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## · 临床研究 ·

## 经皮介入封堵冠状动脉-肺动脉瘘治疗分析\*

沈健<sup>1,2</sup> 陈亮<sup>1</sup> 李攀<sup>1</sup> 曾振宇<sup>1</sup> 唐文栋<sup>1</sup> 赵仙先<sup>1Δ</sup>

(1 第二军医大学附属长海医院心血管内科 上海 200433; 2 解放军第四一〇一医院心血管内科 上海 200081)

**摘要 目的:**分析冠状动脉-肺动脉瘘(coronary artery-to-pulmonary artery fistula, CPAF)行经皮介入封堵治疗的可行性、安全性及疗效。**方法:**回顾性分析长海医院心内科于2009年7月至2016年2月之间接受经皮介入封堵术的58例CPAF患者的临床资料,排除合并其他复杂心脏病变而需要外科手术治疗的患者。**结果:**58名CPAF患者经介入封堵均获成功,平均植入封堵材料(2.35±0.87)枚。24名(41.38%)患者成功封堵后残余分流立即消失,34名(58.62%)患者仍有少量分流。未出现手术相关并发症。术后随访2~61个月,无出血、缺血等并发症。随访造影显示,其中3名(5.17%)患者出现了大量再通,后者随后均接受了再次封堵术并成功封堵。**结论:**经皮介入封堵CPAF切实可行,但应选择适宜患者,且需要经验丰富的术者操作。经治疗后冠状动脉瘘可能出现再通,因此对这些患者应进行随访造影或其他影像学检查。

**关键词:**冠状动脉-肺动脉瘘;冠状动脉造影;经皮介入封堵

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## Percutaneous Closure of Congenital Coronary Artery-to-Pulmonary Artery Fistula\*

SHEN Jian<sup>1,2</sup>, CHEN Liang<sup>1</sup>, LI Pan<sup>1</sup>, ZENG Zhen-yu<sup>1</sup>, TANG Wen-dong<sup>1</sup>, ZHAO Xian-xian<sup>1Δ</sup>

(1 Department of Cardiology, Affiliated Changhai Hospital, Second Military Medical University, Shanghai, 200433, China;

2 Department of Cardiology, No. 411 Hospital, PLA, Shanghai, 200081, China)

**ABSTRACT Objective:** This study sought to assess feasibility, safety and effectiveness of percutaneous closure of coronary artery-to-pulmonary artery fistula (CPAF). **Methods:** Among the cases of CPAF confirmed by coronary angiography during July 2009 to February 2016 at our hospital, interventional treatment was performed in 58 patients. Patients with other complex cardiac lesions and those requiring surgery were excluded. **Results:** Fifty-eight patients with CPAF underwent 61 percutaneous closure procedures. Successful closure occurred immediately in all patients with no residual flow in 41.38% and with trivial flow in 58.62%. A follow-up angiogram was obtained with following-up angiography of 2 to 61 months. Three patients (5.17%) of the 58 patients with follow-up angiography had large recanalization. A repeat closure procedure was performed in all 3 patients of the latter successfully. **Conclusions:** Percutaneous closure of CPAF is feasible and should be considered in carefully selected patients and performed by experienced operators. Recanalization of the treated coronary fistulae may occur, so follow-up angiography or other imaging modality should be performed in these patients.

**Key words:** Coronary artery to pulmonary artery fistula; Coronary angiography; Percutaneous closure

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## 前言

冠状动脉瘘为冠状动脉和心腔或胸腔内主要血管(动静脉)之间的异常连接。大多数冠状动脉瘘为先天性,也可获得性<sup>[1-3]</sup>。冠状动脉瘘较为罕见,接受造影检查人群中检出率约0.2%,普通人群中患病率约0.002%<sup>[4,5]</sup>。虽然最早由德国解剖学家Wilhelm Krause在1865年报道,但冠状动脉瘘的临床意义目前仍不甚清楚。大多数患者并无症状。出现症状的最常见原因是因左向右分流引起容量超负荷继而发生心力衰竭、冠脉窃血而致缺血、心律失常、瘘破裂或栓塞、感染性心内膜炎等<sup>[6-14]</sup>。

由于这些潜在并发症,美国心脏病协会/美国心脏学会

(The American College of Cardiology/American Heart Association, ACC/AHA)(2008)成人先天性心脏病管理指南建议较大的冠状动脉瘘不论是否伴随症状均应行介入或外科手术封堵;小至中等冠状动脉瘘仅在有症状(包括缺血、心律失常、不能解释的收缩或舒张功能不全)情况下进行封堵;对无症状的小型冠状动脉瘘则不建议封堵<sup>[15,16]</sup>。相比开放性心脏外科手术,介入封堵理论上有着多种优势,包括住院时间更短、恢复更快等。本研究的目的为评估冠状动脉-肺动脉瘘(coronary artery-to-pulmonary artery fistula, CPAF)患者接受经皮介入封堵术的临床疗效和安全性。

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作者简介:沈健(1985-),硕士,研究方向:从事冠心病介入诊疗研究

