



doi:10.7659/j.issn.1005-6947.2020.12.008  
http://dx.doi.org/10.7659/j.issn.1005-6947.2020.12.008  
Chinese Journal of General Surgery, 2020, 29(12):1468-1474.

· 临床研究 ·

## 腹腔镜下腔静脉滤器取出术安全性与可行性分析

王海东<sup>1</sup>, 刘建龙<sup>2</sup>, 朱晓斐<sup>1</sup>, 王海<sup>1</sup>, 李贵忠<sup>1</sup>, 周宁<sup>1</sup>, 贾伟<sup>2</sup>, 蒋鹏<sup>2</sup>, 满立波<sup>1</sup>

(北京积水潭医院 1. 泌尿外科 2. 血管外科, 北京 100096)

### 摘要

**背景与目的:** 笔者所在医院自2016年率先在国内开展腹腔镜下腔静脉滤器取出术以来, 已进行了多例该项手术。本文通过分析10例行该手术患者的临床资料, 总结两种腹腔镜下腔静脉滤器取出的手术途径(经腹腔途径、经腹膜后途径)的手术经验, 为开展及推广该手术提供参考。

**方法:** 回顾性分析2016年12月—2018年11月10例行腹腔镜下腔静脉滤器取出术的患者临床资料。其中男7例, 女3例; 年龄24~66岁, 平均(47±12.5)岁; 经CT分型: 滤器头端位于肾静脉水平以上1例, 位于肾静脉水平4例, 位于肾静脉水平以下5例; 滤器头端贴近下腔静脉前壁或前侧壁者5例, 贴近后外侧壁者4例, 位于下腔静脉腔内者1例。9例患者置入Cook Celect滤器, 1例患者置入Denali滤器。所有滤器均为可回收滤器。患者均在当地医院置入, 因髂静脉及下肢静脉血栓形成而预防性置入滤器7例, 因肋骨及骨盆多发骨折而预防性置入滤器1例, 因下肢静脉血栓致肺栓塞而置入滤器2例, 患者既往均在当地医院腔内取滤器失败次数1~3次失败后转入我院。10例患者均行下腔静脉滤器取出术, 包括经腹腔途径6例, 经腹膜后途径4例。手术通常放置3~4个Trocar, 游离下腔静脉, 根据CT检查, 找到滤器头端的具体位置, 纵行切开下腔静脉, 取出滤器。术后注意观察引流情况, 24h经腹腔途径引流量50mL以下, 经腹膜后途径引流20mL以下即可拔出引流管。根据引流情况, 术后24~48h皮下注射低分子量肝素钠注射液, 防止下肢深静脉血栓形成。患者第2天开始进流质饮食, 并逐渐过渡至普通饮食, 鼓励患者适度下床活动。

**结果:** 10例患者中9例腹腔镜下腔静脉滤器取出成功, 1例未成功。下腔静脉阻断1例, 阻断时间20min, 其余未阻断。手术时间150~420min, 平均(253.5±86.7)min; 术中出血量10~500mL, 平均(67.0±152.6)mL; 9例出血量较少(10~50mL), 未输血, 1例患者出血500mL, 输悬浮红细胞4单位。住院时间7~15d, 平均(12.3±2.4)d。所有患者术后均未出现相关并发症。术后随访至今, 所有患者均未见血栓复发。

**结论:** 腹腔镜滤器取出手术难度大、技术复杂, 充分的术前准备, 熟练的手术技巧可以提高手术的安全性和成功率。对于每位患者, 都要仔细观察CT片, 根据滤器头端的不同位置, 采用不同的手术方法, 才能提高成功率。

### 关键词

腔静脉滤器; 滤器取出术; 腹腔镜

中图分类号: R654.3

## Safety and feasibility of laparoscopic retrieval of inferior vena cava filters

WANG Haidong<sup>1</sup>, LIU Jianlong<sup>2</sup>, ZHU Xiaofei<sup>1</sup>, WANG Hai<sup>1</sup>, LI Guizhong<sup>1</sup>, ZHOU Ning<sup>1</sup>, JIA Wei<sup>2</sup>,  
JIANG Peng<sup>2</sup>, MAN Libo<sup>1</sup>

(1. Department of Urology 2. Department of Vascular Surgery, Beijing Jishuitan Hospital, Beijing 100096, China)

收稿日期: 2019-12-25; 修订日期: 2020-06-24。

作者简介: 王海东, 北京积水潭医院主任医师, 主要从事腹腔镜手术方面的研究。

通信作者: 刘建龙, Email: lj\_lhy88@sina.com

**Abstract**

**Background and Aims:** Since the authors' hospital initially conducted laparoscopic retrieval of inferior vena cava (IVC) filters in 2016, a number of cases of this operation have been performed. The aim of this article is to summarize the surgical experience of two approaches (transperitoneal approach and retroperitoneal approach) of laparoscopic retrieval of IVC filters by analyzing the clinical data of 10 patients undergoing this operation, so as to provide a reference for its popularization and promotion.

