guided pericardiocentesis was primarily performed on the patient; however, the quality of the transthoracic echocardiography images was inadequate to guide the procedure, resulting in procedure-related pericardial injury. When cardiac tamponade recurred, a computed tomography-guided approach successfully treated the patient, with the success owed to precise intraoperative visualization of the needle and organs.

Conclusion: Our case suggests that computed tomography guidance is safe and useful in pericardiocentesis, especially for patients who are ineligible to undergo an echo-guided approach.

Keywords: pericardiocentesis, computed tomography,

Introduction

Computed tomography (CT)-guided pericardiocentesis has been shown to be technically feasible and safe for treating pericardial effusion (PE). However, unlike that with echocardiographic guidance, there are no recommendations regarding treatment by the CT approach for pericardiocentesis in the current standard guidelines, including those from the 2015 European Society of Cardiology and 2017 Japanese Circulation Society[1,2]. These guidelines introduce no alternative to surgical management as a second-best approach to treat cardiac tamponade in patients ineligible for conventional echocardiography-guided pericardiocentesis. Conventional echocardiography-guided pericardiocentesis is contraindicated in patients due to the absence of an optimal acoustic window, which is typically associated with chronic obstructive pulmonary disease, obesity, or post-thoracic surgery. One potential reason for the lack of guidance concerning CT-guided pericardiocentesis is that evidence supporting the competitive advantage of CT guidance over transthoracic echocardiography (TTE) is still lacking[3-5]. Thus, the optimal application of CT guidance for pericardiocentesis is unclear. We report on a case of successful computed tomography-guided pericardiocentesis after performing a failed conventional transthoracic echocardiography-guided approach in a patient with pericardial effusion.

Case Presentation

A 71-year-old man visited our hospital with progressive chest discomfort. There was no past and family history of disease and no alcohol consumption. He had smoked 20 cigarettes daily for

50 years. His vital measurements on arrival were as follows: blood pressure, 105/75 mmHg; heart rate, 84 beats/min; respiratory rate, 24 breaths/min. He was admitted to the hospital under suspicion of pneumonia with pleural effusion.

Approximately 36 h after admission, his circulatory and respiratory condition worsened. His blood pressure decreased to 86/54 mmHg. and heart rate and respiratory rate increased to 112 beats/min and 40 breaths/min, respectively. Repetitive TTE and his physical signs and symptoms confirmed emergent cardiac tamponade (Figure 1A).

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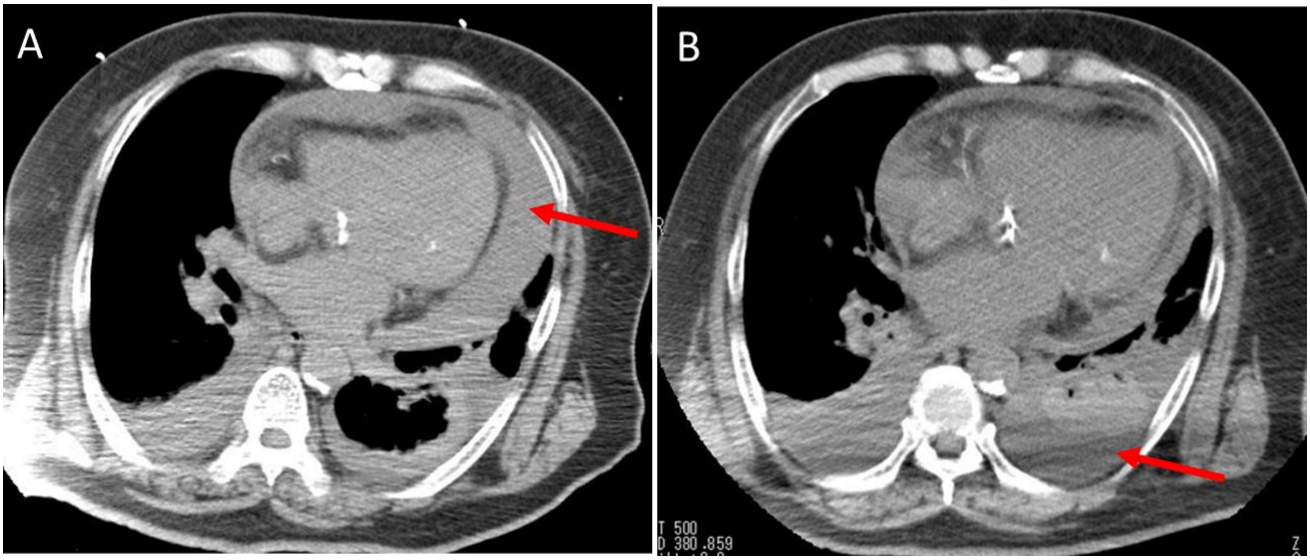

