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Case Report

Percutaneous Thrombectomy with a Half-Deployed Stent for the Treatment of Acute Inferior Vena Cava Thrombosis

Hyejin Mo[1], Young Ho So[2], and In Mok Jung[1]

Departments of [1]Surgery and [2]Radiology, Seoul Metropolitan Government-Seoul National University Boramae Medical Center, Seoul, Korea

Inferior vena cava (IVC) thrombosis, a type of deep vein thrombosis (DVT), is a relatively rare and poorly known disease compared to lower extremity DVT. We present a case of a 68-year-old woman with abdominal pain and mild lower leg swelling due to IVC thrombosis extending from the common iliac vein to the infrahepatic IVC. The thrombus was removed using a 14-mm Niti-S stent (Taewoong Medical, Korea) inserted via the right internal jugular vein. The stent was partially deployed and gently advanced to cover the thrombus, and then retracted through a vascular sheath capturing the thrombus. This case presents a therapeutic approach for the treatment of IVC thrombosis using a half-deployed stent as a filter and a basket. Follow-up evaluation after 5 years revealed a patent IVC and common iliac vein.

Key Words: Inferior vena cava, Venous thrombosis, Stents, Embolic protection devices

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Corresponding author: In Mok Jung
Department of Surgery, Seoul Metropolitan Government-Seoul National University Boramae Medical Center, 20 Boramae-ro 5-gil, Dongjak-gu, Seoul 07061, Korea
Tel: 82-2-870-2270
Fax: 82-2-870-3861
E-mail: sboy5240@gmail.com
https://orcid.org/0000-0002-5957-4207

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INTRODUCTION

Inferior vena cava (IVC) thrombosis is a type of deep vein thrombosis (DVT); however, it is observed at a significantly lower frequency than lower extremity DVT [1]. The causes of IVC thrombosis are divided into congenital factors such as an IVC anomaly and acquired factors such as a malignancy, thrombosis due to external compression, and acquired predispositions to DVT [2]. Depending on the timing and etiology of IVC thrombosis, various treatment methods are applicable, including most treatment methods applied to DVT of the lower extremity. However, there are differences in the location, burden, and etiology of thrombosis; thus the treatment method should be chosen considering these factors. In particular, IVC thrombosis with proximal extension may be unsuitable for IVC filter insertion, which is recommended to be deployed at the infrarenal IVC [3,4].

Herein, we report a case in which IVC thrombosis was removed by percutaneous thrombectomy using a half-deployed stent as a filter and a basket.

CASE

A 68-year-old woman was admitted to the emergency department for abdominal pain and lower leg swelling that had begun about 2 months prior and worsened a day ago. She underwent cholecystectomy and appendectomy 5 years previously and had a medical history of hypercholesterolemia and hypertension. A colonoscopy was performed approximately a year ago, and there was no abnormality except for mild colitis. Physical examination revealed mild swelling of the lower extremities and no abdominal tenderness.

