间或微泡浓度超过一定阈值后，大量的人骨髓MSCs会因辐照能量过高或空化核浓度过大而死亡，导致相应的SDF-1分泌量也减少。本研究采用均匀设计法和回归分析的统计学方法筛选出体外超声辐照微泡促人骨髓MSCs分泌SDF-1的最优影响因素组合，即超声辐照强度0.6 W/cm^2，超声辐照时间30 s，微泡浓度10^6个/ml。使用该最优组合时人骨髓MSCs的存活率为(88.51±4.03)%，同时SDF-1分泌量显著增加，达(551.67±40.88)ρg/ml。当然，超声辐照微泡作用于动物或人体时，涉及的相关超声作用因素更多，优化筛选过程也会更加复杂，需后续实验研究的进一步探讨。

综上所述，采用拟水平均匀设计法筛选出超声辐照微泡促人骨髓MSCs分泌SDF-1和细胞存活率达到相对匹配的最优影响因素组合为：超声辐照强度0.6 W/cm^2，超声辐照时间30 s，微泡浓度10^6个/ml。

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·病例报道·

Echocardiographic diagnosis of anomalous origin of left coronary artery from pulmonary artery: a case report

超声心动图诊断左冠状动脉异常起源于肺动脉1例

姜述怡 王丽红

[中图法分类号]R540.45；R714.252 [文献标识码]B

患儿女，3个月9 d。因拒奶、呼吸急促半天入院。体格检查：体温37.9℃，心率190次/min，血压71/36 mm Hg(1 mm Hg=0.133 kPa)，血氧分压60%；吸气性“三凹征”阳性，听诊双肺呼吸音粗，可闻及散在湿啰音，心浊音界向左下扩大，心音低钝，可闻及奔马律，心前区可闻及Ⅱ~Ⅲ期/6级杂音。胸片提示：心影增大。超声心动图检查：左房室内径增大；左室整体收缩功能减弱；室间隔与左室后壁呈同向运动；二尖瓣腱索、瓣膜、乳头肌回声增强，彩色多普勒探及二尖瓣中度反流；左冠状动脉主干内径纤细，宽约1.2 mm(图1)，左前降支内径宽约1.7 mm，左回旋支内径宽约1.3 mm，右冠状动脉主干内径明显增宽，约2.9 mm(图2)，主动脉左冠状动脉窦未探及左冠状动脉开口，左冠状动脉内为逆向灌注血流(图3)。超声心动图提示：①冠状动脉异常起源，起源于肺动脉？②左房室腔扩大伴二尖瓣中量反流；③左室收缩功能减低。后于外院行冠状动脉造影检查显示：左侧冠状动脉内径宽约1.0 mm，来源于肺动脉。

讨论：冠状动脉异常起源于肺动脉，是一种非常罕见的冠状动脉先天性异常疾病，是由于胚胎发育过程中冠状动脉芽向主动脉瓣窦融合失败所致，以左冠状动脉较为常见，被称为Bland-White-Garland综合征，发病率约占三十万分之一[1]。新生儿时期由于肺动脉压力较高，有效灌注压满足左冠状动脉对心肌的血供，随着肺动脉压逐渐下降，左、右冠状动脉间需建立侧支循环维持左冠状动脉对左心肌的血供，当左、右冠状动脉间未建立或极少建立侧支循环时，患儿会出现左室扩大、左心收缩功能降低等一系列心肌缺血的非特异性征象，常表现为不明原因的气促、多汗、拒奶、哭闹不安、面色苍白等。若不及时治疗，约90%患儿会于出生后1年内死于因缺血性左室功能障碍造成的心力衰竭[2]。

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作者单位：264000 山东省烟台市，青岛大学附属烟台毓璜顶医院超声科
通讯作者：王丽红，Email：wangwangjn168@163.com

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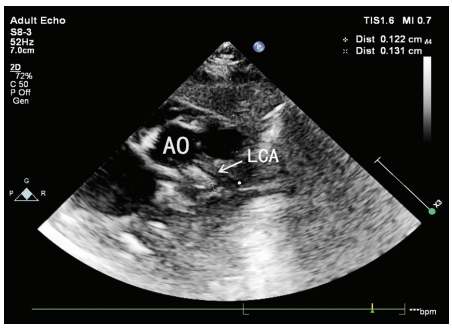

图1 声像图示左冠状动脉(LCA)主干内径纤细(箭头示),宽约1.2 mm。AO:主动脉

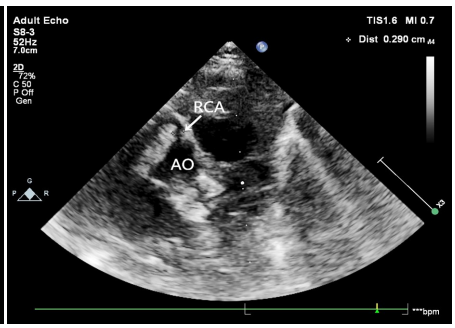

图2 声像图示右冠状动脉(RCA)主干内径明显增宽(箭头示),约2.9 mm。AO:主动脉

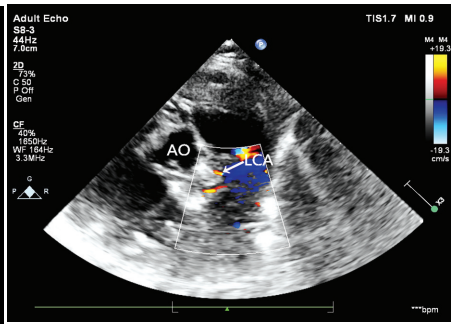

图3 声像图示左冠状动脉(LCA)未与主动脉(AO)相连,左冠状动脉内为逆向灌注血流(箭头示)

结合本病例特点,总结左冠状动脉起源肺动脉的主要超声表现:①主动脉左冠状动脉窦处未探及明确左冠状动脉开口且左冠状动脉来源于肺动脉;②若右冠状动脉与左冠状动脉侧支循环已建立,左冠状动脉内可出现逆向血流信号;③右冠状动脉起源正常且代偿性增宽;④常可合并因心肌缺血引起的其他改变,包括左心扩大、左心功能减低、左室壁运动异常和二尖瓣关闭不全等。诊断本病的最直接征象为左冠状动脉起源于肺动脉。研究[3]显示当左冠状动脉起源于肺动脉右后方时,胸骨旁大动脉短轴切面可出现左冠状动脉似与主动脉根部相连的假象,但彩色多普勒仍可发现左冠状动脉内为逆向灌注血流。因此,即使二维超声下隐约探及左冠状动脉与主动脉相连,但只要左冠状动脉出现逆向血流信号仍需高度怀疑本病。

临床本病需注意与病毒性心肌炎、扩张性心肌病、心内膜弹力纤维增生症、爆发性心肌炎、主动脉弓离断等相鉴别。当遇到婴幼儿不明原因的拒奶、气促、哭闹不安等临床症状且超声心动图表现为左心腔扩大、左心功能减低等心肌缺血表现时,应高度关注冠状动脉宽度,积极查找冠状动脉开口,探查其血流方向,提高诊断冠状动脉异常起源的意识。当超声心动图不能准确判断开口位置时,可结合冠状动脉造影,以便尽早明确诊断、及时治疗。

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