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Temporary and Permanent Inferior Vena Cava Filter Combination in a Young Patient: To Implant or Not to Implant?

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Abstract

The decision to implant vena cava filters, either temporary or permanent, is difficult in young patients. We present the case of a young man with pulmonary embolism in whom temporary and permanent inferior vena cava filters were implanted. The decision process is discussed in relation to the current literature.

Key words: Inferior vena cava filter—Pulmonary embolism—Inferior vena cava thrombosis

Deep vein thrombosis (DVT) is a common disease. Although preventive measures such as prophylactic anticoagulation with low-dose heparin, adjusted-dose heparin, moderate-dose warfarin or low-molecular-weight heparin, and compressive stockings are generally employed, fatal pulmonary embolism (PE) due to DVT is still an important problem [1, 2]. But in some cases these measures might be inefficient and the implantation of an inferior vena cava (IVC) filter is required [3]. The indications for placement of IVC filters are expanding. In addition to generally accepted, standard indications (contraindications to or complications of anticoagulation therapy, failure of anticoagulation, recurrence of venous thromboembolism despite adequate anticoagulation, poor compliance with anticoagulant medications, massive PE with residual DVT in a patient at high risk for further PE, severe cardiopulmonary disease and DVT, free-floating iliofemoral or IVC thrombosis), there are newer and expanding additional indications that are mainly for prophylaxis (as in severe trauma such as closed head or spinal cord injuries and multiple long bone or pelvic fractures, in patients without documented PE or DVT, and in high-risk patients such as immobilized, intensive care patients, etc.) [4, 5]. Besides the long-known permanent IVC filters, temporary IVC filters might be an ideal solution for young patients who are at high risk for PE and need short-term protection [6]. But the implantation of permanent filters may be needed in patients who require further protection beyond the recommended maximum implantation time.

Case Report

A 34-year old man who had broken his left fibula playing football and had a long leg cast was applied 50 days previously was admitted to the emergency department due to the development of sudden and severe chest pain, difficulty in breathing and tachycardia. Physical examination was normal. Except for increased factor VIII (200%; normal range 60–150) his laboratory values were within the normal limits. A chest roentgenogram was normal.

Color Doppler US examination demonstrated complete thrombosis of the left popliteal and femoral veins and partial left iliac vein thrombus. Echocardiography showed decreased motion of the right ventricle wall and an increased PAP value (50 mmHg). Pulmonary perfusion scintigraphy (with 3 mCi ^{99m}Tc macro-aggregated albumin i.v.) revealed regular large segmentary hypoperfusion areas and wedge-shaped perfusion defects in both lungs. A scintigram revealed a high probability for pulmonary emboli according to the Biello criteria. From all these findings the patient was diagnosed as having pulmonary emboli.

Heparin (80 IU/kg i.v. bolus, and 18 IU/kg infusion) and coumadin treatments were initiated. On the fifth day of anticoagulation heparin infusion was stopped and coumadin treatment continued to maintain the INR between 2 and 3. Control Doppler examinations revealed disappearance of the iliac thrombi, slightly mobile thrombi in a partially recanalized femoral vein, and persistence of popliteal thrombi. A control roentgenogram of the fracture in his left fibula showed a malunion, and a new cast was applied.

Although there was no contraindication to anticoagulation, the patient was accepted as having a high risk for recurrent PE due to the presence of DVT high up in the iliac and femoral veins, which have a high rate of detachment. Therefore given his young age with an otherwise normal life expectancy, a prophylactic IVC filter insertion was considered. A temporary vena cava filter (LGT, B. Braun, Celsa, France) was implanted through the right internal jugular vein below the renal veins after inferior vena cavography showed patency and a normal diameter of the IVC (Fig. 1). Implantation was uneventful. Transient high-dose heparinization (80 IU/kg i.v. bolus, and 18 IU/kg infusion) was initiated and continued for 2 days. After the implantation, Doppler control of the IVC and thrombus was performed on the fifth and tenth days. No filter-related adverse effect was encountered. The iliac thrombus progressively disappeared, but the femoral vein remained partially recanalized and the popliteal vein thrombus persisted at the end of the recommended maximal implantation period (10 days) of the filter. No filter migration was encountered on serial roentgenograms. Since the patient showed improvement, an additional 5 day period was considered. There was no catheter- related infection. Doppler examination on the fifteenth day revealed thrombus in the IVC and a venacavogram performed through the right femoral vein showed moderate narrowing and wall-adherent thrombus which was thought to have broken off from the femoral thrombus and then incorporated into the left lateral wall of the IVC (Fig. 2).

