● Case Report ●

Strut Deformation of the Greenfield IVC Filter Associated with Blunt Trauma

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Abstract: We report an unusual traumatic complication of inferior vena cava (IVC) perforation by a Greenfield filter (GF) in a 19-year-old woman. She was inserted the Greenfield IVC filter in suprarenal position because of deep vein thrombosis associated with pulmonary embolism. Six months later, after repeated falls during skiing, she was readmitted to our hospital for paralytic ileus. A plain abdominal radiogram showed a 5 cm caudal migration of the filter and deformation of the struts. A computed tomography (CT) and contrast venacavography demonstrated that inferior vena cava and bilateral renal veins were perforated by the filter strut. One of struts had came in contact with aortic wall, and risk of aortic wall injury was considered. A surgical removal was performed in order to evade aortic wall injury. The extraction of the filter required cardiopulmonary bypass because of fixation to the IVC wall and massive bleeding. This case report describes a rare complication of the Greenfield filter due to trauma. With the increasing use of caval filter placement, specific complication such as this will be encountered.(J. Jpn. Coll. Angiol., 2003, **43**: 639-642)

Key words: Greenfield filter, IVC perforation, Blunt trauma

Introduction

Since its introduction in 1972, the Greenfield filter (GF) has been widely accepted as the best device currently available for the interruption of the inferior vena cava (IVC) in preventing pulmonary embolism. Despite its proven safety and efficacy, many complications such as migration, IVC perforation and the filter angulation have been occasionally reported. Most of them have been found innocuous and surgical action is rarely required. In addition, a case report of the comparatively early complication caused by trauma is quite rare. We report a case of an early complication associated with blunt trauma and its surgical treatment.

Case Report

A 19-year-old woman was admitted to our hospital with progressive shortness of breath, palpitation and hypotension. At that time, echocardiography showed right heart failure such as right ventricular pressure overload and pulmonary artery dilatation. A computed tomography (CT) revealed large thrombus in bilateral pulmonary arteries and right popliteal vein. Hematologic inspection showed that she had protein S deficiency disease. After insertion of Antheor temporary vena cava filter (Boston Scientific Co. Natick. USA) via a right femoral vein approach, thrombolytic therapy was performed with intravenous administration of urokinase and heparin. After one week of the thrombolytic therapy, a follow-up CT revealed that thrombus remained in pulmonary artery, IVC, and right femoral vein, and that the thrombus of IVC was located distally in the renal veins. And the temporary filter trapped a floating thrombus. Therefore, we scheduled to insert a permanent IVC filter for prevention of recurrence of pulmonary embolism. The GF was inserted in suprarenal position via a right juglar vein approach for avoiding thrombus. The diameter of suprarenal IVC was about 40 mm.

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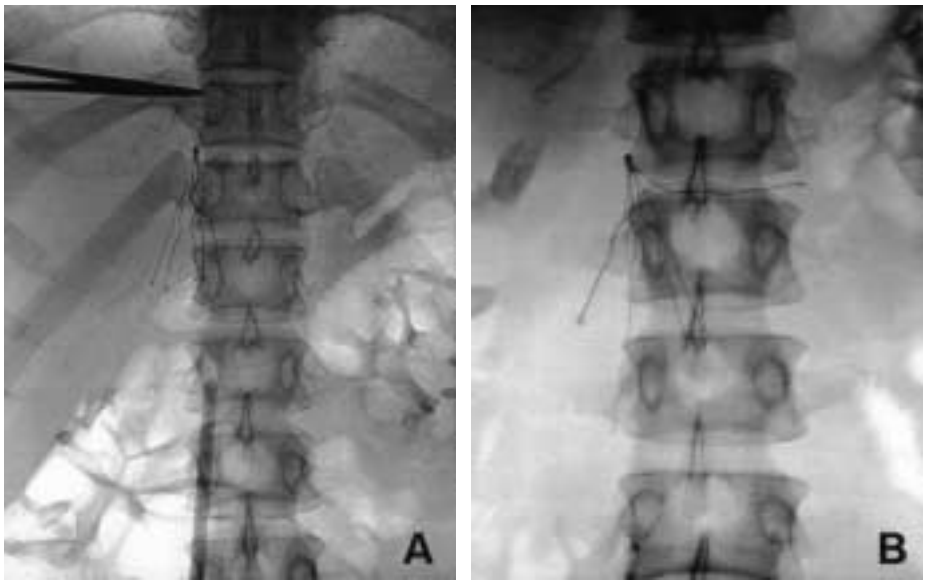

Figure 1
A: Plain abdominal radiography after insertion of Greenfield filter.
B: Plain abdominal radiography demonstrates a 5 cm distal migration of the filter and marked deformation of the vena cava filter struts.