**Methods:** The clinical data of 10 patients undergoing laparoscopic retrieval of IVC filters during December 2016 and November 2018 were retrospectively analyzed. Among these patients, 7 were males and 3 were females, aged from 24 to 66 years, with an average age of (47±12.5) years. CT findings were that the head of the IVC filter dislocated above the renal vein in 1 case, at the renal vein level in 4 cases, and inferior to renal vein in 5 cases; the head of the IVC filter located close to the anterior or anterior lateral wall of the IVC in 5 cases, posterior lateral wall of the IVC in 4 cases, and in the lumen of the IVC in 1 case. All IVC filters were retrievable filters, including Celect filter used in 9 cases, and Denali filter in 1 case. All filters were inserted in others hospital. Seven patients underwent prophylactic placement of IVC filters due to iliac and lower extremity venous thrombosis, one case underwent prophylactic placement of IVC filters due to multiple traumatic rib and pelvis fractures, and IVC filter placement for 2 patients was in the setting of acute pulmonary embolism due to deep venous thrombosis. All patients were transferred to our hospital after previous endovascular retrieval failure for 1-3 times in other hospitals. All the 10 patients underwent laparoscopic IVC filter retrieval through transperitoneal approach in 6 cases and through retroperitoneal approach in 4 cases. Using a standard 3-port or 4-port technique, the IVC was dissected, the location of filter hook was found according to CT scan, a longitudinal incision in the wall of the IVC over the filter hook was made, and the filter was then retrieved. After operation, the volume and color of drainage were checked carefully. If the 24-h drainage volume was less than 50 mL for transperitoneal approach or less than 20 mL for retroperitoneal approach, the tube could be removed. Patients were given subcutaneous heparin 24 to 48 h after operation depending on surgical drainage for prevention of lower extremity deep venous thrombosis. Patients were started on a liquid diet the following day after operation, then slowly return to a normal diet and were encouraged to ambulate as much as tolerable.

**Results:** IVC filter retrieval was successfully performed in 9 cases, and failed in one case. IVC occlusion was performed in one patient for 20 min, and was not required in other patients. the operative time was 150–420 min, with an average time of (253.5±86.7) min, the blood loss was 10–500 mL, with an average of (67.0±152.6) mL, 9 patients did not need a blood transfusion small for amounts of blood loss (10–50 mL), and one patient blood loss of 500 mL was transfused with 4 U of red blood cell suspension. The length of hospital stay was 7-15 d, with an average of (12.3±2.4) d. No operation-related complications occurred in all patients. No deep venous thrombosis recurred during the follow-up period.

**Conclusion:** Laparoscopic retrieval of IVC filters is a complex and technically demanding operation. Careful preoperative preparation, rich operative experiences and proficient skills might improve the safety and success rate of the operation. According to CT scan and hook location of each patient, choosing different laparoscopic retrieval technique is important for improving the success rates.

**Key words**

Vena Cava Filters; Filter Retrieval; Laparoscopes

**CLC number:** R654.3

肺栓塞发病急, 病死率高, 下肢深静脉血栓脱落是导致肺栓塞的最主要原因, 经皮置入下腔静脉滤器, 在保持下腔静脉血流通畅情况下, 可以有效拦截脱落的血栓, 预防肺栓塞的发生<sup>[1]</sup>。1967年滤器首先应用于临床<sup>[2]</sup>, 经过不断改进, 滤器的品种逐渐增多, 滤过效果明显提高, 大大

降低了肺动脉栓塞的发生率及病死率<sup>[3-4]</sup>, 下腔静脉滤器可分为: 临时性滤器、永久性滤器和可回收滤器。随着科技的发展和理念的更新, 可回收滤器使用率逐年升高。美国食药监局(FDA)警告: 在患者肺栓塞的风险过去后, 就应该考虑及时取出滤器<sup>[5]</sup>。目前常规的滤器取出方式是经股静

脉或颈静脉穿刺入路行腔内回收滤器。但其回收率并不理想,有文献<sup>[6-7]</sup>报道,回收率仅为10.1%~45%。如果腔内滤器回收失败,大多选择放弃回收,由于滤器相关并发症而必须要取出滤器的患者,目前常规采用开放手术,但开放手术的创伤较大,患者恢复慢,因此开放手术报道很少。通过腹腔镜行下腔静脉滤器取出的报道罕见<sup>[8]</sup>,2016年我院率先在国内开展了腹腔镜下腔静脉取滤器手术<sup>[9]</sup>,至此我院已完成10例腹腔镜下腔静脉滤器取出术。现将经验教训进行总结,以便手术的开展及推广,报告如下。

