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· 临床研究 ·

Interlock 可解脱弹簧圈在脾动脉瘤腔内治疗中的应用 *

张 省¹ 范 毓² 秦金保¹ 李维敏¹ 殷敏毅¹ 叶开创¹ 杨心蕊¹ 陆信武^{1Δ}

(1 上海交通大学医学院附属第九人民医院血管外科 上海 200011; 2 上海交通大学医学院附属第九人民医院放射科 上海 200011)

摘要 目的:探究 Interlock 可解脱弹簧圈在脾动脉瘤的腔内治疗中的应用价值。**方法:**回顾性分析 2016 年 2 月至 2019 年 2 月于本中心使用 Interlock 可解脱弹簧圈治疗的 36 例脾动脉瘤患者的临床资料, 包括 10 例男性, 26 例女性, 31 例真性动脉瘤, 5 例假性脾动脉瘤, 术前均行超声或 CTA 明确诊断。术中栓塞后, 立即血管造影以明确技术成功率。围手术期及术后 2 周、3 个月和 6 个月监测血常规、胰淀粉酶和主动脉 CTA, 观察并发症的发生情况。**结果:**6 例患者弹簧圈栓塞动脉瘤远端及瘤腔, 其余仅栓塞脾动脉瘤瘤腔。术中 DSA 血管造影提示即刻脾动脉瘤栓塞闭塞率为 97% 以上, 术中共用 128 枚 Interlock 弹簧圈, 其中 104 枚为钻石型, 24 枚为普通 2D 型。弹簧圈平均直径为 $6.3 \pm 4.2(2-12)$ mm, 平均长度为 $16 \pm 13.5(3-32)$ mm, 瘤体平均尺寸为 $40.6 \pm 12.5(15-70)$ mm。围手术期无并发症发生。平均随访 $10.0 \pm 3.2(6-15)$ 个月, 1 月后 2 例出现脾梗死, 7 例发生轻微腹痛及低热等症状, 所有病例均未见瘤腔再通和瘤体增大。**结论:**Interlock 可解脱弹簧圈可以安全有效地治疗脾动脉瘤, 但其远期疗效需长期随访观察。**关键词:**脾动脉瘤; Interlock 可解脱弹簧圈; 栓塞; 腔内治疗

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Application Value of Interlock Detachable Coils in the Endovascular Therapy for Splenic Artery Aneurysm*

ZHANG Xing¹, FAN Yu², QIN Jin-bao¹, LI Wei-min¹, YIN Min-yi¹, YE Kai-chuang¹, YANG Xin-rui¹, LU Xin-wu^{1Δ}

(1 Department of Vascular Surgery, Shanghai Ninth People's Hospital Affiliated to Shanghai JiaoTong University, School of Medicine, Shanghai, 200011, China; 2 Department of Radiology, Shanghai Ninth People's Hospital Affiliated to Shanghai JiaoTong University, School of Medicine, Shanghai, 200011, China)

ABSTRACT Objective: To investigate the application value of Interlock detachable coils for the endovascular treatment of splenic aneurysms. **Methods:** The clinical data of 36 patients with splenic aneurysms treated with Interlock detachable coils from February 2016 to February 2019 were retrospectively analyzed, including 10 cases of male, 26 cases of female, 31 cases of true aneurysms. 5 cases of pseudo splenic aneurysm were diagnosed by ultrasound or CTA preoperation. An angiogram was performed immediately after embolization to determine the technical success rate. The blood routine, pancreatic amylase and aortic CTA were monitored during the perioperative period and at 2 weeks, 3 months and 6 months after surgery to observe the incidence of complications. **Results:** 6 patients underwent embolization of the aneurysm at the proximal end and the tumor cavity, and the rest only embolized the spleen aneurysm tumor cavity. Intraoperative DSA angiography showed that the occlusion rate of the splenic aneurysm was higher than 97%. A total of 128 Interlock coils were used during the operation, of which 104 were diamond-shaped and 24 were ordinary 2D. The average diameter of the coils is $6.3 \pm 4.2(2-12)$ mm, the average length is $16 \pm 13.5(3-32)$ mm, and the average size of the tumor is $40.6 \pm 12.5(15-70)$ mm. No complications occurred during the perioperative period. The average follow-up was $10.0 \pm 3.2(6-15)$ months. After 1 month, 2 cases had spleen infarction, 7 cases had mild abdominal pain and low fever. In all cases, no tumor cavity recanalization and tumor enlargement were observed. **Conclusion:** Interlock can release the coils safely and effectively for the treatment of splenic aneurysms. It has a wide application prospect and its long-term efficacy needs long-term follow-up observation.