A computed tomography (CT) scan revealed a large

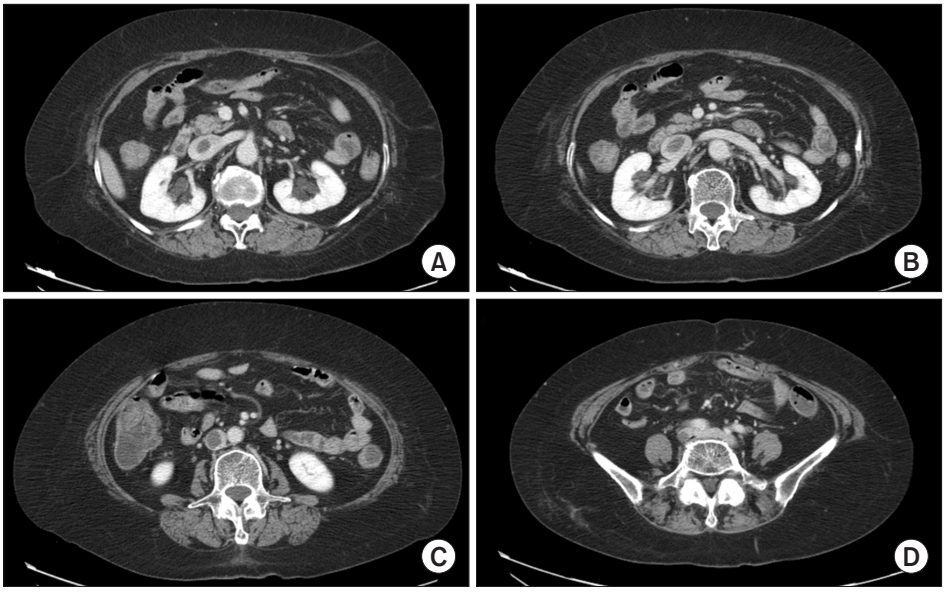

Fig. 1. Computed tomography scan shows inferior vena cava (IVC) thrombosis at the level of the left renal vein (A), the right renal vein (B), the infrarenal IVC (C), and the right common iliac vein (D).

thrombus from just below the intrahepatic IVC to the common iliac vein (CIV), which seemed to be acute-on-chronic DVT (Fig. 1). There were no lesions causing external compression to the IVC. Only D-dimer was increased to 0.95 mg/L fibrinogen equivalent units, and laboratory tests including protein C, protein S, antithrombin, IgG anticardiolipin, lupus anticoagulant, and homocysteine levels were all normal.

1) Thrombectomy procedure

After puncture of the right internal jugular vein, venography was performed. Venography showed the thrombus from just below the intrahepatic IVC to the right CIV, over a length of approximately 16 cm (Fig. 2). A 14-mm×10-cm Niti-S stent (Taewoong Medical, Seoul, Korea) was inserted via the right internal jugular vein to remove the IVC thrombus. The stent was woven from a single thread of nitinol wire in a tubular configuration and could be retrieved after partial deployment by advancing the outer sheath. After positioning of the stent at the top of the thrombus, the stent was partially deployed and gently advanced to cover the thrombus. Subsequently, the 12-F outer vascular sheath was advanced to capture the thrombus, and the stent was retracted through the vascular sheath capturing the thrombus. This procedure was repeated until the entire thrombus was removed (Fig. 3). On final venography, most of the IVC thrombus was removed; however, a small amount of the thrombus remained firmly attached to the lower IVC and the right CIV wall (Fig. 4). Blood flow was improved, and the procedure was completed without additional stent insertion.

Fig. 2. Angiographic findings of thrombus from just below the intrahepatic inferior vena cava (dotted arrow) to the right common iliac vein (arrow).

The patient had received subcutaneous low-molecular-weight heparin (enoxaparin; Clexane®, Sanofi-Aventis, Paris, France) therapy for 5 days since she was admitted to the emergency department. Subsequently, low-molecular-weight heparin was switched to warfarin that was used for more than 5 years with a target international normalized ratio of 2-3.

