ESC European Society of Cardiology

European Heart Journal - Case Reports (2018) **2**, 1–4
doi:10.1093/ehjcr/yty035

**CASE REPORT**

# The cryoballoon as a bailout in a severely perforated left atrial appendage: a case report

**Andreas Metzner*, Feifan Ouyang, Felix Kreidel, and Karl-Heinz Kuck**

Department of Cardiology, Asklepios-Klinik St. Georg, Lohmühlenstr. 5, 20099 Hamburg, Germany

*Received 11 January 2018; accepted 27 February 2018; online publish-ahead-of-print 26 March 2018*

**Introduction** Interventional left atrial appendage (LAA) occlusion is frequently performed in patients with atrial fibrillation with contraindications for or complications under oral anticoagulation or patients after electrical LAA isolation.

**Case presentation** An endocardial LAA occlusion was attempted but resulted in perforation of the distal LAA and severe pericardial tamponade. To prevent open heart surgery, a cryoballoon was advanced to the base of the LAA and inflation resulted in complete occlusion and stopped further pericardial bleeding. An epicardial LAA suture device was then successfully implanted and completely sealed the LAA. No further pericardial bleeding occurred, and the patient fully recovered.

**Discussion** A combination of a balloon device to occlude the base of the LAA and an epicardial suture device can be an emergency bail-out option in patients with a perforated LAA.

**Keywords** Case report • Left atrial appendage • Perforation • Cryoballoon • Lariat • Epicardial ligation

## Learning points

(1) If perforation of the distal left atrial appendage (LAA) occurs during intervention proximal occlusion of the LAA using a compliant balloon such as the cryoballoon should be considered as an emergency bail-out option to stop pericardial bleeding.
(2) In case of distal LAA perforation, occlusion of the LAA applying an epicardial suture device can be considered.

## Introduction

Ablation of atrial fibrillation (AF) is an established treatment option for symptomatic patients.[1] Ablation strategies beyond pulmonary vein isolation are less established. Isolation of the left atrial appendage (LAA) in patients with fast activity or frequent automaticity inside the LAA can be beneficial.[2] However, after electrical isolation of the LAA the incidence of thrombus formation inside the LAA and of clinical thrombo-embolic events is high despite continuous oral anticoagulation. Therefore occlusion of the LAA applying an endo- or epicardial occluder device should be considered.[3]

## Timeline

| | |
|---|---|
| 1 year before presentation | Pulmonary vein isolation due to drug-refractory symptomatic persistent atrial fibrillation (AF). |
| 3 months before presentation | Repeat ablation procedure including electrical isolation of the left atrial appendage (LAA) due to recurrences of persistent AF. |
| At presentation | Patient admitted for endocardial LAA closure device 3 months after previous LAA isolation. Patient in stable sinus rhythm. No LAA thrombus in transoesophageal echocardiography. |
| During procedure | LAA still electrically isolated. Perforation of distal LAA with device sheath resulting in severe pericardial tamponade. Emergency occlusion of the proximal LAA with a cryoballoon and ligation of the LAA applying an epicardial LAA suture device. |
| Day 1 post-procedure | No further pericardial effusion. |
| Follow-up at 1 month | Patient asymptomatic and still free of arrhythmias. |

* Corresponding author. Tel: ++49-(0)40-1818 852305, Fax: ++49-(0)40-1818 854435, Email: a.metzner@asklepios.com. This case report was reviewed by Philipp Sommer and Panagiotis Xaplanteris.

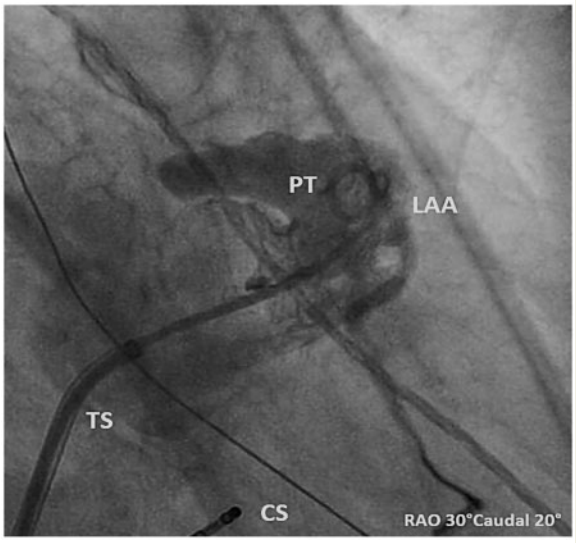


**Figure 1** Angiography of the left atrial appendage in RAO 30°/caudal 20° projection demonstrating a chickenwing morphology. CS, coronary sinus; LAA, left atrial appendage; PT, pigtail catheter; RAO, right anterior oblique; TS, transseptal sheath.

