

Available online at www.sciencedirect.com

ScienceDirect

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

Case Report

Endovascular retrieval of a Gunther-tulip vena cava filter migrated into the right atrium [☆]

Takayuki Yamada, MD, PhD^{a,*}, Yasumoto Shinjo, MD^{a,1}, Kunihiro Yagihashi, MD, PhD^{a,2}, Kazuki Hashimoto, MD^b, Shingo Hamaguchi, MD^b

^a Department of Radiology, St. Marianna University School of Medicine, Yokohama city Seibu Hospital, 1197-1 Yasashi-cho Asahi-Ward Yokohama, Kanagawa 241-0811 Japan

^b Department of Radiology, St. Marianna University School of Medicine, Kanagawa, Japan

ARTICLE INFO

Article history:

Received 31 March 2020

Revised 23 April 2020

Accepted 24 April 2020

Keywords:

IVC filter
migration
retrieval
endovascular

ABSTRACT

A 72-year-old male underwent placement of a Gunther-tulip vena cava filter to prevent development of a pulmonary embolism. One month later, when we tried to retrieve the Gunther-tulip vena cava filter via a transjugular approach, the filter detached from the snare and became free in the outer sheath. The Gunther-tulip vena cava filter did not reopen in the inferior vena cava probably because it became entangled with a thrombus; rather, the filter migrated into the right atrium. The filter orientation rendered the transjugular approach inappropriate; we used a bilateral transfemoral approach to aid filter retrieval. It is necessary to be very cautious when reopening a filter that has closed within the sheath. Although the filter migrated into the heart, we retrieved it using a combined approach.

© 2020 The Authors. Published by Elsevier Inc. on behalf of University of Washington.

This is an open access article under the CC BY-NC-ND license.

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Introduction

An inferior vena cava (IVC) filter is useful for preventing the development of fatal pulmonary embolism in patients with deep-vein thrombosis. Modern devices can be retrieved when the embolic risk disappears. During retrieval, one critical complication is filter migration to the heart or pulmonary artery [1], which can be life-threatening. We describe successful en-

dovascular retrieval of an IVC filter that migrated into the right atrium.

Case report

A 72-year-old male was admitted with lower-extremity edema caused by deep-vein thrombosis in both common iliac veins.

[☆] Declarations of Interests: The authors have declared that no competing interests exist.

* Corresponding author.

E-mail address: yamataka@marianna-u.ac.jp (T. Yamada).

¹ Present affiliation: Department of Radiology, Yame General Hospital, 540-2 Takatsuka Yame Fukuoka 834-0034 Japan.

² Present affiliation: Department of Radiology, Kawasaki Municipal Tama Hospital, 1-30-37 Syukugawara Tama-Ward Kawasaki Kanagawa 214-8525 Japan.

<https://doi.org/10.1016/j.radcr.2020.04.056>

1930-0433/© 2020 The Authors. Published by Elsevier Inc. on behalf of University of Washington. This is an open access article under the CC BY-NC-ND license. (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

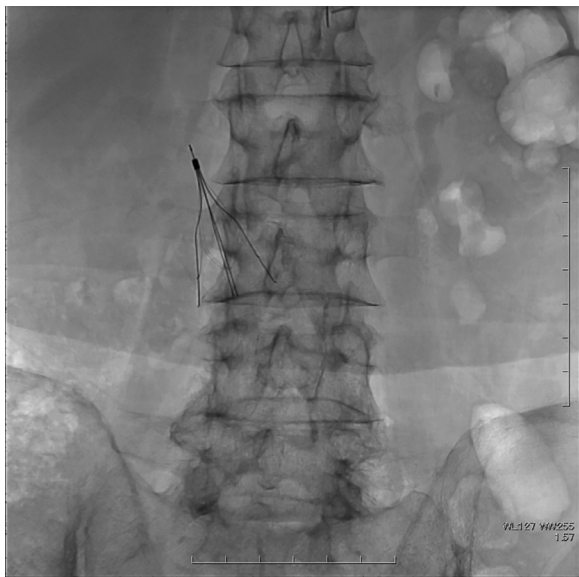


Fig. 1 – Frontal view. A Gunther-tulip vena cava filter (GTF) was placed in the inferior vena cava at the level of the third lumbar vertebra.