## 1 资料与方法

### 1.1 一般资料

2016年12月—2018年11月,我院共完成10例腹腔镜下滤器取出术,其中男7例,女3例;年龄

24~66岁,平均(47±12.5)岁,经CT确诊并分型:滤器头端位于肾静脉水平以上1例,位于肾静脉水平4例,位于肾静脉水平以下5例;滤器头端贴近下腔静脉前壁或前侧壁者5例(图1A),位于下腔静脉腔内者1例(图1B),贴近后外侧壁者4例(图1C)。所有置入的滤器均为可回收滤器。患者均在当地医院置入,滤器类型:9例患者体内置入Celect滤器(美国Cook医疗公司),1例患者体内置入Denali滤器(美国Bard医疗公司)。因髂静脉及下肢静脉血栓形成而预防性置入滤器7例,因多发肋骨及骨盆骨折而预防性置入滤器1例,因下肢静脉血栓致肺栓塞而置入滤器2例(其中1例置入滤器2个,于当地医院腔内仅取出1个)。患者既往腔内取滤器失败次数1~3次,滤器存留体内时间2~12个月。患者均在当地医院取滤器失败后转入我院。

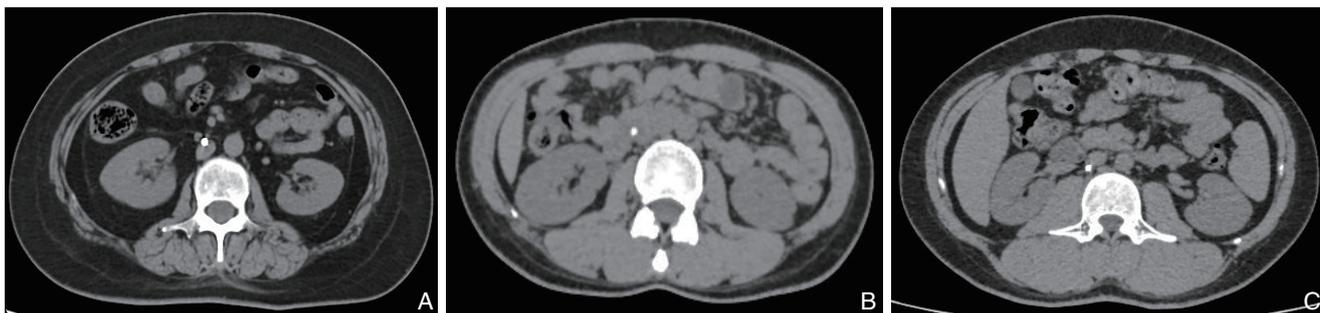


图1 患者CT图像 A: 滤器头贴近下腔静脉前壁; B: 滤器头位于下腔静脉内; C: 滤器头端向下腔静脉后外侧壁突出  
Figure 1 CT images of the patients A: The head of filter close to the anterior wall of the IVC; B: The head of filter located in IVC lumen; C: The head of filter close to the posterior lateral wall of the IVC

### 1.2 手术方法

经腹腔途径:采用全身麻醉,左侧卧位,体型瘦者于脐放置第1个10 mm Trocar,肥胖者于脐外侧4~5 cm放置第1个Trocar,然后于该Trocar头侧、脚侧及右侧约6 cm放置10 mm, 10 mm, 10 mm Trocar。于右结肠旁沟外侧切开侧腹膜,将升结肠和十二指肠向内推,切开肾周筋膜,显露肾静脉及下腔静脉,游离下腔静脉。如果滤器回收钩突出于下腔静脉壁,可以不必阻断下腔静脉的血流,直接取滤器,预先于滤器钩上下约3 mm处,用5-0 Prolene线各缝合1针,用电钩切开滤器钩处静脉壁,显露滤器钩,通过Trocar置入鹅颈抓捕器,用抓捕环套于滤器钩上(图2A),然后收紧抓捕环,将滤器拉入回收鞘内,收紧缝合