2) Follow-up

Considering the possibility of thrombus migration dur-

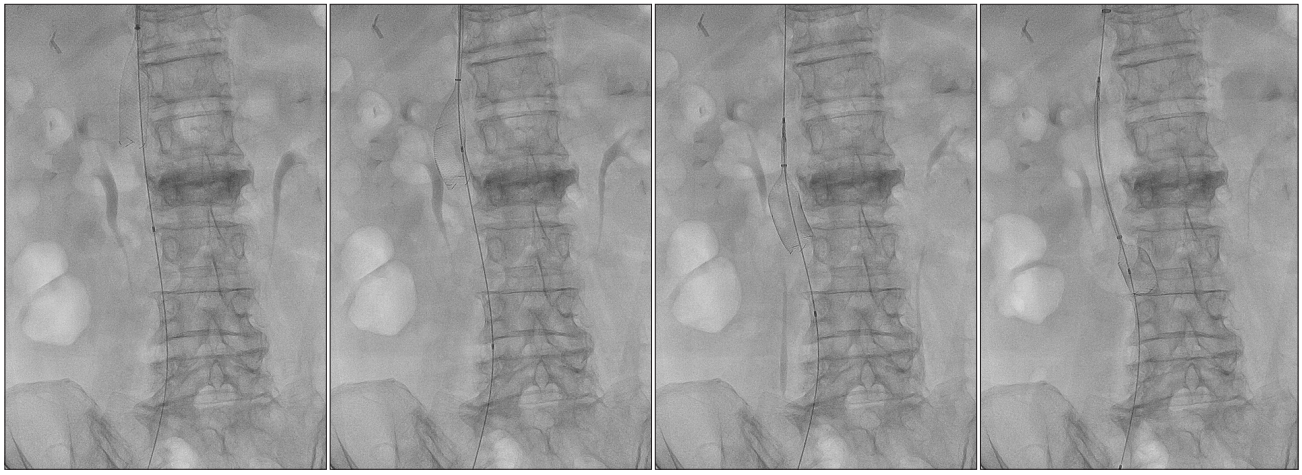

Fig. 3. Percutaneous thrombectomy by capturing the thrombus from the top using a half-deployed stent as a filter and a basket.

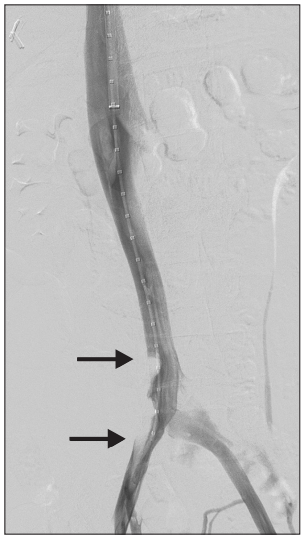

Fig. 4. Final angiographic findings of the residual thrombosis (arrows) on the lower inferior vena cava and the right common iliac vein wall.

ing the procedure, a CT scan of the pulmonary artery was performed. A week after the procedure, a small amount of embolus was found in the pulmonary artery on a CT scan. Nine months after the procedure, pulmonary thromboembolism nearly disappeared while anticoagulation was maintained. On follow-up at 5 years, the remaining thrombus at the IVC and the right CIV thrombus all disappeared (Fig. 5), and there was no recurrence of her symptoms.

DISCUSSION

IVC thrombosis, a type of DVT, is a relatively rare and poorly known disease compared to lower extremity DVT [2]. The incidence of IVC thrombosis is approximately 1.5% in patients with confirmed DVT [1]. There remains a lack of clear consensus on how best to treat IVC thrombosis due to the rare incidence of the disease and insufficient evidence. A high level of suspicion is important for diagnosis, and it can be diagnosed through venous duplex ultrasonography, CT scan, or magnetic resonance imaging. The method of treatment should be determined according to the timing, etiology of thrombosis, and severity of symptoms. Anticoagulation, systemic or localized thrombolysis, percutaneous thrombectomy, angioplasty, stenting, and surgical thrombectomy are the basis of therapeutic modalities [5,6]. In the case of acute IVC thrombosis, it is known that a combination of thrombolysis therapy rather than anticoagulation alone improves both short-term and long-term patency [7-9]. In addition, a recent meta-analysis reported that percutaneous mechanical thrombectomy with or without catheter-directed thrombolysis is an effective and safe treatment for patients with lower extremity DVT [10].

There is still controversy over the need for an IVC filer during endovascular treatment for DVT, however, there have been several reports that this is necessary [11-14]. Nevertheless, there are often situations where the IVC filter cannot be inserted. According to the instructions for use, patients with a large IVC diameter, risk of septic embolism, or uncontrolled sepsis are not suitable for IVC filter insertion. Although an IVC filter was originally intended to be placed inferior to the renal veins, it is sometimes placed in the suprarenal IVC when the proximal extent of the thrombus exceeds the renal vein. However, considering the risk of migration, fracture, and renal failure, a consensus for suprarenal IVC filter has not been fully established [3,4,15].

