JACC: CLINICAL ELECTROPHYSIOLOGY VOL. ■, NO. ■, 2024

IMAGES AND VIGNETTES IN CLINICAL ELECTROPHYSIOLOGY

First-in-Human Percutaneous Removal of Left Atrial Appendage Occlusion Devices With a Novel Retrieval System

Daniel Hermann, MD,[a] Zahoor Khan, MD,[b] Zaka Khan, MD,[a] Juan Abreu, MD,[c] Pranav Loyalka, MD,[b] Athar M. Qureshi, MD[d,e]

Embolization of left atrial appendage occlusion (LAAO) devices is associated with significant morbidity and mortality. Data from the National Cardiovascular Data Registry LAAO Registry demonstrated that surgical retrieval was frequently required for LAAO device embolization and was associated with a significant risk of mortality.[1] In addition, percutaneous retrieval of embolized/malpositioned LAAO devices can be challenging, particularly when attempting to retrieve these devices into large-bore sheaths.[2] In this report, we describe the use of the novel ŌNŌ retrieval system (ŌNŌCOR LLC) to facilitate retrieval of LAAO devices in 3 patients (**Figures 1-8**, Videos 1-3). The ŌNŌ retrieval system has been used in different scenarios to date to remove a variety of cardiac devices and large balloon fragments.[3] It offers potential advantages over existing retrieval techniques used for removing embolized/malpositioned LAAO devices and may facilitate safer and more effective percutaneous retrieval.

FUNDING SUPPORT AND AUTHOR DISCLOSURES

Dr Qureshi is a consultant for Medtronic Inc, W.L. Gore and Associates, and B. Braun. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

ADDRESS FOR CORRESPONDENCE: Dr Athar M. Qureshi, Mullins Cardiac Catheterization Laboratories, The Lillie Frank Abercrombie Section of Cardiology, Texas Children's Hospital, 6651 Main Street, E 1920, Houston, Texas 77030, USA. E-mail: axquresh@texaschildrens.org.

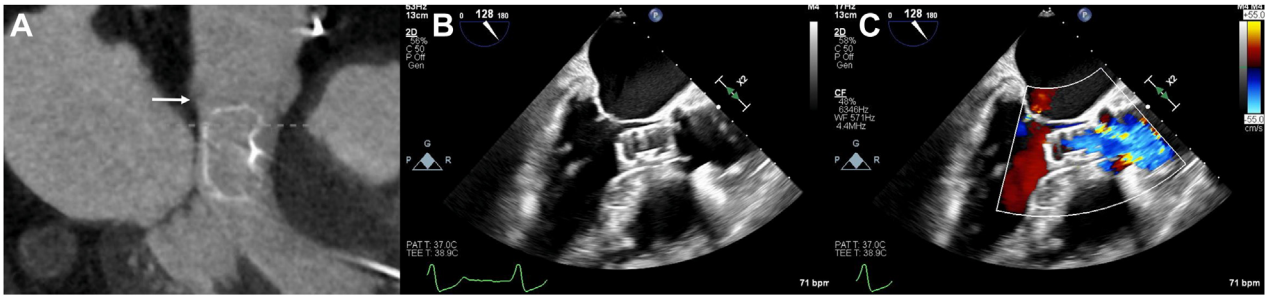
From the [a]Division of Cardiology, Memorial Herman Health System, Houston, Texas, USA; [b]Houston Heart, Hospital Corporation of America, Houston Healthcare, Houston, Texas, USA; [c]Division of Cardiovascular Surgery, Memorial Herman Health System, Houston, Texas, USA; [d]The Lillie Frank Abercrombie Division of Cardiology, Texas Children's Hospital, Houston, Texas, USA; and the [e]Department of Pediatrics, Baylor College of Medicine, Houston, Texas, USA.

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 January 25, 2024; accepted January 26, 2024.