Key words: Splenic artery aneurysm; Interlock detachable coils; Embolization; Endovascular therapy**Chinese Library Classification(CLC):** R605; R654.4 **Document code:** A**Article ID:** 1673-6273(2020)11-2059-05

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上海交通大学医学院附属第九人民医院临床研究助力计划项目(JYLJ019)

作者简介: 张省(1993-0, 男, 博士研究生, 主要研究方向: 外周血管疾病, E-mail: 3117119013@sjtu.edu.cn

Δ 通讯作者: 陆信武, 男, 教授, 主任医师, 电话: 021-23271699, E-mail: luxinwu@shsmu.edu.cn

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前言

内脏动脉瘤(Visceral artery aneurysms, VAA)是一种罕见但危及生命的疾病,发病率为0.1%-2%^[1,2]。其中,脾动脉瘤(Splenic artery aneurysms, SAA) 占有内脏动脉瘤的60%,在腹腔内动脉瘤的发生率中仅次于主髂动脉瘤^[3]。脾动脉瘤的发病率为0.1%-10.4%,病变大部分位于脾动脉中远端,破裂率高达3%-20%^[4,5]。真性SAA多见于女性,并伴有多发性和门静脉高压,假性SAA则多见于胰腺炎^[6]。近年来,随着腔内技术及器械的飞速发展,腔内介入手术以其微创、简单、保留脾脏的优点逐渐取代了传统开放手术^[7]。在腔内手术常用的器械中,Interlock可解脱弹簧圈系统以其安全可控、快速精确释放且可术中多次回收的优点备受血管外科医生的青睐。我中心于2016年2月至2019年2月使用Interlock可解脱弹簧圈治疗36例脾动脉瘤并随访,现报道如下。

1 材料与方法

1.1 一般资料

采用回顾性横断面研究方法,整理并分析本中心从2016年2月至2019年2月使用Interlock可解脱弹簧圈系统治疗SAA的36例患者临床资料,包括性别、年龄、临床症状、真假性动脉瘤数量、SAA的位置及瘤体尺寸、术中使用Interlock弹簧圈数量及型号、栓塞部位、技术成功率。

1.2 术前准备

患者均常规行术前血液学及心肺功能检查首先确保患者无造影及手术禁忌症,患者均经CTA确诊脾动脉瘤并获得脾动脉瘤位置、形状及瘤颈大小、载瘤动脉直径等数据,通过以上数据的分析评估,初步确定穿刺入路位置和将使用的弹簧圈规格和数量(图1)。

