

The use of IVC Filters in Obstetrics: A Review.

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Abstract: The joy of nurturing a new life within oneself, comes with its side-effects. One of the most common ones being: an imminent risk of clotting of blood within the leg-veins; followed closely behind by the chance that the clot might travel to the lungs, obstruct the blood supply, and lead to sudden death. Is there a way to prevent it? Yes. Stop the clot on its way up by placing a filter in the IVC. Sounds perfect theoretically, but how effective are IVC-filters really? Are they safe for pregnant ladies? Are there any special precautions and methods to be kept in mind while employing IVC-filters in obstetrics? Although a few studies have been done to find the above answers, there is still need for a lot more for the conclusions to be generalised. In case of a patient presenting with an extensive thrombus in late pregnancy or labour, or with an imminent Caesarean section within the next 2 weeks, it may be advisable to place an IVC filter. The present studies and documented cases show a minimal major-complication and mortality rate associated with the use of IVC filters during pregnancy. On the other hand, the compression of IVC by the gravid contracting uterus might pose a limitation to the placement and the retrievability of a filter. Yet, retrievable IVC-filters are preferred during the short-lived hyper-coagulable gravid state, so as to avoid the morbidity associated with permanent filters. In the meanwhile, routine prophylactic use of IVC filters in pregnant patients with VTE is being practised at a lot of places.

VENOUS THROMBO-EMBOLISM IN OBSTETRICS

Venous thrombo-embolism (VTE) has been, and remains despite preventive measures, a significant cause of obstetric morbidity and mortality. Recent US epidemiological data states that the relative-risk of VTE in pregnancy is 4.29¹; the incidence being 0.76-1.72 per 1000pregnancies, highest during first post-partum week².

Pulmonary Embolism (PE) is the leading cause of maternal-death, taking about 1.1-1.5 per 100,000deliveries in US and Europe². 79% patients who present with PE have evidence of deep-venous-thrombosis (DVT)¹. 30% of patients with apparently isolated PE have silent DVT and a silent PE is present in 40-50% of patients presenting with isolated DVT².

What makes pregnancy prone to VTE? Two out of three factors in Virchow's triad of thrombus formation become active during pregnancy:

- 1.) **Hypercoagulability:** Levels of coagulation factors and fibrin are increased while fibrinolysis is decreased.
- 2.) **Stasis of Blood:** There is hemostatic activation [increased prothrombin fragment F1+2 and D-dimer]. Venous flow velocity in the lower limbs is reduced to 50%.

Common *symptoms* of VTE, like leg swelling, tachycardia, tachypnea, dyspnea, may be normally present in a pregnant lady, and could be easily neglected, missed or over diagnosed. Less than 10% of suspected cases are confirmed.

The *key-management* of VTE is prompt anticoagulation with low-molecular-weight or fractionated heparin. But, in patients such as mentioned above, use of filters to interrupt the Inferior Vena Cava (IVC), in order to prevent embolization to heart and lungs: is salutary, on the rise, and being claimed as safe during pregnancy.

INFERIOR VENA CAVA FILTERS

BRIEF HISTORY

Trousseau in 1868 first suggested surgically interrupting the IVC to prevent PE, which was subsequently performed by Bottini in 1893. In 1959, Moretz described external clipping of the IVC by means of a clip that created a single slit like channel. Transvenous interruption of the vena cava, eliminating the need for general anesthesia and a

laparotomy became clinically feasible in 1967 with the introduction of the Mobin-Uddin filter. Due to the unacceptably high incidence of IVC occlusion associated with this device, the Kimray-Greenfield filter, introduced into clinical practice soon thereafter, became the preferred device for transvenous caval interruption. Nearly 50,000 patients underwent IVC filter placement in the US in the year 1999. Scurr in 1981, first used a vena caval filter in a pregnant patient.

IDEAL FILTER

1. Trap most thrombi, while itself being non-thrombogenic, durable, bio-compatible, non-corrosive and non-ferromagnetic.
2. Maintain caval patency
3. Easily delivered into the IVC, and stable once placed.
4. Provide acceptable clot trapping even with filter deployment.
5. Be retrieved.

Removal of these filters post-partum can be technically difficult or impossible, as the filter might get tilted due to lateral displacement by the gravid uterus or by forceful uterine-contractions during labour.⁶

INDICATIONS

The indications for the use of IVC-filter implantation in pregnancy are similar to those in other patients^{2,3,7,8}:

- Contraindications to anticoagulation:
 - Active/recent hemorrhage
 - Intracranial bleed in past 5 years
 - Need for major surgical procedure (like Caesarian-section) in next 2weeks.
 - Severe, prolonged thrombocytopenia
 - Poor compliance
- Failure of anticoagulation
- Poor cardiopulmonary reserve
- Free-floating ilio-femoral or caval thrombus
- Development of PE or extensive thrombo-embolism in late pregnancy or labour.
- Massive PE: additional emboli might be lethal

Two absolute contraindications are³

- Uncorrectable severe coagulopathy
- Complete thrombosis of IVC.