Since the patient was considered to be at a significant risk of PE, despite the absence of a contraindication to anticoagulation, due to the development of IVC thrombus and remaining DVT, a permanent IVC filter (LGM, B. Braun, Celsa, France) was implanted through the right femoral vein below the renal veins just above the thrombus under the protection of a temporary

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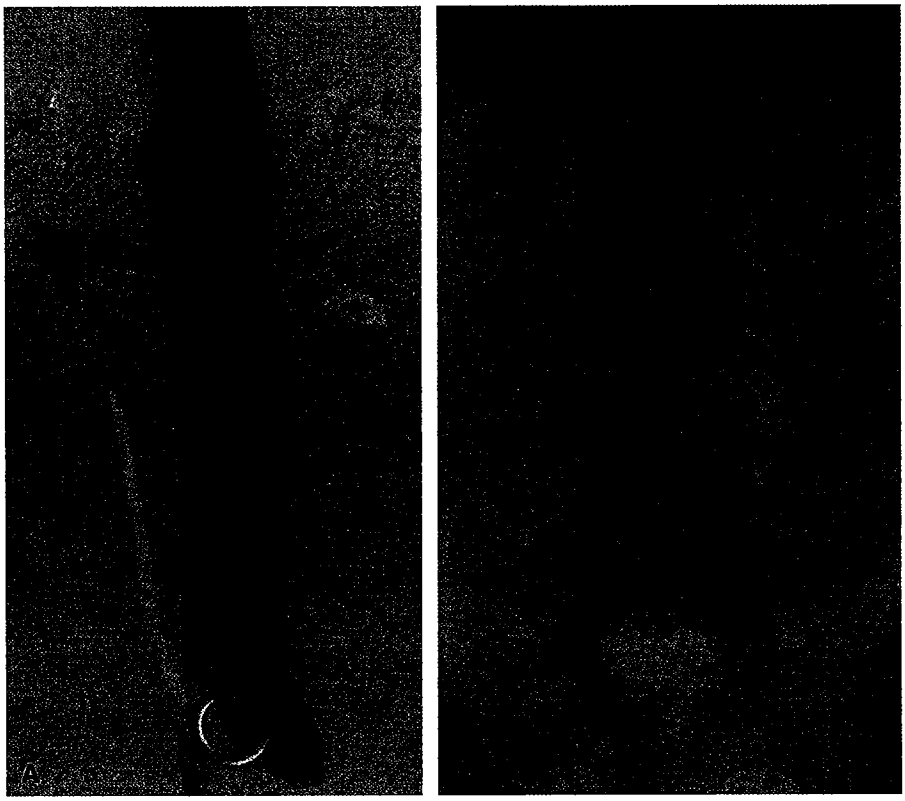

Figure 1. **A** Inferior vena cavography through the right internal jugular vein shows normal caliber and patency of IVC. **B** Control digital roentgenogram shows the proper location of the temporary vena cava filter.

filter which was withdrawn above the renal veins (Fig. 3). The temporary filter was recovered easily by pulling smoothly on the tethering catheter of the filter (Fig. 4). The patient was discharged the following day.

Due to the presence of regressing DVT and caval thrombus, he is under coumadin treatment with periodic INR control, which is planned to continue for at least 1 year depending on the course of the thrombi. A venacavogram performed in the third post-implantation month showed a patent IVC and regression in the size of the thrombus (Fig. 5). During the follow-up, the factor VIII level, which is also an acute-phase reactant and could have been increased during the acute phase of PE, was checked twice after the coumadin treatment had been switched to low-dose heparin for 10 days. The level was within normal limits. The patient has been followed up by monthly Doppler examination; he is free of symptoms and no progression of the thrombus in the IVC was noted.

