JACC: CASE REPORTS VOL. 29, 2024
© 2024 THE AUTHORS. PUBLISHED BY ELSEVIER ON BEHALF OF THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION. THIS IS AN OPEN ACCESS ARTICLE UNDER THE CC BY-NC-ND LICENSE (http://creativecommons.org/licenses/by-nc-nd/4.0/).

STRUCTURAL HEART DISEASE

CASE REPORT: CLINICAL CASE

ST-Segment Elevation During Percutaneous Left Atrial Appendage Closure

Tatsuro Shoji, MD, Yukio Sato, MD, PhD, Daisuke Togashi, MD, Shingo Kuwata, MD, PhD, Masaki Izumo, MD, PhD, Tomoo Harada, MD, PhD, Yoshihiro J. Akashi, MD, PhD

ABSTRACT

A 70-year-old patient with paroxysmal atrial fibrillation underwent left atrial appendage closure. The patient experienced transient hypotension during device implantation. The procedure was abandoned because of ST-T-wave changes on electrocardiography and elevated coronary flow velocity on transesophageal echocardiography, which indicated that the device caused coronary artery compression. (J Am Coll Cardiol Case Rep 2024;29:102216) © 2024 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

HISTORY OF PRESENTATION

A 70-year-old man presented to our hospital (St. Marianna University Hospital, Kanagawa, Japan) for percutaneous left atrial appendage closure (LAAC).

LEARNING OBJECTIVES

- To understand the critical role of sound clinical judgment when determining whether to continue or discontinue a procedure, particularly when faced with complex scenarios or unforeseen complications.
- To acknowledge the importance of disseminating unique case findings within the medical community to heighten awareness, comprehension, and handling of infrequent complications.
- To estimate factors that could increase the risk of inducing coronary artery compression during LAAC procedures.

The patient presented with symptomatic cardiogenic stroke caused by paroxysmal atrial fibrillation (PAF) and underwent pulmonary vein isolation with catheter ablation therapy. However, PAF recurred, and his CHADS2 score was 2 points, indicating a high risk of embolism. The patient continued to receive apixaban at a dose of 10 mg/d. Despite receiving apixaban, the patient experienced 3 strokes and was switched to dabigatran at a dose of 300 mg/d.

PAST MEDICAL HISTORY

The patient had undergone insertion of an implantable cardiac monitor 2 years before presentation and had a history of hyperlipidemia.

DIFFERENTIAL DIAGNOSIS

Differential diagnoses for the cause of stroke included atherothrombotic cerebral infarction, lacunar infarction, and embolic stroke of undetermined origin.

From the Department of Cardiology, St. Marianna University School of Medicine, Kanagawa, Japan.
The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

Manuscript received December 14, 2023; accepted December 21, 2023.

