Original article

Clinical outcomes and causes of death in Japanese patients with long-term inferior vena cava filter implants and deep vein thrombosis

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ABSTRACT

Background and purpose: We assessed the causes of death and efficacy of permanent inferior vena cava (IVC) filters for preventing new pulmonary embolisms (PE) in Japanese deep vein thrombosis (DVT) patients with or without PE.

Methods and subjects: We studied the clinical outcomes during the follow-up period of 1 day to 9 years (median: 18 months; mean: 28 months) in 66 of 72 consecutive patients (44 with acute PE, 27 with intrapelvic DVT, and 1 with floating femoral vein thrombosis). Fifty of 66 patients received anticoagulant therapy after the filter placement.

Results: Five patients died within 1 month (median 9 days) after the filter placement: three from recurrence of PE, one from cancer, and one from sepsis. Two of the three patients with recurrence of PE had preexisting intracardiac thrombi in the right atrium or main pulmonary artery before filter implantation. Ten patients died from the underlying disease (cancer: 7; brain hemorrhage: 1; amyotrophic lateral sclerosis: 1; pneumonia: 1) over 1 month after the filter placement (median follow-up period: 21 months). No new symptomatic PE recurrence was observed over 1 month after the filter placement. The 61 patients with long-term follow-up had no deterioration of DVT, and all the 31 patients who underwent multi-slice computed tomography showed no PE recurrence or filter thrombus occlusion, fracture, or migration.

Conclusions: Underlying diseases and preexisting intracardiac thrombi may be the determining factors for the prognosis of DVT patients. Permanent IVC filters with anticoagulant therapy may be effective for preventing death from new PE in Japanese DVT patients.

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Introduction

Pulmonary embolism (PE) is a fatal disease and the inferior vena cava (IVC) filter has been widely used to prevent PE development in patients with deep vein thrombosis (DVT) [1–8]. The general currently accepted indications for filter placement include patients with contraindications to anticoagulant treatment, such as gastrointestinal bleeding, intracranial hemorrhage, or bleeding complications during antithrombotic treatment,

thromboembolism recurrences despite optimal anticoagulation, and floating thrombi in the iliac vein [5,6]. IVC filters have been used for PE prophylaxis in patients with head injury, trauma, and pregnancy, and in preoperative DVT patients [9–12]. However, numerous complications are associated with the use of IVC filters, including migration, thrombosis, and IVC perforation, in patients with long-term use (over 30 days) [13–21]. Filter retrieval is recommended once the risk of PE is reduced and anticoagulant therapy is no longer contraindicated [22]. However, it is difficult to judge the risk of PE development following IVC filter retrieval; thus this procedure is often not performed at the appropriate time. Moreover, during filter retrieval, massive PE or injury to the vein may occur, and this procedure is unsuccessful in 10–20% of the patients because of filter adhesion to the vessel wall, technical problems due to the tilt of the filter, etc. [23]. A recent Japanese study on

retrievable extracorporeal IVC filters also reported complications due to IVC filter removal [24]. After IVC filter retrieval, DVT relapses in 4.0% of the patients, and the PE mortality rate following this procedure is high (2.6%) [25]. The long-term outcomes may differ between Japanese and Western individuals, as Asian individuals show less thrombogenesis and smaller body size compared to Westerners, which may affect filter migration. In the present study, we investigated the causes of death and the efficacy of permanent IVC filters for preventing new PE in Japanese DVT patients at risk for PE development.

Study population and methods

We studied 72 consecutive patients who underwent permanent IVC filter implantation between January 1996 and May 2009 at Hiroshima Prefectural Hospital. When a short PE prophylaxis duration was used in patients with small or non-floating DVT, we used a temporary filter (Newhaus Protect, Toray Medical, Tokyo, Japan) connected to a tethering catheter; therefore, these patients were excluded from the present study. Permanent filters were implanted into 44 acute PE patients, 27 intrapelvic DVT patients, and 1 patient with floating femoral vein thrombosis. The mean age of the patients was 69 years, and the study included 33 men and 39 women. The underlying diseases or risk factors for DVT were prolonged bed rest (27 patients), hematological or coagulation disorders (8 patients, including protein S deficiency, antiphospholipid antibody syndrome, essential thrombocythemia, and estrogenic drug use), postoperative state (6 patients), posttraumatic state or bone fracture (8 patients), cancer (14 patients), cerebrovascular disease (6 patients), leg varices (3 patients), pregnancy (1 patient), and nephrotic syndrome (1 patient). The following IVC filters were used: Greenfield (3 patients; Boston Scientific, Natick, MA, USA), Celsa (19 patients; B. Braun Medical, Bethlehem, PA, USA), Günther (40 patients; Cook, Bloomington, IN, USA), and OptEase (5 patients; Cordis, Roden, The Netherlands). We were unable to determine the filter type used in five cases. The reasons for permanent IVC filter placement included poor compliance or a high risk of anticoagulant therapy-related complications (16 patients), recurrent venous thromboembolism despite adequate anticoagulant therapy (9 patients), free-floating DVT (33 patients), decreased cardiac function or severe pulmonary hypertension (8 patients), residual thrombus 2 weeks after temporary IVC filter placement (31 patients), and the presence of a condition associated with a high risk of recurrent PE (23 patients). We could not identify the reason for permanent IVC filter placement in two cases.