Δ 通讯作者:赵仙先, E-mail: shchyy\_zxx@163.com

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## 1 材料与方法

### 1.1 一般临床资料

回顾性分析第二军医大学附属长海医院心血管内科 2009 年 7 月至 2016 年 2 月间收治的经冠状动脉造影明确诊断为 CPAF 的患者共 93 名,其中 58 名 CPAF 患者接受了 61 例次介入封堵术。有症状或瘘管为中 - 大型并接受介入封堵治疗的患者纳入本研究,小型瘘管和伴随其他心脏病变及需要外科手术治疗的患者则排除。采集患者的年龄、性别、症状等病史资料。所有患者均于手术前接受心电图、胸部 X 线、超声心动图及腹部超声检查等。

### 1.2 介入封堵

患者取平卧位,常规消毒皮肤,铺手术巾、单,以 2%利多卡因作局部麻醉,穿刺右侧桡动脉或股动脉,置入 6F 桡动脉防漏鞘管。经鞘管送入 5F TIG 冠状动脉造影导管(Terumo,日本),分别于 LAO 45° 和 RAO 30° 投影位,加头位和足位,行左、右冠状动脉造影。以 Artis one 数字减影血管造影机(Siemens,德国)采集血管造影图像。手动注入造影剂以使冠脉解剖情况、瘘血管部位包括入口和出口显影。应用指引导管、微导管和冠脉导丝以到达瘘血管处。应用封堵器械包括 Matrix HELICAL ULTRASOFT SR 弹簧圈、Helix Standard Fiber 弹簧圈、Helix ev3 弹簧圈、HyperSoft Helical MicroPlex10 弹簧圈和液体栓塞剂 Onyx。上述器械均根据瘘血管大小和其他特点而选择。弹簧圈主要应用于小至中等瘘血管,大型瘘血管封堵效果不佳时同时应用液体栓塞剂 Onyx 1-2 mL。器械及其特点输送系统的操作细节参照既往报道<sup>[17,18]</sup>。封堵器植入后立即进行选择性冠状动脉造影以评估残余分流情况。

### 1.3 统计学分析

计数资料以率表示,正态分布计量资料以平均数± 标准差表示,非正态分布计量资料以中位数表示。两组间计数资料比较以 t 检验分析,以 P<0.05 为差异具有统计学意义。以 SPSS 18.0 软件进行统计学分析。

## 2 结果

### 2.1 一般临床特征

58 名患者接受了 61 例次介入封堵术。其中男性 37 名(63.79%),女性 21 名(36.21%),接受介入封堵时的中位年龄为 60.5 岁。最常见的症状为胸闷 (n=37,64.91%),其次为胸痛 (n=15,26.32%)、头晕(n=2,3.51%)、呼吸困难(n=2,3.51%)。体格检查发现口唇发绀 1 例(1.75%),心前区可闻及杂音者 4 例(6.90%),均为连续性杂音(见表 1)。心电图、超声心电图、胸部 X 线等检查均未见明显特异性表现。

### 2.2 冠状动脉造影及介入治疗情况

根据冠状动脉造影结果判断,单支 CPAF 为 40 例(68.97%)。58 名 CPAF 患者经介入封堵均获成功,平均植入封堵材料(2.35± 0.87)枚,7 例次合并应用弹簧圈及液体栓塞剂 Onyx。24 名(41.38%)患者成功封堵后残余分流立即消失(图 1),34 名(58.62%)患者仍有少量分流。术后随访 2~61 个月,无出血、缺血等并发症。6 月后随访造影显示,28 例残余少量分流患者分流消失,3 例(5.55%)患者出现了大量再通,后者随后

均接受了再次封堵术,均成功封堵(见表 2)。

表 1 纳入患者的一般临床特征

| Table 1 Clinical Characteristics of the Cohort |                                       |
|------------------------------------------------|---------------------------------------|
| Clinical Characteristics                       | n (%) or median (interquartile range) |
| Gender                                         |                                       |
| Male                                           | 37(63.79%)                            |
| Female                                         | 21(36.21%)                            |
| Age at catheterization, yrs                    | 60.5(48.5-70)                         |
| Recorded symptoms                              |                                       |
| Chest tightness                                | 37(64.91%)                            |
| Chest pain                                     | 15(26.32%)                            |
| dizziness                                      | 2(3.51%)                              |
| Dyspnea                                        | 2(3.51%)                              |
| Signs                                          |                                       |
| Murmur (continuous diastolic)                  | 4(6.90%)                              |
| Cyanosis                                       | 1(1.75%)                              |