Figure-1: Computed tomography (CT) imaging before and after transthoracic echocardiography- guided pericardiocentesis. (A) Pre-procedural CT scan revealing the presence of extensive fluid collection (arrow), which was predominantly in the pericardial cavity. (B) Procedure-related epicardial injury causing a shift of fluid from the pericardial cavity to the thoracic cavity (arrow).

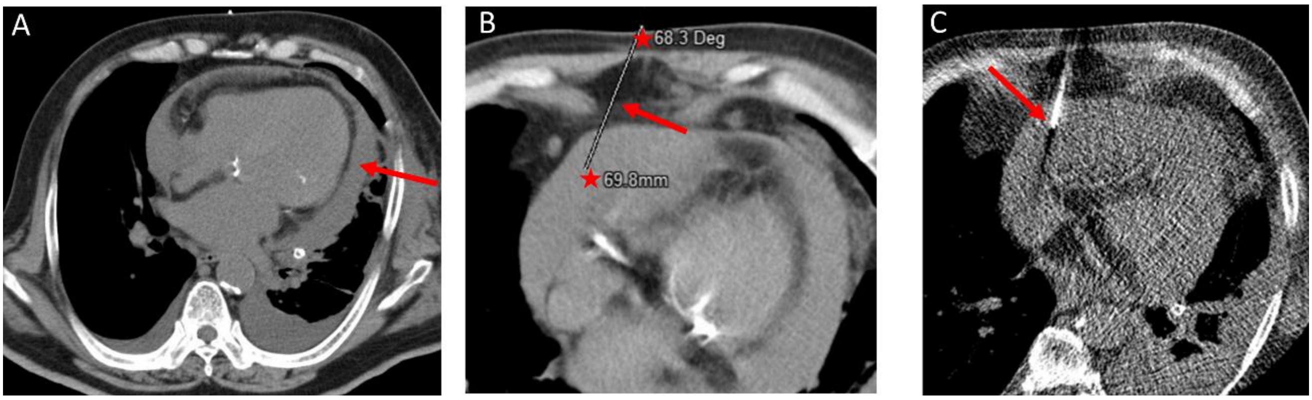

Figure-2: Procedural images of the computed tomography-guided approach. (A) Re-accumulation of pericardial effusion (arrow) was observed. (B) Both the distance to the pericardial cavity and angle of approach (stars) to the pericardial cavity were calculated based on the pre-designed route of needle insertion (arrow). (C) Computed tomography fluoroscopy provided accurate information about the position of the needle tip.

TTE-guided pericardiocentesis was attempted using a commercially available pericardiocentesis kit (Merit Medical Systems, South Jordan, Utah, USA). However, the quality of the TTE images was insufficient for complete visualization of the puncture needle due to ultrasound attenuation by intervening tissues and organs. Needle insertion was forced several times under suboptimal TTE image guidance, which resulted in injury-induced pericardial fenestration and subsequent relief from tamponade through efflux of pericardial fluid into the thoracic cavity (Figure 1B). Nine days later, cardiac tamponade recurred with a smaller amount of PE than what had accumulated during the first pericardiocentesis (Figure 2A). We decided to use a CT-guided approach to overcome the technical difficulties experienced with the previous TTE-guided procedure. Axial images acquired using a multidetector-row CT scanner (Aquilion Prime, Toshiba Medical Systems, Japan) clearly visualized both the puncture needle and surrounding structures. The images enabled us to determine the optimal puncture site and direction satisfying the following criteria to avoid injury to the surrounding organs: confirming that the parietal pericardium was directly attached to the thoracic wall and that sufficient pericardial space for needle penetration was present (Figure 2B). An 18-gauge puncture needle was advanced into the pericardial cavity under intermittent-mode CT guidance (Figure 2C). After controlled penetration of the needle into the pericardial cavity, a 0.035-inch guidewire was advanced through the needle sheath. A 6 Fr pigtail drainage catheter was inserted in the pericardial cavity over the guidewire using the Seldinger technique. A post-procedural CT scan was performed to confirm that the drainage catheter was placed within the pericardial space and that there were no procedure- associated complications (Figure 3A, B). Hemodynamic compromise was successfully relieved. Cytological analysis of the fluid samples provided evidence of malignant adenocarcinoma. His total duration of hospital stay was 45 days, and she was discharged home without neurological defects.

