Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

Endovascular retrieval of a migrated covered stent from the pulmonary artery ☆,☆☆

Ziga Cizman, MD, William Zachery Paden, MD, Tyler Smith, MD, Samuel Wilhite, MD, David Strain, MD, Wael Saad, FSIR, MBBCh*

Department of Interventional Radiology, University of Utah School of Medicine, 50 N Medical Dr, Salt Lake City, UT 84132, USA

ARTICLE INFO

Article history:
Received 2 February 2024
Revised 12 February 2024
Accepted 14 February 2024
Available online 8 March 2024

Keywords:
Stent migration
Tricuspid regurgitation
Nutcracker syndrome
Endovascular stent retrieval

ABSTRACT

Stent migration is a rare but significant complication following endovascular procedures. Techniques for managing dislodged stents have included surgical, endovascular, and conservative approaches. This case details a patient who had a covered stent placed within the left renal vein which later migrated to the pulmonary artery causing damage to the tricuspid valve. The migrated stent was successfully removed using a percutaneous endovascular approach utilizing fluoroscopy and transesophageal echocardiogram guidance.

Introduction

Stent migration is an underreported phenomenon in the literature, despite an estimated occurrence rate of 2%-5% following percutaneous endovascular stent procedures [1,2]. Various techniques have been described for the retrieval of migrated stents, including endovascular and surgical approaches. Watchful waiting has also been described in the literature depending on the location of the embolized stent and patient symptoms [3,4]. A migrated stent within a proximal pulmonary artery raises concern for vessel injury, pulmonary thrombosis, and pulmonary infarction [5]. Few reports of endovascular retrieval of migrated Viabahn stents (Gore &

☆ Acknowledgments: None.

☆☆ Competing Interests: The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Wael Saad is a paid consultant for Siemens, Gore & associates. Wael Saad also has received payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Siemens, Gore & associates. All other authors have no known competing financial interest or personal relationships that could have appeared to influence the work reported in this paper.

* Corresponding author.
E-mail address: tyler.a.smith@hsc.utah.edu (T. Smith).

https://doi.org/10.1016/j.radcr.2024.02.045

Associates, Flagstaff, AZ) from the pulmonary arteries exist in the literature [2,3]. This case report presents the retrieval of an 8 x 50 mm Viabahn stent (Gore & Associates, Flagstaff, AZ) initially placed within the left renal vein in the setting of Nutcracker syndrome that later migrated to the right pulmonary artery. Using a modified technique first described by Dashkoff et al. [3], the stent was successfully removed using an endovascular approach under fluoroscopic and transesophageal echocardiogram (TEE) guidance.

Case report

The patient was transferred a tertiary referral center after presenting at an outside hospital emergency department with shortness of breath and diaphoresis. Initial imaging demonstrated a migrated Viabahn stent (Gore & Associates, Flagstaff, AZ) (Fig. 1) lodged a proximal right pulmonary artery. There were multiple associated pulmonary emboli within the downstream segmental branches of the right lower lobe. Transesophageal echocardiogram (TEE) was significant for new severe tricuspid regurgitation secondary to a flail anterior leaflet. A multidisciplinary review of the patient's case was undertaken with interventional radiology, cardiothoracic surgery, and vascular surgery. The decision was made to undergo endovascular removal in a hybrid operating room with cardiothoracic surgery back-up. After obtaining appropriate consent, the procedure was performed under general anesthesia. A TEE probe was introduced to assist with real time guidance during the procedure.

