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Case Report

Incomplete opening of an ALN-type inferior vena cava filter due to entanglement of the filter legs resulting in filter migration and inferior vena cava perforation ☆,☆☆,★

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ABSTRACT

Incomplete filter opening, causing filter migration and inferior vena cava (IVC) perforation, have often been observed with the Greenfield-type IVC filter, but reports of incomplete opening of the ALN-type IVC filter are extremely rare. We present herein the case of incomplete opening of an ALN-type IVC filter due to entanglement of the filter legs, which caused filter migration, IVC wall perforation, and penetration into the kidney and iliopsoas muscle. Successful percutaneous retrieval was performed without complications. Our experience provides guidance for similar situations in the future, including the need to check for complete filter opening.

Introduction

Inferior vena cava (IVC) filters are widely used in the primary and secondary prevention of acute pulmonary thromboembolisms. IVC filter implantation for deep venous thrombosis is indicated in patients who have contraindications for anticoagulant therapy or who have a mobile thrombus in the pelvic vein. Adverse events associated with IVC filters include IVC perforation and obstruction, complications during insertion, filter movement, and perforation of surrounding organs and aorta [1,2,3,4]. IVC perforation rarely causes bleeding required surgical treatment [3]. Incomplete filter opening, causing filter migration and IVC perforation, has often been observed with the Greenfield-type IVC filter [1], but reports of incomplete opening with the ALN-type IVC filter are extremely rare.

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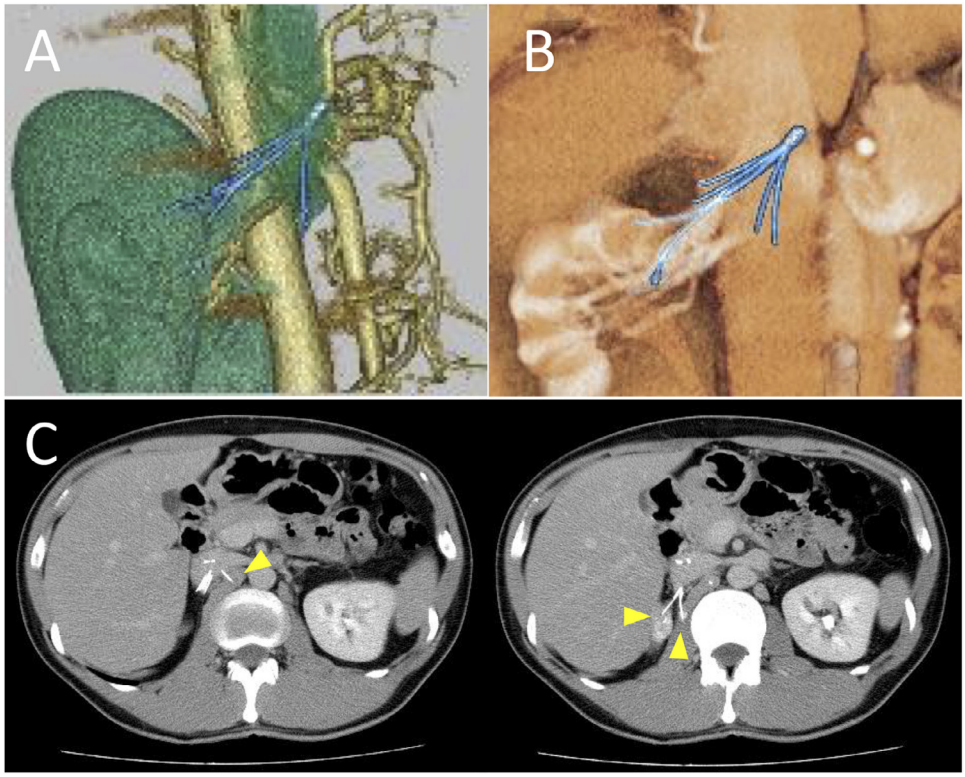

Fig. 1 – Enhanced computed tomography (CT) images one month after implantation of an ALN-type inferior vena cava (IVC) filter. CT images show the first legs of the IVC filter (A, B) incompletely open and greatly tilted and (C) perforating the IVC wall and penetrating into the kidney and the iliopsoas muscle (yellow arrowheads). (Color version of figure is available online.)

Case report

A 36-year-old man who had undergone surgery for a bilateral knee meniscus injury was transferred to our hospital in respiratory distress. A contrast computed tomography (CT) scan showed a massive pulmonary thromboembolism and a large amount of residual thrombus in the left iliac vein. He was started on anticoagulation therapy and an ALN-type filter was implanted in the IVC just below the renal vein. One month later, contrast CT revealed that the first legs of the IVC filter had incompletely opened and was greatly tilted (Figs. 1A, 1B). Furthermore, the filter legs had perforated 25 mm into the IVC wall and penetrated into the upper kidney pole and the iliopsoas muscle (Fig. 1C).