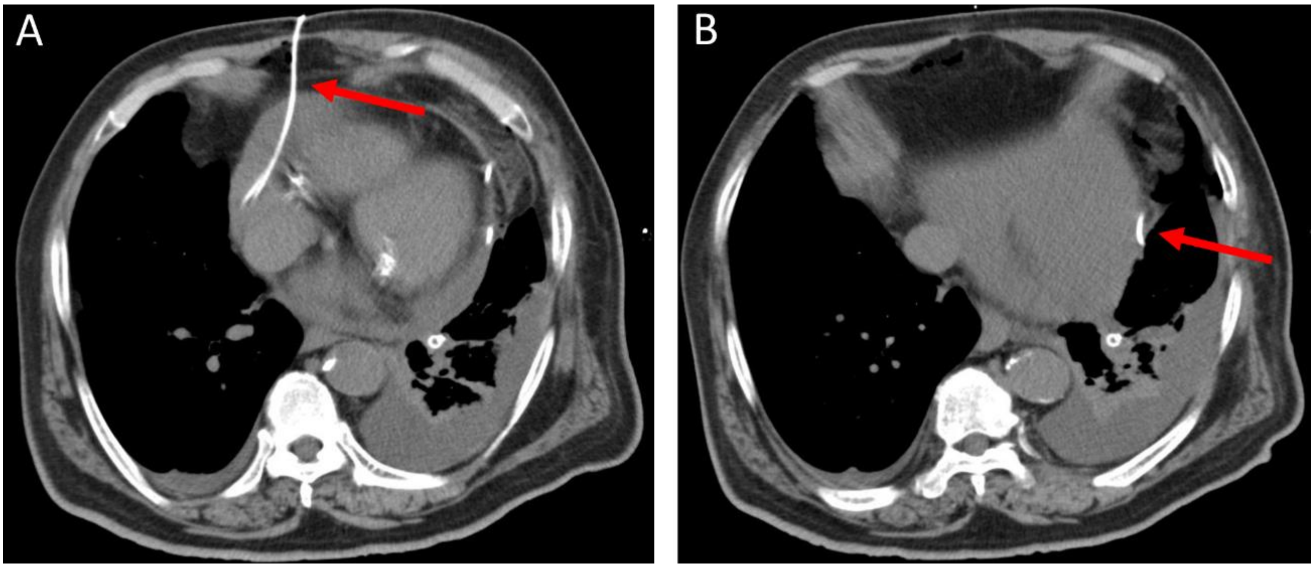

Figure-3: Post-procedural computed tomography imaging. (A, B) A drainage catheter (arrows) was successfully positioned within the pericardial cavity and the pericardial effusion was removed.

Discussion

In the present case, CT-guided pericardiocentesis was successfully performed, even with a comparatively small volume of PE, in a patient for whom initial TTE-guided pericardiocentesis failed due to the poor quality of the sonographic images. While ultrasound imaging is insubstantial due to air-filled organs or bone, CT overcomes the potential limitations of TTE by enabling precise visualization of the intervention needle independent of procedural skill or experience, even when lesions are deep-seated.

