Use of a Removable Vena Caval Filter for Prevention of Recurrent Embolism after Emergency Pulmonary Embolectomy

A Flexible Approach

Intraluminal vena caval filters, inserted via the transvenous approach, are used often in the prevention of recurrent pulmonary embolism. Until lately, such filters have been unremovable. In a recent case, however, we treated a patient who experienced acute massive pulmonary embolism after having undergone an emergency right hemicolecction. He underwent a successful emergency pulmonary embolectomy with the help of cardiopulmonary bypass; to prevent recurrent embolism, we inserted a removable intracaval filter through the right atriotomy with an introducer set. On the 7th postoperative day, the absence of significant residual thrombi was confirmed by means of phlebography, and the caval filter was removed percutaneously via the femoral approach.

Although the value of routine use of the filter in this application has yet to be established, we feel that it warrants further investigation because it relieves the surgeon, during an emergency procedure, of the need to decide quickly whether or not to place a filter. The question becomes one of whether or not to remove the filter, and that decision can await the results of proper postoperative diagnostic studies. (Texas Heart Institute Journal 1989;16:15-17)

Massive pulmonary embolism obstructing more than 50% of the pulmonary arterial tree causes considerable patient morbidity and mortality. Recurrent embolism is also a danger. In a 1975 report of the Urokinase Pulmonary Embolism Trial, the recurrence rate of pulmonary embolism was 18%, despite adequate coagulation; half of these recurrences proved fatal. Prevention of recurrence cannot, therefore, be overemphasized, although this subject is hardly a new one. Preventive measures include heparin administration, thrombolytic therapy, thrombectomy, insertion of an intraluminal inferior vena cava (IVC) filter, and even caval interruption.

In an acute emergency that necessitates pulmonary embolectomy, it is difficult to predict which preventive measures will be most appropriate; and prevention of recurrent pulmonary embolism is generally a secondary consideration. In these cases, the surgeon can avoid a clinical dilemma by installing a removable IVC filter intraoperatively.

Case Report

A 58-year-old man underwent an emergency right hemicolecction at our institution and was subsequently given heparin at low dosage. On the 3rd postoperative day, he experienced acute dyspnea. Physical examination disclosed a severely distressed, cyanotic patient with neck vein distention, tachypnea (40 respirations min), tachycardia (120 beats min) and a blood pressure of 90/70 mmHg. Electrocardiography showed right axis deviation in the presence of a left bundle-branch block. Bedside 2-dimensional echocardiography indicated a dilated right atrium and ventricle, with diastolic bulging of the interventricular septum. Multiple cross-sections of a mobile, serpent-like thrombus could be detected in the right atrium.

Key words: Pulmonary embolism; vena cava, inferior; ultrafiltration; blood vessel prosthesis

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Massive pulmonary embolism was diagnosed. Because the patient was deteriorating rapidly, an emergency pulmonary embolectomy was performed, using cardiopulmonary bypass and moderate hypothermia without aortic cross-clamping. A 14-cm-long thrombus was removed through a right atriotomy. We then performed a pulmonary arteriotomy and extracted with forceps and a sucker another 14-cm-long thrombus and a 40-cm-long “saddle” thrombus (Fig. 1).

During a short period of circulatory arrest, an introducer set was used to insert a Gunther caval filter (William Cook Europe A-S; Bjaeverskov; Denmark)* through the right atriotomy into the infrarenal inferior vena cava (Fig. 2).

The patient was extubated on the 1st postoperative day. Intravenous heparin treatment was started, and continued for 1 week, before replacement with oral anticoagulants. When phlebography of the femorokavilac venous system failed to reveal significant residual thrombi on the 7th day after operation, the filter was removed percutaneously via the transfemoral approach. The patient’s postoperative course was uneventful, and he was discharged from the hospital on the 19th postoperative day. Eight weeks after operation, phlebography and pulmonary angiography disclosed no residual thrombi.

**Discussion**

In the treatment of acute massive pulmonary embolism necessitating surgical intervention, the goal is complete restoration of the pulmonary blood flow and prevention of both early and late recurrence. In a recent series, 3 out of 55 patients (5.4%) who had not undergone caval interruption required a 2nd pulmonary embolectomy.† The choice of preventive measures is controversial. Theoretically, prophylaxis can be accomplished by means of caval ligation (to achieve complete occlusion) or, less radically, by caval plication or clipping (to achieve partial occlusion). Even ligation, however, cannot prevent recurrent pulmonary embolism absolutely, and it carries a potential for considerable subsequent morbidity (IVC syndrome). For this reason, use of intraluminal caval filters, inserted via the transvenous approach, has become common; these, however, are unremovable. Despite all such preventive measures, the reported cumulative incidence of recurrent pulmonary embolism is still 3%.§

This newest generation of removable IVC filters has been shown, in animal experiments, to become adherent to the caval wall after 5 days, but is still removable as late as 14 days after operation.¶ In initial clinical applications, these devices have remained stably positioned, have shown good capturing properties, and have proved permeable through 13 months of follow-up.¶¶ Each filter is provided with a retrieval

*This filter is not yet available in the United States.

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References


Fig. 3 Gunther caval filter with retrieval catheter.

set to allow repositioning (Fig. 3). In our case the filter was installed intraoperatively to prevent early recurrence of pulmonary embolism. It was inserted through the atriotomy with an introducer set during a short period of circulatory arrest.* Because the patient had no history of previous thromboembolism or coagulation disorders, and because the source of the emboli was well known and no major residual thromboemboli were detected upon phlebography, we decided to remove the filter. Until the advent of the removable filter, the filter would have been left in place to prevent long-term recurrence, thereby increasing the risk of IVC syndrome inherent to any caval filter. Our intraoperative use of this device is a new one.

The availability of a removable filter for intraoperative installation during an emergency procedure relieves the surgeon of the need to decide quickly whether or not to place a filter. The question becomes, rather, one of whether or not the filter should be removed. Intraoperative use of a removable filter allows time for proper postoperative diagnostic assessment, and for tailoring individual treatment. Although the value of routine use of the filter in this application has yet to be established, we feel that our rationale warrants this approach.

*It could also have been installed through the atrial purse-string suture after removal of the IVC cannula.