ISSN 2666-0849 https://doi.org/10.1016/j.jaccas.2023.102216

ABBREVIATIONS AND ACRONYMS

ECG = electrocardiogram

LAA = left atrial appendage

LAAC = left atrial appendage closure

LCA = left coronary artery

LCx = left circumflex

PAF = paroxysmal atrial fibrillation

TEE = transesophageal echocardiography

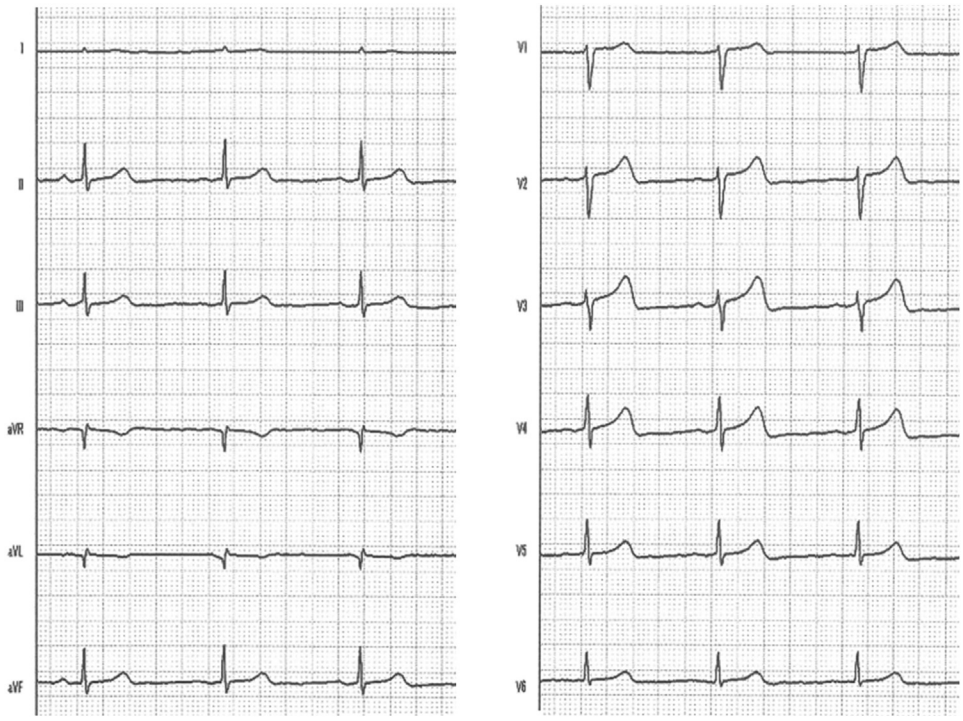
INVESTIGATIONS

The patient presented with stable vital signs on admission, with a blood pressure of 109/62 mm Hg, a regular heart rate of 75 beats/min, and peripheral oxygen saturation of 98%. Furthermore, there were no neurologic symptoms suggestive of stroke complications, such as impaired consciousness, paralysis of the limbs, or dysarthria. Results of blood tests on admission showed no anemia, liver dysfunction, or kidney dysfunction. The electrocardiogram (ECG) at admission was in sinus rhythm, and no ST-T-wave change was noted (Figure 1). The left ventricular ejection fraction was preserved, and no significant valvular disease was observed. Transesophageal echocardiography (TEE) was performed for measuring left atrial appendage (LAA) size, width × depth: 20.7 × 11.3 mm at 0°, 18.6 × 12.3 mm at 45°, 21.5 × 12.7 mm at 90°, and 24.4 × 14.9 mm at 135°. Preoperative computed tomography showed no significant stenosis in the coronary artery, and the form of the LAA was windsock.

MANAGEMENT

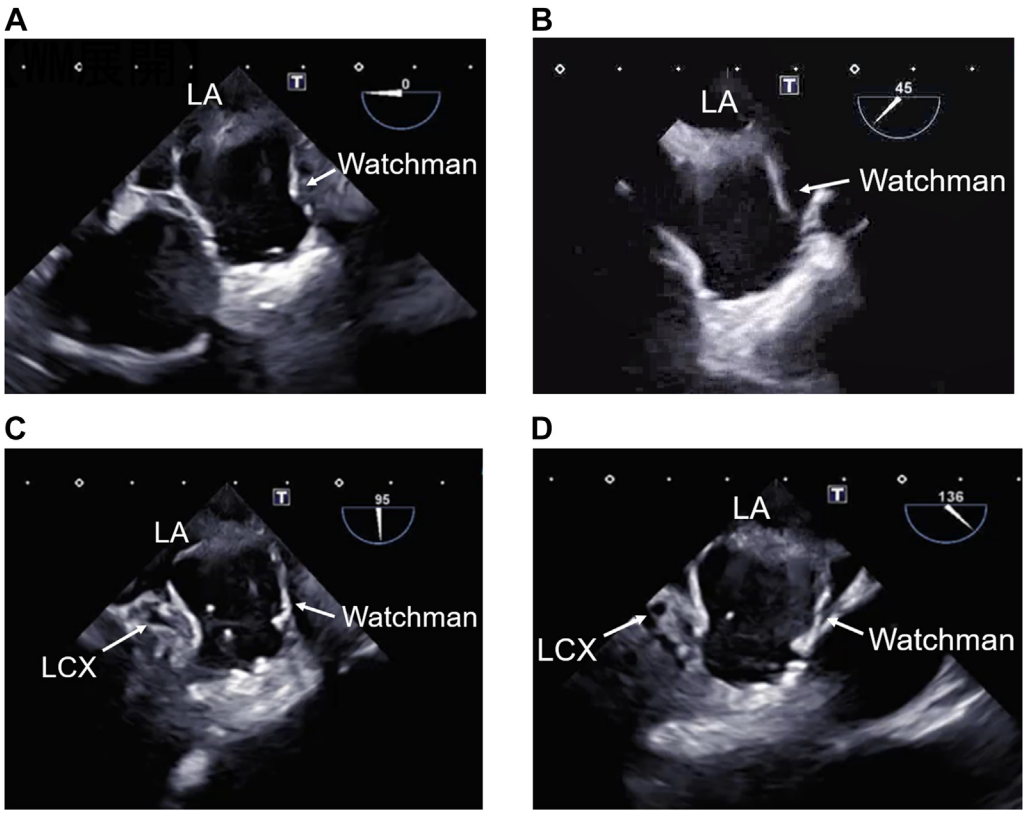
The patient was admitted to the hospital for percutaneous LAAC because of bleeding from internal hemorrhoids and a high risk of bleeding with a HAS-BLED score of 3 points. The maximum width of the LAA ostium was 24.4 mm at 135°. Therefore, we selected the 31-mm device because the 27-mm device would have a compression ratio of <10%. After deployment, the device width measured 23.1 mm at 0°, 21.5 mm at 45°, 22.9 mm at 90°, and 25.2 mm at 135°. The compression ratio ranged from 18.7% to 30.6%, with an indication of overcompression at 45°. Although the device position was fine at 0°, 45°, and 90°, one-half of the shoulder of the device protruded on the posterior side at