表 2 CPAF 的冠状动脉造影及介入治疗情况

| Table 2 Characteristics of CPAF on Coronary Angiography and Percutaneous Closure |            |
|----------------------------------------------------------------------------------|------------|
| Characteristics of CPAF on Coronary Angiography and Percutaneous Closure         | n (%)      |
| Characteristics of CPAF on Coronary Angiography                                  |            |
| Origin from single coronary artery                                               | 40(68.97%) |
| Origin from more than 2 coronary arteries                                        | 18(31.03%) |
| Angiography after closure                                                        |            |
| No residual flow                                                                 | 24(41.38%) |
| Trivial flow                                                                     | 34(58.62%) |
| Large recanalization                                                             | 3(5.17%)   |
| Occlusion Device                                                                 |            |
| 1 coil implanted                                                                 | 5(8.62%)   |
| 2 coils implanted                                                                | 28(48.28%) |
| 3 coils implanted                                                                | 12(20.69%) |
| 4 coils implanted                                                                | 1(1.72%)   |
| 5 coils implanted                                                                | 2(3.45%)   |
| Closure with coils and Onyx                                                      | 7(12.07%)  |

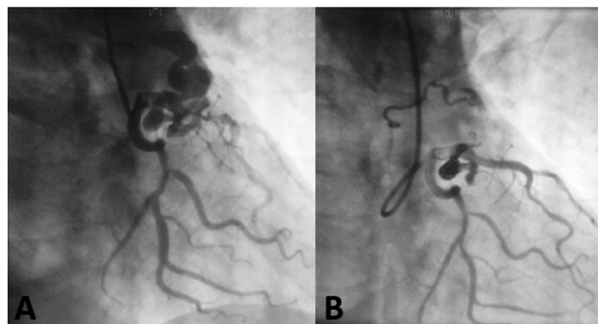


图 1 弹簧圈封堵治疗 CPAF 造影图像

Fig.1 Selective angiography of closing CPAF with coils

Note: Selective angiography of LAD-to- pulmonary artery (A) before and (B) after coils.

### 3 讨论

在经皮介入治疗出现之前,外科手术闭合冠状动脉瘘是唯一的治疗方法,最早由 Biorck 等报道。总体上外科手术治疗死亡率低(约 1%),单支结扎常见,瘘管切除罕见。据报道并发症罕见,主要包括心律失常、心肌梗死、卒中、心电图 ST-T 改变。外科手术文献报道约 10%存在闭合不全或瘘管再通,且瘘管再通发生率高于血管内封堵治疗<sup>[19]</sup>。

介入封堵对于解剖条件适宜且无其他心脏复杂病变如合并瓣膜性心脏病的患者而言是一种新型替代治疗方法。该方法最早由 Reidy 等于 1983 年报道。总体看,介入治疗较外科手术发病率和死亡率更低。多种器械被应用于介入封堵,弹簧圈、Amplatzer 血管 Plug、可脱卸式球囊、动脉导管未闭封堵伞、覆膜支架等<sup>[17,20-25]</sup>,其中瘘口直径较大者适用 Amplatzer 血管 Plug 或动脉导管未闭封堵伞,易栓塞瘘管则适合弹簧圈。

液体栓塞剂 Onyx 为一种新型栓塞剂,其弥散性能好、黏性低、聚合较慢,故而允许较长的注射时间从而具有较理想的控制能力,2005 年美国食品及药品管理局批准了 Onyx 液体栓塞系统用于脑动静脉急性的治疗<sup>[26]</sup>。在我中心手术实践中发现,弹簧圈作为支撑物配合 Onyx 的弥散特性,有助于增进封堵成功率,与其他中心经验报道类似<sup>[27]</sup>。虽然大多数研究报道介入手术成功率很高,但瘘管的短期和长期再通率方面数据仍然有限。而且值得注意的是,上述封堵材料均为标签外应用。

本研究中,台上封堵成功率较前期类似患者数量的介入封堵研究结果相同或更佳<sup>[28]</sup>。在外科手术相关文献报道中,随访造影关注到了许多其他异常,包括顽固性瘘管和冠状动脉扩张<sup>[19]</sup>。Latosn 等<sup>[29]</sup>报道 4 名在其中心行外科手术治疗冠状动脉瘘后 4 至 41 年随访评估的患者。其中 3 名发现上一级冠状动脉内出现血栓。由于除数个个案报道外没有相关数据,因此不论外科手术还是介入封堵术后冠状动脉血栓形成的风险仍然未知<sup>[29]</sup>。瘘管封堵后血栓形成机制仍然未知,但其潜在原因包括动脉瘤和动脉损伤部位血流流速减慢。虽然本研究中患者在介入术前常规应用了阿司匹林,但这些患者术前或术后应接受抗血小板药物治疗还是应用华法林等抗凝药物仍缺乏循证证据。当然,长期存在的冠状动脉瘘封堵后可能出现血流瘀滞,应考虑到口服抗凝的必要性。

当出现瘘管再通时,即便患者并无症状,也应常规对这些患者进行随访。相较其他如心脏超声或 CT 扫描等检查方式,造影的优点在于能够直接显示再通瘘管并测量大小<sup>[30,31]</sup>。

经皮介入封堵 CPAF 切实可行,但应选择适宜患者,且需要经验丰富的术者操作。经治疗后冠状动脉瘘可能出现再通,因此对这些患者应进行随访造影或其他影像学检查。

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