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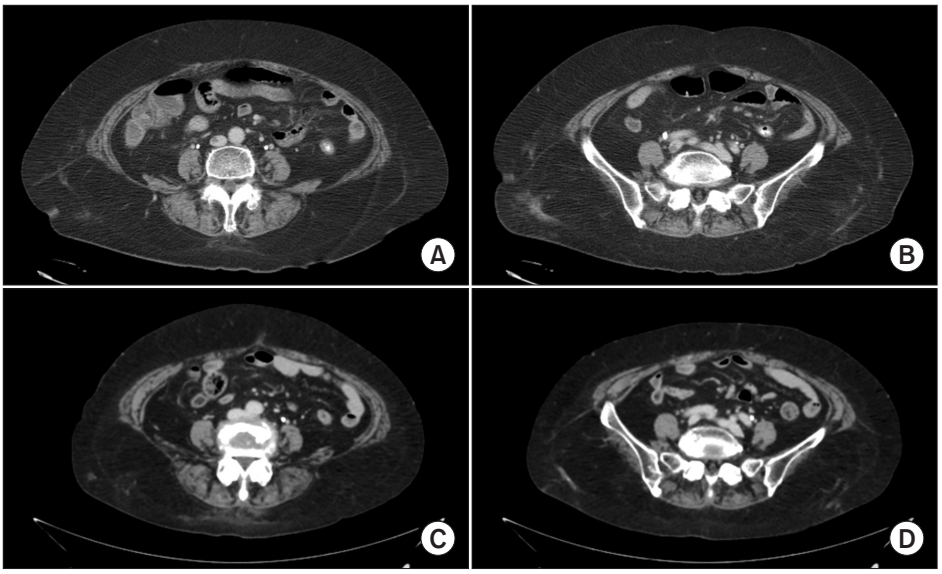

Fig. 5. Computed tomography scan shows the inferior vena cava and right common iliac vein immediately after the procedure (A, B) and 5 years later (C, D).

There are various ways to provide proximal protection, even without an IVC filter. Wilner and Carrillo [16] reported a case of aspiration thrombectomy using the AngioVac suction cannula system (Angiodynamics, Latham, NY, USA) by inserting catheters into the internal jugular vein and femoral vein. Kim et al. [17] published a case in which aspiration thrombectomy was performed through the right common femoral vein while using a half-deployed stent as a filter, which was inserted via the internal jugular vein. Truong et al. [18] reported a case in which mechanical thrombectomy was performed with a combination of a rotatory fragmentation device and a large wire basket while using a half-deployed stent as a filter. The methods presented above may enable thrombectomy while providing proximal protection in situations where IVC filter insertion is not recommended.

In our case, the stent was advanced from above, and then only half deployed and used as a filter to prevent thrombus migration and at the same time acting as a basket to capture the thrombus. This was a modification of the method used by Kim et al. [17]. Our patient presented with abdominal pain and lower leg swelling that began about 2 months prior and worsened the previous day. On the CT scan, the thrombus seemed to be an acute-on-chronic thrombosis; thus, it was thought that it would be difficult to completely remove with aspiration thrombectomy as described by Kim et al. [17]. However, in our case, a small amount of the thrombus migrated and became a pulmonary thromboembolism, which was resolved by anticoagulation alone. If the lumen of the iliac vein was less than 50% after thrombectomy or compression syndrome was suspected, an adjunctive stent would have been inserted. In this case however, we did not perform stent insertion as the above mentioned criteria were not met, and the venous flow was considered to be restored sufficiently. After the procedure, the patient's symptoms resolved. A CT scan taken 5 years later revealed no evidence of DVT in either the right CIV or the IVC. Although this case was successfully treated, we recommend that this technique should be performed in selected experienced centers. There are risks of thrombus fragmentation and pulmonary embolism due to small thrombi during this procedure.

In summary, this case illustrates that percutaneous thrombectomy using a half-deployed stent as a filter and a basket may offer a treatment option for acute-on-chronic IVC thrombosis in selected patients.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

ORCID

Hyejin Mo
https://orcid.org/0000-0002-5383-0863
Young Ho So
https://orcid.org/0000-0002-1508-6869
In Mok Jung
https://orcid.org/0000-0002-5957-4207

AUTHOR CONTRIBUTIONS

Concept and design: HM, IMJ. Analysis and interpretation: HM, YHS. Data collection: HM. Writing the article: HM. Critical revision of the article: YHS. Final approval of the article: all authors. Obtained funding: none. Overall responsibility: IMJ.