FIGURE 1 Electrocardiogram Before Left Atrial Appendage Closure



Electrocardiogram on admission demonstrating a normal sinus rhythm with no ST-T-wave changes.

FIGURE 2 Midesophageal Transesophageal Echocardiography Image After Watchman (Boston Scientific) Device Deployment



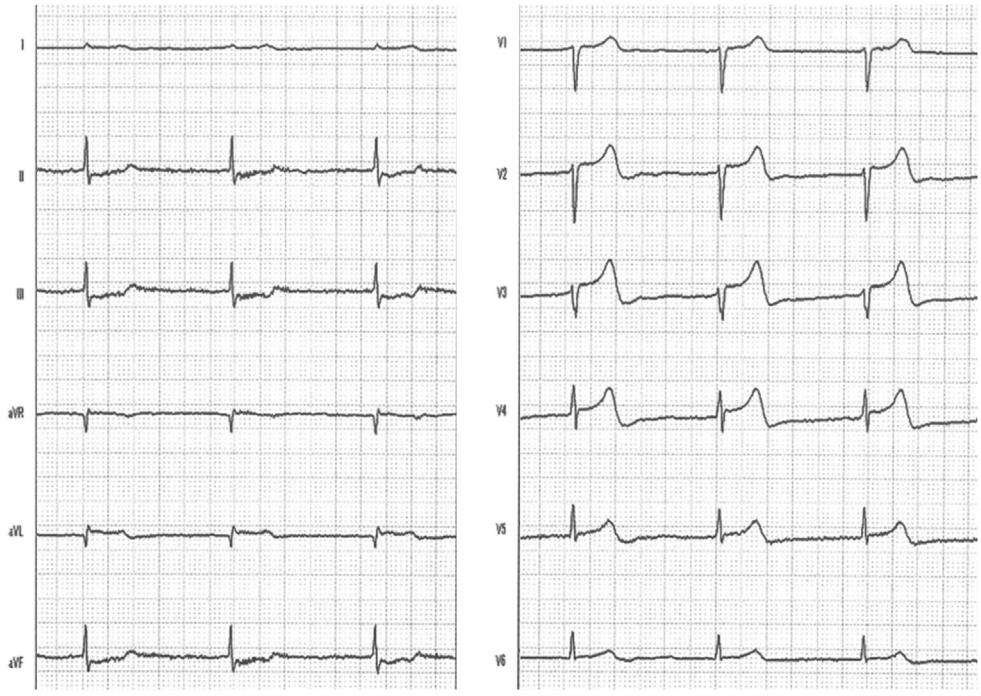
(A to D) Although the anchor and seal were satisfactory, the compression ratio at 45° was 30.6%, indicating overcompression. Furthermore, one-half of the shoulder of the device protruded on the posterior side at 135°. LA = left atrium; LCX = left circumflex artery.

