ESC European Society of Cardiology
European Heart Journal - Case Reports
doi:10.1093/ehjcr/ytab187

CASE REPORT
Cardiac imaging

Left atrial appendage perforation during appendage angiography treated by percutaneous left atrial appendage closure: a case report

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Received 20 October 2020; first decision 13 November 2020; accepted 16 April 2021

Background Pericardial effusion is a common complication of percutaneous left atrial appendage (LAA) closure. Acute management is the cornerstone of pericardial effusion treatment and interrupting the intervention is often required.

Case summary A 65-year-old man presented an acute 10 mm pericardial effusion following pigtail contrast appendage injection. A rapid Watchman Flex 24 mm (Boston Scientific) deployment permitted bleeding interruption. A needle pericardiocentesis was achieved in order to prevent any haemodynamical instability.

Discussion This case report describes an atypical cause of pericardial effusion and a technique for bleeding control with LAA closure device deployment.

Keywords Left atrial appendage closure • Acute complication • Pericardial effusion • Perforation • Case report

Learning points

- Left atrial appendage (LAA) angiography with a pigtail catheter with abnormal contrast flow rate can induce LAA perforation and pericardial effusion.
- In case of an acute LAA perforation and a well-tolerated pericardial effusion, LAA closure device deployment can be achieved to interrupt active bleeding.
- This technique is safe and efficient with no residual pericardial effusion at a 6-month follow-up echocardiography.

Introduction

Percutaneous left atrial appendage (LAA) closure is effective to prevent cardioembolic events and ischaemic stroke in case of non-valvular atrial fibrillation (AF). It is a recognized alternative in patients with AF contraindicated for oral anticoagulants due to relevant bleeding complications.[1] Pericardial tamponade is a serious complication in LAA closure procedures, which was reported in 1–3% of case.[1,2] This complication requires in most of the cases interrupting the intervention and a pericardial effusion evacuation.

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Handling Editor: Georg Goliasch
Peer-reviewers: Julien Adjedj and Alice Wood
Compliance Editor: Max Sayers
Supplementary Material Editor: Deepti Ranganathan

Timeline

Time	Event
Baseline	Bladder cancer, radiotherapy, haematuria. Long-term anticoagulation contraindication.
Day 0	Pericardial effusion during left atrial appendage angiography with an automatic injector through a pigtail catheter. Watchman Flex 24 mm (Boston Scientific) device deployment. No residual para-prosthetic leak, stable 10 mm pericardial effusion without tamponade sign, mild active bleeding suggested by transoesophageal echocardiography with injectable cardiovascular ultrasound enhancement agent (DEFINITY®). Needle pericardiocentesis with aspiration of 100 mL.
Day 1	Pericardial drain removing, no residual pericardial effusion.
Day 2	Hospital discharge (Aspirin + Clopidogrel).
Month 6	Asymptomatic, no residual pericardial effusion, Aspirin alone.

Case presentation

A 65-year-old man with paroxysmal AF and a contraindication for long-term anticoagulation was admitted for percutaneous LAA closure. His past medical history included hypertension, transient ischaemic attack with a CHA_2DS_2VASc score of 4 and bladder cancer treated with radiotherapy. He had recurrent haematuria on Rivaroxaban 20 mg that was stopped. The procedure was performed in March 2020 under general anaesthesia with transoesophageal echocardiography (TOE) and fluoroscopy guidance. At the time of the procedure, the patient was in sinus rhythm. TOE measurements showed a small atrial appendage with a maximum diameter at the landing zone of 18 mm width with maximum depth of 13 mm. A TOE-guided transseptal puncture was performed using an 8.5-Fr transseptal sheath (St-Jude Medical) and an RF tip needle (Baylis medical) followed by the introduction of a dual curve sheath (Boston Scientific) in the left atrium over a protrack pigtail wire (Baylis medical). After removing the protrack, a 5-Fr Pigtail catheter was introduced inside the sheath and was moved gently in the LAA. The first angiography with an automatic injector showed an extravasation of contrast outside the LAA. Another injection confirmed the LAA perforation caused by the first Pigtail angiography with leakage of contrast in the pericardial space (*Figure 1*). By that time, the dual curve sheath had not been in contact yet with the LAA. TEE confirmed a 10 mm circumferential pericardial effusion (*Figure 2*).