REFERENCES

1) Stein PD, Matta F, Yaekoub AY. Incidence of vena cava thrombosis in the United States. Am J Cardiol 2008;102:927-929.
2) McAree BJ, O'Donnell ME, Fitzmaurice GJ, Reid JA, Spence RA, Lee B. Inferior vena cava thrombosis: a review of current practice. Vasc Med 2013;18:32-43.
3) Ganguli S, Tham JC, Komlos F, Rabkin DJ. Fracture and migration of a suprarenal inferior vena cava filter in a pregnant patient. J Vasc Interv Radiol 2006;17:1707-1711.
4) Marcy PY, Magné N, Frenay M, Bruneton JN. Renal failure secondary to thrombotic complications of suprarenal inferior vena cava filter in cancer patients. Cardiovasc Intervent Radiol 2001;24:257-259.
5) Wells PS, Forgie MA, Rodger MA. Treatment of venous thromboembolism. JAMA 2014;311:717-728.
6) Augustinos P, Ouriel K. Invasive approaches to treatment of venous thromboembolism. Circulation 2004;110(9 Suppl 1):I27-I34.
7) Enden T, Kløw NE, Sandvik L, Slagsvold CE, Ghanima W, Hafsahl G, et al.; CaVenT Study Group. Catheter-directed thrombolysis vs. anticoagulant therapy alone in deep vein thrombosis: results of an open randomized, controlled trial reporting on short-term patency. J Thromb Haemost 2009;7:1268-1275.
8) Enden T, Haig Y, Kløw NE, Slagsvold CE, Sandvik L, Ghanima W, et al.; CaVenT Study Group. Long-term outcome after additional catheter-directed thrombolysis versus standard treatment for acute iliofemoral deep vein thrombosis (the CaVenT study): a randomised controlled trial. Lancet 2012;379:31-38.
9) Elsharawy M, Elzayat E. Early results of thrombolysis vs anticoagulation in iliofemoral venous thrombosis. A randomised clinical trial. Eur J Vasc Endovasc Surg 2002;24:209-214.
10) Wang W, Sun R, Chen Y, Liu C. Meta-analysis and systematic review of percutaneous mechanical thrombectomy for lower extremity deep vein thrombosis. J Vasc Surg Venous Lymphat Disord 2018;6:788-800.
11) Protack CD, Bakken AM, Patel N, Saad WE, Waldman DL, Davies MG. Long-term outcomes of catheter directed thrombolysis for lower extremity deep venous thrombosis without prophylactic inferior vena cava filter placement. J Vasc Surg 2007;45:992-997.
12) Akhtar OS, Lakhter V, Zack CJ, Hussain H, Aggarwal V, Oliveros E, et al. Contemporary trends and comparative outcomes with adjunctive inferior vena cava filter placement in patients undergoing catheter-directed thrombolysis for deep vein thrombosis in the United States: insights from the national inpatient sample. JACC Cardiovasc Interv 2018;11:1390-1397.
13) Kölbel T, Alhadad A, Acosta S, Lindh M, Ivancev K, Gottsäter A. Thrombus embolization into IVC filters during catheter-directed thrombolysis for proximal deep venous thrombosis. J Endovasc Ther 2008;15:605-613.
14) Sharifi M, Bay C, Skrocki L, Lawson D, Mazdeh S. Role of IVC filters in endovenous therapy for deep venous thrombosis: the FILTER-PEVI (filter implantation to lower thromboembolic risk in percutaneous endovenous intervention) trial. Cardiovasc Intervent Radiol 2012;35:1408-1413.
15) Bihorac A, Kitchens CS. Successful thrombolytic therapy for acute kidney injury secondary to thrombosis of suprarenal inferior vena cava filter. J Thromb Thrombolysis 2009;28:500-505.
16) Wilner BR, Carrillo RG. Vacuum-assisted inferior vena cava thrombus removal using a percutaneous technique. J Card Surg 2015;30:265-267.
17) Kim SY, Kim HC, Oh MD, Chung JW, Kim SJ, Min SK. Successful percutaneous thrombectomy of an infected vena-caval thrombus due to a toothpick. J Vasc Surg 2011;54:1498-1500.
18) Truong TH, Spuentrup E, Staatz G, Wildberger JE, Schmitz-Rode T, Nolte-Ernsting CC, et al. Mechanical thrombectomy of iliocaval thrombosis using a protective expandable sheath. Cardiovasc Intervent Radiol 2004;27:254-258.

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