线并打结止血。如果需要阻断下腔静脉,那就必须彻底游离下腔静脉及其分支,向上游离至滤器头端,向下游离至滤器的尾端,然后用Hemlok血管夹(美国泰利福公司)夹闭并切断生殖静脉和腰静脉。于滤器的头端和尾端,分别用血管阻断带穿过下腔静脉,最好绕两圈。取长约1.5~2 cm 20 F引流管,将血管阻断带穿过该段引流管(图2B)。依次阻断下腔静脉远端以及近端。于IVC滤器回收钩处,纵行切开下腔静脉,长度约3 cm,将滤器回收钩分离出来。置入抓捕器,用抓捕环套住回收钩,将滤器拉入至回收鞘中(图2C)。用肝素盐水冲洗下腔静脉管腔,清除其内残存的血块,以防栓塞。用5-0 Prolene线纵行连续缝合下腔静脉切口,然后松开下腔静脉近端血管阻断

带,若无出血,继续松开远端血管阻断带。

采用腹膜后途径,患者取左侧卧位,抬高腰桥,增加肋弓与髂嵴间的距离,分别于右侧肋缘下腋后线、腋前线、腋中线髂嵴上2 cm,置入10、10、10 mm Trocar,必要时可在髂前上棘上3 cm加1个5 mm Trocar。于肾蒂处找到肾动脉和肾

静脉,根据CT所示滤器头的位置,沿下腔静脉向上下充分游离,滤器钩处下腔静脉往往与周围组织粘连,仔细分离后,可见滤器回收钩,用电钩切开回收钩处的下腔静脉壁,将抓捕环套在滤器回收钩上(图2D),将滤器回收,同样用Prolene线缝合腔静脉切口,以防出血。

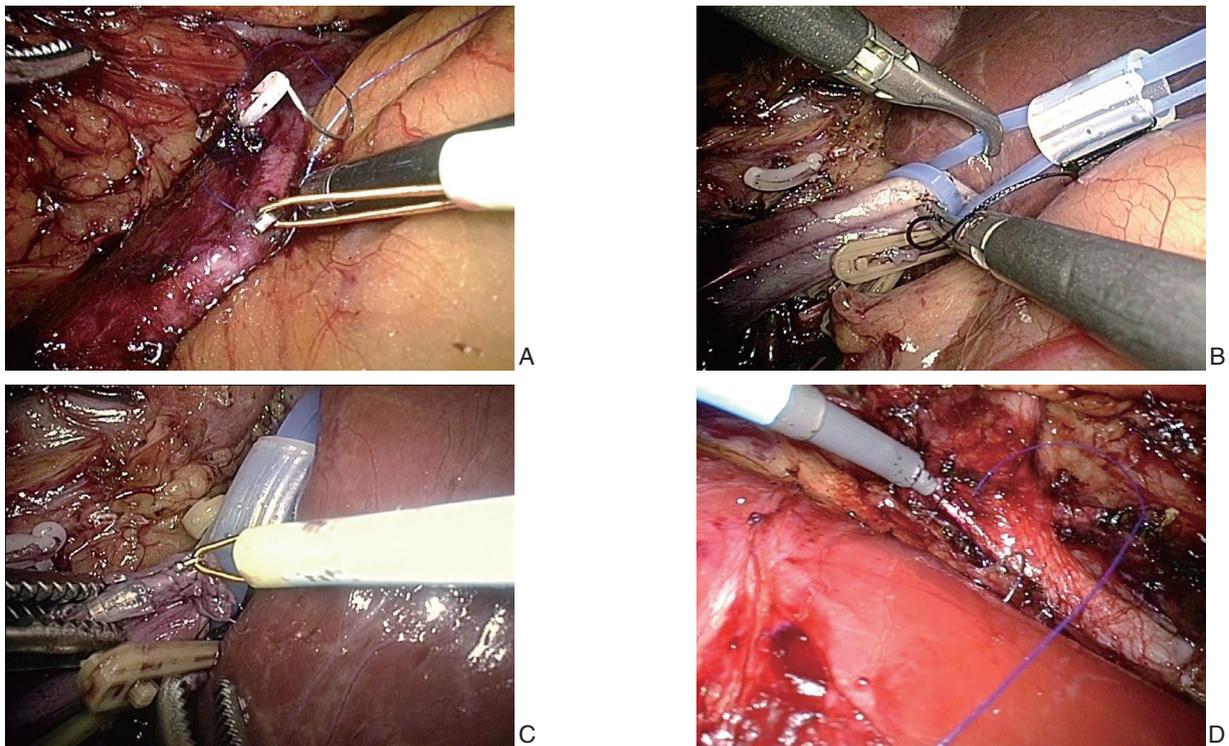


图2 术中相关照片 A: 经腹腔途径,分离出滤器钩,使用抓捕器,回收滤器; B: 下腔静脉阻断方法; C: 阻断并切下腔静脉后,将抓捕器套圈套在滤器钩上,回收滤器; D: 经腹膜后途径,抓捕环套住滤器回收钩,回收滤器至鞘内