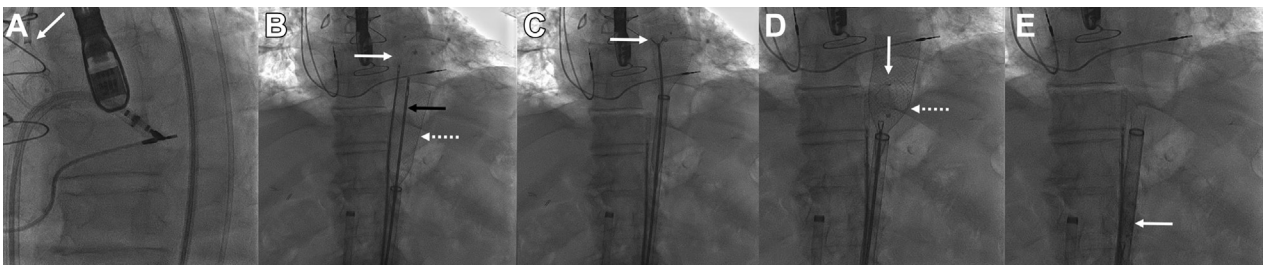
ISSN 2405-500X https://doi.org/10.1016/j.jacep.2024.102328

FIGURE 1 **Left Atrial Appendage Occlusion Device Embolization to Left Ventricular Outflow Tract**



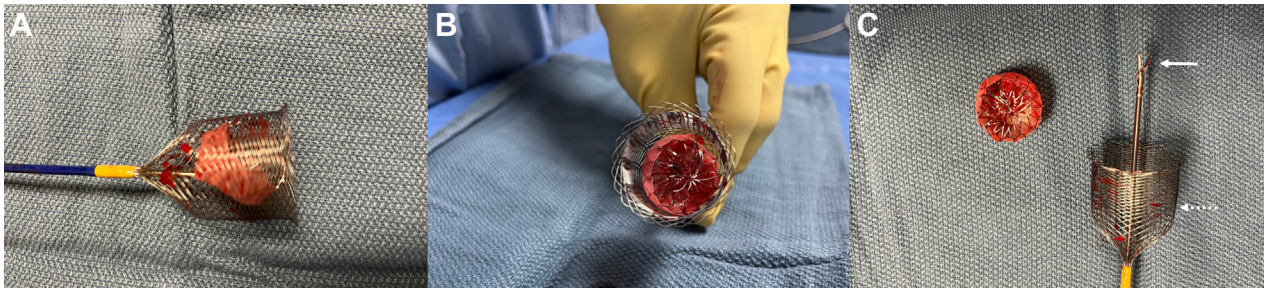
Case 1. An 83-year-old man with coronary artery disease and chronic atrial fibrillation underwent placement of a 27-mm Watchman FLX device (Boston Scientific) in the left atrial appendage. On the day of anticipated discharge, the device was noted to have embolized to the left ventricular outflow tract. The device was in a stable and nonobstructive position on the (A) computed tomography scan below the aortic valve (arrow) and transesophageal echocardiography (B) without and (C) with color Doppler.

FIGURE 2 **Percutaneous Retrieval of Left Atrial Appendage Occlusion Device From the Left Ventricular Outflow Tract**