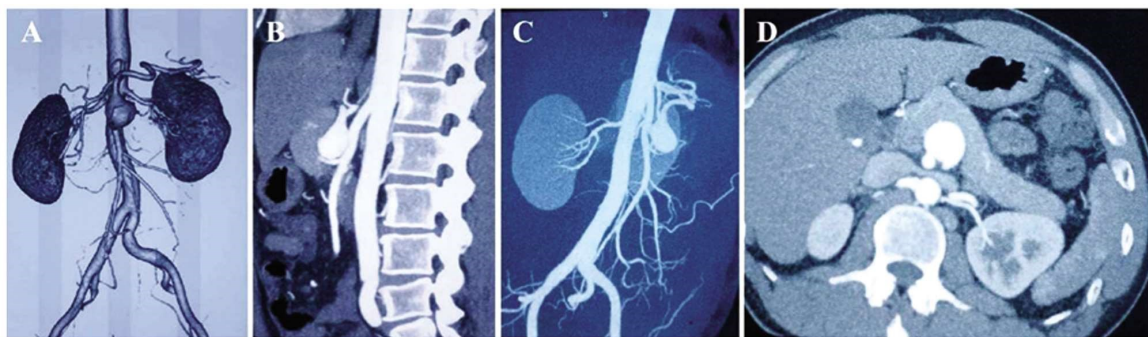


图1 脾动脉瘤术前图像

A 术前CTA三维成像;B 术前CTA脾动脉侧视图;C 术前CTA脾动脉瘤矢状面观;D 术前CTA脾动脉瘤横断面观。

Fig.1 Preoperative image of splenic aneurysm

A preoperative CTA three-dimensional imaging; B. Preoperative lateral view of CTA splenic artery; C. Sagittal view of splenic aneurysm of CTA before operation; D. Preoperative cross-sectional view of CTA splenic aneurysm.

1.3 手术方法

常规消毒铺巾及局部麻醉后,穿刺右股动脉后放置5F鞘并更换为6F长鞘。通过血管造影明确腹腔干与脾动脉的位置。然后用硬导丝配合Cobra导管或Simmons导管(4F)进入脾动脉并进行多角度造影,探明脾动脉瘤尺寸、位置、形状及瘤颈大小、载瘤动脉直径、主要分支的流入和流出情况等,鉴别瘤体为真假性动脉瘤,确定手术角度并准备特定栓塞材料。术中对8例瘤体按照远端动脉、瘤腔及近心端开口处的顺序进行Interlock可解脱弹簧圈系统的栓塞,即时血管造影提示瘤腔无任何血流灌注。对其余30例瘤体采用导管置入瘤腔后依次用从大到小的Interlock可解脱弹簧圈填充的治疗方式。血管造影提示载瘤动脉血流通畅,脾脏显影正常,瘤腔内无造影剂存在及溢出。

1.4 术后处理及随访

术后护理时注意监测穿刺点有无渗血、血肿及股动脉异常搏动等情况。术后3天复查血液学指标及血淀粉酶及腹部体征,观察患者有无并发症,每日皮下注射低分子肝素直至患者出院。术后2周、3月和6月分别随访血常规、胰淀粉酶和主动脉CTA^[8]。观察瘤体是否有明显增大或破裂,是否有SAA复通或增大、弹簧圈移位及脾梗死等并发症发生。

1.5 统计学分析

应用SPSS 18.0统计软件进行分析,正态分布的计量资料以 $\bar{x} \pm s$ 表示。

2 结果

2.1 患者的资料分析

本研究共纳入36例SAA患者,共38个瘤体,包括男性10例,10个瘤体,女性26例,28个瘤体,平均年龄为 $59.4 \pm 13.1(36-77)$ 岁。其中,4例患者因左上腹不适2年以上检查发现SAA,5例患者因中上腹闷痛伴呕吐数日检查发现SAA,其余患者为常规体检发现SAA。36例患者中,2例女性为多发SAA(分别有两个瘤体),其余为单发SAA。假性SAA为5例(5例瘤体),真性SAA为31例(33例瘤体)。相对于脾动脉的位置,12例瘤体在近心端,18例在中段,8例在远心端。瘤体平均尺寸为 $40.6 \pm 12.5(15-70)$ mm。术中6例患者应用Interlock弹簧圈系统栓塞SAA远近端及瘤腔,其余仅栓塞SAA瘤腔。所有SAA栓塞技术成功率均为100%,平均造影剂用量 $87.6 \pm 4.2(60-100)$ mL,平均手术时间 $60.0 \pm 10.0(40-80)$ min。Interlock弹簧圈使用总计128个,其中钻石型104个,普通2D型24个。弹簧圈平均直径为 $6.3 \pm 4.2(2-12)$ mm,平均长度为 $16 \pm 13.5(3-32)$ mm(表1)。

表 1 脾动脉瘤患者的基线特征和手术细节

Table 1 Basic characteristics and operation details of the splenic aneurysm

patients	
Basic Characteristics	
Age (year)	59.4± 13.1(36-77)
Gender	
Male	10
Female	26
Clinical signs	
Celiacgia	5
Asymptomatic	31
Aneurysmal sacs	38
Pseudo-aneurysm	5
Location	
Proximal end	12
Middle	18
Distal end	8
Average size	40.6± 12.5 (15-70)
Operation Details	
Technical success rate	100%
operation time(min)	60.0± 10.0(40-80)
Imaging dose(mL)	87.6± 4.2(60-100)
Spring coils used	128
Diamond spring coil	104
Common type 2D	24
Average diameter(mm)	6.3± 4.2(2-12)
Average length(mm)	16± 13.5(3-32)