In order to stop the bleeding and to avoid open heart surgery, an emergency closure of the LAA was performed. A Watchman Flex 24 mm (Boston Scientific) device was deployed successfully into the LAA on first attempt (*Video 1*). The activated clotting time during deployment was 285 s. The device achieved optimal compression of approximately 15–20% for a good stability with no residual leak (*Figures 3* and *4*). The patient stayed haemodynamically stable throughout the whole procedure. The anticoagulation was reversed with protamine after the Watchman delivery. After LAA occlusion, the 10 mm pericardial effusion stayed stable with cessation of fluid accumulation in the pericardial space and no sign of tamponade on TOE. However, small amount of injectable cardiovascular ultrasound enhancement agent (DEFINITY®) was visualized in the pericardial space suggesting mild active bleeding. To prevent any haemodynamic instability, a needle pericardiocentesis with aspiration of 100 mL of blood was performed, and a pericardial drain was left in place for 24 hours with no further accumulation or drainage and the drain was removed. The patient was discharged 48 h after the procedure on Aspirin and

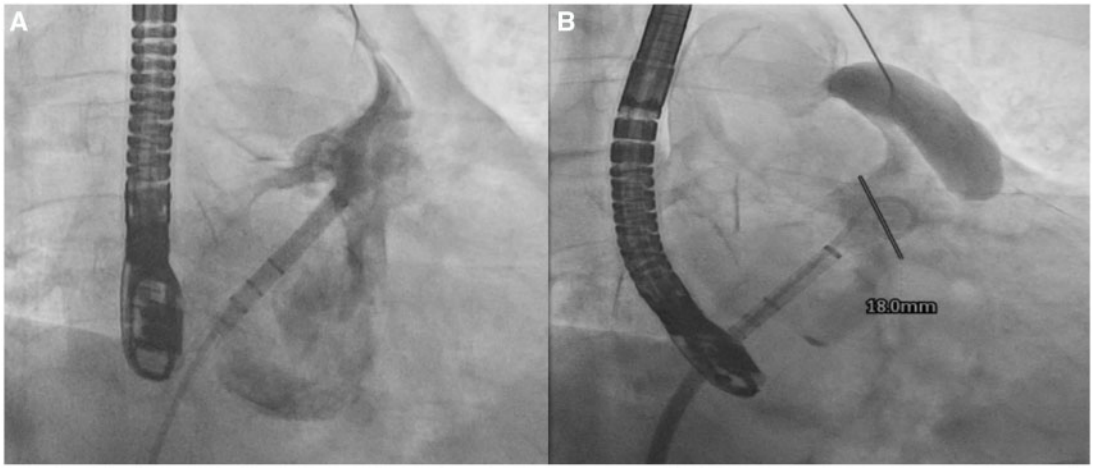


Figure 1 Acute pericardial effusion. (*A*) First injection with contrast extravasation in the pericardial space. (*B*) Second injection with confirmation of left atrial appendage perforation and pericardial accumulation of contrast.

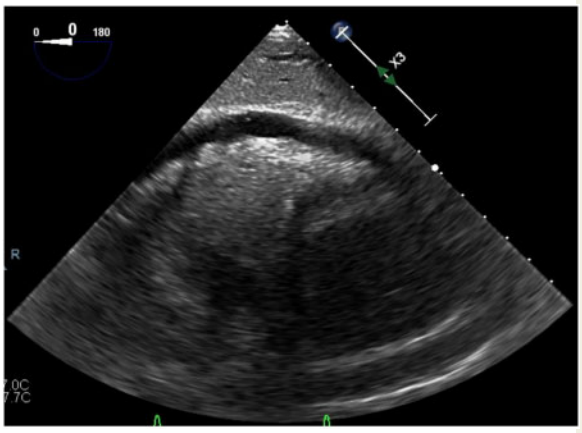


Figure 2 Echocardiographic view of pericardial effusion.

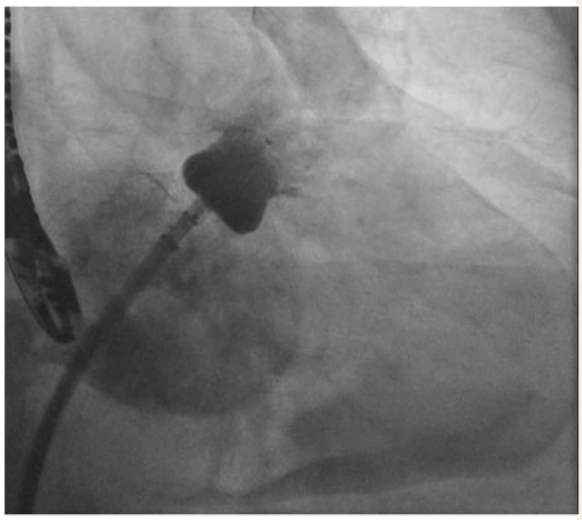


Figure 3 The deployment of the device. Contrast injection confirming no residual leakage.

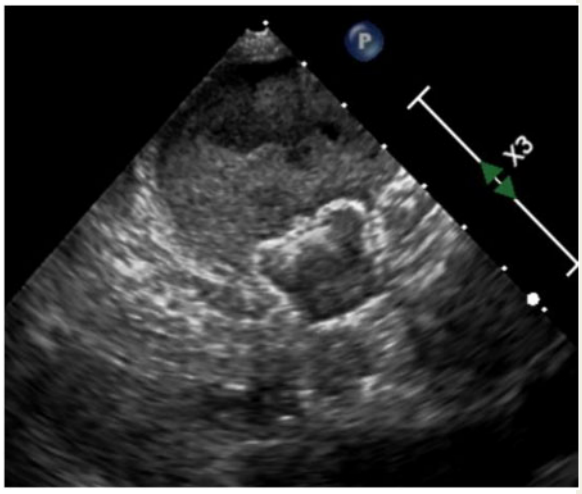


Figure 4 Echocardiographic view of the device.

