

Electrode Detachment and Coronary Embolization from an Achieve™ Circular Mapping Catheter During Cryoballoon Ablation

Kriyobalon Ablasyonu Sırasında Achieve™ Dairesel Haritalama Kateterinden Elektrot Ayrılması ve Koroner Embolizasyon

Although the Achieve™ circular mapping catheter is central to cryoballoon-guided pulmonary vein isolation (PVI), rare mechanical failures, including spline deformation, electrode detachment, and systemic embolization can occur. Device reuse, practiced in some centers, may exacerbate cumulative structural degradation.


A 72-year-old male patient with highly symptomatic paroxysmal atrial fibrillation (AF) was referred for catheter ablation after failure of antiarrhythmic drug therapy. He had no known structural heart disease and underwent cryoballoon ablation under mild sedation with uninterrupted anticoagulation following preprocedural transesophageal echocardiography. After vascular access was obtained and a decapolar catheter was placed in the coronary sinus, systemic anticoagulation with unfractionated heparin was initiated. A standard transeptal puncture was then performed, and a 12F steerable sheath (FlexCath Advance™, Medtronic) was advanced through the septum (Figure 1A). The cryoballoon catheter (28-mm Arctic Front Advance™, Medtronic)–circular mapping catheter (20-mm reprocessed Achieve Advance™, Medtronic) assembly was advanced through the sheath, and the left upper pulmonary vein was occluded for the first freeze–thaw cycle. At this stage, a small radiodense structure was noted at the left lateral border of the cardiac silhouette (Figure 1B). A 20-mm Achieve catheter with eight electrodes was used; however, only seven electrodes were visible on fluoroscopy in multiple projections during the first application. The fifth electrode was therefore suspected to have embolized (Figure 1C). Detachment of the electrode may have occurred either during loading of the Achieve catheter into the balloon lumen or shortly after it was exposed from the balloon during catheter advancement; however, no resistance was felt during manipulation. Based on the precise stability and cyclical movement of the embolized electrode synchronized with the cardiac cycle, coronary embolization was suspected. The patient was asymptomatic, and no abnormalities were observed on electrocardiography. To prevent further foreign body or air embolization, the cryoballoon–Achieve assembly was not withdrawn. With careful and gentle catheter manipulation, the remaining pulmonary veins were successfully isolated. At the end of the ablation procedure, the assembly was withdrawn into the sheath without retracting the Achieve catheter into the balloon. Selective left coronary angiography performed immediately after ablation demonstrated the embolized electrode lodged in a small-caliber distal branch of the circumflex artery, without evidence of distal flow restriction or spasm (Figure 1D). Given the potential risk of future arterial narrowing or occlusion, a floppy guidewire was advanced into the affected branch, and a microcatheter was positioned over the guidewire adjacent to the electrode. After removal of the guidewire, a microsnare was advanced through the microcatheter in an attempt to retrieve the electrode (Figure 1E, Video 1). However, grasping was unsuccessful, and manipulation with the microsnare resulted in slight distal migration of the embolized electrode. Baseline distal Thrombolysis in Myocardial Infarction (TIMI) grade 3 flow was preserved and remained unchanged after intracoronary nitroglycerin administration. Given the small caliber of the involved vessel, the absence of ischemia, and the substantial procedural risks associated with attempted coronary retrieval, including dissection, perforation, or


CASE IMAGE OLGU GÖRÜNTÜSÜ

Serkan Çay 


Muhammet Geneş 

Meryem Kara 

Özcan Özeke 

Elif Hande Özcan Çetin 

Ahmet Korkmaz 

Fırat Özcan 

Serkan Topaloğlu 

*Division of Arrhythmia and Electrophysiology,
Department of Cardiology, University
of Health Sciences, Yüksek İhtisas
Cardiovascular Building, Ankara City
Hospital, Ankara, Türkiye*

Corresponding author:

Serkan Çay
✉ cayserkan@yahoo.com

Received: December 23, 2025

Accepted: January 09, 2026

Cite this article as: Çay S, Geneş M, Kara M, et al. Electrode Detachment and Coronary Embolization from an Achieve™ Circular Mapping Catheter During Cryoballoon Ablation. *Türk Kardiyol Dern Ars.* 2026;54(2):199–201.