2.2 术后即刻影像学表现

Interlock 弹簧圈系统使用后即刻 DSA 显示脾动脉瘤闭塞率为 97%以上, SAA 栓塞后瘤体形态较好, 表现为类球形。瘤腔填塞的脾动脉瘤未见明显增大或破裂, 瘤腔内填充完全, 无血流通过, 无脾梗死出现(图 2)。

2.3 术后随访结果

26 例患者术后出现恶心, 10 例患者出现呕吐等消化道症状, 出院前复查血常规和血淀粉酶未见异常, 出院时体温正常, 无不适, 嘱定期随访。平均随访 10.0± 3.2(6-15)个月, 出院后 2 周、3 个月和 6 个月各行门诊 CTA 复查 1 次, 均未见脾动脉瘤复通或增大, 无弹簧圈移位(图 3)。1 月时 2 例发生脾梗死, 4 例发生偶尔腹痛, 3 例出现发热, 自行好转。其余患者平素无长期低热或者短期高热出现, 无左季肋部隐痛等处腹痛症状发生, 无并发症如脾脓肿、梗死和胰腺炎等出现(表 2)。

3 讨论

SAA 包括真性与假性动脉瘤, 真性 SAA 可能为动脉硬化、纤维发育不良、结缔组织疾病和门静脉高压等血流紊乱所造成。真性 SAA 主要表现为囊状与梭形两种形态。假性动脉瘤可由创伤、外科手术, 内窥镜或放射介入手术引起的医源性损伤, 或者炎症及感染性疾病引起^[9]。SAA 占有 VAA 的 60%, 2%至 10%的脾动脉瘤有破裂的危险, SAA 破裂患者的死亡率为 20%~30%^[10,11]。手术指征为:① 有症状的患者, ② SAA 扩大的患者, ③ 怀孕或预期怀孕的患者, ④ 计划进行肝脏移植的门静脉高压症患者, ⑤ SAA 直径大于 2 cm 的患者。此外, 我们认为 SAA 直径大于 2cm 的患者应接受弹簧圈栓塞术, 患有乙肝或丙肝的 SAA 患者即使病变小于 2 cm 也应进行弹簧圈栓塞治疗^[10]。