A Gunther-tulip vena cava filter (GTF) (Cook Medical, Bloomington, IN) was placed in the IVC to prevent a pulmonary embolism (Fig. 1). GTF retrieval was scheduled to take place 1 month later. Retrieval commenced via the right internal jugular vein. The hook at the top of the GTF was snared and the GTF closed in the inner sheath. Next, the outer sheath was moved in an effort to cover the inner sheath containing the GTF. However, the anchors of the GTF legs were caught by the edge of the outer sheath and the movement of the outer sheath pulled both the GTF and the snare out of the inner sheath. In hindsight, the snare was not adequately fixed and thus became unfastened from the hook at the tip of the GTF.

When we sought to reopen the GTF in the IVC, the legs did not move; the GTF immediately migrated to the right atrium. A small space was available around the GTF hook (Fig. 2).

We tried to lasso the legs using a snare catheter (GTF retrieval set; Cook Medical) delivered via a right transfemoral approach; we wished to move the GTF from the right atrium to the superior vena cava or the IVC. However, we failed to lasso all 4 legs. When 2 legs were grasped, the other 2 legs extended and escaped from the snare. We then caught a third leg via an additional left transfemoral approach. Thus, we caught 3 legs using 2 snare catheters (Fig. 3). Although we could not move the GTF as we had initially planned, we were able to change its orientation in the right atrium, creating a small space around the hook. Therefore, we again tried to catch the GTF via a transjugular approach while holding it in an appropriate orientation via the transfemoral approaches. A 5-Fr left-sided Judkins catheter was employed to approach the GTF hook and a 10-mm gooseneck snare (Medtronic, Minneapolis, MN) was inserted through the catheter. The GTF orientation was altered by pulling and pushing the legs via the transfemoral approaches. After several attempts, we caught the hook (Fig. 4), withdrew the filter into the outer sheath (Fig. 5), and removed

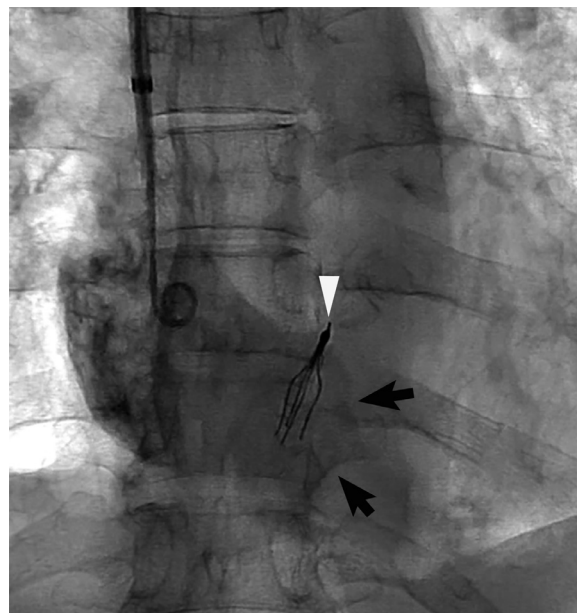


Fig. 2 – Angiogram of the right atrium. The tip of the migrated GTF pointed toward the root of the tricuspid valve and a small space was available around the hook (arrowhead). The arrows indicate the tricuspid valve.