DOI: 10.5543/tkda.2026.85986



Copyright © Author(s)
Available online at archivestsc.com.
Content of this journal is licensed under a
Creative Commons Attribution –
NonCommercial–NoDerivatives 4.0
International License.

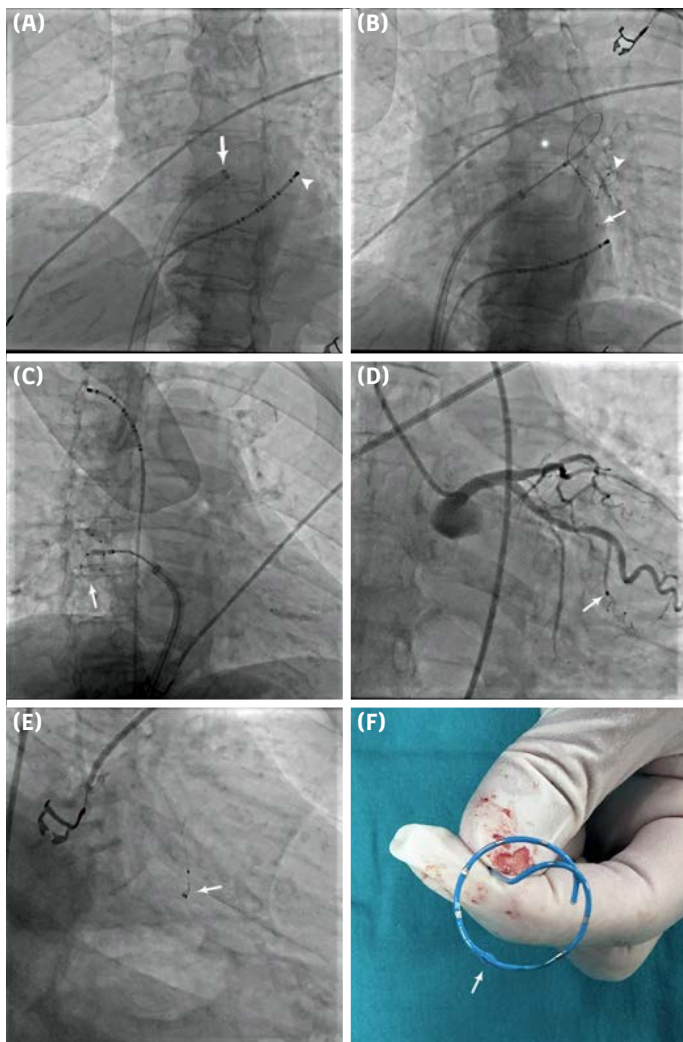


Figure 1. Fluoroscopic images demonstrating: (A) a steerable sheath (arrow) positioned in the left atrium with a decapolar catheter (arrowhead) in the coronary sinus in the left anterior oblique (LAO) view; (B) the cryoballoon (asterisk)-Achieve (arrowhead) assembly during freezing of the left superior pulmonary vein, with an embolized electrode (arrow) visible along the left border of the cardiac silhouette in the LAO view; (C) absence of the fifth electrode of the Achieve catheter (arrow) during freezing of the right inferior pulmonary vein in the right anterior oblique (RAO) view; (D) selective left coronary angiography showing the embolized electrode (arrow) lodged in a small branch of the circumflex artery without flow limitation in the RAO caudal view; (E) the microcatheter-microsnare assembly (arrow) during an attempt to grasp the embolized electrode in the RAO caudal view; and (F) the Achieve circular mapping catheter with the missing fifth electrode (arrow).

