Cardiovasc Intervent Radiol (2019) 42:165–168
https://doi.org/10.1007/s00270-018-2077-y

REVIEW VENOUS INTERVENTIONS

Inferior Vena Cava Filters in the Asymptomatic Chronically Occluded Cava: To Remove or Not Remove?

Warren Clements[1,2]

Received: 31 July 2018 / Accepted: 10 September 2018 / Published online: 21 September 2018

Abstract Risks of IVC filter insertion are numerous but include IVC stenosis or thrombosis and may result in caval occlusion. Acute IVC occlusion is almost always symptomatic, and treatment can be aggressive such as catheter-directed thrombolysis or conservative such as anticoagulation. The more challenging cohort of patients is those where there has been chronic complete occlusion of the IVC without symptoms, sometimes only identified at the time of routine filter retrieval. We explore the available evidence and discuss different management approaches in this circumstance ranging from aggressive to conservative. However, given that the overall incidence of filter-related complications is very low, at this stage we find no compelling evidence to support aggressive management without symptoms.

Keywords IVC filter · Central venous occlusion

Introduction

Inferior vena cava (IVC) interruption is an established means for preventing clinically significant pulmonary embolus is a cohort of patients [1]. Risks of IVC filter insertion are numerous but include IVC stenosis or thrombosis and may result in symptomatic central venous occlusion [1, 2]. Occlusion of the cava in this setting is uncommon and may be due to either thrombosis in situ of the filter or capture of a large embolus [2].

Some authors have suggested that the use of IVC filters confers a higher risk of developing new deep venous thrombosis (DVT). Beleba suggested this rate to be 40% [3], while Greenfield and Proctor showed this rate to be 13.3% [4]. The risk may be even higher in trauma patients as shown by Wojcik et al. [5] where 44% of trauma patients with an IVC filter placed prophylactically developed a new DVT after filter placement. It is worth noting that many of these filter types have been superseded in the market and whether the rate of complications is similar in newer designs or is even related to the filter is not established.

Many practitioners advocate for anticoagulation to be started as soon as clinically feasible and to continue until the filter is retrieved [6]; however, there are also arguments that anticoagulation does not improve the rate of IVC thrombosis [7], and Decousus et al. [8] even showed that patients treated with both IVC filter and anticoagulation had a higher rate of DVT than those treated with anticoagulation alone. It is worth noting that this study was underpowered and patients were at high background risk.

Acute IVC occlusion is a more established treatment algorithm as patients are almost always symptomatic and may present with a range of symptoms such as back pain, abdominal pain, acute lower limb oedema, or even phlegmasia cerulea dolens [8–11]. In these circumstances, the risks of aggressive treatment may be offset by the symptom morbidity which often justifies intervention, and there are favourable short-term outcomes in this cohort [9–11].

✉ Warren Clements
w.clements@alfred.org.au

[1] Department of Radiology, Alfred Health, Alfred Hospital, 55 Commercial Road, Melbourne, VIC 3004, Australia

[2] Department of Surgery, Monash University, Clayton, Australia

Chronic IVC Occlusion

The more challenging cohort of patients is those where there has been chronic complete occlusion of the IVC without symptoms. Patients may have not recognised a problem or may have no symptoms at all, i.e. CEAP classification C0 [12, 13]. Pan et al. [14] suggest that in their cohort of trauma patients with IVC interruption, complete occlusion of the filter can be seen at the time of retrieval in up to 2.4% of patients, while Athanasoulis et al. [15] suggested this rate can be up to 2.7% in all patients regardless of filter indication. Ahmad et al. showed in their cohort of 598 patients with IVC filters who were followed up with abdominal CT that up to 18.3% had asymptomatic thrombus in the filter and 10.8% of patients had an occluded IVC. The median time to develop thrombus was only 35 days, and anticoagulation after detection of thrombus only resolved the thrombus in 33.9% [16]. Grassi et al. [17] showed that in a high-risk cohort and certain filter types, up to 50% can see chronic IVC occlusion but these patients were symptomatic. These studies overall are underpowered to give a true indication of occlusion rate, and it is entirely possible that patients in the community with IVC filters who are lost to follow-up have chronic occlusion of the IVC without symptoms.

Those with asymptomatic IVC occlusion are still at risk of the sequelae of central venous stenosis. This includes recurrent DVT, post-thrombotic syndrome (PTS), venous claudication, venous ulcers, oedema, and varicosities [12, 13]. Collateral vessels which form around the occlusion occur in most if not all chronically occluded cava and have been suggested to still carry a risk of embolic pathway for lower limb or pelvic DVT [18].