135° (Figures 2A to 2D). Ten minutes later, his systolic blood pressure decreased to 40 mm Hg; the ECG showed ST-segment elevation in leads I, aVL, and V_3 to V_6, and ST-segment depression in leads II, III, and aVF (Figure 3); and TEE showed an increase in left coronary artery (LCA) blood flow velocity to 108.7 cm/s. After removal of the device, the ST-T-wave change on ECG improved, the systolic blood pressure quickly improved to 80 mm Hg, and LCA blood flow velocity on TEE decreased to 63.1 cm/s (Figures 4A and 4B). Considering the effect of the device being implanted in the shallow part of the LAA, we attempted again to place the device in the deeper part of the LAA, but similarly, we observed the device protruding on the posterior side, and similar ST-T-wave changes were also observed in the ECG. We therefore judged that the implantation was difficult, and the procedure was discontinued. Thereafter, although the troponin T value increased to approximately 0.041 ng/mL, there were no creatine kinase and creatine kinase-MB fraction elevations or ECG changes, and the patient was discharged from the hospital on the fifth day.

DISCUSSION

To our knowledge, this is the first case of coronary artery compression during percutaneous LAAC. Although there have been reports of left circumflex (LCx) artery occlusion and left main trunk stenosis caused by the AtriClip (AtriCure) in surgical LAA ligation, there have been no reports of coronary artery compression caused by the Watchman device (Boston Scientific).[1] In cases of iatrogenic coronary artery occlusion during LAAC procedures using the AtriClip, the anatomical position of the LAA and

FIGURE 3 Electrocardiogram After Device Deployment



Electrocardiogram showing ST-segment elevation in leads I, aVL, V_3 to V_6 and ST-segment depression in leads II, III, and aVF after device deployment.

coronary artery may have influenced the results. Another study measured the distance to structures around the device in 29 patients with implanted Watchman devices. The most adjacent structure was the LCx artery, with a median distance of 2.7 mm (range, 2.2-3.2 mm).[2] There was no difference in device landing zone or implanted device size according to LAA morphologic features.

We considered sizing down and reimplanting the device, but in this case, the distance to the LCx artery was 2.1 mm, and considering that the coronary artery and LAA were running parallel (Figure 5), we deemed device implantation to be high risk and decided to abandon the procedure. In this case, factors leading to compression of the coronary artery were hypothesized to include the adjacent position of the LAA and coronary artery and their parallel courses, as well as the high compression ratio of the device.

FOLLOW-UP

At 30-day follow-up, no symptoms of stroke or ischemic heart disease were observed, and the patient was doing well. However, considering the risk of recurrent cerebral infarction, we plan to perform surgical resection of the LAA.

CONCLUSIONS

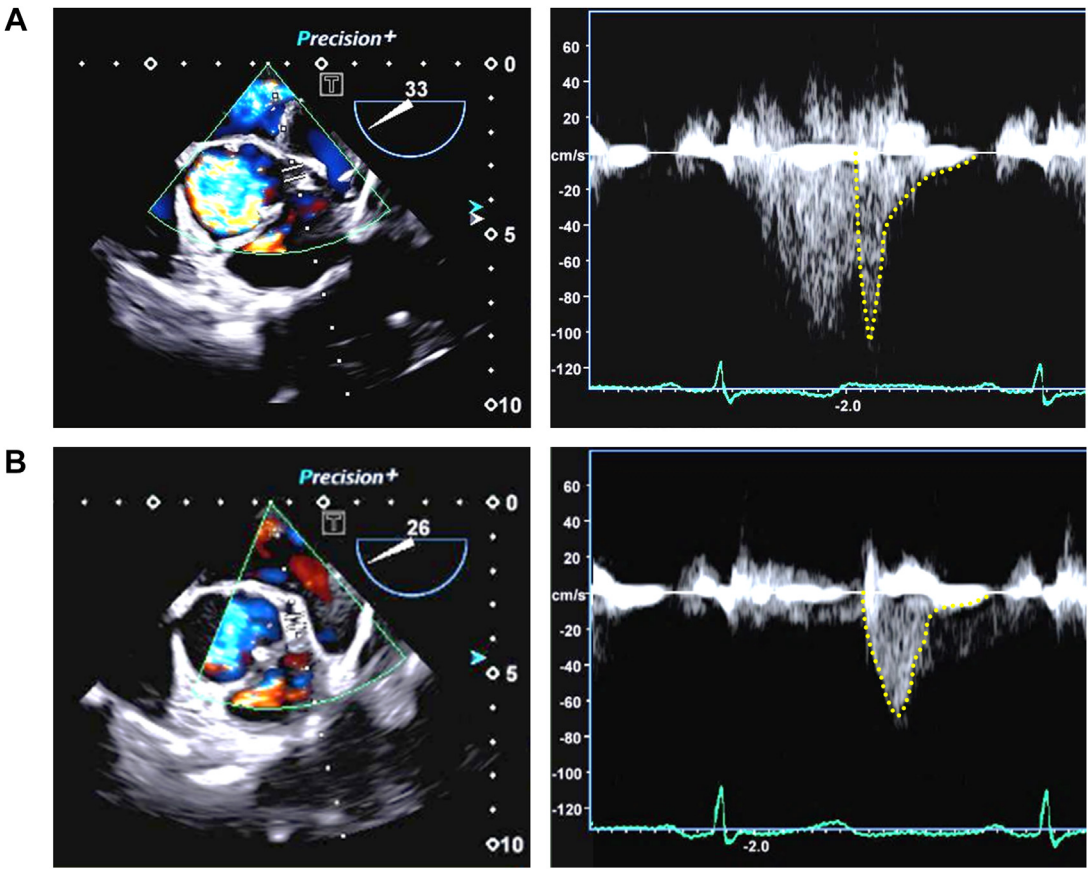
We encountered a case of transient hypotension caused by coronary artery compression during percutaneous LAAC resulting from implantation of the LAAC device. Although this is a rare complication, it is a critical condition that should be considered when performing LAAC.