The filter was percutaneously retrieved through the right jugular vein (Figs. 2A-C) with blood transfusion and emergency surgery on standby. As not only the first legs but also the second legs had penetrated the IVC wall, there was a risk of tearing the IVC wall between the first and second legs during removal of the filter. Therefore, after the head of the filter was caught by snare, the filter was immediately raised in a cranial direction to pull out the second legs from the IVC wall, then the sheath was advanced to collect the filter. An angiography and CT scan after the procedure showed no extravasation and the patient was discharged without complications. In hindsight, the filter had incompletely opened immediately after implantation (Fig. 3A). There was no obvious deformation or defect in the structure of the retrieved filter (Fig. 3B)

Discussion

Among the various IVC filters, the ALN-type filter has been reported to have fewer complications related to filter migration and IVC perforation [2,5]. There has been no report of the ALN-type IVC filter incompletely opening due to entanglement of the legs, leading to migration of the filter and IVC perforation.

Significant migration of the IVC filter is defined as movement of the filter more than 2 cm from the site where it was initially placed [6], and is associated with a risk of IVC perforation. It has been reported that the ALN-type IVC filter is likely to migrate in the IVC diameter of 28 mm or more [1]. In this case, the IVC diameter where the filter was placed was 25 mm × 20 mm, which should not have been large enough for migration. In addition, it has been reported that the type and incidence of complications depends on the structure of the filter [2,3]. Although conical filters have been recognized as having a higher risk of IVC perforation and migration, the ALN filter has been reported to have a relatively low risk [2,5]. Furthermore, it has been reported that 71% of the Greenfield-type filters incompletely open [1], in contrast, reports of incomplete opening with the ALN-type IVC filter are extremely

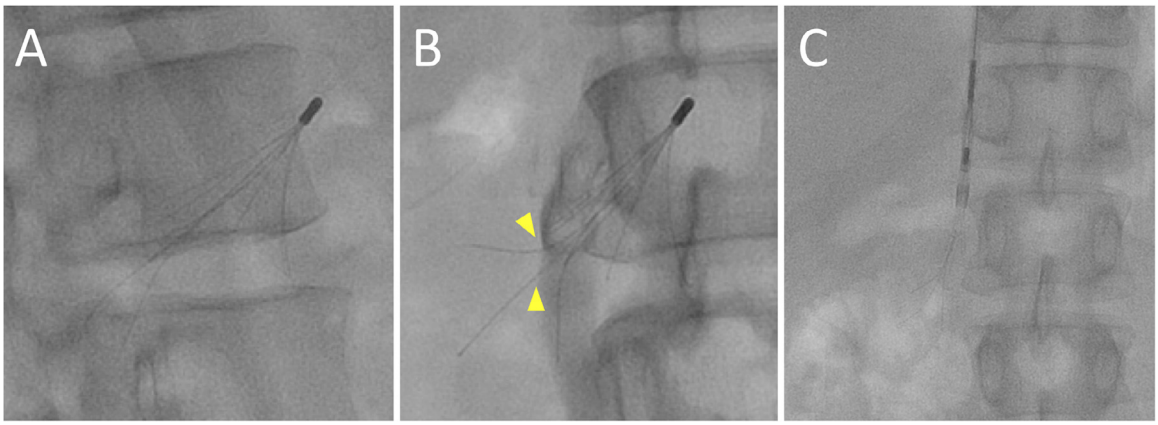

Fig. 2 – The incompletely opened inferior vena cava (IVC) filter before and during retrieval. (A) Fluoroscopy before retrieval shows that he filter was greatly tilted, and the filter legs were twisted and incompletely opened. (B) Angiography shows that the filter legs perforate the IVC wall (yellow arrowheads). (C) The filter was percutaneously retrieved through the right jugular vein. (Color version of figure is available online.)

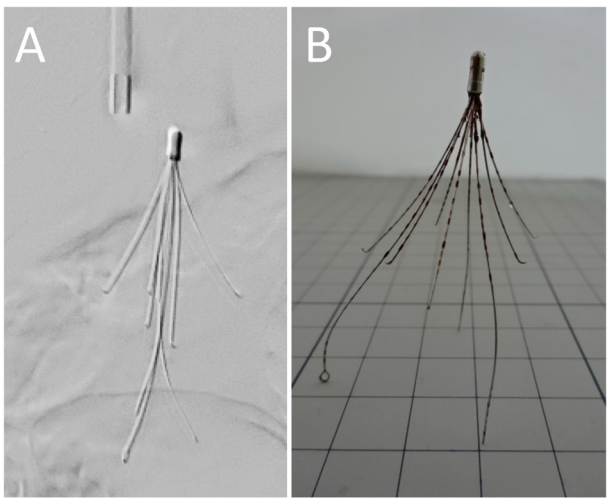

Fig. 3 – The incompletely opened inferior vena cava (IVC) filter immediately after implantation and before retrieval. (A) The filter immediately after implantation shows incomplete opening. (B) The retrieved filter showing no obvious deformation or defect in the structure.