occlusion, no further retrieval attempts were undertaken. The patient remained asymptomatic, with no electrocardiographic changes immediately after the procedure or on the following day. The total procedure duration was 88 minutes, with a fluoroscopy time of 37.4 minutes. Postprocedural analysis of the damaged Achieve catheter, including gross inspection, revealed surface

abrasion and loss of the detached electrode (Figure 1F, Video 2). An anticoagulation-only strategy, without antiplatelet therapy, was chosen for the patient due to the absence of symptoms, lack of flow restriction or ischemia, small vessel caliber, and the increased risk of bleeding associated with dual antithrombotic therapy. At one-month follow-up, no adverse clinical events were observed.

At our institution, one Achieve catheter is supplied for every two cryoballoon catheters, and reprocessing and reuse are performed in accordance with institutional practice to support procedural availability and resource utilization. The device used in this case had undergone two prior reprocessing and reuse cycles before the index procedure. Vacuum-based ethylene oxide sterilization was used for reprocessing of the Achieve catheter. This method provides the required sterility assurance level without exposing the device to excessive heat, moisture, or radiation, thereby preserving catheter integrity. Following sterilization, the catheter underwent visual inspection to assess potential structural damage or material degradation. No gross abnormalities in loop geometry or electrode appearance were observed; however, no microscopic or tensile integrity testing was performed. Cumulative fatigue from reprocessing and reuse weakened the structural integrity of the catheter, lowering the threshold for mechanical failure during manipulation.

At the time of the procedure, reprocessing of the Achieve catheter consisted of vacuum-based ethylene oxide sterilization followed by macroscopic visual inspection. While this ensured sterility and excluded gross defects, the present event highlighted the inability of visual inspection alone to detect cumulative microstructural fatigue resulting from repeated use. Following this case, our division restricted reprocessing to a single reuse, with mandatory device retirement thereafter, and expanded post-reprocessing quality control to include enhanced functional inspection. This inspection places specific emphasis on electrode integrity and mechanical resistance during catheter loading into the cryoballoon, advancement within and beyond the balloon, and withdrawal back into the balloon lumen during preparation. Although routine microscopic or tensile testing is impractical, these protocol changes aim to mitigate the risk of rare but potentially serious mechanical failures while balancing procedural efficiency and resource utilization.

Published data on mechanical failure of cryoballoon-compatible circular mapping catheters are limited and consist largely of case reports. Specifically regarding the Achieve catheter, fracture of the distal portion of a 20-mm Achieve catheter within a pulmonary vein during cryoballoon ablation has been reported, requiring complex retrieval techniques, including the use of advanced tools after unsuccessful snaring. This underscores that significant device disruption can occur during challenging manipulation or withdrawal from the pulmonary venous system. In another report, fracture of an Achieve catheter was recognized fluoroscopically after abnormal resistance was encountered during catheter manipulation, with a radiopaque electrode fragment visualized as embolized within the systemic circulation. The report emphasized the mechanical vulnerability of the Achieve catheter's distal electrode assembly, particularly when exposed

to repetitive torque, traction, or deformation during positioning or withdrawal from the pulmonary veins. Importantly, such failures may occur even in the absence of overt manufacturing defects and may be facilitated by cumulative mechanical stress during the procedure. Beyond Achieve™, analogous events have been reported with other circular mapping catheters, including electrode dislodgement and retention of a metallic electrode visualized fluoroscopically in the left atrium with subsequent lodging in a small vessel. These reports highlight the potential risk of systemic embolization and underscore the importance of careful inspection and fluoroscopic accounting of electrode markers when resistance or abnormal catheter behavior is encountered.