She was discharged without any symptom after insertion of the IVC filter. After discharge, she was treated with warfarin sodium with a target thrombo test-international normalized ratio (INR) of 2.0-2.5 at the outpatient clinic. On interval X-ray examination, abnormality was not recognized in the area of the filter.

She fell and hit herself hard and repeatedly in skiing. Two days after skiing, she was readmitted to our hospital for paralytic ileus. A plain abdominal radiography demonstrated a 5 cm distal migration of the filter and marked deformation of the vena cava filter struts (**Fig. 1**). A CT and contrast venacavography demonstrated that some struts had penetrated IVC and one of them was in contact with the aortic wall (**Fig. 2, 3**). Because there was possibility of aortic wall injury by filter struts, an operation was done for the filter removal.

The operation was conducted through a standard transperitoneal approach and the exposure of the right femoral vessels were performed simultaneously. The retroperitoneal space was opened. No pericaval hematoma was observed. The IVC and bilateral renal veins were exposed. At first, IVC was clamped at the upper and lower sides of the filter, and opened longitudinally. But the extraction of the filter was technically difficult because the prongs at distal extremities of the struts penetrated the IVC and renal veins (**Fig. 4**). Then the operation was performed using cardiopulmonary bypass to control massive bleeding. The filter was extracted after cutting the struts. Although re-insertion of a filter was considered, the thrombus of the pulmonary arteries and the IVC had disappeared at this point already, so filter insertion was not carried out. The IVC and renal veins were resumed in direct suture and the cavotomy was sutured. The postoperative course was uneventful. A CT and contrast venacavography demonstrated that IVC and renal veins remained patent. She does not have recurrence of pulmonary embolism and is doing well 11 months later with anticoagulant therapy.

Discussion

The GF has been widely used for prevention of pulmonary embolism in patients with contraindications to or complication from anticoagulant therapy, recurrent pulmonary embolism despite anticoagulation, and high risk pulmonary embolism of deep vein thrombosis.[1] And prophylactic GF placement in high risk trauma patients increased recently,

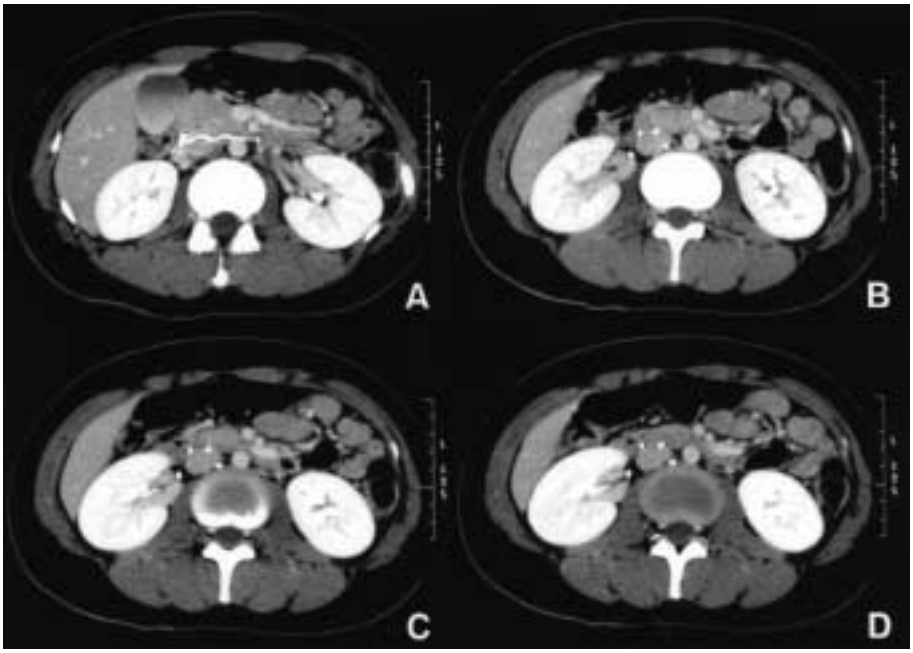

Figure 2 CT scan shows prongs of Greenfield filter outside inferior vena cava (B, C, D). One prong is seen in contact with the aortic wall (A).