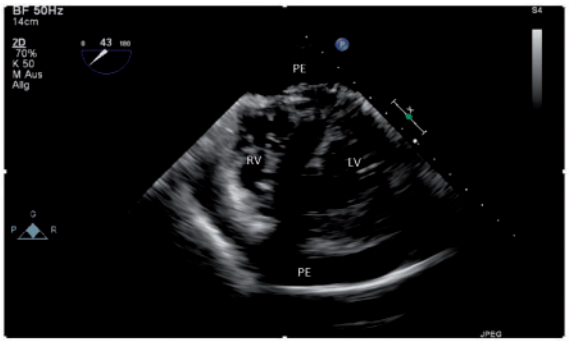


**Figure 2** Transoesophageal echocardiography in a transgastric view demonstrating the massive pericardial effusion. LV, left ventricle; PE, pericardial effusion; RV, right ventricle.

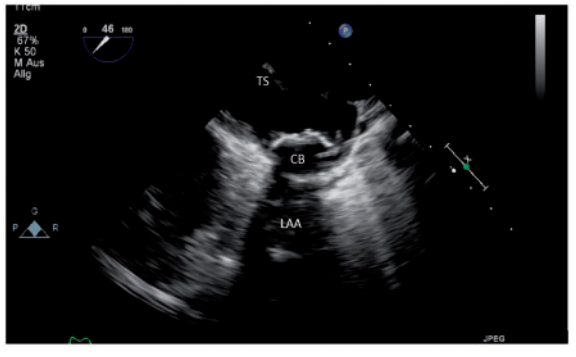


**Figure 3** Transoesophageal echocardiography in a short axis showing the transseptal sheath and the inflated cryoballoon at the proximal aspect of the left atrial appendage. CB, cryoballoon; LAA, left atrial appendage; TS, transseptal sheath.

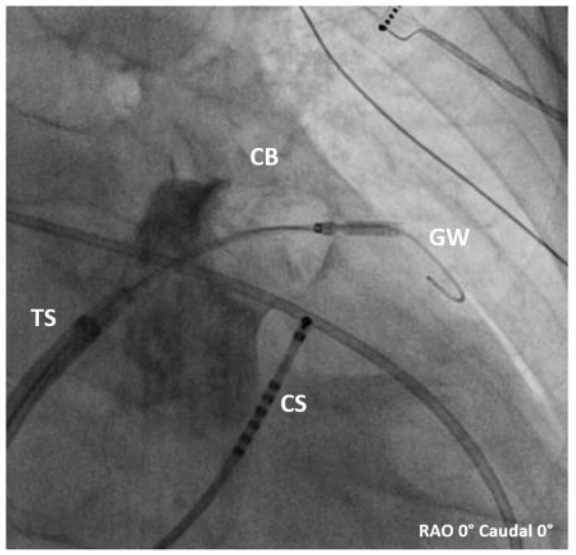


**Figure 4** The cryoballoon is introduced via a 12 transseptal sheath and over-the-guidewire to the base of the left atrial appendage and is inflated manually. Injection of contrast medium over the transseptal sheath demonstrates complete basal occlusion of the left atrial appendage. Note that the guidewire leaves via the distal left atrial appendage into the pericardium. CB, cryoballoon; CS, coronary sinus; GW, guidewire; TS, transseptal sheath.

## Case report

In a 78-year-old female patient with long history of persistent AF and symptomatic AF recurrences despite multiple previous ablation procedures and persistently isolated pulmonary veins, we performed isolation of the LAA by applying an anterior and a mitral isthmus line. Following a waiting period of 6 weeks post-LAAI and oral anticoagulation with a direct novel oral anticoagulant (Apixaban), we readmitted the patient in order to implant an endocardial LAA occluder device (Watchman; Boston Scientific, Marlborough, MA, USA). A preprocedural transoesophageal echocardiography (TOE) was performed and excluded a left atrial (LA) thrombus. The novel oral anticoagulant was stopped the day of the procedure. Under deep sedation using midazolam, sufentanil, and continuous infusion of propofol, a single transseptal puncture was performed using a regular 8, 5 Fr SL1 transseptal sheath (St. Jude Medical, Inc., St. Paul, MN, USA) after a multi-electrode diagnostic catheter was inserted into the coronary sinus. Intravenous Heparin was administered with a target-activated clotting time (ACT) of 300 s. Angiography of the LAA was performed revealing a 'chicken-wing' morphology (*Figure 1*). The maximal diameter at the landing zone as measured in fluoroscopy and TOE was 30 mm. Accordingly, a 33 mm Watchman device was selected to occlude the LAA. The transseptal sheath was changed