rare. In hindsight, in this case, the filter had already been incompletely opened immediately after implantation (Fig. 3A), however, could not be recognized due to insufficient confirmation. As there was no obvious deformation or defect in the filter structure after retrieval (Fig. 3B), it was considered that the first legs of the filter were entangled before or during placement, which caused the incomplete opening and filter migration, resulting in perforation of the IVC wall [7]. As the filter implantation was performed easily, it is unlikely that thrombus formation in the sheath disturbed the opening of the filter legs. It is assumed that the filter legs were already twisted in the sheath, but it is still unclear why this occurred. To avoid this complication in future, the full opening of filter legs immediately after filter implantation should be confirmed, and if insufficient opening is seen, prompt retrieval and replacement is required.

IVC perforation with the IVC filter is defined as a part of the filter penetrating more than 3 mm through the IVC wall [6]. In this case, the filter legs penetrated a maximum of 25 mm into the IVC wall, which is much further than in previous reports [4]. IVC perforations associated with a filter are usually asymptomatic, and their harmfulness is unknown. In symptomatic cases, the surrounding organs or large vessels are often damaged and filter removal should be considered in these cases [3]. Filter removal is also recommended when the risk of pulmonary embolism is reduced (within 29-54 days after IVC filter placement) [8] because long-term placement of unnecessary filters increases the risk of venous thrombosis [9,10]. Therefore, in this case, since severe perforation of the IVC wall and penetration into the kidney and the iliopsoas muscle were observed a month after implantation, the filter was removed. In this case, penetration into kidney and iliac psoas muscle was observed, so the possibility of retroperitoneal hemorrhage after filter removal was carefully monitored. The filter leg entanglement was also carefully managed during removal of the filter to avoid the risk of tearing the IVC wall between the filter legs.

Conclusion

This is the first report of incomplete opening of an ALN-type IVC filter due to entanglement of the filter legs, which caused filter migration, IVC wall perforation and penetration into surrounding tissue, but successful percutaneous retrieval was able to be performed without complications. The complete opening of filter legs should be confirmed even with an ALN-type IVC filter, and the filter should be replaced immediately if the legs do not completely open.

REFERENCES

[1] Grewal S, Chamarthy MR, Kalva SP. Complication of inferior vena cava filters. Cardiovasc Diagn Ther 2016;6:632–41.
[2] Deso SE, Idakoji IA, Kuo WT. Evidence-based evaluation of inferior vena cava filter complications based on filter type. Semin Intervent Radiol 2016;33:93–100.
[3] Jia Z, Wu A, Tam M, Spain J, McKinney JM, Wang W. Caval penetration by inferior vena cava filters. A systematic literature review of clinical significance and management. Circulation 2015;132:944–52.
[4] Ota S, Yamada N, Tsuji A, Ishikura K, Nakamura M, Isaka N, et al. The Gunther-Tulip retrievable IVC filter-Clinical experience in 118 consecutive patients. Circ J 2008;72:287–92.
[5] Pellerin O, Barral FG, Lions C, Novelli L, Beregi JP, Sapoval M. Early and late retrieval of the ALN removable vena cava filter: results from a multicenter study. Cardiovasc Intervent Radiol 2008;31:889–96.
[6] Caplin DM, Nikolic B, Kalva SP, Ganguli S, Saad WE, Zuckerman DA. Society of Interventional Radiology Standards of Practice Committee. Quality improvement guidelines for the performance of inferior vena cava filter placement for the prevention of pulmonary embolism. J Vasc Interv Radiol 2011;22:1499–506.
[7] Berland LL, Maddison FE, Bernhard VM. Radiologic follow-up of vena cava filter devices. AJR Am J Roentgenol 1980;134:1047–52.
[8] Morales JP, Li X, Irony TZ, Ibrahim NG, Moynahan M, Cavanaugh KJ Jr. Decision analysis of retrievable inferior vena cava filters in patients without pulmonary embolism. J Vasc Surg Venous Lymphat Disord 2013;1:376–84.
[9] Decousus H, Leizorovicz A, Parent F, Page Y, Tardy B, Girard P, et al. A clinical trial of vena caval filters in the prevention of pulmonary embolism in patients with proximal deep-vein thrombosis. N Engl J Med 1998;338:409–16.
[10] PREPIC Study Group Eight-year follow-up of patients with permanent vena cava filters in the prevention of pulmonary embolism: the PREPIC (Prevention du Risque d'Embolie Pulmonaire par Interruption Cava) randomized study. Circulation 2005;112:416–22.