Hong Kong J Radiol. 2017;20:121-5 | DOI: 10.12809/hkjr1715388

ORIGINAL ARTICLE

Inferior Vena Cava Filter Retrieval: a Review of Seven Years' Experience at a Regional Hospital

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ABSTRACT

Objective: *To identify predictors of successful retrieval of inferior vena cava (IVC) filter by comparing patients with and without a retrieval request.*

Methods: *Medical records of consecutive patients who underwent insertion / retrieval of the IVC Cordis OptEase retrievable filter via the femoral route between January 2008 and December 2014 at a regional hospital were reviewed.*

Results: *64 male and 93 female patients aged 15 to 94 (mean, 66.7) years were divided into those with (n = 37) or without (n = 120) a retrieval request. Compared with patients without a retrieval request, those with such a request were more likely to be aged <70 years (73.0% vs. 44.2%, p = 0.002), be scheduled for anticoagulation therapy on discharge (45.9% vs. 1.7%, p < 0.001), and have prophylactic filter insertion for surgery or high-risk patients (37.8% vs. 7.5%, p < 0.001), as well as less likely to have a history of malignancy (16.2% vs. 40.0%, p = 0.008) or any contraindication to anticoagulation therapy (70.3% vs. 92.5%, p = 0.001). Predictors for filter retrieval were patient age of <70 years (odds ratio [OR] = 3.55, p = 0.033), no history of malignancy (OR = 0.15, p = 0.010), scheduled for anticoagulation therapy on discharge (OR = 63.08, p < 0.001), prophylactic filter insertion for surgery or high-risk patients (OR = 14.57, p < 0.001), and contraindication to anticoagulation owing to postoperation within 2 weeks (OR = 6.19, p = 0.004). Only 23 of 37 patients with a retrieval request attempted retrieval, with 17 being successful. Compared with patients with failed retrieval, those with successful retrieval had a shorter mean retrieval interval (27.2 vs. 77.7 days, p = 0.014). The success rate was higher when retrieval was within 23 days of insertion compared with a longer time (100% vs. 53.8%, p = 0.019).*

Conclusion: *Predictors for filter retrieval were patient age of <70 years, no history of malignancy, scheduled for anticoagulation therapy on discharge, prophylactic filter insertion for surgery or high-risk patients, and contraindication to anticoagulation owing to postoperation within 2 weeks. A shorter retrieval interval was associated with successful retrieval.*

Key Words: *Pulmonary embolism; Vena cava filters*

中文摘要

回收下腔靜脈過濾器：一所分區醫院7年經驗回顧

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目的：通過比較有和沒有請求回收下腔靜脈（IVC）過濾器的患者來確定成功回收IVC過濾器的預測因子。

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Submitted: 16 Dec 2015; Accepted: 21 Mar 2016.

Disclosure of Conflicts of Interest: All authors have disclosed no conflicts of interest.

方法：回顧2008年1月至2014年12月間在一所分區醫院接受植入IVC Cordis OptEase過濾器的患者。
結果：64名男性和93名女性年約15至94（平均，66.7）歲的患者被分類為有（n = 37）或沒有（n = 120）要求回收IVC濾過器。與沒有要求回收的患者相比，有要求回收的患者傾向<70歲（73.0%對44.2%，p = 0.002）、計劃出院後接受抗凝治療（45.9%對1.7%，p < 0.001）、預防性地為手術植入過濾器或高風險患者（37.8%對7.5%，p < 0.001）。有要求回收的患者不傾向有惡性病史（16.2%對40.0%，p = 0.008）或任何抗凝治療禁忌（70.3%對92.5%，p = 0.001）。回收過濾器的預測因子為年齡<70歲（比值比[OR] = 3.55，p = 0.033）、沒有惡性腫瘤史（OR = 0.15，p = 0.010）、計劃出院後接受抗凝治療（OR = 63.08，p < 0.001）、預防性地為手術植入過濾器或高風險患者（OR = 14.57，p < 0.001）、及由於術後2週內的抗凝禁忌（OR = 6.19，p = 0.004）。37名要求回收的患者中只有23名嘗試回收，其中17名成功。與回收失敗的患者相比，回收成功的患者平均回收間隔較短（27.2對77.7天，p = 0.014）。於23天內回收成功率較更久間隔高（100%對53.8%，p = 0.019）。
結論：回收過濾器的預測因子為年齡<70歲、沒有惡性腫瘤史、計劃出院後接受抗凝治療、預防性地為手術植入過濾器或高風險患者及由於術後2週內的抗凝禁忌。較短的回收間隔與成功回收有關聯。