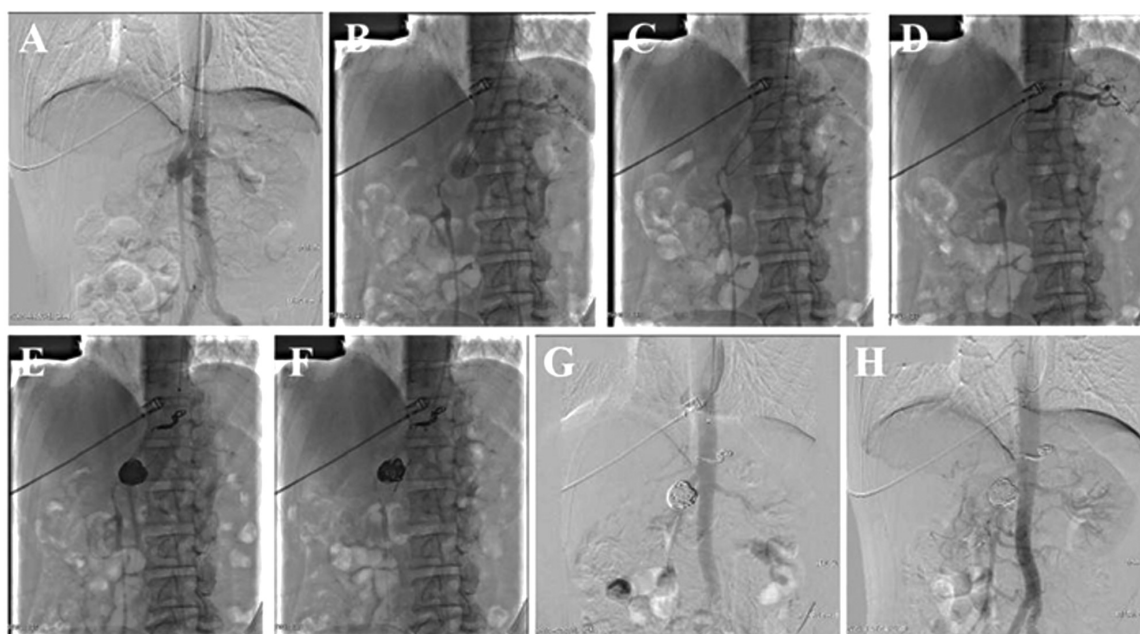


图 2 脾动脉瘤术中图像

A-D 术中瘤腔造影证实并评估脾动脉瘤; E-G 术中 DSA 下 Interlock 可解脱弹簧圈系统栓塞瘤腔; H 即刻造影显示脾动脉瘤栓塞成功

Fig.2 Intraoperative image of splenic aneurysm

A-D The splenic aneurysm was confirmed and evaluated by intraoperative anatomic angiography. E-G Interlock detachable coils system embolized the cavity of splenic artery aneurysms under DSA intraoperatively. H Immediate angiography showed successful splenic aneurysm embolization

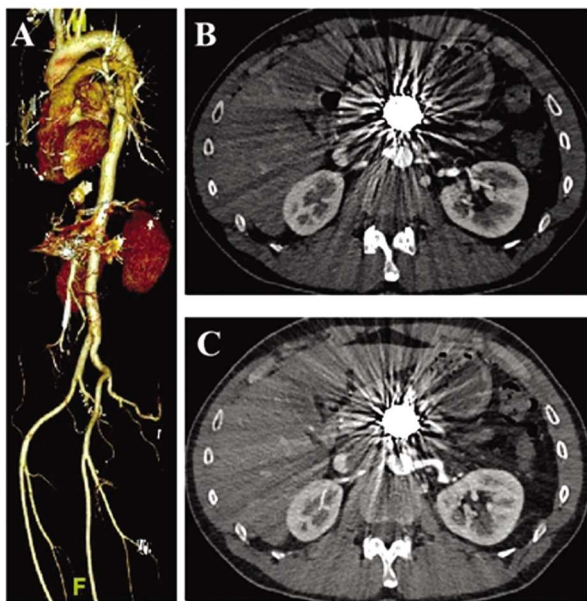


图 3 脾动脉瘤术后随访图像

A 术后 CTA 三维成像;B、C 术后 1 月复诊 CTA 横断面

Fig.3 Follow-up images of splenic aneurysm after operation

A Postoperative CTA three-dimensional imaging; B, C CTA reexamination 1 month after surgery from the cross-section

SAA 的治疗方案通常取决于瘤体的解剖位置、形态特点及尺寸。直到最近十年,传统开放手术仍是治疗的主要手段,手术方式为远端脾动脉结扎或脾切除术^[11]。但随着微创理念的普及与腔内技术及器械的飞速发展,涌现了诸如腹腔镜手术、弹簧圈栓塞及支架置入等治疗手段^[12,13]。对于不在脾门深处的 SAA,微创手段可免于脾切除,以保持免疫功能。其中,腹腔镜手术虽然微创,但技术难度大大增加,需要经验极其丰富以及术中超声持续检查。而 SAA 的支架植入术虽然可以排除动脉的气动扩张,同时保持正常的血流量。但受限于脾动脉的大小和弯曲度以及 SAA 的位置,因此更适合近端动脉瘤。同时,这些移植物的长期耐久性和通畅性仍然未知^[14,15]。而经导管弹簧圈栓塞自从首先由 Probst 等在 1978 年报道后,数字减影血管造影的进展以及各种动脉导管和相关设备的开发使其技术成果率增加到近 85-100%。现在普遍认为其是大多数 SAA 患者的一线治疗方法,特别是偶发性无症状 SAA^[16,17]。特别强调的是,手术前的 CT 扫描对于规划手术至关重要。用于栓塞的药物包括凝胶泡沫明胶、弹簧圈、可拆卸球囊、凝血酶、氰基丙烯酸正丁酯以及组织胶囊^[18-20],可对除了位于脾门的动脉瘤之外的所有 SAA 进行栓塞,特别适合开放手术无法进行的患者。需要注意的是这项技术的并发症包括线圈移位和远端梗死,脓肿形成以及发生率很低的动脉瘤破裂^[21]。