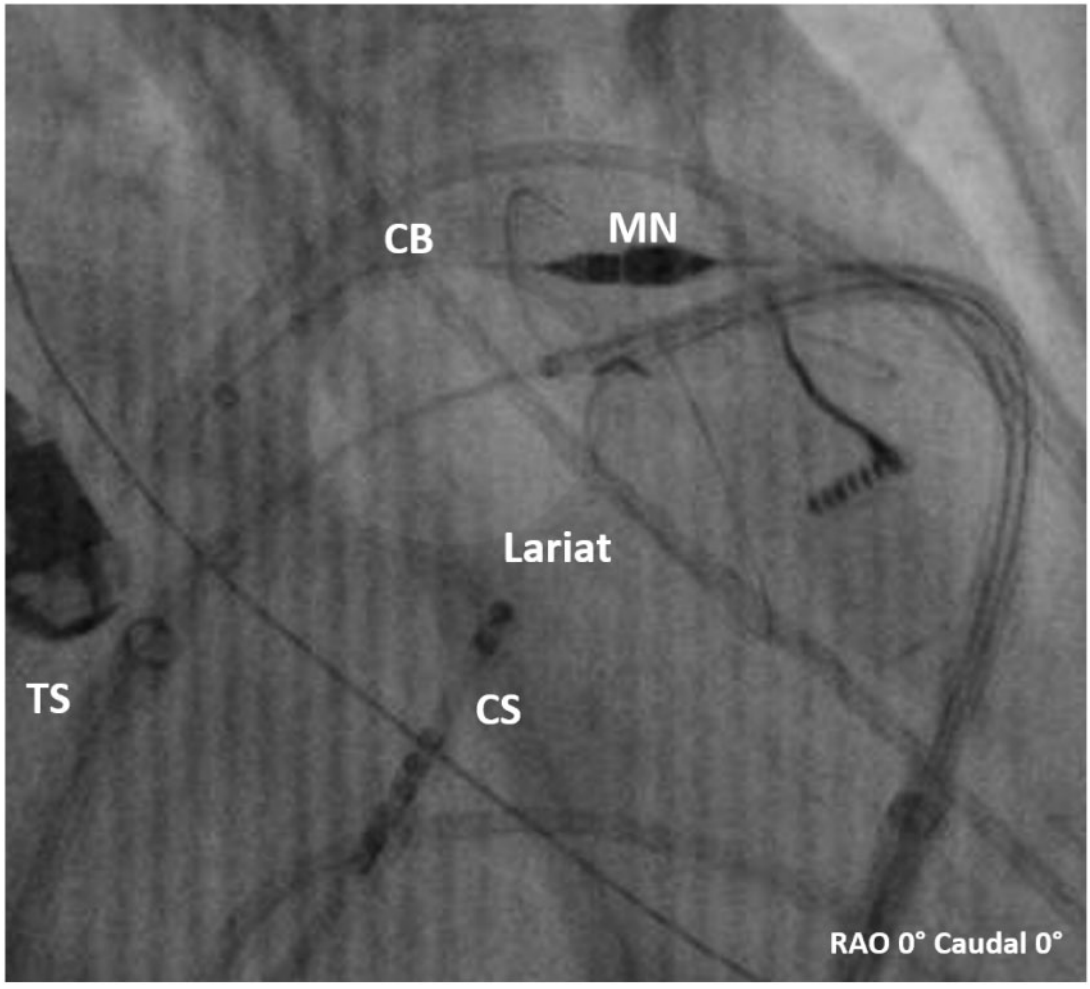


**Figure 5** The endocardial magnet is advanced across the temporarily deflated cryoballoon into the left atrial appendage and the epicardial magnet via an epicardial sheath. The Lariat is introduced over the epicardial sheath and is advanced over the left atrial appendage to the base of the left atrial appendage. CB, cryoballoon; CS, coronary sinus; MN, magnets; TS, transseptal sheath.

over a regular guidewire for the 15 Fr non-steerable Watchman sheath (Boston Scientific, Marlborough, MA, USA), which was gently advanced over the wire into the distal LAA until the according marker was in the predefined landing zone. Suddenly the patient became hypotensive and TOE showed a massive pericardial effusion (*Figure 2*). Immediate pericardiocentesis was performed, and a 7 Fr pigtail catheter introduced into the pericardial space. The 15 Fr Watchman sheath was immediately withdrawn into the inferior vena cava to avoid potential thrombus formation along the sheath. The ACT was measured with 357 s. A total of 5000 I.E. of protamine was immediately applied resulting in an ACT of 157 s. Aspirated epicardial blood was autotransfused via a right femoral vein access, but despite continuous aspiration the effusion remained unchanged indicating a massive perforation of the distal LAA.