Discussion

Permanent IVC filters have been used since the 1960s in preventing pulmonary emboli by capturing the thrombi and recent studies have demonstrated their efficiency [7, 8]. Following reports showing their effectiveness and favorable experiences with newer devices and improved safety profiles, indications for caval filtering are expanding [4]. Apart from generally agreed indications, such as contraindication to anticoagulation, complications and failure of anticoagulation, massive PE with residual DVT, and free-floating iliofemoral or caval thrombus, newer indications are proposed that are basically prophylactic, such as the prevention of PE in patients with severe trauma, or in association with another procedure (e.g., during lytic therapy, thrombectomy [4, 5, 9]. Although they are made of biocompatible and non-thrombogenic materials, these devices are, basically, foreign objects. Thus, they are not so innocent or devoid of complications such as migration, fracture, IVC thrombosis or penetration in addition to possible, but as yet unknown, long-term complications [10]. Young patients with a normal life expectancy who are considered to be at high risk for PE and need PE prophylaxis due to thrombus constitute an important problematic group of filter candidates whose indications have not been universally accepted. These concerns led to the development of temporary IVC filters that could be left inside the IVC for a certain period and then retrieved or left as a permanent IVC filter [2, 6, 7].

Temporary caval filters are usually attached to a catheter or guidewire that may project from the insertion site [2, 6]. With these devices, there is risk of infection due to the external catheter and they should be removed after a certain period of time. On the other hand, retrievable caval filters are permanent filters that can either be removed or left in situ if the patient has developed an ongoing contraindication to anticoagulation or requires further protection after the maximum implantation period. They can be removed though the retrieval technique is relatively complex and the cost of the retrieval kit is high [2]. Temporary caval filters are reported to have no long-term complications per se, and thus their use seems sensible as long as there are stringent indications, including the presence of iliac vein or caval thrombosis and the risk of thrombus mobilization [11]. Although the indications for the insertion of these filters are not well established, the main indications include prophylaxis in trauma patients, patients with a short-term contraindication to anticoagulation, prophylactic placement after PE, PE despite anticoagulation, protection during thrombolytic therapy for lower extremity DVT, and pregnant patients with venous thrombosis complicating childbirth or a history of PE [2, 6, 7]. Handling of thrombi in the filter before explantation, and the danger of endothelization with prolonged implantation, are important criticisms [7]. The maximum implantation time varies according to the type of

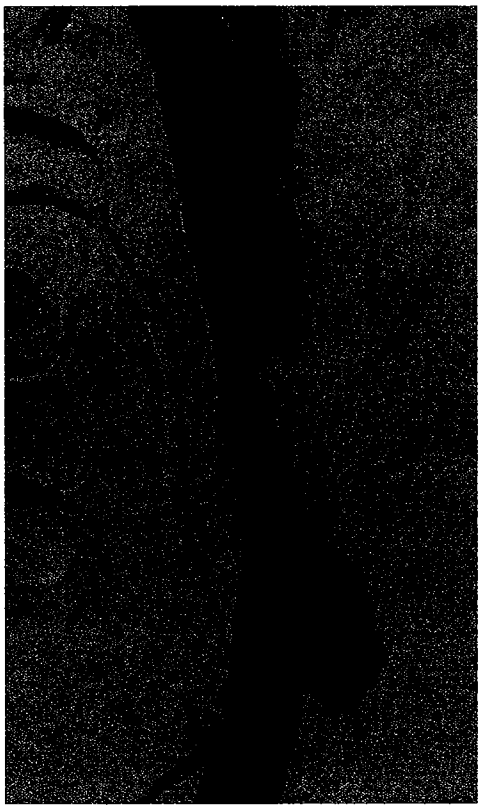

Figure 2. Inferior vena cavography demonstrating moderate narrowing and thrombus adherent to the left lateral wall of the IVC.