The chart records were reviewed and telephone interviews were conducted to examine the patient prognosis. We were able to follow up in 66 of the 72 patients and examined their clinical outcomes. Clinical outcomes were examined in 5 patients during the follow-up period within 1 month, and in 61 patients there was more than 1-month follow-up period (1 month to 9 years; median, 21 months). The underlying diseases of 18 patients were unknown (Table 1). Anticoagulant therapy was performed in 50 of the 61 patients, who could receive oral warfarin clinically during the follow-up period.

Multislice computed tomography (MDCT) was performed in 31 of the 51 surviving patients to investigate PE recurrence, filter thrombus occlusion, fracture, and migration.

Results

Five of the 66 patients died within 1 month (1–21 days, median 9 days) after the IVC filter placement . The causes of death were acute PE in three cases, cancer in one case, and sepsis in one case (Table 2). The acute PE patients

Table 1
Patient characteristics.

Characteristic	Number of patients
Men/women	32/34
Age (years)	65 ± 15
Reasons of filter	
Acute PE + DVT	40
Intrapelvic DVT	25
Floating femoral vein thrombosis	1
Underlying diseases and risk factors	
Prolonged bed rest	24
Hematological or coagulation disorder	8
Protein S deficiency	5
Antiphospholipid antibody syndrome	1
Essential thrombocythemia	1
Estrogenic drug	1
Postoperative state	6
Posttraumatic state, bone fracture	7
Cancer	14
Cerebrovascular disease	6
Leg varix	3
Pregnancy	1
Nephrotic syndrome	1
Unknown	17
Anticoagulant therapy	50

PE, pulmonary embolism; DVT, deep vein thrombosis.

died on the first, third, and eighth days after IVC filter placement. The thrombi that caused acute PE were preexisting at the proximal site of the IVC filter (the right atrium or main pulmonary artery) in two of these patients prior to IVC filter implantation. In the remaining patient, a fresh thrombus in the bilateral main pulmonary artery was confirmed by autopsy, while there was no evidence of a central thrombus at the time of filter placement.

Over 1 month after the placement of IVC filters, 51 of 61 patients (84%) survived the median follow-up period of 21 months. Ten patients died and the cause of death was cancer in seven cases, brain hemorrhage in one case, amyotrophic lateral sclerosis in one case, and pneumonia in one case. The symptomatic recurrence of acute PE was none over 1 month after IVC filter placement (Fig. 1). Anticoagulant therapy was administered to 50 of the 61 surviving patients and there were no signs of DVT deterioration. All 31 of the surviving patients who underwent MDCT revealed no recurrence of PE or filter thrombus occlusion, fracture, or migration.

Discussion

In 1027 Japanese medical patients with acute PE, the main risk factors were a prolonged immobilization, stroke, cancer, and indwelling central venous catheter, and in-hospital mortality rate was 23% [26]. Hematological or coagulation disorders were evident as the other causes in the present study. Mortality among 465 acute Japanese PE patients was 0.8% in patients without shock or right ventricular overload, 2.7% in patients with right ventricular overload without shock, and 15.6% in patients with shock [27].

Table 2
Causes of death within 1 month after IVC filter implantation.

Cause of death	Number of patients
Acute PE	
Thrombus in the right atrium or main pulmonary artery before placing the filter	2
Fresh thrombus in the bilateral main pulmonary artery	1
Underlying disease	
Cancer	1
Sepsis	1

IVC, inferior vena cava; PE, pulmonary embolism.