弹簧圈栓塞逐渐成为 SAA 治疗的主流方案,这就对弹簧圈释放的可控性精准性以及学习曲线的缩短提出了更多的要求。Interlock 可解脱弹簧圈系统是一项较新的释放与栓塞系统。其可以使栓塞弹簧圈的释放更加可控,如果弹簧圈没有释放到最佳位置,可以简单地取回该装置。这种由可回收系统提供的安全性对于神经内血管的应用以及不适合用常规弹簧圈栓塞的血管具有特别的价值。互锁可拆卸线圈(IDC)系统是一

表 2 脾动脉瘤患者术后随访情况

Table 2 Follow-up details of the splenic aneurysm patients after intervention

Follow-up details	
Follow-up time (month)	6
CTA	
Coils shift	0
Aneurysm recanalization	0
Aneurysm enlargement	0
Complications	
Nausea	26
Emesis	10
Celialgia	4
Fever	3
Splenic infarction	2

种 0.018 英寸的弹簧圈,带有可伸缩的互锁机制,可精确放置弹簧圈。迄今为止,Interlock 可解脱弹簧圈系统已于脑动脉瘤、内脏动脉瘤、肺动脉和肾静脉静脉瘘以及先天性心脏病中的血管瘘等多种疾病中普遍应用^[22-24]。与常规弹簧圈不同,IDC 的互锁臂和输送线可以允许弹簧圈在最终释放前在血管中前进和缩回,从而提供对输送的更多控制,尤其适合于病变比较复杂的血管,因为必须对不同血管或血管病变进行精确的栓塞治疗。

Oliver Dudeck 等通过一项对比标准可推进弹簧圈和 Interlock 带纤毛可解脱弹簧圈应用于胃十二指肠动脉栓塞的前瞻性研究证实,与标准可推进的弹簧圈相比,使用 Interlock 带纤毛可解脱弹簧圈栓塞胃十二指肠动脉是安全、有效的,程序简单、缩短了 47% 的手术时间。在实现精确的弹簧圈释放的同时节省器材费用,使用的弹簧圈的数量是标准可推进弹簧圈的 20%。如果考虑到操作时间和人工,节省的费用可能会大得多。此外,Interlock 带纤毛可解脱弹簧圈使患者减少了 77% 的辐射剂量暴露以及 54% 的造影剂量^[25]。

在手术操作中,应注意视具体情况而选择不同尺寸和类型的 Interlock 弹簧圈。Interlock 弹簧圈主要分为立体、2D 螺旋及钻石三种,尺寸分为 Interlock 35 和 Interlock 18 两种类型,2D 螺旋形状弹簧圈可以保证弹簧圈和直形或渐细血管壁的持续不变的接触和贴壁。钻石形状弹簧圈近端和远端渐细,可以最大化血流阻断作用。立体形状的弹簧圈可以提供圆周式的贴壁作用和出色的填充性能,也是最适用于 SAA 的弹簧圈^[26]。笔者团队结合国内外报道及自身经验得出的建议是:对于瘤径大于 2 cm 的脾动脉瘤建议先采用钻石型弹簧圈栓塞,以最大化的阻断血流;对于小于 2 cm 的 SAA 可采用 2D 弹簧圈进行栓塞^[27-30]。

综上所述,Interlock 可解脱弹簧圈应用于 SAA 的治疗安全有效,具有良好的早中期疗效,是一种简单快速、精确可控、安全经济的治疗方法,具有良好广泛的应用前景。在临床应用时,应根据实际情况选择具体弹簧圈的类型与尺寸,严格按照流程操作,以达到患者疗效的最大化,且其远期疗效尚需长期的随访观察。

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