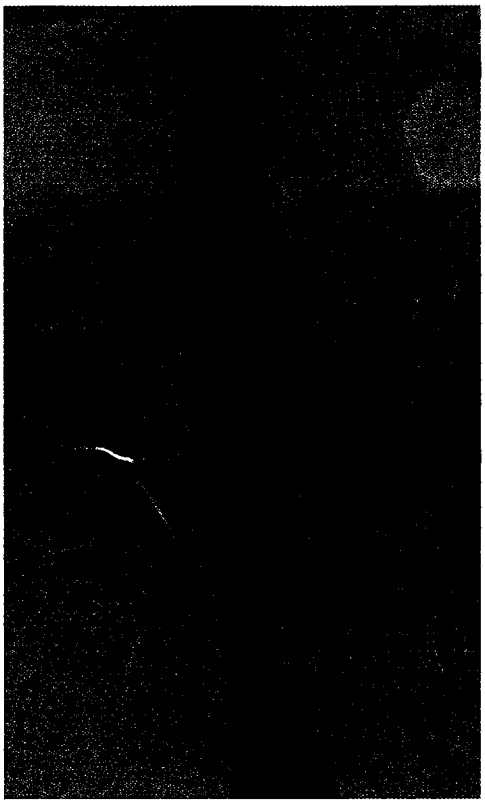

Figure 3. Cavography after implantation of the permanent IVC filter under the protection of a temporary filter.

filter and depends on many factors such as the design, material, and removal technique [2, 12].

Our case was a young patient who has a long life expectancy, and responded to anticoagulation therapy. But the appearance of remaining thrombi necessitated protection during the anticoagulation period. For that reason, we wanted to take advantage of the prophylactic effects of a temporary IVC filter in addition to considering the long-term possible complications of permanent filters. The LGT filter, originally designed for caval protection during thrombolysis, is an MR-compatible, eight-legged cone-shaped device attached to a tethering catheter. It is designed for use via a jugular approach, and has smooth struts with no hooks. We had no difficulty either in implantation or in retrieval of the LGT filter. This might be due to the design of the filtration legs, which it is claimed limit endothelial ingrowth into the legs, minimize vessel trauma and allow easy retrieval. No filter migration was observed on the serial control roentgenograms during the implantation period, which might be due to mechanical stability of the filter. Even though endothelization has been reported to lead to explantation problems after 12 days [7], we had no difficulty achieving explantation after 15 days.

Replacement of a temporary filter with a new temporary or permanent filter might be needed under certain circumstances [13]. Malignant disease diagnosed during the implantation period of the temporary filter, inability to perform the intended thrombolytic therapy, insufficient result of thrombolysis, no improvement under therapy, and excessive filter thrombosis that prevents removal are among the reported indications that require replacement of a temporary with a permanent filter [7]. Most of these indications can not be estimated before the implantation of temporary filters, as in our case. In such cases retrievable filters, which can be used as a permanent filter, might be a promising alternative [14]. Replacement with a permanent filter was successful in our case.

In the literature it has been reported that iliofemoral vein thromboses are the almost universal precursor of lung embolism and in cases of massive or fulminant PE deep cava/iliac vein thrombosis is inevitably present [11]. The incidence of PE in the presence of iliofemoral thrombosis can be significantly reduced from 10% to less than 2% by heparin [1]. Thrombolytic therapy with agents such as streptokinase, urokinase or recombinant tissue plasminogen activators has been shown to be successful in lysis of this type of thrombus; but the risk of PE increases with these therapies [1]. Since our case responded to heparin and coumadin treatments we did not employed thrombolytic agents.

IVC thrombosis has been reported to be a rare condition that can result from various causes [15]. Recent IVC filter placement or other procedures that traumatize the intima of the IVC might also cause isolated IVC thrombosis [16]. Although IVC thrombosis is an uncommon complication of IVC filter placement, it will occur in about 7.7% of patients, or in 15.3% if concurrent anticoagulation is not administered [3]. It has been reported that the symptoms associated with IVC thrombosis are quite variable [16]. If left untreated or inadequately treated IVC thrombosis can lead to severe postphlebitic sequelae such as chronic venous stasis problems or PE

Figure 4. Digital roentgenogram showing the explanation of the temporary IVC filter.