After recognition of the embolized electrode, the cryoballoon–Achieve assembly was already positioned within the left atrium. Exchanging the Achieve catheter would have required retraction into the balloon lumen and advancement of a new catheter, a maneuver considered to carry a non-negligible risk of thromboembolism or air embolization; therefore, the procedure was continued using the same Achieve catheter. The ablation was completed under heightened safety precautions, including repeated fluoroscopic assessments in multiple projections to exclude additional radiopaque fragments and continuous monitoring of the Achieve catheter, which revealed no further structural abnormalities. Catheter manipulation was minimized and performed with gentle, controlled movements, avoiding forceful advancement, excessive torque, or high-tension maneuvers. Importantly, the Achieve catheter was never retracted into the balloon lumen at any point during or after the ablation, thereby avoiding potential shear forces at the balloon–catheter interface. At the end of the procedure, the cryoballoon–Achieve assembly was withdrawn together into the FlexCath sheath.

Follow-up in the present case was limited to one month, during which the patient remained completely asymptomatic, with no electrocardiographic or echocardiographic evidence of myocardial ischemia, infarction, pericardial effusion, or other structural complications. No additional ischemia-directed functional testing or advanced cardiac imaging was performed, given the absence of symptoms, preserved ventricular function, stable electrocardiographic findings, normal echocardiographic parameters, preserved distal TIMI-3 flow on the index coronary angiogram, and the very small caliber of the involved distal circumflex branch. Nevertheless, the retained metallic intracoronary foreign body raises theoretical concerns regarding late complications, including delayed thrombotic occlusion, chronic inflammatory response, or subsequent ischemic events. The absence of long-term follow-up represents an important limitation of this report, and longer-term surveillance is warranted in similar cases to better define the natural history and optimal management strategy of such rare complications.

From a sustainability perspective, reprocessing selected devices labeled as “single use” has been proposed to reduce waste and material use in electrophysiology. Studies evaluating the life cycle of remanufactured or reprocessed electrophysiology catheters have demonstrated a lower environmental impact compared with disposal after a single use. However, these benefits depend on reprocessing being performed within standardized and validated programs. Such programs must include proper cleaning, sterilization, functional testing, and clear device identification during each reuse cycle, and must adhere to established quality systems and regulatory requirements. In the United States, reprocessed single-use devices are regulated by the Food and Drug Administration to ensure safety and effectiveness. In Europe, these practices are governed by the Medical Device Regulation.

In conclusion, this case highlights a rare but serious complication associated with the reprocessing of mapping catheters. Repeated mechanical cycling and sterilization can cause structural fatigue, increasing the risk of electrode detachment, particularly during high-tension maneuvers. Retrieval of small intracardiac metallic fragments is technically challenging. In selected cases, conservative management may be considered after careful risk-benefit assessment when the patient is clinically stable, coronary flow is preserved, and percutaneous retrieval attempts are unsuccessful.

Ethics Committee Approval: This is a single case image, and therefore ethics committee approval was not required in accordance with institutional policies.

Informed Consent: The patient provided written informed consent for the publication of this case report and any accompanying images. All identifiable information has been anonymized to protect patient privacy.

Conflict of Interest: The authors have no conflicts of interest to declare.

Funding: The authors declared that this study received no financial support.

Use of AI for Writing Assistance: No artificial intelligence (AI)-assisted technologies were used in the production of the submitted work.

Author Contributions: Concept – S.Ç.; Design – S.Ç.; Supervision – S.Ç.; Resource – S.Ç.; Materials – S.Ç.; Data Collection and/or Processing – S.Ç.; Analysis and/or Interpretation – S.Ç.; Literature Review – S.Ç.; Writing – S.Ç.; Critical Review – M.G., M.K., Ö.Ö., E.H.Ö.Ç., A.K., F.Ö., S.T.

Peer-review: Internally peer-reviewed.

Video 1. Fluoroscopic recording showing an embolized Achieve catheter electrode in a distal circumflex artery branch and an attempted retrieval using a microcatheter–microsnare assembly in the right anterior oblique (RAO) caudal view.

Video 2. Achieve circular mapping catheter with the missing fifth electrode and deformation at the site of the missing electrode.