INTRODUCTION

Prophylactic use of an inferior vena cava (IVC) filter effectively decreases morbidity and mortality from pulmonary embolism in patients for whom anticoagulation is contraindicated. The Cordis OptEase retrievable filter (Cordis Endovascular; J&J, Roden, Netherlands) has a hook for retrieval, six superior barbs to prevent migration, and six slide struts to decrease filter tilting within the IVC. This design increases its contact surface area with the IVC at the expense of potential early epithelisation, compared with other types of filter.[1-3] It is recommended that this filter be retrieved within 12 days,[4] but this duration is often insufficient to correct any contraindication to anticoagulation. The optimal retrieval interval remains controversial; the consensus is to retrieve the filter once its utility is exhausted.[5,6] The mean retrieval interval has been reported to be 9 to 16 (range, 3-48) days.[7-10] In our department, filter placement is considered permanent after 28 days, although late retrieval requests can be considered on a case-by-case basis. This study aimed to identify predictors of successful retrieval of IVC filter by comparing patients with and without a retrieval request.

METHODS

This study was approved by the ethics committee of the New Territories West Cluster and conducted in compliance with Declaration of Helsinki. Medical records of consecutive patients who underwent insertion / retrieval of the IVC Cordis OptEase retrievable filter via the femoral route between January 2008 and December 2014 at a regional hospital in Hong Kong were reviewed.

Factors relevant to filter retrieval were included: patient age, history of malignancy, radiological evidence of pulmonary embolism and thrombosis distal to the inferior vena cava, post-insertion symptomatic pulmonary embolism, hospital stay, scheduled anticoagulation therapy on discharge, prophylactic filter insertion prior to surgery, and contraindication to anticoagulation.[11] The two groups were compared using the Chi-squared test or Fisher's exact test to identify factors associated with filter retrieval. Predictors for filter retrieval were identified using binary logistic regression. A p value of <0.05 was considered statistically significant.

RESULTS

64 male and 93 female patients aged 15 to 94 (mean, 66.7) years were divided into those with (n = 37) or without (n = 120) a retrieval request. The filter retrieval request rate was 23.6%. Patients with a retrieval request were younger (59.0 vs. 69.1 years, p < 0.001) and had a lower 30-day mortality rate (0% vs. 17.5%, p = 0.004) [Table 1]. No patient had filter-insertion complication or died. Post-insertion symptomatic pulmonary embolism occurred in six (3.8%) patients, comparable with other studies.[6,10,11]

Compared with patients without a retrieval request, those with a retrieval request were more likely to

be aged <70 years (73.0% vs. 44.2%, p = 0.002), be scheduled for anticoagulation therapy on discharge (45.9% vs. 1.7%, p < 0.001), and have prophylactic filter insertion for surgery or high-risk patients (37.8% vs. 7.5%, p < 0.001), as well as less likely to have a history of malignancy (16.2% vs. 40.0%, p = 0.008) or any contraindication to anticoagulation therapy (70.3% vs. 92.5%, p = 0.001) [Table 2]. In addition, patients with a retrieval request were more likely to have contraindication to anticoagulation owing to postoperation within 2 weeks (35.1% vs. 19.2%, p = 0.043) and less likely to have contraindication to anticoagulation owing to intracranial haemorrhage (21.6% vs. 40.8%, p = 0.034) [Table 2].

Using binary logistic regression, predictors for filter retrieval were patient age of <70 years (odds ratio [OR] = 3.55, p = 0.033), no history of malignancy (OR = 0.15, p = 0.010), scheduled for anticoagulation therapy on discharge (OR = 63.08, p < 0.001), prophylactic filter insertion for surgery or high-risk patients (OR = 14.57, p < 0.001), and contraindication to anticoagulation owing to postoperation within 2 weeks (OR = 6.19, p = 0.004) [Table 3].

Of 37 patients with a retrieval request, eight had persistent deep vein thrombosis and retrieval was aborted, six underwent venous puncture without attempting retrieval in view of persistent thrombus

Table 1. Demographics of patients with or without a retrieval request.

Demographic	Total (n=157)	Patients with a retrieval request (n=37)	Patients without a retrieval request (n=120)	p Value
Mean (range) age (years)	66.7 (15-94)	59.0 (32-81)	69.1 (15-94)	<0.001
No. of male : female	64 : 93	16 : 21	48 : 72	0.726
Mean (range) hospital stay (days)	53.4 (3-371)	53.4 (3-143)	53.4 (3-371)	0.999
30-day mortality (% of patients)	13.4	0	17.5	0.004

Table 2. Factors relevant to inferior vena cava filter retrieval.