**Figure 2 Intraoperative images** A: Isolating the IVC filter hook and removing the IVC filter by a snare through transperitoneal approach; B: Method for IVC occlusion; C: Filter retrieval by using a snare after IVC blockage and incision; D: Filter hook captured by a snare device, and retrieved into the sheath through retroperitoneal approach

### 1.3 术后处理及随访

术后注意观察引流情况,24 h经腹腔途径引流量50 mL以下,经腹膜后途径引流20 mL以下即可拔出引流管,术后24~48 h根据引流情况,给予皮下注射低分子量肝素钠注射液,0.4 mL/12 h,持续约1周。患者第2天开始进流质饮食,并逐渐过渡至普通饮食,鼓励患者适度下床活动。建议患者每3个月复诊。

## 2 结果

### 2.1 手术结果

10例患者中采用经腹腔途径6例,经腹膜后途径4例。9例腹腔镜下腔静脉滤器取出成功,

1例因下腔静脉血栓机化,机化的血栓包裹滤器,未能取出。下腔静脉未阻断9例,阻断1例,阻断时间20 min。手术时间150~420 min,平均 $(253.5 \pm 86.7)$  min,术中出血量10~500 mL,平均 $(67.0 \pm 152.6)$  mL。1例出血500 mL,输悬浮红细胞4单位,其余9例出血量10~50 mL。

### 2.2 术后情况

住院时间7~15 d,平均 $(12.3 \pm 2.4)$  d。所有患者术后均未出现相关并发症。患者出院后口服拜瑞妥,20 mg/d,持续3个月(其中1例未取出滤器的患者,继续长期服用)。术后随访至今,所有患者经彩超复查均未见下肢深静脉血栓复发,未见下腔静脉狭窄。

### 3 讨论

尽管放置下腔静脉滤器能够降低肺栓塞的发病风险,但同时也增加了与滤器相关的并发症,如下肢深静脉血栓复发的风险升高,还可出现以下并发症:滤器移位于心脏、滤器倾斜、滤器变形、十二指肠损伤、输尿管损伤、滤器断裂移位、滤器支脚穿透血管壁、腹膜后血肿等等<sup>[10-16]</sup>。随着科技的进步和滤器的改进,可回收滤器使用逐渐增多,成为目前的主流,如果不再需要滤器保护,就应该及早取出滤器。由于滤器严重倾斜移位、回收钩紧贴下腔静脉壁或被组织包裹等因素<sup>[17]</sup>,有些滤器难以取出,本组10例患者均存在着滤器倾斜,滤器头被纤维组织包裹。对于这种情况,有学者<sup>[18]</sup>认为不必取出。亦有学者主张尽量将滤器取出,因为滤器毕竟为异物,如果不取,患者需要终生抗凝治疗,因此生活质量受到严重影响,并承担相当的负担和出血的风险。另外随着滤器存在体内时间的延长,并发症会逐渐增多,甚至危及患者的生命<sup>[19-21]</sup>。

对于使用常规的鹅颈抓捕器无法回收的滤器,国内外文献报道了多种特殊技术,例如:支气管钳法、激光辅助法、导丝成袢法、胃镜活检钳辅助法、猪尾导管搅拌法、双导丝技术,LOOP导丝辅助技术、球囊辅助技术等等<sup>[22-28]</sup>,尽管有些滤器得以成功回收,但仍有一部分滤器未能取出<sup>[29]</sup>,在使用这些技术的同时,并发症的几率也明显升高,如:下腔静脉损伤,动静脉瘘,腹膜后血肿等等<sup>[30-34]</sup>。如果腔内不能取出滤器,目前通常采用开放手术,由于开放手术创伤大,患者不容易接受。手术风险大,医师不愿意开展,因此,国内外报道很少<sup>[35-36]</sup>。腹腔镜下取滤器手术难度大,积水潭医院开展多学科诊疗模式,共同攻关,在国内成功开展该手术<sup>[37]</sup>。腹腔镜手术创伤小,技术要求高。如果下腔静脉损伤致大出血,腹腔镜下缝合较开放手术难度大。有利方面是:在气腹压的作用下,出血较开放手术容易控制。

腹腔镜手术的难度与滤器头的位置有关,滤器头贴近下腔静脉前壁或前侧壁者,宜采用经腹腔途径,游离出下腔静脉后,有些患者可见明显突出的滤器头,而有些患者局部粘连较重,可能与腔内取滤器致局部出血有关,需要仔细分离才能找到滤器钩,用血管钳按压下腔静脉壁,有助于辨别滤器头的位置。