In the meantime, the patient was intubated. Suspecting distal LAA perforation as the source of the massive bleeding proximal occlusion of the LAA was desired. Therefore a new transseptal puncture using a 8.5 Fr SL1 sheath (St. Jude Medical, Inc., St. Paul, MN, USA) was performed, and a guidewire was advanced into the LAA. The guidewire went via the distal LAA into the pericardial space proving the distal LAA perforation. Now, the SL1 transseptal sheath was changed over the wire for 12F steerable FlexCath Advance sheath (Medtronic, Inc., Minneapolis, MN, USA) which was advanced to the base of the LAA followed by introduction of a 28 mm cryoballoon (ArcticFront Advance, Medtronic, Inc., Minneapolis, MN, USA). The cryoballoon was gently moved over a guidewire to the base of the LAA and manually inflated using the cryoballoon manual retraction kit (Medtronic, Inc., Minneapolis, MN, USA) (*Figure 3*). Contrast medium was applied over the Flexcath sheath and demonstrated complete sealing of the LAA (*Figure 4*). Later the epicardial blood could be completely aspirated resulting in haemodynamic stability of the patient.

Since emergency open heart surgery in this older patient would have been associated with high peri- and post-operative risk, we decided to attempt epicardial LAA closure applying the Lariat epicardial LAA suture device (Sentreheart, Redwood City, CA, USA). Another anterior epicardial puncture was performed, and the epicardial magnet was introduced via the epicardial Lariat-sheath while the endocardial magnet was advanced over a second transseptal sheath

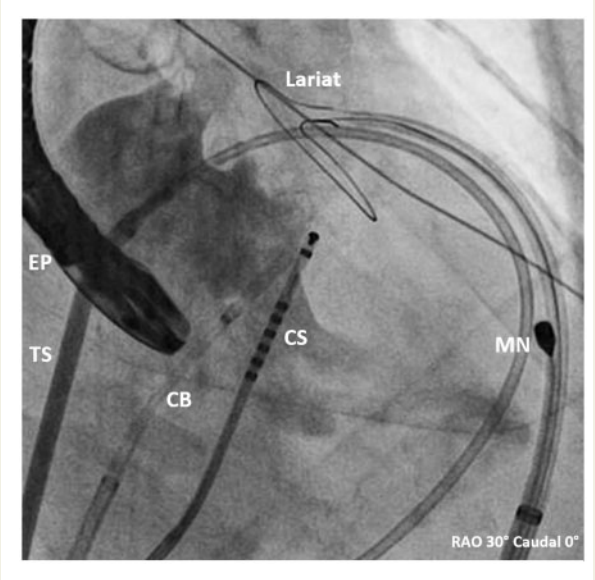


**Figure 6** After deflation of the cryoballoon the Lariat is closed resulting in complete occlusion of the left atrial appendage as demonstrated by contrast medium injection via the transseptal sheath. The Lariat snare and the endo- and epicardial magnets are pulled back. CB, cryoballoon; CS, coronary sinus; EP, echoprobe; MN, magnets; TS, transseptal sheath.

and across the temporarily deflated cryoballon into the LAA. Both magnets connected and the Lariat device was brought into the pericardium and gently advanced over the LAA and over the cryoballoon to the LAA base (*Figure 5*). After echocardiographic and fluoroscopic verification of the position of the Lariat snare, the snare was closed and the cryoballoon deflated and pulled back into the LA which resulted in complete closure of the LAA (*Figure 6*). The Lariat suture was tightened one and a second time after a waiting period of 5 min. A final TOE evaluation as well as another contrast injection via the transseptal sheath demonstrated complete LAA occlusion, no further pericardial effusion occurred. All sheaths except a pericardial 7 Fr pigtail catheter were removed and the patient was transferred to ICU for further monitoring. The patient was extubated 2 h after the LAA closure and after exclusion of further epicardial effusion during the next 24 h the pigtail catheter was removed. She was discharged 10 days after the procedure. Three months from discharge the patient had one episode of persistent AF requiring electrical cardioversion, and she had no further pericardial effusion.