The Asymptomatic Patient

Interventional Radiology centres with active involvement in filter retrieval will likely come across the situation where the cava is found to be chronically occluded yet asymptomatic at the time of routine retrieval. What is the best strategy in this situation?

There is an argument to leave the filter in situ. While occluded, the patient is asymptomatic and thus has most likely compensated with collaterals already. Aggressive filter retrieval in chronic complete occlusion may result in IVC injury, and both the risk and sequelae of this may need to be considered given it is established that complex filter retrievals are at higher risk of IVC injury than for simple retrievals [19, 20]. It would be unfortunate for a new complication to materialise when the filter was not otherwise providing any therapeutic antiembolic effect (assuming CEAP C0). Conversely, leaving the filter may confer a continued pro-thrombotic effect [3–5].

There is also an argument to remove the filter in spite of the IVC occlusion, mainly due to the risks of filter-related complications [21]. Filters left in situ still harbour a risk (albeit low) of infection seeding in the event of future bacteraemia [22, 23]. The risk of limb penetration also remains and can be a cause of significant morbidity and even mortality, with case reports of penetration of duodenum, aorta, and adjacent vertebrae leading to haemorrhage, ulceration, and arteriovenous fistula formation [24–27]. There are also reports of spontaneous retroperitoneal haematoma [27].

But, given the cava is chronically occluded, removal of filter as an isolated procedure will not restore flow. If the true incidence of DVT associated with the IVC filter is to be believed as previously discussed (up to 44% [5]), and assumed that this mechanism is felt to be a pro-thrombotic effect of the filter itself [4–6], then removal of the filter may obviate that effect. It won't however reduce the central venous occlusion and thus the patient may still need lifelong anticoagulation to prevent lower limb DVT and/or PTS associated with poor central flow [28, 29].

The most aggressive approach would be to consider filter retrieval, recanalisation of the IVC, and IVC stent or stent graft placement. If flow is restored, then the patient could be transitioned from therapeutic anticoagulation to antiplatelet treatment [30, 31] although the anticoagulation/antiplatelet role has not been directly studied with large stents in the central veins and is mostly extrapolated from studies on other anatomic sites. Studies to date have shown that there are high patency rates in the short term from caval stents. While placement in the infrarenal segment is usually feasible, some studies have shown that even placement of bare stent across the renal or hepatic vein tributaries if absolutely required for IVC patency may not lead to occlusion [12, 33]. However, caution should be exercised in this often pro-thrombotic cohort and this practice is probably best avoided unless absolutely necessary. Logic would suggest that stenting the IVC will improve flow, but the stent may still be pro-thrombotic [8] and whether and by how much this reduces the true incidence of DVT, PTS, or venous insufficiency in the long term is also not established. Technology such as stent grafts could also be considered and may reduce the risk of re-occlusion but most would advocate for continued antiplatelet even though the evidence is lacking and again there is no long-term data [33, 34].

Neglen et al. published a series of 17 patients with occluded IVC in the context of IVC filter, where recanalisation and bare stent placement resulted in restoration of flow in 16 out of 17. Filters had been placed between 4 months and 20 years prior. However, 36% developed

stent stenosis/occlusion including 12% in the first 30 days, requiring further intervention [35]. It is worth noting that these patients did not have the filter retrieved before the stent was placed and that the CEAP classification of these patients were all greater than 0 indicating that they were symptomatic.

Vedantham et al. published a series of 7 patients with symptomatic thrombosis of IVC filter, where stent placement occurred through/across the IVC filter. This resulted in technical success in all patients, however either deformity or fracture of the filter was seen in 5 out of 7 patients, although there was no filter component migration or embolus [36].

Razavi et al. [32] showed a cohort of 17 patients with chronically occluded IVC where technical success in recannalisaiton and stent placement was achieved in 15, and the stent remained patent in 80% at a mean of 19-months follow-up.

As yet there is no strong evidence of the long-term patency of stents due to small studies and lack of adequate follow-up. If the stent were to be become stenotic or occlude/thrombose in the future, the patient may have new symptoms of acute central venous occlusion when they were previously asymptomatic, which occurred in 36% of the Neglen study. A stent graft may partially obviate these risks [34] but has not been convincingly proven in the IVC, and the role of anticoagulation is also not clear in the long term beyond anecdotes or without correlating data from other venous or arterial anatomic sites [29, 33, 34].

Other factors that may influence the decision to remove or not remove the IVC filter and place a stent may relate to patient age, level of activity, co-morbidities, and even geographic location [29]; however, these factors are not unique to the occluded IVC and should be considered in the algorithm for all IVC filter retrieval attempts.