滤器头贴近下腔静脉后外侧壁者,宜采用经腹膜后途径。如果采用经腹途径,则需从前面掀开下腔静脉后壁,则手术操作很困难。笔者率先开展此类手术,经查国内外未见报道<sup>[37]</sup>。对于适合经腹膜后途径的患者,手术更快捷,更安全,因不干扰肠道,肠功能恢复快。

对于滤器头不贴近静脉壁者,通常采用阻断下腔静脉取滤器。因置入滤器的患者,下腔静脉周围粘连重,阻断并切开下腔静脉,有以下手术风险:(1)因部分滤器脚已戳破静脉壁,分离时下腔静脉壁容易破裂致大出血;(2)CO<sub>2</sub>进入下腔静脉致气体栓塞;(3)因腰静脉很短,处理时血管夹容易滑脱致大出血。有1例患者在分离下腔静脉时,因粘连重,致下腔静脉损伤大出血,用5-0 Prolene线缝合止血。如果腹腔镜缝合困难,应立即中转为开放手术。

另外有1例患者,采用经腹膜后途径腹腔镜手术,虽经反复寻找均未发现滤器头,遂改为开放手术,因下腔静脉内血栓机化,无法触及滤器头,下腔静脉与周围组织粘连很重,无法彻底游离并阻断,如果不阻断的情况下强行切开下腔静脉,大出血可能性大,机化的血栓碎块脱落可能致肺栓塞,考虑到患者生命安全最为重要,故终止手术。

综上所述,腹腔镜下取出下腔静脉滤器是一项复杂且技术要求高的手术,采用何种手术方式要根据具体情况,充分的术前准备,熟练的手术技巧可以提高手术的安全性和成功率。因腹腔镜技术在血管外科应用不多,而在泌尿外科中广泛应用,特别是腹膜后腹腔镜技术,只有泌尿外科使用。因此取滤器需要两个科室密切合作才能顺利完成,在2年内完成取滤器手术10例,手术量不大,不过目前国内外文献尚未见更多例数的报道,因该手术处于摸索阶段,安全起见,只能谨慎开展。随着经验的积累、同道们的参与、手术的普及,相信手术会越来越多、越来越快、越来越安全,让更多的患者收益。

### 参考文献

- [1] 刘建龙,张蕴鑫.急性深静脉血栓诊疗新理念[J].中国普通外科杂志,2018,27(12):1495-1504. doi: 10.7659/j.issn.1005-6947.2018.12.001.  
Liu JL, Zhang YX. New concepts in diagnosis and treatment