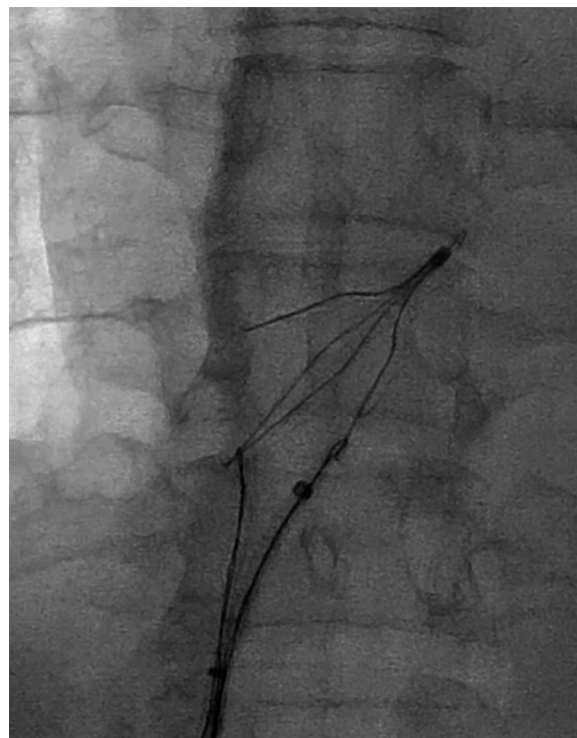


Fig. 3 – Frontal view. Two retrieval sets delivered via 2 transfemoral approaches caught 2 and one GTF legs respectively. The GTF now pointed to the right (please compare with Figure 1).

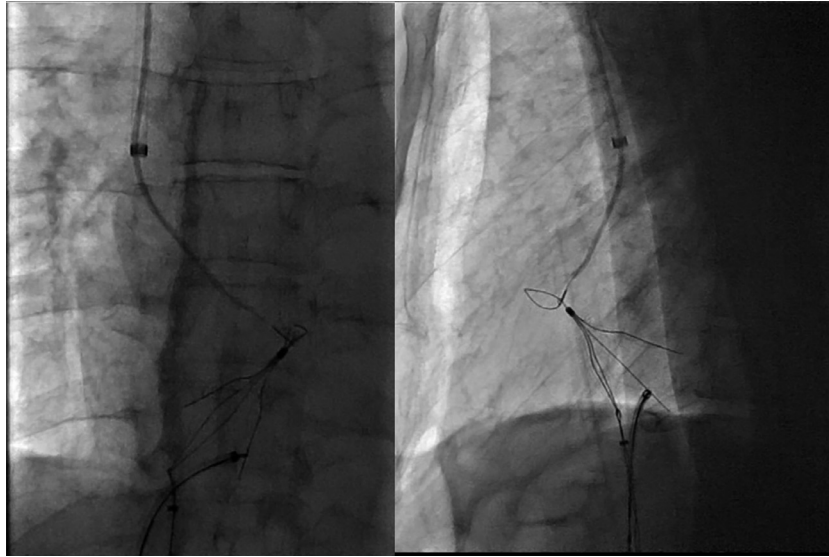


Fig. 4 – Frontal and lateral views. Using a transjugular approach, the tip of a 5-Fr. left-side Judkins catheter faced toward the GTF hook, which was then caught using a 10-mm gooseneck snare.

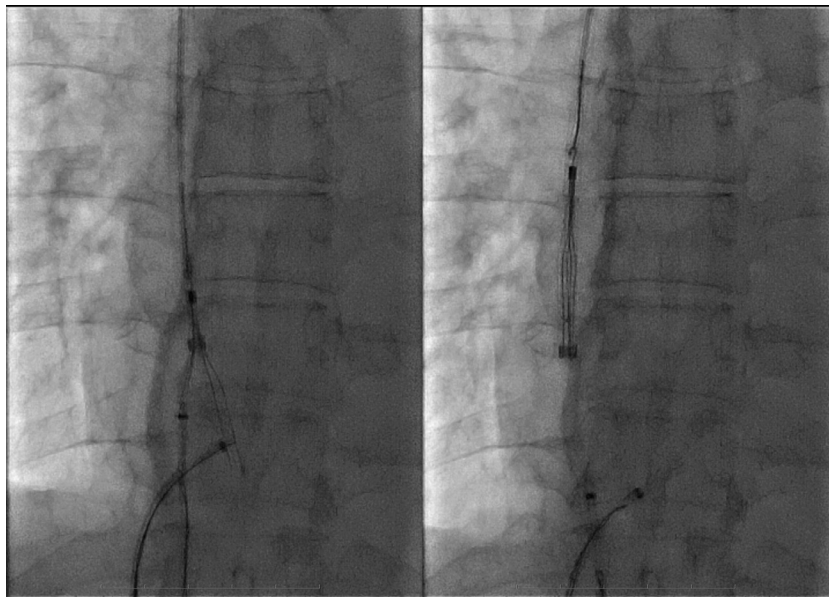


Fig. 5 – Frontal view. The GTF was reinserted into its outer sheath using the transjugular approach.

the entire system. The procedure time after migration of the GTF into the right atrium was about 150 minutes.