Clopidogrel with no complication at the 6 months of follow-up and a TOE was performed with no leakage or thrombus and no residual pericardial effusion.

All steps of the procedure were reviewed to understand why this perforation occurred.

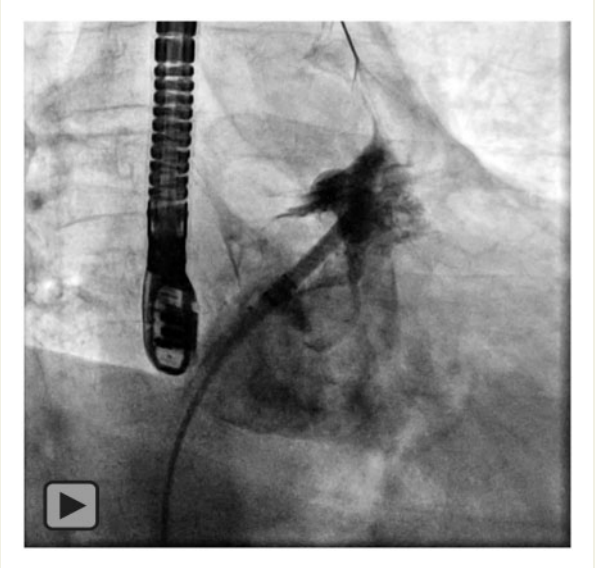
An unrecognized reset of the automatic injector had happened just before the LAA injection. The first injection was performed at 1000 PSI for 20 mL contrast (10 mL/s), as usual for a left ventricular (LV) angiogram. In our centre, during LAA closure procedures, we used 400 PSI for LAA angiography or we performed a manual injection.

Discussion

AF, the most common cardiac arrhythmia, is frequently associated with thromboembolism, and approximatively 75–90% of thrombi form in the LAA.[3] Thus, LAA closure with percutaneous devices can decrease the thromboembolic risk. Generally, the most common complication of this procedure is a pericardial effusion.[4] Most effusions occur at the time of the LAA closure device deployment or during manipulations of the sheaths deep inside the LAA. Sinus rhythm with LAA contraction may exert a mechanical force on the device that can eventually cause pericardial effusion.[5] Pigtail catheters for LAA angiography are preferred for this type of procedure as they minimize the risk of LAA perforation and cardiac tamponade.[6] However, in our patient, LAA perforation occurred since the excessive high pressure was applied by automatic contrast injection through the pigtail catheter before the deployment of the Watchman device. Physicians should always double check the injector parameters before starting the injection since in our case, an automatic reset occurred with nominal parameters set for an LV angiogram.

This case reports describes a novel method to seal the LAA perforation with rapid deployment of the Watchman device thus preventing an open-heart surgery.

In the Post-approval US LAA closure study, in a cohort of 3822 patients, cardiac tamponade occurred in 39 patients (1.02%): 24 patients were treated percutaneously, 12 surgically, and 3 patients had a fatal outcome.[7] No perforations were addressed by rapid deployment of the LAA closure device. Lorenzoni *et al.*[8] previously described a case of tamponade during sheath appendage cannulation successfully treated by rapid LAA closure device deployment plus pericardiocentesis. In post-approval registry, the implantation success rate was 94.9% and the main procedure-related complications were tamponade (1.24%), stroke (0.18%), device embolization (0.25%), and death (0.06%).[7] Despite a rate of procedure-related severe acute event of 3.6%, the LAA closure is a safe and effective alternative to oral anticoagulants for stroke prevention in case of non-valvular AF patients.[9,10]

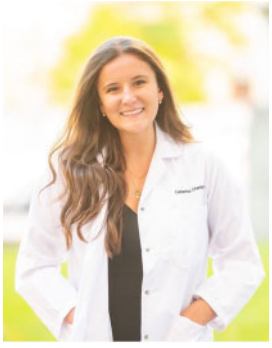


Video 1 Left Atrial Appendage Effusion Occurence and Closure Device Deployment.

Conclusion

Even though using a Pigtail catheter is considered a safe technique for LAA angiography before LAA closure, heart perforation with leakage of contrast in the pericardial space remains a risk. Rapid release of the Watchman device in cases where the perforation is located inside the LAA could be performed rapidly to seal the perforation and avoid cardiac surgery.

Lead author biography



Catherine Champagne is a medicine student at Montréal University (Montréal, Quebec, Canada) and was received for a research traineeship at the Québec Heart and Lung Institute (Québec City, Québec, Canada). She is interested in structural cardiology, left atrial appendage closure, rhythmic devices, and cardiac arrhythmias.

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

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

Consent: The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: None declared.

Funding: none declared.

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