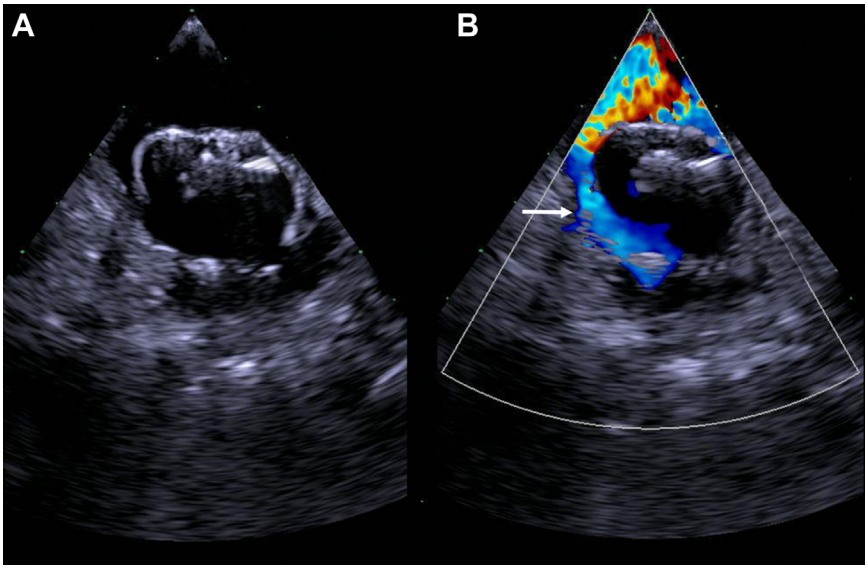
(A) In the cardiac catheterization laboratory, under fluoroscopy, the Watchman FLX device was removed from below the aortic valve with a retrieval forceps through a 7-F guiding catheter (white arrow) to (B) the descending aorta (white arrow) via the left femoral artery. A 2.4-mm Raptor forceps (Steris) (black arrow in B) was advanced through a 12-F ŌNŌ retrieval device (white dotted arrow in B) via a 24-F sheath in the right femoral artery. (C) The Watchman device FLX is grasped with the Raptor forceps through the ŌNŌ retrieval device (white arrow), and the previously used forceps is released. (D) The Watchman FLX device (white arrow) was collapsed within the ŌNŌ retrieval device (white dotted arrow) and (E) removed through the sheath (white arrow).

FIGURE 3 **Fully Retrieved Left Atrial Appendage Occlusion Device**



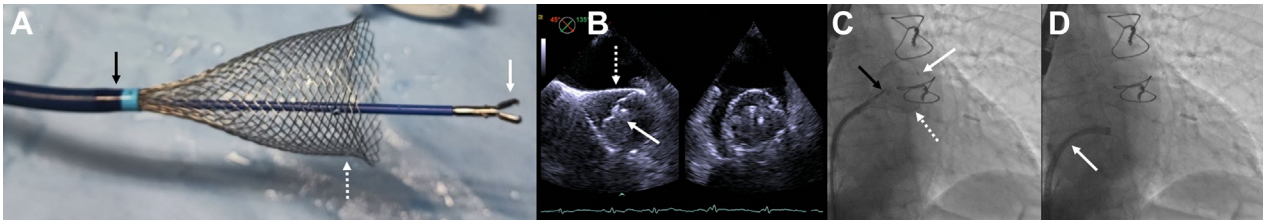
The Watchman FLX device is seen (A and B) within and (C) alongside the ŌNŌ retrieval device (dotted arrow) and Raptor forceps (arrow). The ŌNŌ retrieval device consists of a 35-mm self-expanding nitinol basket attached to a 12-F catheter shaft with a 7.5-F inner lumen.

FIGURE 4 **Unstable Left Atrial Appendage Occlusion Device Position in the Left Atrial Appendage**



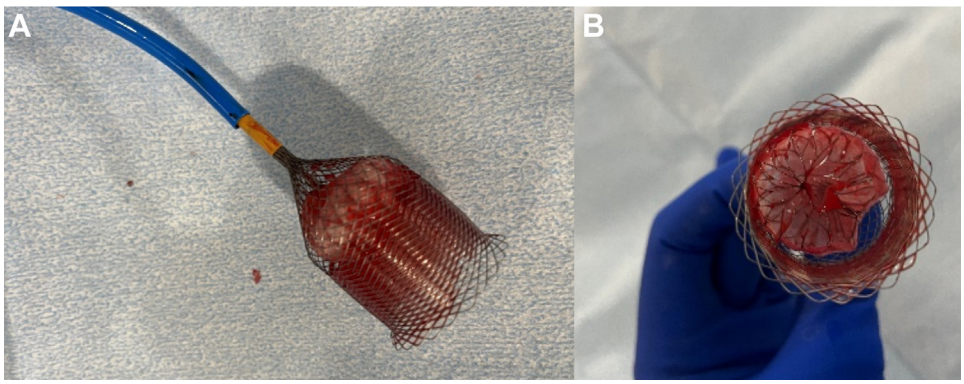
Case 2. An 82-year-old man with a history of paroxysmal atrial fibrillation, chronic systolic congestive heart failure, coronary artery disease, hyperlipidemia, hypertension, peripheral arterial disease, and stroke underwent placement of a 31-mm Watchman FLX device in the left atrial appendage. The device was noted to be in unstable position in the (A) left atrial appendage with (B) a residual leak (arrow) on transesophageal echocardiography in the 135° view.

