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心力衰竭的物理诊断现状

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摘要: 心力衰竭是各种心脏疾病发展的终末阶段,及时准确的确诊心力衰竭、辨别其病情变化可进一步指导治疗及缩短住院时间,并为心力衰竭的预后评价提供参考依据。目前,确诊心力衰竭主要基于患者的临床症状、体征及各种影像学表现、生化指标等做出综合评价,而物理诊断是诊断心力衰竭不可或缺的依据。心脏彩超已应用于临床多年,可从多个层面评估左室充盈压,是初步评价心脏功能的便捷措施。核心脏病学可评估心脏交感神经支配的区域及激活模式,预测心力衰竭的发病率和死亡率。心脏磁共振可用于进行危险分层及确定是否适合手术 / 介入治疗。此外, 心脏 CT 及心导管术也是用于评价心功能的常见物理检查方法。本文主要总结了目前各种诊断心力衰竭的物理诊断方法的最新进展,以进一步指导临床实践。

关键词: 心力衰竭;物理诊断;心脏磁共振;心脏彩超;心导管术
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The Current Situation of Physical Diagnosis of Heart Failure

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ABSTRACT: Heart failure was the end stage of the development of various heart diseases, Timely and accurate diagnosis and identification of the changes of patients' condition could further guide the treatment, shorten the hospital stay and provide references for the prognostic evaluation of heart failure. Currently, the diagnosis of heart failure was mainly based on many methods to make a comprehensive evaluation including clinical symptoms, signs, and various imaging, biochemical indicators. The physical diagnosis was the indispensable basis for the diagnosis of heart failure. Echocardiography had been used in clinical applications for many years, which could assess the left ventricular filling pressure from several levels, and become a convenient measure to evaluate the preliminarily cardiac function. Nuclear cardiology could assess the cardiac sympathetic innervations regional and active mode which could predict the morbidity and mortality of heart failure. The role of cardiac magnetic resonance imaging in heart failure had been recognized, and could be used to establish the risk stratification and the suitability of surgical/interventional treatment. In addition, cardiac CT and cardiac catheterization were also used to assess the cardiac function. This article summarized the current situation of physical diagnosis of heart failure to further guide clinical practice.

Key words: Heart failure; Physical Diagnosis; Cardiac magnetic resonance; Heart color ultrasound; Cardiac catheterization
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前言

心力衰竭是各种心脏结构或功能性疾病导致心室充盈和射血能力受损而引起的一组临床综合征,是各种心脏病发展的终末阶段。据估计,在美国心力衰竭所造成的直接和间接成本超过 300 亿美元[1],随着老龄化加重和社会医学的进步,庞大的心衰患者人群,正消耗着大量的医疗资源,带来了巨大的社会经济学负担。目前,尚无单一测试可确诊心力衰竭[2],需借助心脏彩超、核医学、磁共振和 CT 等物理诊断及血浆 B 型利钠肽(BNP)等生化指标作出综合评价,本文旨在就心力衰竭的物理诊断现状作一综述。

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1 心脏彩超

心脏彩超是临床上最常用的方法, 能够显示各心腔大小、心瓣膜结构及功能情况,超声心动图技术可以从多个层面评估左心室充盈(left ventricular developed pressure, LVFP)。研究表明,超声心动图技术在评估 LVFP 方面与心导管技术有较好的相关性[3],且简便易行、可重复操作,是评估 LVFP 的良好方法[4]。组织多普勒成像(tissue Doppler imaging, TDI)技术是一项无创、定量分析室壁运动的新技术,主要通过测定心肌的运动速度评价心肌的舒张功能,以 TDI 速度模式在心尖四腔观记录舒张期二尖瓣环沿长轴方向的运动,其运动速度相对不受心脏负荷状态影响[5],是目前评价左心室整体舒张功能的主要指标之一,可分为静态 TDI 和动态 TDI。TDI 测定的参数有二尖瓣环舒张早期运动速度(Em)、舒张晚期运动速度(Am)、两者的比值(Em/Am)及收缩期运动速度峰值(Sm)。目前,用以评价心力衰竭严重性和预后的方法均为静息状态下进行的,如果能测定运

