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Temporary Inferior vena caval filters: Are they worth the effort?

KEYWORDS

Retrievable, IVC filter, pulmonary thromboembolism

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ABSTRACT Background: Implantation of inferior vena cava (IVC) filter is a safe and effective method to prevent or reduce fatal pulmonary thromboembolism. Objective: To evaluate the safety of implanting retrievable IVC filters and feasibility of retrieving them. Materials and Methods: A prospective observational study of patients of retrievable IVC filter implantation. Implantation and retrieval was done according to standard protocols. Baseline clinical and demographic data, indication, duration, difficulty and technique of retrieval were noted. Results: The mean age was 32 ± 10 years. There were 15 males and 11 females. 26 Retrievable filters were implanted. Technical success of implantation was achieved in 24 cases. Technical and clinical success of retrieval was achieved in 17 (65.3%) patients. Retrieval was done at 1-3 months in five (29.4%) and at 6 months in twelve (70.6%) patients. Conclusion: The advent of retrievable IVC filter designs have lowered thresholds for IVC filter placement. Ideal retrieval time is 1-3 months, through feasible up to 6 months. An aggressive approach to filter retrieval is justifiable and safe.

Introduction: Implantation of inferior vena cava filter (IVC) is a safe and effective method to prevent or reduce fatal pulmonary thromboembolism (1). The first surgical vena caval ligation (complete occlusion of the vena cava with sutures or external clips) was successfully performed in 1893. Filters which could be inserted percutaneous were developed in the 1970s. At present, the only accepted and validated indications for IVC filter implantation stated by the American College of Chest Physicians (ACCP) are:

- Those who have a proximal DVT or pulmonary embolism, or both, with absolute contraindication to therapeutic anticoagulation (I b)
- Those who continue to have recurrent emboli despitealready receiving appropriate levels of anticoagulation (II a).

Eastern Association for the Surgery of Trauma (EAST) guidelines suggests prophylactic IVC filter use in high-risk patients, but the American College of Chest Physicians (ACCP) guidelines (2) do not. Controversy to their use in the literature (3, 4) exists for the following subsets: prophylactic use in extensive trauma, large free-floating ilieo-femoral thrombosis, cancer and pregnancy with concurrent venous thromboembolism.

Materials and methods: This is a prospective, observational study of all patients who have undergone implantation of the retrievable IVC filter (G2X retrievable filter- C. R. BARD) from January 2014 to December 2015. Implantation and retrieval was done according to standard described protocol.

Implantation: Filter placement was performed via the right femoral vein/ left femoral vein/ right internal jugular vein. 7-F filter placement sheath (C.R. Bard) for perfemoral placement or a 10-F filter placement sheath for transjugular placement is introduced. Manual venogram is done to exclude thrombus. Renal veins identified. G2x Retrievable filter is placed with the filter apex below the level of the renal veins by withdrawing the sheath (Figure 1). All patients were kept on low molecular weight heparin for 1 month and later shifted to oral anticoagulation with PT with INR being monitored. Patients were under regular outpatient follow up. Retrieval was planned when there was no longer any indication for continuation of filter such as resolved PTE and DVT.

Retrieval: Removal procedures were performed under local anaesthesia with 1% lidocaine. The right internal jugular vein is punctured with a 21-gauge needle and a 6f sheath placed which was exchanged for the 12-F sheath provided with the Recovery Cone removal system (C.R. Bard). Pigtail is passed over a guidewire upto caval bifurcation and venogram done to exclude thrombus on filter. The tip of the sheath was placed one vertebral body above the filter tip (Figure 2a). The Recovery Cone is then advanced through the sheath until it opened just outside of the sheath. The sheath and the cone advanced as a unit with rotation of the retrieval cone to aid engagement of the filter apex (Figure 2b). When the filter tip had docked in the cone, the sheath is advanced to close the retrieval cone on the filter (figure 2c). Then the recovery cone and filter are withdrawn into the sheath (figure 2d).

Baseline clinical and demographic data were noted. Patients were followed over a period of 6 months or till the time of retrieval which ever was longer. Retrieval duration, technique opted and difficulties encountered were analyzed. Complication during retrieval and in those in whom the filter could not be retrieved was analyzed. Technical success of IVC filter placement was placement of the filter below the renal veins with adequate opening distribution and alignment. Technical success of IVC filter retrieval was defined simply as retrieval of the filter. Clinical success was defined as technical successful filter placement without subsequent PE, symptomatic caval thrombosis, or other complication requiring intervention. Filter Tilt, migration and Filter fracture are to be noted on posteroanterior projections. Categorical variables are expressed as counts and percentages. Continuous variables are presented as the mean ± SD.

Results: The mean age was 32± 10 years. There were 15 (58%) males and 11 (42%) females. IVC filter implantation was class IB in 9 cases and class IIa in 17 cases. A total of 26 Retrievable filters were implanted. Implantation was right femoral route in 11 (42%) patients, left femoral in 3 (12%) patients and right jugular vein in 12 (46%) patients. Technical success of implantation was achieved in 24 (92.3%) cases. Filter tilt was seen in 2 cases (both implanted through left femoral route).