FIGURE 5 **Percutaneous Left Atrial Appendage Occlusion Device Retrieval From the Left Atrial Appendage**



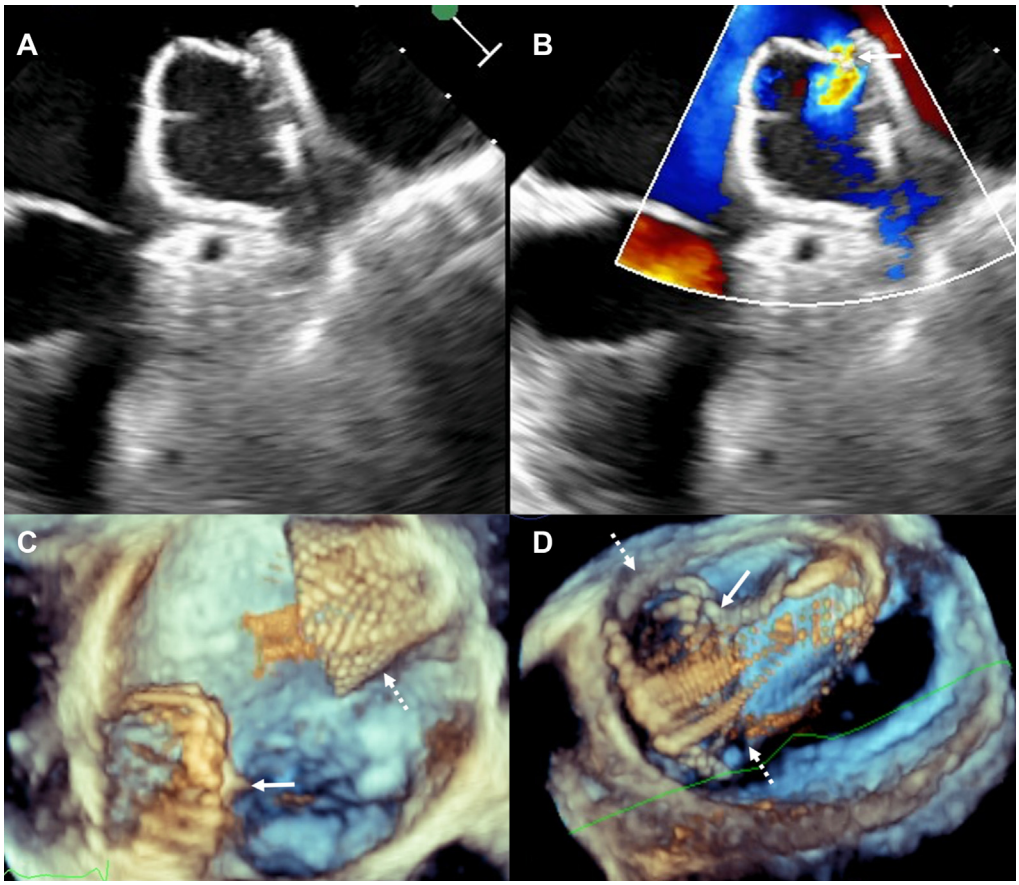
(A) A 2.4-mm Raptor forceps (white arrow) is seen through the lumen of the ŌNŌ retrieval device (white dotted arrow). The ŌNŌ retrieval device is introduced through a deflectable sheath (black arrow) to facilitate alignment. (B) The Watchman FLX device (white arrow) is seen encompassed by the ŌNŌ retrieval device (white dotted arrow) on transesophageal echocardiography with a corresponding adjacent orthogonal "en face" view. The ŌNŌ retrieval device was advanced in the deflectable sheath via a 26-F sheath in the right femoral vein. (C) The Watchman FLX device (white arrow) is encompassed within the ŌNŌ retrieval device (white dotted arrow) and grasped with the Raptor forceps (black arrow) using fluoroscopy. (D) The Watchman FLX device was collapsed within the ŌNŌ retrieval device and withdrawn through the long sheath (white arrow).