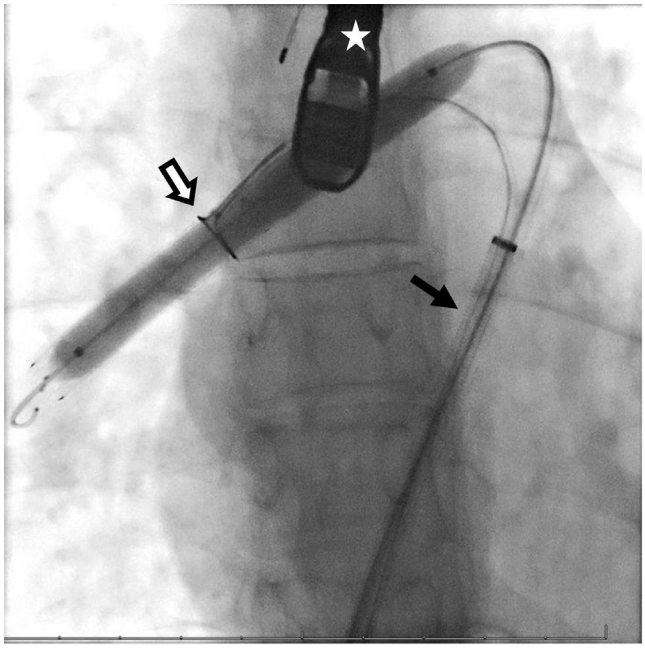
The right common femoral vein was accessed under ultrasound guidance with a 21-gauge needle using micropuncture set (Cook, Bloomington, IN). This was serially dilated and a 16 French sheath was placed (Cook, Bloomington, IN). Main pulmonary artery was accessed and pulmonary angiography was performed using 5 French pigtail catheter (Cook, Bloomington, IN). Wire access across the stent was obtained using a Kumpe catheter (Cook, Bloomington, IN) and Bentson wire (Cook, Bloomington, IN). This was then exchanged for a Rosen wire (Cook, Bloomington, IN). Over the Rosen (Cook, Bloomington, IN) a 12 French sheath was advanced into the main pulmonary artery for stability. A 10 x 8 cm balloon (Advance LP 35 Cook, Bloomington, IN) was loaded onto the wire, and proximal portion of the balloon was snared with using 15 mm ONE Snare (Merit, Salt Lake City, UT) outside the body then advanced in tandem over the wire through the sheath to level of the migrated pulmonary artery stent. Once the balloon/snare complex was positioned through the stent, the snare repositioned off the balloon and over the proximal aspect of the covered stent. The balloon was then inflated to nominal pressure within the stent. The snare was tightened over the stent with the balloon inflated, which eliminated the step off that would otherwise occur with snaring the stent alone (Fig. 2). The balloon snare stent complex was then slowly retracted over the wire across the pulmonic and tricuspid valves under fluoroscopic and TEE guidance. Once the balloon snare stent complex was outside the heart, the balloon was slowly deflated as the proximal end of the sent was retracted into the 12 F sheath. This entire system was retracted through the right atrium and IVC into a 16 French sheath.

Fig. 1 (A) – Portable upright AP radiograph demonstrating a retained stent in a proximal right pulmonary artery (white arrow). (B) Subsequent CT of the chest was performed demonstrating the stent in the proximal right middle pulmonary artery on maximum intensity projection imaging (white arrow).

Repeat pulmonary arteriograms demonstrated complete removal without vascular injury (Fig. 3). The sheaths and catheter were removed, and hemostasis was achieved with Perclose ProGlide closure device (Abbott Vascular, Santa Clara, CA).

Discussion

Stent migration occurs in 2%-5% of cases, and are most often due to improper stent sizing, inadequate deployment tech-



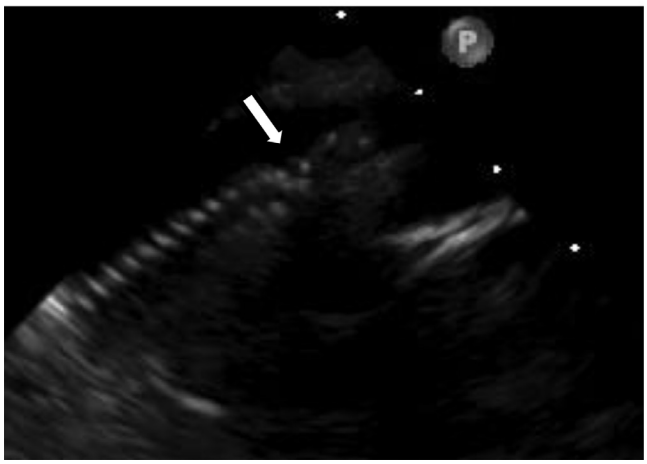


Fig. 2 (A) – Procedural fluoroscopic image demonstrating a 10 x 8 cm balloon inflated in the migrated stent oven a 0.035 inch Rosen wire, with a 15 mm ONEsnare over the stent and balloon (white arrow). Transesophageal echocardiography probe (white star) is seen projecting over the stent. A 12 French sheath is positioned in the main pulmonary artery (black arrow). (B) Intraprocedural transesophageal echocardiography image demonstrating the stent with an indentation proximally where the stare has been tightened over the stent/balloon complex (white arrow).

