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• 研究快报 •

改良的血管缝合器经左心耳途径缝合左房室瓣的体外实验

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[摘要] **目的** 通过体外实验初步探讨改良的血管缝合器经左心耳途径缝合左房室瓣的可行性, 探索治疗左房室瓣反流的新技术。**方法** 对市售股动脉血管缝合器进行改良, 剪除缝合器前端的延长管, 保留使穿刺导丝通过的标记孔, 将缝合器打开时的缝针针距适当增宽。取离体山羊心脏标本 20 只, 打开心包膜暴露左心耳, 用 Cordis 桡动脉穿刺针穿刺左心耳, 送入普通“J”型导丝, 沿室间沟剪开左心室, 确认“J”型导丝在左心室内, 从左心耳侧沿该导丝送入改良的血管缝合器至左心室, 在左房室瓣心室侧打开缝合器, 回撤缝合器, 将左房室瓣前、后瓣缝合在一起。**结果** 改良的血管缝合器可以成功地将左房室瓣前、后瓣膜缝合在一起, 瓣膜及瓣下结构无破坏。**结论** 改良的血管缝合器设计合理, 可以将左房室瓣前、后瓣缝合。

[关键词] 缝合技术; 血管缝合器; 心脏导管插入术; 左房室瓣

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Per-left auricle suture of mitral valve using modified vascular closure device: an *in vitro* experiment

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[Abstract] **Objective** To investigate the feasibility of per-left auricle suture of mitral valve using modified vascular closure device via *in vitro* experiment, so as to search for new technique for treatment of mitral regurgitation. **Methods** The market vascular closure device was modified by cutting the tip of extension tube, while reserving the marking hole for passing the puncture wire and broadening the needle pitch. Twenty goat hearts were obtained and the pericardium was opened to expose the left auricle. After puncture of the left auricle with the Cordis needle, a “J” type guide wire was inserted through the needle sheath. It was confirmed that the “J” type guide wire must be in the left ventricle through cutting the left ventricle along the interventricular groove. Then the modified vascular closure device was introduced into the left ventricle along the “J” wire. The anterior leaflet and posterior leaflet of mitral valve were sutured together by the vascular closure device in ventricular side of the mitral valve. **Results** Our modified vascular closure device could successfully suture the anterior leaflet and posterior leaflet of mitral valve, without damaging the valve structure. **Conclusion** The modified vascular closure device is well designed and can be used for suturing anterior leaflet and posterior leaflet of mitral valve.

[Key words] suture techniques; vascular closure device; heart catheterization; mitral valve

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左房室瓣成形术已经取代左房室瓣置换术, 是治疗退行性左房室瓣关闭不全的主要术式^[1], 随着经导管瓣膜置换和修复技术的快速发展, 针对左房室瓣反流的经导管治疗装置也越来越多。其中最具代表性的为 MitraClip 系统, 是一个宽 4 mm 的“V”字形钴铬合金钳夹装置, 夹子的两条臂可以在人为控制下自由开合。MitraClip 系统对左房室瓣反流

的治疗有着良好的有效性和安全性^[2], 但 MitraClip 系统需进行房间隔穿刺, 技术较复杂。受经心尖主动脉瓣置换技术的启发, 我们对目前经股动脉冠状动脉介入治疗中所应用的动脉血管缝合器进行改良, 拟采用经左心耳途径进行左房室瓣缝合的体外实验, 探讨改良的血管缝合器经左心耳途径缝合左房室瓣的可行性, 为进一步改进缝合器及微创治疗

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左房室瓣反流途径提供实验依据。

1 材料和方法

1.1 左房室瓣的应用解剖 50只健康山羊心脏标本(由上海复兴肉食加工厂提供),雌性23只,雄性27只,(26.0 ± 5.3)个月龄,体质量(31.0 ± 4.7) kg。电击放血处死后经胸骨正中取出心脏,保留上腔和下腔静脉各2 cm、主肺动脉干2 cm及完整的心脏包膜。测量前保存于 -80°C 冰箱中备用。取30只心脏,解冻后去除左室前壁,用游标卡尺(精确度0.01 mm)测量左房室瓣环大小及瓣环高度和宽度,观察左房室瓣环解剖形态。

1.2 血管缝合器的改良 先剪去市售的股动脉血管缝合器(亚创血管缝合系统,徐州亚创科技有限公司)前端的延长管,保留导丝前行的标记孔;再根据上述的应用解剖数据将缝合器打开时的针距适当增宽至6 mm(由徐州亚太科技有限公司完成)。

1.3 体外缝合左房室瓣过程 取离体山羊心脏标本20只,打开心包膜暴露左心耳,沿室间沟去除左室前壁,用Cordis 桡动脉穿刺针穿刺左心耳,送入普通“J”型导丝,确认导丝在左心室内,沿导丝送入改良的血管缝合器至左房室瓣心室侧,打开缝合器按照缝合器使用步骤将左房室瓣前、后瓣缝合在一起。

2 结果

2.1 左房室瓣环的大体解剖形态 左房室瓣环分为前瓣环与后瓣环,分别占整个瓣环周径的1/3和2/3。左房室瓣环周长(47.00 ± 7.39) mm,前瓣高度(7.93 ± 2.03) mm,前瓣宽度(21.58 ± 4.17) mm;后瓣高度(9.89 ± 1.90) mm,后瓣宽度(20.61 ± 4.22) mm。前瓣环与主动脉心肌纤维支架紧密相连;后瓣环主要为弹力纤维,伸展性大。