## Discussion

Bleeding complications under oral anticoagulation therapy, intolerance to oral anticoagulation agents, or, as described in our case report, previous electrical LAA isolation might demand interventional occlusion of the LAA applying an endo- or epicardial closure device.[1,4] During catheter ablation but also during LAA occluder device implantation, LAA perforation resulting in pericardial effusion/tamponade can occur. Smaller leakages might be handled conservatively by pericardiocentesis without the need for open heart surgery. However, in case of a significant LAA perforation open heart surgery is mandatory. Using the 28 mm cryoballoon to occlude the LAA base can be a bail-out option for patients with major LAA leakage. In case of LAA perforation, the 28 mm cryoballoon can be advanced to the base of the LAA and manual inflation of the balloon using the cryoballoon manual retraction kit completely occludes the base of the LAA, thus allowing aspiration of pericardial effusion in order to further stabilize the haemodynamic condition of the patient. The Lariat epicardial LAA suture device can be an option in patients with a distal LAA perforation. However, the Lariat cannot be used in all LAA anatomies. The Lariat snare has a maximal diameter of 45 mm. Accordingly, LAAs with maximal diameter of >45 mm cannot be targeted. The Lariat can also not be applied if parts of the LAA extend behind the pulmonary artery. However, even if epicardial LAA ligation is not an option, occlusion of the LAA with the cryoballoon will stabilize the patient and allows for safe transfer to the operating room. Instead of the cryoballoon, also other compliant balloon devices allowing for titrated inflation might work in this particular setting.

## Conclusion

In a patient with distal LAA perforation, the 28 mm cryoballoon was used to effectively occlude the LAA base and stop the bleeding. Subsequently successful LAA closure with a Lariat epicardial suture device was performed to prevent open heart surgery.

**Consent:** The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

**Conflict of interest:** Andreas Metzner received travel grants and lecture honoraria from Medtronic. Karl-Heinz Kuck received travel and research grants and lecture honoraria from Medtronic.

Feifan Ouyang and Felix Kreidel have nothing to declare.

## References

1. Calkins H, Hindricks G, Cappato R, Kim YH, Saad EB, Aguinaga L, Akar JG, Badhwar V, Brugada J, Camm J, Chen PS, Chen SA, Chung MK, Nielsen JC, Curtis AB, Davies DW, Day JD, d'Avila A, de Groot NMSN, Di Biase L, Duytschaever M, Edgerton JR, Ellenbogen KA, Ellinor PT, Ernst S, Fenelon G, Gerstenfeld EP, Haines DE,Haissaguerre M, Helm RH, Hylek E, Jackman WM, Jalife J, Kalman JM, Kautzner J,Kottkamp H, Kuck KH, Kumagai K, Lee R, Lewalter T, Lindsay BD, Macle L, Mansour M, Marchlinski FE, Michaud GF, Nakagawa H, Natale A, Nattel S, Okumura K, Packer D, Pokushalov E, Reynolds MR, Sanders P, Scanavacca M, Schilling R, Tondo C, Tsao HM, Verma A, Wilber DJ, Yamane T. 2017 HRS/EHRA/ECAS/APHRS/SOLAECE expert consensus statement on catheter and surgical ablation of atrial fibrillation. *Heart Rhythm* 2017;**14**:e275–e444.
2. Di Biase L, Burkhardt JD, Mohanty P, Mohanty S, Sanchez JE, Trivedi C, Güneş M, Gökoğlan Y, Gianni C, Horton RP, Themistoclakis S, Gallinghouse GJ, Bailey S, Zagrodzky JD, Hongo RH, Beheiry S, Santangeli P, Casella M, Dello Russo A, Al-Ahmad A, Hranitzky P, Lakkireddy D, Tondo C, Natale A. Left atrial appendage isolation in patients with longstanding persistent AF undergoing catheter ablation: BELIEF trial. *J Am Coll Cardiol* 2016;**68**:1929–1940.
3. Rillig A, Tilz RR, Lin T, Fink T, Heeger C-H, Arya A, Metzner A, Mathew S, Wissner E, Makimoto H, Wohlmuth P, Kuck K-H, Ouyang F. Unexpectedly high incidence of stroke and left atrial appendage thrombus formation after electrical isolation of the left atrial appendage for the treatment of atrial tachyarrhythmias. *Circ Arrhythm Electrophysiol* 2016;**9**:e004556.
4. Masoudi FA, Calkins H, Kavinsky CJ, Drozda JP, Gainsley P, Slotwiner DJ, Turi ZG. 2015 ACC/HRS/SCAI left atrial appendage occlusion device societal overview. *Heart Rhythm* 2015;**12**:e122–e136.