Discussion

IVC filter migration typically occurs on deployment because of technical issues [1]. However, the migration we experienced commenced on retrieval; a technical issue was also in play. The snare did not adequately hold the filter in the inner sheath; the filter became free in the outer sheath. Robust snare fixation is imperative; however, caution is required when re-

opening an IVC filter that has closed within the sheath. This filter did not open, probably because it became entangled with a thrombus. We should have attempted to snare the filter hook via a microsnare inserted into the inner sheath. We retrospectively confirmed that insertion of a microsnare into the inner sheath can catch the hook of the GTF.

The effects of a migrated filter differ among patients, ranging from no symptoms to sudden cardiac arrest. Hypotension, syncope, and dyspnea are more common when the filter is in the right cardiac chamber, while cardiac arrhythmia is more likely when the filter lodges in the tricuspid valve. It is safe for a filter to remain within the cardiac chamber, but the long-term consequences of a filter within the heart

of an asymptomatic patient remain unknown. Cardiac perforation due to further migration, foreign-body infection, or filter thrombosis are all potential complications. Some patients die from sudden cardiac arrest or recurrent pulmonary embolism after filter migration. Thus, migrated filters are usually removed either surgically or via an endovascular approach. The success rate of the latter technique is about 70%, and about 70% of successfully removed filters are removed from the right atrium [1]. Filters that migrate beyond the tricuspid valve are generally surgically removed, especially in patients exhibiting valvular or chordal involvement. Although the outcomes of patients with migrated GTFs have not been widely reported [2], to retrieve filters (including GTFs) that have migrated into the right atrium an endovascular approach should probably be used initially; an earlier review described relevant techniques [3]. In 5 cases, migrated filters were located in the right atrium and the techniques used for their retrieval involved combined transfemoral and transjugular approaches. In 1 patient, the apex of a Greenfield filter was stabilized in the right atrium via the transjugular route, and was snared and retrieved via the transfemoral route [4]. Our method was similar, except that the stabilization and retrieval approaches were reversed. In our case, the filter lay adjacent to the tricuspid valve; retrieval via a transjugular approach was impossible. Although we failed to catch all of the legs using a transfemoral approach, we were able to catch 3 of the 4 and then move the GTF into the range of a transjugular approach. Our

procedure is somewhat similar to that used to treat a patient via 2 transfemoral and one transjugular approaches; the migrated filter was tilted and moved to the right innominate vein [3]. Combined approaches allow for efficient endovascular retrieval once the filter location and orientation, and the amount of space around the apex of the filter, have been determined.

In conclusion, caution must be exercised when reopening an IVC filter that has closed within the sheath. A filter that migrates into the heart can be retrieved by combining various approaches to change the filter orientation.

REFERENCES

- [1] Owens CA, Bui JT, Knuttinen MG, Gaba RC, Carrillo TC, Hoefling N, et al. Intracardiac migration of inferior vena cava filters: Review of published data. *Chest* 2009;136(3):877–87. doi:10.1378/chest.09-0153.
- [2] Bull PG, Mendel H, Schlegl A. Gunther vena caval filter: clinical appraisal. *J Vasc Interv Radiol* 1992;3(2):395–9. doi:10.1016/s1051-0443(92)72052-1.
- [3] Owens CA, Bui JT, Knuttinen MG, Gaba RC, Carrillo TC, Gast T. Endovascular retrieval of intracardiac inferior vena cava filters: a review of published techniques. *J Vasc Interv Radiol* 2009;20(11):1418–28. doi:10.1016/j.jvir.2009.08.001.
- [4] Cynamon J, Bakal CW, Epstein SB, Gabelman G. Percutaneous removal of a titanium Greenfield filter. *AJR Am J Roentgenol* 1992;159(4):777–8. doi:10.2214/ajr.159.4.1529842.