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PLACEMENT

Filters are inserted percutaneously via femoral or jugular approach, into the IVC; just below the renal-veins. However, it is wiser to place the filter supra-renal during pregnancy due to the compression of the infra-renal portion of inferior vena cava by the gravid uterus⁸. Placement may be guided by fuorscopy; however, to avoid the exposure to teratogenic radiation, sure-duplex-ultrasound or intravascular-ultrasound are the safer options during pregnancy.

EFFECTIVENESS

Despite theoretical benefits, carefully controlled trails that demonstrate decreased recurrence-rates or mortality from pulmonary embolism have not been performed. Reports on the individual filters lack clearly defined end-points and objective criteria for PE recurrence and mortality⁹.

In one of the largest trials to date, examining the effectiveness of IVC-filters, patients with DVT were randomly assigned standard anticoagulation alone or anticoagulation+ insertion of IVC-filters. During first 12days after randomization, significantly fewer patients in the IVC-filter group suffered PE (1vs 5%). However, after a follow-up, there were no significant differences in the survival or symptomatic PE between the 2 groups and higher rate of recurrent DVT among patients who received IVC-filter (2% vs12%).

SAFETY DURING PREGNANCY

Cheung et al.⁴ report 2(two) cases in which IVC –Filters were placed in pregnant patients and safely removed post-partum: 9 days (Gunther-Tulip) and 75 days (RNF) after insertion. They witnessed no significant complications because of IVC-filters, except:

- Minimal filter migration in first case, with no clinical consequence.
- Filter-fracture in patient with RNF filter [acceptable complication]

In 2009, Milford, Chadha and Lust reported another complication-free filter implantation and retrieval during pregnancy¹⁰.

Gupta and colleagues reviewed the outcome of 12 pregnancies in 6 women in which IVC-filters had been used over an 11-year period. There was no compromise on fetomaternal condition due to filter placement and no recurrent thrombo-embolism in pregnancies with an IVC-filter in-situ before conception, although they did fail to retrieve three temporary devices¹¹.

A similar study, documenting the harmlessness of IVC-filter use in pregnant patients, was conducted in Japan between 1998-2004¹².

Initially, the only IVC filters available were permanent ones³. The important ones include:

Device	Size of introducer*	Insertion site (jugular/femoral)	Comments
Bird's Nest	14 Fr	Either (separate kits)	Can be used in IVC up to 40 mm; requires 5-8 cm of IVC to insert; not MRI compatible
Greenfield (stainless steel)	14 Fr	Either (separate kits)	Less insertion control (all-or-none release); not MRI compatible
Simon Nitinol	9 Fr	Either (separate kits)	Thermal-mechanical memory; max IVC diameter 28 mm; MRI compatible
TrapEase	8 Fr	Either (1 kit for both)	Little data; maximum IVC up to 30 mm; MRI compatible
VenaTech	14.6 Fr	Either (one kit)	MRI-compatible

* Outer diameter of introducer system.

There have been numerous long-term complications and preclude MRI-use, while obstetric patients are usually young and healthy, with long anticipated life-spans. Also, studies show that there is no advantage of continued IVC-filter use, once the acute risk for VTE [pregnancy, in this context] has passed, and the clot has dissolved⁴. Thus, it makes more sense to use filters that can be retrieved post-partum.

The first retrievable-filter to be approved was Gunther-Tulip filter, which must be removed within 10-14 days of placement, to avoid

development of endothelial-hyperplasia. Owen and Krarup documented placing Gunther-Tulip filter in late pregnancy, followed by Caesarian-section, and later removed it without complications³. The potentially retrievable filters³ are:

Device	Size of introducer*	Insertion site (jugular/femoral)	Comments
Gunther Tulip	12 Fr	Either (separate kits)	Maximum IVC up to 30 mm; MRI compatible
OptEase	8 Fr	Either	Little data; maximum IVC up to 30 mm; MRI compatible
Recovery Filter	9 Fr	Femoral	Retrievable up to several weeks or months after implantation using a 12 Fr retrieval catheter, thus ideal for Peri-partum use; MRI compatible.

* Outer diameter

The major problems associated with them include: *filter thrombosis and migration*.

Removal of these filters post-partum can be technically difficult or impossible, as the filter might get tilted due to lateral displacement by the gravid uterus or by forceful uterine-contractions during labour⁶.