- of acute deep vein thrombosis[J]. Chinese Journal of General Surgery, 2018, 27(12):1495–1504. doi:10.7659/j.issn.1005-6947.2018.12.001.
- [2] Mobin-Uddin K, Utley JR, Bryant LR. The inferior vena cava umbrella filter[J]. Prog Cardiovasc Dis, 1975, 17(5):391–399. doi:10.1016/s0033-0620(75)80014-4.
- [3] Ho KM, Rao S, Honeybul S, et al. A Multicenter Trial of Vena Cava Filters in Severely Injured Patients[J]. N Engl J Med, 2019, 381(4):328–337. doi:10.1056/NEJMoa1806515.
- [4] Stein PD, Matta F, Hughes MJ. Inferior Vena Cava Filters in Stable Patients With Pulmonary Embolism and Heart Failure[J]. Am J Cardiol, 2019, 124(2):292–295. doi:10.1016/j.amjcard.2019.04.024.
- [5] Daye D, Walker TG. Novel and Advanced Techniques for Complex IVC Filter Retrieval[J]. Curr Treat Options Cardiovasc Med, 2017, 19(4):28. doi:10.1007/s11936-017-0529-3.
- [6] Tashbayev A, Belenky A, Litvin S, et al. Retrievable Inferior Vena Cava Filters: Indications, Indwelling Time, Removal, Success and Complication Rates[J]. Isr Med Assoc J, 2016, 18(2):104–107.
- [7] Winters JP, Morris CS, Holmes CE, et al. A multidisciplinary quality improvement program increases the inferior vena cava filter retrieval rate[J]. Vasc Med, 2017, 22(1):51–56. doi:10.1177/1358863X16676658.
- [8] Benrashid E, Adkar SS, Bennett KM, et al. Total laparoscopic retrieval of inferior vena cava filter[J]. SAGE Open Med Case Rep, 2015, 3:2050313X15597356. doi:10.1177/2050313X15597356.
- [9] Wang HD, Liu JL, Jia W, et al. Laparoscopic Retrieval of a Tilted Inferior Vena Cava Filter[J]. Chin Med J (Engl), 2018, 131(7):875–876. doi:10.4103/0366-6999.228246.
- [10] Ayad MT, Gillespie DL. Long-term complications of inferior vena cava filters[J]. J Vasc Surg Venous Lymphat Disord, 2019, 7(1):139–144. doi:10.1016/j.jvsv.2018.01.022.
- [11] Nas H, Bowe D, Soubani AO. An unusual complication after placement of an inferior vena cava filter via right internal jugular vein access[J]. J Vasc Access, 2019, 20(1):102–104. doi:10.1177/1129729818777967.
- [12] Piercecchi CW, Vasquez JC, Kaplan SJ, et al. Cardiac Perforation by Migrated Fractured Strut of Inferior Vena Cava Filter Mimicking Acute Coronary Syndrome[J]. Heart Lung Circ, 2017, 26(2):e11–13. doi:10.1016/j.hlc.2016.07.017.
- [13] Magee GA, Bartley MG, Plotkin A, et al. Inferior Vena Cava Filter Resulting in Perforation and Massive Retroperitoneal Hematoma Presenting as Acute Onset of Lower Extremity Weakness[J]. Ann Vasc Surg, 2019, 57:48.e13–48.e17. doi:10.1016/j.avsg.2018.09.002.
- [14] Yost MD, Klaas JP. Paradoxical embolism in the setting of inferior vena cava filter removal[J]. Vasc Med, 2017, 22(5):440–441. doi:10.1177/1358863X17714885.
- [15] Park HO, Choi JY, Jang IS, et al. Perforation of inferior vena cava and duodenum by strut of inferior vena cava filter: A case report[J]. Medicine (Baltimore), 2019, 98(47):e17835. doi:10.1097/MD.0000000000017835.
- [16] Abdel-Aal AK, Ezzeldin IB, Moustafa AS, et al. Inferior vena cava filter penetration following Whipple surgical procedure causing ureteral injury[J]. J Radiol Case Rep, 2015, 9(12):37–43. doi:10.3941/jrcr.v9i12.2508.
- [17] Morrow KL, Bena J, Lyden SP, et al. Factors predicting failure of retrieval of inferior vena cava filters[J]. J Vasc Surg Venous Lymphat Disord, 2020, 8(1):44–52. doi:10.1016/j.jvsv.2019.07.010.
- [18] Pratt WB, Sandhu HK, Leake SS, et al. Asymptomatic patients with unsuccessful percutaneous inferior vena cava filter retrieval rarely develop complications despite strut penetrations through the caval wall[J]. J Vasc Surg Venous Lymphat Disord, 2020, 8(1):54–61. doi:10.1016/j.jvsv.2019.03.017.
- [19] Parsons B, Polewski PJ, Smith AL, et al. Does Timing of Inferior Vena Cava Filter Retrieval Planning Impact Retrieval Rates? A Comparison of Planning Before or After Hospital Discharge[J]. WMJ, 2019, 118(1):30–34.
- [20] Gunn AJ, Ertel NW. Endovascular Retrieval of a Migrated TrapEase Inferior Vena Cava Filter From the Right Atrium: A Brief Report and Literature Review[J]. Vasc Endovascular Surg, 2018, 52(4):291–294. doi:10.1177/1538574418760104.
- [21] Jackson BS, Sepula M, Marx JT, et al. Inferior Vena Cava Filter Limb Fracture with Embolization to the Right Ventricle[J]. J Emerg Med, 2017, 53(2):248–251. doi:10.1016/j.jemermed.2017.01.047.
- [22] 孙振阳, 芮清峰. 复杂可回收下腔静脉滤器回收的方法和技巧: 附29例分析[J]. 中国普通外科杂志, 2017, 26(6):752–757. doi:10.3978/j.issn.1005-6947.2017.06.013.
- Sun ZY, Rui QF. Methods and technical skills for complicated filter retrieval of retrievable inferior vena cava filter: an analysis of 29 cases[J]. Chinese Journal of General Surgery, 2017, 26(6):752–757. doi:10.3978/j.issn.1005-6947.2017.06.013.
- [23] Chen JX, Montgomery J, McLennan G, et al. Endobronchial Forceps-Assisted and Excimer Laser-Assisted Inferior Vena Cava Filter Removal: The Data, Where We Are, and How It Is Done[J]. Tech Vasc Interv Radiol, 2018, 21(2):85–91. doi:10.1053/j.tvir.2018.03.004.
- [24] Tavri S, Patel IJ, Kavali P, et al. Endobronchial forceps-assisted complex retrieval of inferior vena cava filters[J]. J Vasc Surg Venous Lymphat Disord, 2019, 7(3):413–419. doi:10.1016/j.jvsv.2018.08.005.