Conclusions

These circumstances yet again draw our attention to the importance of rigorous attention to filter insertion indications, robust discussion of the risks and benefits with the patient at the time of insertion, and to have in place measures to retrieve the filter as soon as possible. There is no ideal guideline on whether anticoagulation is necessary or even beneficial in these patients once the risk returns to background and the filter is no longer indicated. In addition, studies on rates of DVT and the potential prothrombotic effect of the filter are older and have not since been replicated.

When the cava is found to be chronically occluded yet asymptomatic at the time of routine IVC filter retrieval, we don't yet have an evidence-based answer to guide us. There are both arguments for conservative management and aggressive management, but these are at best level 4 evidence.

Given that the overall incidence of filter-related complications is very low (limited to mostly case series), that the patient in this situation is asymptomatic, and that there is evidence to support successful recanalisation of the IVC, a strong argument is to consider conservative treatment (leaving the filter in situ) and closely monitor for sequelae of central venous occlusion. At this stage, there is no compelling evidence to support aggressive management without venous symptoms. The success of stenting of the chronically occluded IVC even with filter in place could be reserved for if/when symptoms occur, having shown to be effective in one study for a filter placed as long as 20 years prior.

There is a gap in this area of the literature to follow long-term outcomes and complications of this specific patient group and to re-explore the role of long-term anticoagulation.

The procedural plan is an important decision to make, beginning in an outpatient clinic setting with adequate planning, where the risks and benefits of attempting removal can be discussed at length with the patient, documenting a plan for clinical follow-up if late symptoms occur.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethics Approval and Consent to Participate Research without human participants was performed in accordance with our local HREC guidelines and the Helsinki Declaration.

Consent for Publication Not applicable.

Availability of Data and Materials Not applicable.

Ethical Standard All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

References

1. Becker DM, Philbrick JT, Selby JB. Inferior vena cava filters. Indications, safety, effectiveness. Arch Intern Med. 1992;152:1985.
2. White RH, Brunson A, Romano PS, et al. Outcomes After vena cava filter use in noncancer patients with acute venous thromboembolism: a population-based study. Circulation. 2016;133:2018.