COMPLICATIONS

The mortality associated with IVC-filters is low: only 3deaths were reported by Becker et al., in a review of 2557patients undergoing filter insertion; a second series of 1765insertions had a major- complication rate of only 0.3%⁹.

The non-fatal complications⁹ include:

- Complications related to *insertion process*
- Acute venous *thrombosis* at the site of insertion {reported in 40% of patients undergoing filter placement, more in femoral approach and large introducers }
- Filter *migration* {rare }
- Filter erosion through IVC wall
- *IVC obstruction* (5-18% cases)
- Chronic Thrombosis: Recurrent DVT is commoner with IVC-filters.

LIMITATIONS

Although filter placement protects the vascular bed, it doesn't lessen thrombotic pre-disposition; neither does it decrease the incidence of lower-extremity DVT. Also, small thrombi might pass through patent filters, or through collaterals around obstructed filters. Thus, concomitant anticoagulation-therapy should be considered, if not contraindicated⁹.

At many places, IVC-filters are routinely being used prophylactically, in obstetric patients with DVT. Studies show that retrievable IVC-filters may be used safely and beneficially during pregnancy, and removed post-partum to prevent long-term complications. Yet, there is need for more research to substantiate the above.

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SYMPOSIUM CHALLENGES OF HEMODIALYSIS IN INDIA

OUR GUEST EDITOR

Dr. (Prof.) S.C. Tiwari, is presently the Director and Chairman at Fortis Institute of Renal Sciences & Transplantation (FIRST) Fortis Hospital Vasant Kunj and Escort Fortis Research Institute, New Delhi. Dr Tiwari is a Gold Medalist and stood First in MBBS, at Ravishankar University, Raipur. He did his MD (Medicine) DM (Nephrology) from PGIMER Chandigarh in 1977. Dr Tiwari served as Lecturer in Medicine at Sewagram wardha from 1979 to 1980. He joined the prestigious All India Institute of Medical Sciences as Lecturer in Medicine in September 1980, then served there as Assistant Professor of Medicine and Additional Professor of Medicine till 1996. He became Professor of Nephrology, and continued to look after resident medical cases. He served at the All India Institute of Medical Sciences, New Delhi for about 30 years as faculty member till 2009. Prof. Tiwari took premature retirement joined the Rockland Hospital as Chief Consultant and Director Nephrology. During tenure of Dr Tiwari at AIIMS the Dept of Nephrology was adjudged best in the country for three consecutive years. He is an excellent clinician of repute. He is the person who created the Dept of Nephrology at AIIMS and started D.M. Nephrology program at AIIMS. He is Examiner for Medicine and DM Nephrology, at various Universities in India. For MD (Med) and Phd at AIIMS and at many National and International Universities. Dr. Tiwari has unmatched clinical and academic excellence; this has been acknowledged in various ways. He is the fellow of the National Academy of Medical Sciences, Fellow, Indian Society of Nephrology, Fellow, Geriatric Society of India, Fellow, International Medical Science Academy (FIMSA), He received the Best Doctor Award from IMA and Best Nephrologist award from Vice President of India, Mr Bhairo Singh Shekhawat, Chikitsa Rattan Award from Bangkok by Deputy Prime Minister of Bangkok and the Life Time Achievement Award for Medicine from Institute of Economic Studies by Governor of Chhatisgarh and Governor of Bihar at New Delhi. He was the visiting Physician and Nephrologist to PM, Vishwanath Pratap Singh and Physician Nephrologist to present President of India. As an administrator, he has held positions of significance. At Present he is President of Indian Society of Hemodialysis, He was past President Indian Society of Nephrology, He was Chairman Hospital Management Board of AIIMS, Member Academic Committee of AIIMS. He was also on the Advisory Board of UPSC and ICMR. Chief Editor of Journal of Renal Sciences and in the Editorial Board of many National & International Scientific Nephrology Journals. Dr. Tiwari is Member Editorial Board of International Journal of Nephrology. He has been Editor of Journal of Renal Sciences. He has been referee for Journal like Renal Failure, Indian Journal of Nephrology and Nephron. Transplant Proceeding and Associate Editor of Journal of International Medical Sciences Academy. He is President Kidney Health Education and Research Foundation and Chairman REIC Institute. Dr Tiwari worked at Abu Dhabi UAE for one year in the Department of Med and Nephrology Central Hospital Abu Dhabi, UAE from 1989 and 1990. As a visiting professor, Dr. Tiwari has been at the Albert Einstein College of Medicine, Long Island Jewish Medical Centre USA, Winthrop University Hospital, Minneola in New York USA, University of Minnesota, Hennepin County Medical Centre Minneapolis, USA. Also at the University of Manitoba, Winnipeg CANADA. He has more than 300 publications in National and International Journals.

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