niques, and vessel tortuosity [1–3,6]. This case demonstrates a novel technique to extract a migrated stent while minimizing the possibility of valvular damage by utilizing intra-operative TEE monitoring and using a balloon/snare combination to eliminate the step-off resulting from snaring of the proximal aspect of a stent. Although an endovascular approach is successful in approximately 90% of cases of stent retrieval [1] the operators should be aware of possible complications including

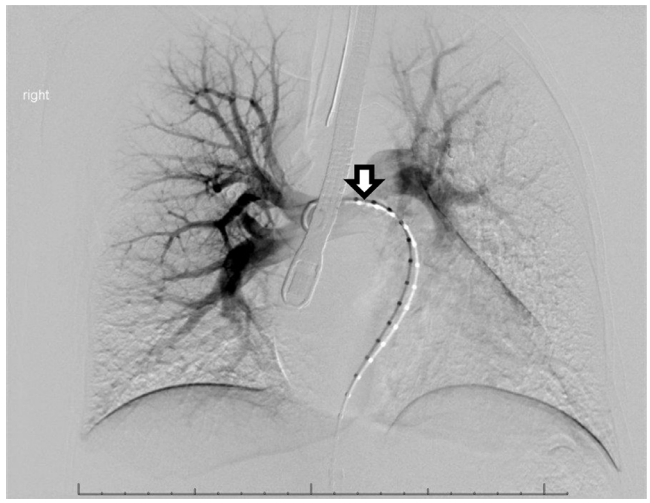


Fig. 3 – Digital subtraction pulmonary angiogram through a pigtail catheter (white arrow) demonstrating successful removal of the stent with no filling defects within the pulmonary arterial system.

vessel injury and valvular injury during retraction. Furthermore, utilizing a hybrid operating room allows for the expeditious conversion to a surgical approach in event of an intraprocedural complications.

Conclusion

This report demonstrates a safe technique for image guided removal of a migrated covered stent from pulmonary arteries without causing vascular or valvular damage. Endovascular approaches for stent retrieval are safe and effective and should be considered in situations of stent migration. As endovascular procedures continue to expand, we suspect cases of stent migration and subsequent retrieval needs will also increase.

Patient consent

The patient discussed in this case report provided written informed consent for publication of their case.

REFERENCES

[1] Gabelmann A, Krämer SC, Tomczak R, Görich J. Percutaneous techniques for managing maldeployed or migrated stents. J Endovasc Ther 2001;8(3):291–302. doi:10.1177/152660280100800309.
[2] Zvavanjanja RC. Percutaneous retrieval of migrated Viabahn stent from a segmental pulmonary artery. CVIR Endovasc 2018;3(1):1. doi:10.1186/s42155-018-0007-3.
[3] Dashkoff N, Blessios GA, Cox MR. Migration of covered stents from hemodialysis A-V access to the pulmonary artery:

percutaneous stent retrieval and procedural trends. Catheter Cardiovasc Interv 2010;76(4):595–601. doi:10.1002/ccd.22553.
[4] Fontana F, Ossola C, Cervarolo MC, Tozzi M, Venturini M. Stent migration: dangerous flight but safe landing. J Vasc Interv Radiol 2021;32(10):1515. doi:10.1016/j.jvir.2021.07.015.
[5] Anand G, Lewanski CR, Cowman SA, Jackson JE. Superior vena cava stent migration into the pulmonary artery causing fatal pulmonary infarction. Cardiovasc Intervent Radiol 2011;34(SUPPL. 2):S198–201. doi:10.1007/s00270-010-9812-3.
[6] El Feghaly M, Soula P, Rousseau H, Chaiban F, Otal P, Joffre F, Cerene A. Endovascular retrieval of two migrated venous stents by means of balloon catheters. J Vasc Surg 1998;28(3):541–6. doi:10.1016/S0741-5214(98)70142-9.