3. Blebea J, Wilson R, Waybill P, et al. Deep venous thrombosis after percutaneous insertion of vena caval filters. J Vasc Surg. 1999;30(5):821–8.
4. Greenfield LJ, Proctor MC. Recurrent thromboembolism in patients with vena cava filters. J Vasc Surg. 2001;33(3):510–4.
5. Wojcik R, Cipolle MD, Fearen I, et al. Long-term follow-up of trauma patients with a vena caval filter. J Trauma. 2000;49(5):839–43.
6. Hann CL, Streiff M. The role of vena caval filters in the management of venous thromboembolism. Blood Rev. 2005;19(4):179–202.
7. Grewal S, Chamarthy MR, Kalva SP. Complications of inferior vena cava filters. Cardiovasc Diagn Ther. 2016;6(6):632–41.
8. Decousus H, Leizorovicz A, Parent F, et al. A clinical trial of vena caval filters in the prevention of pulmonary embolism in patients with proximal deep-vein thrombosis. Prévention du Risque d'Embolie Pulmonaire par Interruption Cave Study Group. N Engl J Med. 1998;338(7):409–15.
9. Sildiroglu O, Ozer H, Cenk Turba U. Management of the thrombosed filter-bearing inferior vena cava. Semin Interv Radiol. 2012;29(1):57–63.
10. Vedantham S, Goldhaber SZ, Julian J, et al. Pharmacomechanical catheter-directed thrombolysis for deep-vein thrombosis. N Engl J Med. 2017;7(377):2240–52.
11. McAree BJ, O'Donnell ME, Fitzmaurice GJ, et al. Inferior vena cava thrombosis: a review of current practice. Vasc Med. 2013;18:32.
12. Raju S, Hollis K, Neglen P. Obstructive lesions of the inferior vena cava: clinical features and endovenous treatment. J Vasc Surg. 2006;44(4):820–7.
13. Kistner RL, Eklof B, Masuda EM. Diagnosis of chronic venous disease of the lower extremities: the "CEAP" classification. Mayo Clin Proc. 1996;71(4):338–45.
14. Pan Y, Zhao J, Mei J, et al. Retrievable inferior vena cava filters in trauma patients: prevalence and management of thrombus within the filter. Eur J Vasc Endovasc Surg. 2016;52:830.
15. Athanasoulis CA, Kaufman JA, Halpern EF, Waltman AC, Geller SC, Fan C. Inferior vena caval filters: review of a 26-year single-center experience. Radiology. 2000;216:54–66.
16. Ahmad I, Yeddula K, Wicky S, Kalva SP. Clinical sequelae of thrombus in an inferior vena cava filter. Cardiovasc Interv Radiol. 2010;33(2):285–9.
17. Grassi CJ, Matsumoto AH, Teitelbaum GP. Vena caval occlusion after Simon nitinol filter placement: identification with MR imaging in patients with malignancy. J Vasc Interv Radiol. 1992;3(3):535–9.
18. Hajduk B, Tomkowski WZ, Malek G, Davidson BL. Vena cava filter occlusion and venous thromboembolism risk in persistently anticoagulated patients: a prospective, observational cohort study. Chest. 2010;137:877.
19. Lee JT, Goh GS, Joseph T, Koukounaras J, Phan T, Clements W. Prolonged balloon tamponade in the initial management of inferior vena cava injury following complicated filter retrieval, without the need for surgery. J Med Imaging Radiat Oncol. 2018. https://doi.org/10.1111/1754-9485.12758.
20. Al-Hkin Rm Kee S, Olinger K, et al. Inferior vena cava filter retrieval: effectiveness and complications of routine and advanced techniques. J Vasc Intv Radiol. 2014;25(6):933–9.
21. Joels CS, Sing RF, Heniford BT. Complications of inferior vena cava filters. Am Surg. 2003;69:654–9.
22. Meda MS, Lopez AJ, Guyot A. Candida inferior vena cava filter infection and septic thrombophlebitis. Br J Radiol. 2007;80:e48–9.
23. Rottenstreich A, Bar-Shalom R, Bloom AI, Kalish Y. Endovascular infection following inferior vena cava (IVC) filter insertion. J Thromb Thrombolysis. 2015;40(4):452–7.
24. Al Zahrani HA. Bird's nest inferior vena caval filter migration into the duodenum: a rare cause of upper gastrointestinal bleeding. J Endovasc Surg. 1995;2:372–5.
25. Feezor RJ, Huber TS, Welborn MB 3rd, Schell SR. Duodenal perforation with an inferior vena cava filter: an unusual cause of abdominal pain. J Vasc Surg. 2002;35:1010–2.
26. Jorger U, Albrecht D, Ritter R, et al. Chronic right heart failure after implantation of a cava filter. Dtsch Med Wochenschr. 1997;122:1415–8.
27. Amano Y, Kumita S, Takahama K, et al. RI venography for retroperitoneal hematoma following anticoagulant therapy for IVC filter thrombosis. Kaku Igaku. 1993;30:423–7.
28. Liu D, Peterson E, Dooner J, et al. Diagnosis and management of iliofemoral deep vein thrombosis: clinical practice guideline. CMAJ. 2015;187(17):1288–96.
29. Ray CE Jr, Prochazka A. The need for anticoagulation following inferior vena cava filter placement: systematic review. Cardiovasc Interv Radiol. 2008;31(2):316–24.
30. Bhatt DL, Kapadia SR, Jajzer CT, et al. Dual antiplatelet therapy with clopidogrel and aspirin after carotid artery stenting. J Invasive Cardiol. 2001;13(12):767–71.
31. Clowes AW, Reidy MA. Prevention of stenosis after vascular reconstruction: pharmacologic control of intimal hyperplasia—a review. J Vasc Surg. 1991;13(6):885–91.
32. Razavi MK, Hansch EC, Kee ST, et al. Chronically occluded inferior venae cavae: endovascular treatment. Radiology. 2000;214(1):133–8.
33. Saratzis A, Saratzis N, Melas N, Kiskinis D. Pharmacotherapy before and after endovascular repair of abdominal aortic aneurysms. Curr Vasc Pharmacol. 2008;6(4):240–9.
34. Ye K, Lu X, Li W, et al. Outcomes of stent placement for chronic occlusion of a filter-bearing inferior vena cava in patients with severe post-thrombotic syndrome. Eur J Vasc Endovasc Surg. 2016;52:839.
35. Neglén P, Oglesbee M, Olivier J, Raju S. Stenting of chronically obstructed inferior vena cava filters. J Vasc Surg. 2011;54(1):153–61.
36. Vedantham S, Vesely TM, Parti N, Darcy MD, Pilgram TK, Sicard GA, et al. Endovascular recanalization of the thrombosed filter-bearing inferior vena cava. J Vasc Interv Radiol. 2003;14:893–903.