Historically, ultrasonography and X-ray fluoroscopy were considered the standard imaging modalities for pericardiocentesis. Current guidelines for the treatment of PE recommend TTE as a routine imaging modality, according to previous reports describing the high success rate of conventional ultrasound-guided pericardiocentesis[1,2,6,7]. However, physicians should be aware that most available evidence supporting the usefulness of TTE guidance have little information regarding the resultant imaging quality of TTE, and have assessed the procedure based on selection of patients deemed technically eligible for TTE-guidance[7-10].

The CT-guided procedure is an established strategy for assisting with percutaneous interventions in a variety of diseases. CT-guided pericardiocentesis is a safe and effective treatment option for patients with PE. Neves et al. reported that CT-guided pericardiocentesis was successful in 94% of patients, and that unsuccessful cases had localized or organized PE, which was shown to be unsuitable for percutaneous drainage[4,8]. Furthermore, Bruning et al. reported that CT-guided pericardiocentesis was successfully performed in 10 of 11 cases, including eight patients where TTE guidance was determined to be inappropriate[3]. These studies indicate a clinical utility for CT-guided pericardiocentesis. Our case further highlights, in a straightforward manner, the importance of CT guidance for pericardiocentesis in patients who could not be appropriately treated using conventional echocardiographic guidance.

An additional advantage of CT guidance revealed by our case is its ability to detect procedure- related injury to non-cardiac organs, especially the lungs, which are difficult to visualize using ultrasonography. Intraoperative CT scans facilitate immediate intervention for serious complications without the need to leave the procedure room[10], It is important for physicians to recognize fluctuations in the size of the pericardial space during the cardiac cycle, especially in patients with small volumes of PE. Continuous-mode CT imaging, which can provide real-time tracking of the needle position, is an additional option. It can minimize technical complications at the expense of a higher radiation dose.

Conlusion

Our case suggests that CT guidance is technically safe and useful, especially to treat for pericardiocentesis in patients ineligible for an echo-guided approach. CT enables optimal imaging to guide needle insertion, thus making the procedure effective and safe to perform. Physicians should be aware that CT-guided pericardiocentesis is readily adapted to a wide variety of clinical presentations, including pericardiocentesis.

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References

1. Nour-Eldin NA, Alsubhi M, Gruber-Rouh T, et al. CT-Guided Drainage of Pericardial Effusion after Open Cardiac Surgery. Cardiovasc Intervent Radiol 2017;40:1223-1228.
2. Adler Y, Charron P, Imazio M, et al. 2015 ESC Guidelines for the diagnosis and management of pericardial diseases: The Task Force for the Diagnosis and Management of Pericardial Diseases of the European Society of Cardiology (ESC)Endorsed by: The European Association for Cardio-Thoracic Surgery (EACTS). Eur Heart J 2015;36:2921-2964.
3. Tsutui CH. Guidelines for Diagnosis and Treatment of Acute and Chronic Heart Failure (JCS 2017/JHFS 2017). 2018.
4. Bruning R, Muehlstaedt M, Becker C, Knez A, Haberl R, Reiser M. Computed tomography-fluoroscopy guided drainage of pericardial effusions: experience in 11 cases. Invest Radiol. 2002;37:328-332.
5. Neves D, Silva G, Morais G, et al. Computed tomography-guided pericardiocentesis - A single- center experience. Rev Port Cardiol 2016;35:285-290.
6. Virk SA, Chandrakumar D, Villanueva C, Wolfenden H, Liou K, Cao C. Systematic review of percutaneous interventions for malignant pericardial effusion. Heart 2015;101:1619-1626.
7. Tsang TS, Enriquez-Sarano M, Freeman WK, et al. Consecutive 1127 therapeutic echocardiographically guided pericardiocenteses: clinical profile, practice patterns, and outcomes spanning 21 years. Mayo Clin Proc 2002;77:429-436.
8. Cooper JP, Oliver RM, Currie P, Walker JM, Swanton RH. How do the clinical findings in patients with pericardial effusions influence the success of aspiration? Br Heart J 1995;73:351-354.
9. Chandraratna PA, Mohar DS, Sidarous PF. Role of echocardiography in the treatment of cardiac tamponade. Echocardiography 2014;31:899-910.
10. Restrepo CS, Lemos DF, Lemos JA, et al. Imaging findings in cardiac tamponade with emphasis on CT. Radiographics 2007;27:1595-1610.