Factor	No. (%) of patients		
	Patients with a retrieval request (n=37)	Patients without a retrieval request (n=120)	p Value
Patient age of <70 years	27 (73.0)	53 (44.2)	0.002
History of malignancy	6 (16.2)	48 (40.0)	0.008
Pulmonary embolism	6 (16.2)	36 (30.0)	0.098
Thrombus distal to inferior vena cava	34 (91.9)	114 (95.0)	0.441
Post-insertion symptomatic pulmonary embolism	2 (5.41)	4 (3.33)	0.627
Hospital stay ≤30 days	11 (29.7)	49 (40.8)	0.224
Scheduled for anticoagulation therapy on discharge	17 (45.9)	2 (1.7)	<0.001
Prophylactic filter insertion for surgery or high-risk patients	14 (37.8)	9 (7.5)	<0.001
Contraindication to anticoagulation	26 (70.3)	111 (92.5)	0.001
Postoperation within 2 weeks	13 (35.1)	23 (19.2)	0.043
Intracranial haemorrhage	8 (21.6)	49 (40.8)	0.034
Other bleeding tendency (haematuria or gastrointestinal bleeding)	10 (27.0)	46 (38.3)	0.209

Table 3. Predictors for inferior vena cava filter retrieval.

Predictor	Odds ratio (95% confidential interval)	p Value
Patient age of <70 years	3.55 (1.11-11.38)	0.033
History of malignancy	0.15 (0.03-0.64)	0.010
Scheduled for anticoagulation therapy on discharge	63.08 (10.30-386.23)	<0.001
Prophylactic filter insertion for surgery or high-risk patients	14.57 (3.35-63.38)	<0.001
Contraindication to anticoagulation owing to postoperation within 2 weeks	6.19 (1.77-21.71)	0.004
Intracranial haemorrhage	1.33 (0.36-4.94)	0.666

Table 4. Successful versus failed retrieval of inferior vena cava filter.

Variable	Successful retrieval (n=17)	Failed retrieval (n=6)	p Value
Mean (range) retrieval interval (days)	27.2 (12-68)	77.7 (26-218)	0.014
Mean (range) diameter of inferior vena cava (cm)	1.8 (1.6-2.1)	1.9 (1.6-2.4)	0.161
No. (%) of patients aged <70 years	11 (64.7)	6 (100)	0.144
No. of male : female	2 : 15	1 : 5	1.000

Table 5. Retrieval success rates for different interval cutoffs.

Retrieval interval (days)	Successful retrieval within interval	Successful retrieval after interval	p Value
12	1/1 (100%)	16/22 (72.7%)	1.000
16	5/5 (100%)	12/18 (66.7%)	0.272
23	10/10 (100%)	7/13 (53.8%)	0.019
28	12/14 (85.7%)	5/9 (55.6%)	0.069

during venography, and the remaining 23 attempted retrieval with 17 being successful (one attempted twice in 4 days). The reasons for retrieval failure were adhesion of the filter due to epithelisation (n = 4) and excessive filter tilting (n = 2). There was no retrieval-related complication. Compared with patients with failed retrieval, those with successful retrieval had a shorter mean retrieval interval (27.2 vs. 77.7 days, p = 0.014, Table 4). To determine the optimal retrieval interval, the success rates at different interval cutoffs of 12 days,[4] 16 days,[7] 23 days (median of our patients), and 28 days (maximum allowed in our department) were compared using the Fisher's exact test. The success rate was higher when retrieval was within 23 days of insertion compared with a longer time (100% vs. 53.8%, p = 0.019, Table 5).

DISCUSSION

The retrieval success rate of our patients was 73.9%, which is lower than the 85% to 100% reported in other studies.[7-9] This could be due to a longer retrieval interval of 28 days. The buddy wire retrieval technique increases the success rate by realigning the filter's hooklet to the course of the vena cava and / or straightening the vena cava and the filter.[12] Percutaneous repositioning of the filter via the internal jugular approach can prolong the retrieval interval and achieve a high retrieval success rate.[3,13]

The retrieval request rate of our patients was 23.6%, which is lower than the 60% in a Canadian study.[11] This could be due to poorer health of our patients, as evidenced by the higher 30-day mortality in older patients. The retrieval request rate can be increased by implementing the retrieval protocol and sending reminders to radiologists.[14] In patients with an expected long retrieval interval, the use of an IVC filter with longer retrieval interval should be considered.

The mean IVC diameter of our patients was slightly smaller than that of Canadian patients (1.82 vs. 2.01 cm).[15] Nonetheless, the IVC diameter did not affect the retrieval success rate in our study. The two patients in whom retrieval failed due to tilting had a relatively larger IVC diameter of 2.1 and 2.4 cm.

Limitations of our study were the small sample size and possible incomplete documentation of records.

CONCLUSION

Predictors for filter retrieval were patient age of <70 years, no history of malignancy, scheduled for anticoagulation therapy on discharge, prophylactic filter insertion for surgery or high-risk patients, and contraindication to anticoagulation owing to postoperation within 2 weeks. A shorter retrieval interval was associated with successful retrieval.

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