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Technical and clinical success of retrieval was achieved in 17 (65.3%) patients. The filter could not be retrieved in 4 (15.38%), was left permanently due to unresolved DVT in 3 (11.53%), and 2 (7.69%) were lost on follow up. Retrieval was done at 1-3 months in five (29.4%) and at 6 months in twelve (70.6%). Failure was due to densely adherent device in 3 and affordability in one. In those in whom the filter couldn't be retrieved, acute abdomen with ileo-ileal intussusception due to intramural hematoma was seen in one and chronic venous insufficiency in two.

Discussion: The role of anticoagulants in the treatment of venous thrombo-embolic disease is proven. The use of inferior vena cava filters as a second line treatment is increasing, of recent with the introduction of retrievable filters. There are limited data on the ideal indications for filter placement. There is only a single RCT till now- The PREPIC Trial (5). Others are only observational studies (White et al.) and the ICOPER registry.
There are two types of IVC filters: Permanent and Temporary/retrievable (Table 1.)

Experience and evidence with permanent filters is more established but so are the complications: Mortality rate from filter insertion- 0.12%, Migration - 3% to 69%. (Little clinical significance), Perforation - 9% to 24%; (radiologically common), IVC thrombosis- 4% to 30%, late DVT, recurrent PE (2to 5%). Advantage of retrievable filters are: Opportunity for removal, thus avoiding longer term sequelae of DVT; repositioning; can be left as permanent implants if their subsequent removal becomes complicated. Failure to retrieve the Filter could be due to: inability to grasp the proximal hook/hub of the filter due to filter tilt, or dense adherence of the filter struts to the caval wall, excessive tissue ingrowth, or thrombus within the filter.

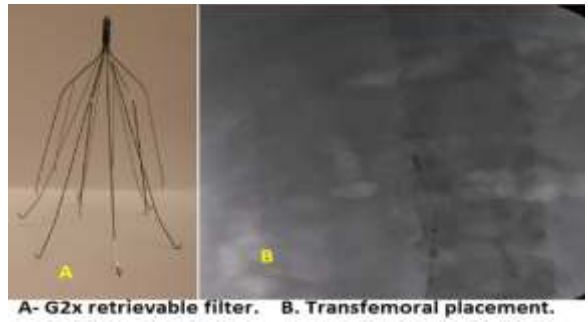
Variable retrieval rates have been reported in the literature, from 22% (Karmy-Jones 2007) (6) to 88% - 100% (Imberti 2005) (7). In Embedded filters, removal of the filter can be technically challenging and potentially unsuccessful. Advanced retrieval techniques (8) would be required in these cases. Centering Techniques using a steerable 0.035-inch guidewire, or an inflated angioplasty balloon can be attempted. If centering techniques fail, Snare-over-guidewire technique (a snare can be brought over the guidewire) or the snare-over-loop technique (a curved catheter placed between the struts of the filter) can be tried. Double-sheath dissection technique and Laser-assisted filter retrieval are other options. For patients with retrievable IVC filters in whom the transient risk of PE has passed, the benefit/risk profile favour filter removal between 29 and 54 days after implantation (1-3 months) (8).

Early complications are procedure related and include access-site thrombosis (8.5%), device Malposition (1.3%), , pneumothorax (0.02%), hematoma (0.6%), air embolism (0.2%), inadvertent carotid artery puncture (0.04%), and arteriovenous fistula (0.02%). Late complications seen with permanent filters (10, 11) can be avoided.

Conclusion: The advent of retrievable IVC filter designs have lowered thresholds for IVC filter placement. Retrievable IVC filters should be used for time-limited indication. Aggressive manoeuvres to remove heavily embedded or adherent filters can generally be performed safely. Further research is needed to ascertain which patient populations outside the strict criteria actually benefit from filter implantation. Finally, prompt filter retrieval is crucial as complications may accrue soon after implantation, and dedicated surveillance and aggressive approach to filter retrieval is justifiable.

Limitation of study: Small sample size of our study.

Abbrevations: IVC- inferior vena cava; PTE-pulmonary thromboembolism; DVT- deep vein thrombosis



A- G2x retrievable filter. B. Transfemoral placement.

Figure 1

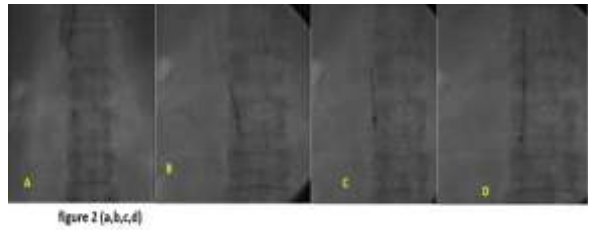


figure 2 (a,b,c,d)

Figure 2

Types of Inferior Vena Cava Filters

	Maximum IVC diameter (mm)	Manufacturer	Required sheath size	Insertion sites	Material
Non-retrievable					
Retrievable					

Table 1

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