FIGURE 6 **Fully Retrieved Left Atrial Appendage Occlusion Device**



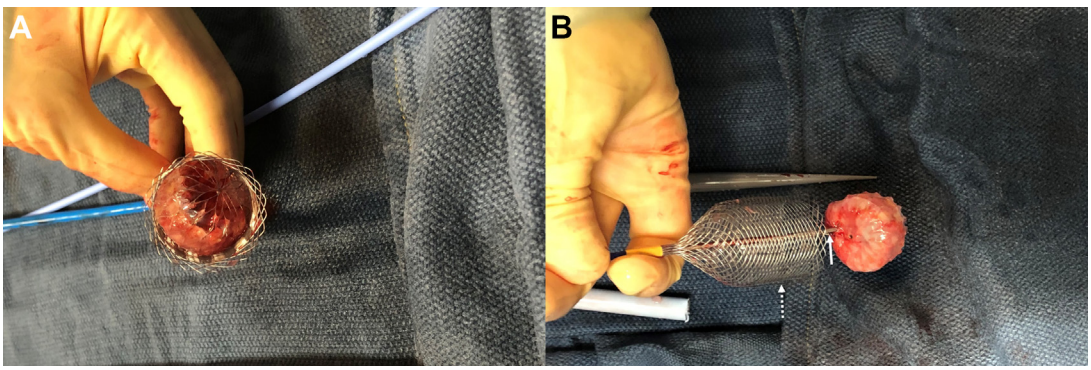
(A and B) The removed Watchman FLX device is seen within the ŌNŌ retrieval device.

FIGURE 7 **Percutaneous Left Atrial Appendage Occlusion Device Retrieval From the Left Atrial Appendage 6 Weeks After Implantation in an 81-Year Old Woman with a History of Chronic Atrial Fibrillation**



Case 3. In this 81-year old woman with a history of chronic atrial fibrillation, a 31 mm Watchman FLX device is seen partially dislodged (6 weeks after implantation) from the left atrial appendage (A) with a residual leak (B, white arrow). The retrieval technique was similar to what was used in the second patient described above. 3-D TEE shows the ŌNŌ retrieval device (C, white dotted arrow) being advanced towards the Watchman FLX device (C, white arrow). The ŌNŌ retrieval device (D, between white dotted arrows) can be seen encompassing the Watchman FLX device (D, white arrow) by 3-D TEE.

FIGURE 8 **Fully Retrieved Left Atrial Appendage Occlusion Device**



The Watchman FLX device is seen inside the ŌNŌ retrieval device (A) and outside the ŌNŌ retrieval device (B, white dotted arrow), grasped by the Raptor forceps (B, white arrow). Note the partially endothelialzed Watchman FLX device.

REFERENCES

1. Friedman DJ, Freeman JV, Zimmerman S, et al. Watchman device migration and embolization: a report from the NCDR LAAO Registry. *J Cardiovasc Electrophysiol*. 2023;34(5):1192-1195.

2. Kany S, Bordignon S, Piorkowski M, et al. Retrieval of embolised left atrial appendage closure devices. *EuroIntervention*. 2021;17(2):e178-e180.

3. Taylor AC, Ghandour MAH, Khan A, et al. Retrieval of large balloon fragments during transcatheter pulmonary valve implantation using a novel retrieval system. *J Am Coll Cardiol Case Rep*. 2023;26:102058.

KEY WORDS atrial fibrillation, left atrial appendage, occlusion device

APPENDIX For supplemental videos, please see the online version of this paper.