- [25] Nakashima M, Kobayashi H, Takenouchi Y, et al. Successful cases of difficult inferior vena cava filter retrieval with the use of biopsy forceps: Biopsy forceps technique[J]. SAGE Open Med Case Rep, 2014, 2:2050313X14547610. doi:10.1177/2050313X14547610.
- [26] Owens CA, Bui JT, Grace Knuttinen M, et al. Difficult removal of retrievable IVC filters: a description of the "double-wire restraining" technique[J]. Cardiovasc Intervent Radiol, 2011, 34(Suppl 2):S218-223. doi:10.1007/s00270-010-9911-1.
- [27] 刘建龙, 张蕴鑫. 建立下腔静脉滤器应用新理念[J]. 中国普通外科杂志, 2017, 26(6):680-685. doi:10.3978/j.issn.1005-6947.2017.06.002.
- Liu JL, Zhang YX. Establishing a new concept in application of inferior vena cava filters[J]. Chinese Journal of General Surgery, 2017, 26(6):680-685. doi:10.3978/j.issn.1005-6947.2017.06.002.
- [28] Mohan PP, Richardson AJ, Salsamendi JT. Percutaneous Retrieval of IVC Filters With Struts Penetrating the Vertebral Body[J]. Vasc Endovascular Surg, 2018, 52(7):550-552. doi:10.1177/1538574418778921.
- [29] Su Q, Ding X, Dong Z, et al. A Modified Loop Snare Technique for Difficult Retrievals of Inferior Vena Cava Filter and Migrated Coil[J]. Int Heart J, 2019, 60(1):93-99. doi:10.1536/ihj.18-075.
- [30] Saeed H, Buxey K, Fitzgerald M. Caval wall injury secondary to inferior vena cava filter removal: a rare complication[J]. ANZ J Surg, 2018, 88(3):240-242. doi:10.1111/ans.14181.
- [31] DeSai C, Lamus D, Kumar G. Arteriovenous Fistula-A Rare Complication of IVC Filter Retrieval[J]. Vasc Endovascular Surg, 2019, 53(6):501-506. doi:10.1177/1538574419849998.
- [32] Marsala A, Hadduck T, Baril D, et al. Rupture of the Inferior Vena Cava during Filter Removal[J]. J Vasc Interv Radiol, 2018, 29(11):1618-1619. doi:10.1016/j.jvir.2018.05.010.
- [33] Malone CD, Shin DS, Ingraham CR. Arteriovenous Fistula and Retroperitoneal Hemorrhage after Removal of Caval Filter Near the Right Renal Artery[J]. J Vasc Interv Radiol, 2018, 29(11):1620-1622. doi:10.1016/j.jvir.2018.07.012.
- [34] Lee JT, Goh GS, Joseph T, et al. Prolonged balloon tamponade in the initial management of inferior vena cava injury following complicated filter retrieval, without the need for surgery[J]. J Med Imaging Radiat Oncol, 2018, 62(6):810-813. doi:10.1111/1754-9485.12758.
- [35] Kim KY, Byun SJ, So BJ. Surgical Removal of the Inferior Vena Cava Filter Using Minimal Cavotomy: A Case Report[J]. Vasc Specialist Int, 2019, 35(1):48-51. doi:10.5758/vsi.2019.35.1.48.
- [36] Rana MA, Głowiczki P, Kalra M, et al. Open surgical removal of retained and dislodged inferior vena cava filters[J]. J Vasc Surg Venous Lymphat Disord, 2015, 3(2):201-206. doi:10.1016/j.jvsv.2014.11.007.
- [37] 王海东, 刘建龙, 贾伟, 等. 腹腔镜下腔静脉滤器取出术三例[J]. 中华医学杂志, 2018, 98(48):3973-3975. doi:10.3760/cma.j.issn.0376-2491.2018.48.014.
- Wang HD, Liu JL, Jia W, et al. Laparoscopic retrieval of inferior vena cava filters in 3 cases[J]. National Medical Journal of China, 2018, 98(48):3973-3975. doi:10.3760/cma.j.issn.0376-2491.2018.48.014.

( 本文编辑 宋涛 )

本文引用格式: 王海东, 刘建龙, 朱晓斐, 等. 腹腔镜下腔静脉滤器取出术安全性与可行性分析[J]. 中国普通外科杂志, 2020, 29(12):1468-1474. doi:10.7659/j.issn.1005-6947.2020.12.008

Cite this article as: Wang HD, Liu JL, Zhu XF, et al. Safety and feasibility of laparoscopic retrieval of inferior vena cava filters[J]. Chin J Gen Surg, 2020, 29(12):1468-1474. doi:10.7659/j.issn.1005-6947.2020.12.008