Figure 5. Control cavogram shows patency of the IVC and the decrease in the size of thrombus.

[16]. Anticoagulation, systemic thrombolytic therapy, surgical thrombectomy and catheter-directed thrombolysis are among the treatment options [16]. It could be speculated that the IVC thrombus in our case might have been induced by the temporary filter; however, we do not think that this was the reason, firstly because our patient was under proper systemic anticoagulation therapy and secondly because the thrombus was below the filter and not touching it. On the other hand, it should be kept in mind that the thrombogenicity of filter material, intimal damage due to the design of the filter and excessive manipulation during filter placement could increase the risk of IVC thrombosis induced by temporary IVC filters [6].

For PE prophylaxis in selected high-risk patients, especially young ones, a temporary or retrievable filter should be tried first before placement of a permanent filter.

References

1. Lorch H, Zwaan M, Siemens HJ, et al. (2000) Temporary vena cava filters and ultrahigh streptokinase thrombolysis therapy: A clinical study. Cardiovasc Intervent Radiol 23:273–278
2. Millward SF (1998) Temporary and retrievable inferior vena cava filters: Current status. J Vasc Interv Radiol 9:381–387
3. Poon WL, Luk SH, Yam KY, et al. (2002) Mechanical thrombectomy in inferior vena cava thrombosis after caval filter placement: A report of three cases. Cardiovasc Intervent Radiol 25:440–443
4. Grassi CJ, Swan TL, Cradella JF, et al. (2001) Quality improvement guidelines for percutaneous permanent inferior vena cava filter placement for the prevention of pulmonary embolism. J Vasc Interv Radiol 12:137–141
5. ACCP Consensus Committee on Pulmonary Embolism (1996) Opinions regarding the diagnosis and management of venous thromboembolic disease. Chest 109:233–237
6. Linsenmaier U, Rieger J, Schenk F, et al. (1998) Indications, management, and complications of temporary inferior vena cava filters. Cardiovasc Intervent Radiol 21:464–469
7. Lorch H, Welger D, Wagner V, et al. (2000) Current practice of temporary vena cava filter insertion: A multicenter registry. J Vasc Interv Radiol 11:83–88
8. Athanasoulis CA, Kaufman JA, Halpern EF, et al. (2000) Inferior vena caval filters: Review of a 26-year single-center clinical experience. Radiology 216:54–56
9. Greenfield LJ, Rutherford RB and the parcitipants in the Vena Caval Filter Consensus Conference. (1999) Recommended reporting standards for vena caval filter placement and patient follow-up. J Vasc Interv Radiol 10:1013–1019
10. Wittenberg G, Kueppers V, Tschammler A, et al. (1998) Long-term results of vena cava filters: Experiences with the LGM and the Titanium Greenfield devices. Cardiovasc Intervent Radiol 21:225–229
11. Zwaan M, Lorch H, Kulke C, et al. (1998) Clinical experience with temporary vena caval filters. J Vasc Interv Radiol 9:594–601
12. Burbridge BE, Walker DR, Millward SF (1996) Incorporation of the Gunther temporary inferior vena cava filter into the caval wall. J Vasc Interv Radiol 7:289–290
13. Vos LD, Tielbeek AV, Bom EP, et al. (1997) The Gunther temporary inferior vena cava filter for short-term protection against pulmonary embolism. Cardiovasc Intervent Radiol 20:91–97
14. Neuerburg JM, Gunther RW, Vorwerk D, et al. (1997) Results of a multicenter study of the retrievable Tulip Vena Cava Filter: Early clinical experience. Cardiovasc Intervent Radiol 20:10–16
15. Razavi MK, Hansch EC, Kee ST, et al. (2000) Chronically occluded inferior venae cavae: Endovascular treatment. Radiology 214:133–138
16. Angle JF, Matsumoto AH, Al Shammari M, et al. (1998) Transcatheter regional urokinase therapy in the management of inferior vena cava thrombosis. J Vasc Interv Radiol 9:917–925