2.2 体外缝合左房室瓣实验结果 20个改良的血管缝合器缝合离体山羊心脏左房室瓣实验均一次性成功缝合。缝合后的标本可见左房室瓣前、后瓣由丝线牢固地缝合在一起,瓣叶及瓣周结构无破坏(图1)。

3 讨论

左房室瓣反流的治疗是临床研究的热点。凡有症状的中度或重度左房室瓣反流患者均应行左房室瓣手术;无症状但伴左心室收缩末期内径 >45 mm、射血分数 $<60\%$ 的患者也被推荐手术治疗^[3]。重度左房室瓣反流若不治疗,年病死率可达 6.3% ^[4]。

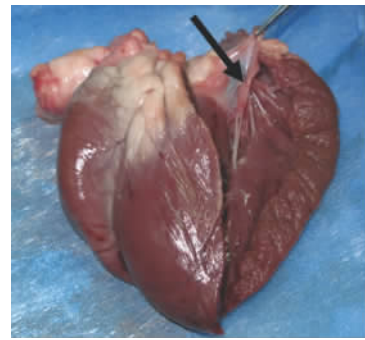


图1 应用改良的血管缝合器缝合后的左房室瓣

Fig 1 Mitral valve has been sutured with stitch by modified vascular closure device

Black arrow indicates the anterior leaflet and posterior leaflet of mitral valve were sutured firmly together and the valve had no damage

目前左房室瓣手术修复方式包括:左房室瓣成形术^[5]、瓣叶修复术^[6]、腱索修复术^[7]及乳头肌修复术^[8]。缘对缘缝合技术是瓣叶修复术的一种,通过将脱垂的左房室瓣瓣叶边缘与对应的前叶或后叶边缘缘对缘缝合起来,形成一双孔或多孔左房室瓣,从而清除瓣膜关闭不全。该方法由Alfieri等^[9]提出并逐渐改良。MitraClip是基于外科缘对缘基础上微创治疗左房室瓣反流的技术,主要步骤是沿股静脉途径进入右心房,行房间隔穿刺进入左心房,从而进入左心室,在心室收缩时用一种带有两臂、臂长4 mm左右的台钳夹住左房室瓣的前、后瓣膜。St Goar等^[10]于2003年使用该技术完成了第1例动物实验。MitraClip技术于2008年3月在欧洲通过GE(General Electric)认证,目前已在欧洲、土耳其、以色列等地区用于临床。但MitraClip技术操作难度较大,需进行房间隔穿刺,同时MitraClip钳价格比较昂贵,置入过程及术后存在许多并发症,如左房室瓣瓣膜损伤、血栓形成、钳夹脱落、出血及血管并发症等^[11]。受经心尖主动脉瓣置换技术的启发,我们尝试用改良的股动脉血管缝合器经左心耳途径缝合左房室瓣,以期对微创治疗左房室瓣反流提供一种新的思路和治疗途径。

血管缝合器最初是用于冠状动脉造影后股动脉血管止血,以减少患者卧床时间,减轻患者痛苦^[12]。我们根据左房室瓣的应用解剖特点,在徐州亚太科技有限公司的协助下,对血管缝合器进行了改造,主要是去除缝合器前端延长管,以减少延长管对心室的损伤,同时保留导丝前行的标记孔,并依据左房室

瓣应用解剖数据,将缝合器打开时针距适当增宽至 6 mm,以便更加容易接触前、后瓣叶,提高缝合的准确率。在体外实施过程中,首先经左心耳途径,从左心耳穿刺置入导丝,确认导丝在左心室内,沿导丝送入缝合器至左房室瓣的心室侧,确认勾住左房室瓣前、后瓣后,按照缝合器使用步骤逐步进行缝合。本研究共进行了 20 例体外实验,均取得成功,没有发现瓣膜及其周围结构的损伤。

本实验通过改良的血管缝合器经左心耳途径成功缝合左房室瓣,为微创治疗左房室瓣反流提供了实验基础。我们课题组将进一步对缝合器进行改进,并行活体动物实验。但在体实验难度较大,与体外实验不同,需要考虑改进的方面有:(1)器械改进重点是两缝针针距的大小及可操控的范围;(2)丝线的韧性及粗细能否保证左房室瓣关闭过程中的稳定性,以免对瓣叶造成撕裂;(3)在经食道超声心动图的实时监测下,如何把握缝合的最佳时机;(4)需要缝合多少针才能保证反流明显减少和如何预防术中出血等。我们认为改良后的技术与目前微创治疗左房室瓣反流 MitraClip 技术相比有以下优点:(1)实现了微创治疗左房室瓣反流国产化,操作简单,经济实惠;(2)可减少操作者及患者 X 线曝光;(3)避免血栓形成;(4)血管并发症降低。不足之处可能有:(1)因开胸,患者需全麻,增加了麻醉风险、延长了住院周期;(2)心耳较脆,做双层荷包缝合止血时易受损伤,从而导致出血;(3)缝合器的开口、丝线韧性以及距前、后瓣缘的距离不易把握。

4 利益冲突

所有作者声明本文不涉及任何利益冲突。

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