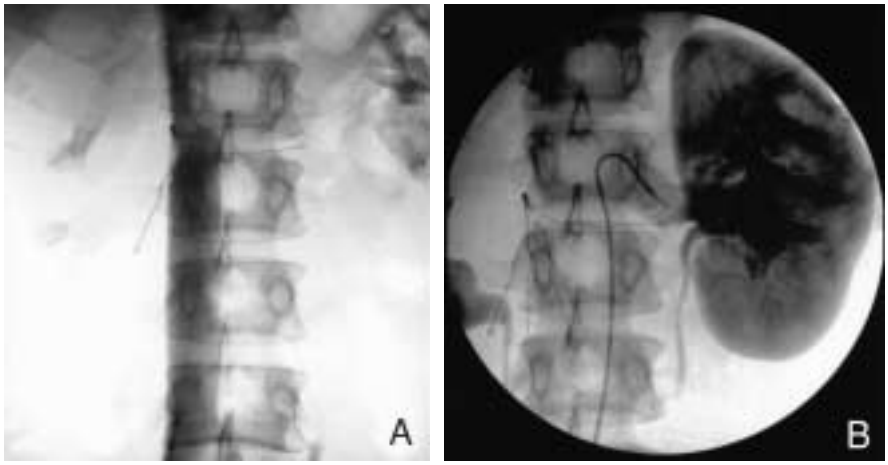

Figure 3 Inferior venacavography showing perforation of inferior vena cava wall by at least four struts of the filter (A) and one strut spreading into left renal vein (B).

too. Although complications from the use of GF filter are rare, various complications associated with this device have been reported in the literature.[2~9] In the follow-up study by Messmer and Greenfield,[10] 29% of the filters migrated 3-18 mm caudad and 6% migrated 2-12 mm cephalad. Perforation of the IVC by the filter has been reported in up to 15% of patients,[1] with occasional penetration of the filter to adjacent organs such as the duodenum, small intestine, portal vein, liver and aorta. But most of them is treated conservatively. In this case, a paralytic ileus following blunt trauma is not

Figure 4 Intraoperative view of the filter covered peal in inferior vena cava lumen.

uncommon, and is not necessarily related to the IVC perforation of the GF. In fact, no pericaval hematoma was observed. But one of struts had came in contact with aortic wall , and risk of aortic wall injury was considered. After consideration of conservative therapy surgical removal was performed in order to evade aortic wall injury.

Because the complication such as this case can be developed, indication of the filter insertion should be determined carefully. In the case that anticoagulant therapy is possible, the GF should be inserted after performing sufficient thrombolytic therapy. Although this case was not a classic indication, the insertion was a logical choice since the floating thrombus was caught in temporary filter. It was thought retrospectively that there was also a method of inserting retrievable filter as Günter filter on the suprarenal position and adding a thrombolytic therapy. The IVC perforation of a filter have been reported, however, many of them are developed without a cause. To our knowledge, a case report of the comparatively early complication associated with blunt trauma is quite rare.

The following points can be considered as the cause of such complications as in this case. First, the filter was inserted on the suprarenal position for avoiding thrombus of perirenal IVC. It was possible that diameter of suprarenal IVC was large comparatively. Therefore the filter was inserted asymmetrically and was not fixed to the IVC wall. Furthermore it was possible that a part of strut had entered into the renal vein at the time of the first insertion. For having been accompanied by an external force in this state, it can be supposed that a tilting filter is easily migrated. Second, it was supposed that the daily life restriction after the filter insertion not performed.

Conclusion

With the increasing use of GF placement, specific complications such as this case will be encountered. Therefore, filter insertion in a young patient with a hematological deficiency disease should be performed with caution. Especially, in cases of suprarenal placement, certain amount of daily life restrictions and prudent progress observations are important after filter insertion.

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