FUNDING SUPPORT AND AUTHOR DISCLOSURES

Dr Harada is a clinical proctor as Boston Scientific. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

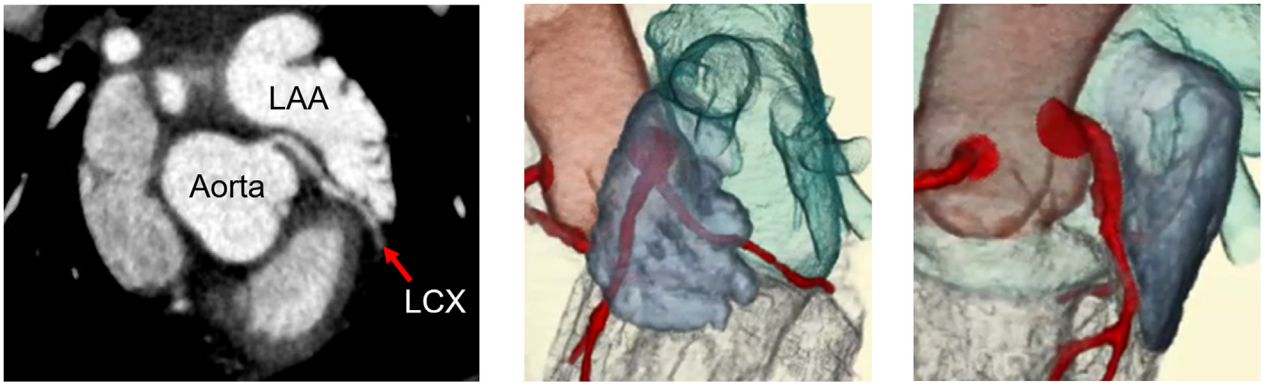
ADDRESS FOR CORRESPONDENCE: Dr Masaki Izumo, Department of Cardiology, St. Marianna University School of Medicine, 2-16-1, Sugao, Miyamae-ku, Kawasaki, Kanagawa 216-8511, Japan. E-mail: heartizumo@yahoo.co.jp.

FIGURE 4 Coronary Blood Flow Velocity After Device Implantation and Removal



(A) After device deployment. (B) After device recapture. The yellow line indicates the diastolic coronary flow. The diastolic peak velocity was elevated to 108.7 cm/s after device deployment; however, it decreased to 63.1 cm/s after the device was recaptured.

FIGURE 5 Anatomical Location of the Left Atrial Appendage and Coronary Arteries (Enhanced Computed Tomography and 3-Dimensional Imaging)



The left atrial appendage (LAA) closure (blue) accompanies the left coronary artery (red) and is in close proximity. LCx = left circumflex artery.

REFERENCES

1. Mhanna M, Nazir S, Ramanathan PK, Letcher JR, Moront MG. Acute compressive coronary artery disease due to left atrial appendage epicardial occlusion. *J Am Coll Cardiol Intv*. 2021;14(10):e113-e114.

2. Lindner S, Behnes M, Wenke A, et al. Relation of left atrial appendage closure devices to topographic neighboring structures using standardized imaging by cardiac computed tomography angiography. *Clin Cardiol*. 2018;42:264-269.

KEY WORDS **left atrial appendage closure, paroxysmal atrial fibrillation, Watchman device**