动状态下 LVFP，可能具有更重要的诊断价值。研究发现，运动状态下舒张早期跨二尖瓣血流速度与舒张早期二尖瓣环运动速度之比(E/Em 值)与心导管测定的 LVEDP 之间有很好的相关性，E/Em 值可以用来识别运动状态下 LVEDP 升高的患者[6]。无论在运动状态、心动过速状态或药物负荷状态下，E/Em 值均可较敏感而准确地反映 LVFP 的变化[7]。目前，二尖瓣 E 峰速度与舒张早期二尖瓣环速度(E/Em)的比例已被证实可用来评估 LVFP，并能反映肺毛细血管压力，是评价心功能的重要指标。

2 核心脏病学

现代核心脏病学发展迅速，包括数字化三维断层显像(SPECT、PET/CT)、心肌灌注、代谢显像、分子影像、心脏受体显像等。迄今为止，只有正电子发射断层扫描(PET)和单光子发射计算机断层显像(SPECT)两种成像模式能够显示交感神经的分布支配及激活[8,9]衰竭的病程中，恶化的心脏射血功能可引起神经激素反馈机制。然而，神经激素的反馈机制可能导致心肌肥厚和纤维化，引起心肌重塑。此外，在慢性心力衰竭的代偿过程中，心肌细胞内β- 肾上腺素能受体的脱敏和向下调控导致心脏功能逐渐下降，交感神经系统功能障碍已被确定为慢性心力衰竭患者预后的重要标记。目前，利用 I123 间碘苯甲胍(123-IMIBG) 行心脏交感神经成像已成为最常见的心脏交感神经支配的评估和激活模式。大多数研究表明 123-IMIBG 心脏交感神经功能成像是一种可靠的预测心力衰竭发病率和死亡率的技术。此外，123-IMIBG 成像可用于预测潜在的致命性室快速性心律失常的心力衰竭患者[10]。ET 显像的主要优点在于其在异常的交感神经支配的空间和时间分辨率的定性、定量方面较 SPECT 显像更为优秀[9]。不同的研究试图使用 PET 显像量化心力衰竭患者全心和异常区域的交感神经支配[11,12]，碳 11 标记的对羟麻黄碱 (11C-HED) 已成为常用的交感神经成像示踪剂。11C-HED 与位于交感神经的神经元蛋白具有高亲和力，更重要的是，11C-HED 并不被存在于终端末梢交感神经神经元的酶类如儿茶酚 -O- 甲基转移(COMT)或单胺氧化酶(MAO)代谢。Vesalainen[11]等发现心衰患者与正常人群的 11C-HED 表达存在明显的差异。

SPECT 和 PET 是目前最适用的非侵入性的分子水平成像技术，因其可用性及持续性使之成为高度精确成像技术，与 CT 或 CMR 的图像相结合能够更好定位解剖，从而克服较低分辨率核成像的不足。PET-CMR 成像能够减少辐射照射，并提供心室功能信息、室壁运动异常、心肌灌注及心肌存活性和疤痕[13]，为心力衰竭的诊断提供更好的选择。

3 心脏磁共振

心脏核磁技术已被广泛应用于临床实践中，在心力衰竭各方面起着举足轻重的作用，可用于确定诊断及其病因，进行危险分层，并为预后提供信息，在确定是否适合手术 / 介入治疗上也有着重要参考意义[14]。MRI 的成像方式大致可分为自旋回波(SE)和电影 MRI，SE 序列 MRI 可提供心脏三维影像，由于心腔内血液的 " 流空效应 "，很容易确定心内膜、心肌和心外膜；相反地，电影 MRI 的任何成像序列(如快速梯度回波、回波平面成像等)流动的血液都表现为高信号。MRI 具有很高的空间分辨率，可准确显示人体心脏的解剖结构，既可显示心腔的结构，也可显示心脏房室壁的结构。同时，由于 MRI 有较高的时间分辨率，其也可准确地反映心内跨瓣血流方式、室壁运动和增厚率、总体和区域射血分数等。对于不同成像技术所测得不同的射血分数，MRI 可被用来确定诊断，在测量左室收缩功能方面具有高精确度和可重复性[15]。

磁共振利用对比剂延迟强化能够识别心肌纤维化，其定义的局灶性纤维化为心力衰竭的患者提供了病因学和危险评估的新视角。后期钆(LGE)成像能够识别透壁或心内下心肌梗死，且能够识别急性梗死区域内的微血管阻塞区域。最重要的是，通过检测瘢痕组织的分布能够准确的区分缺血性与非缺血性心肌疾患。缺血性心肌病所致的瘢痕组织常呈心内膜下或透壁性延迟增强，并与相应血管走行区域一致；非缺血性心肌病所致的瘢痕组织则表现为斑片状心外膜下或室壁中层纵向条纹状亦或整个心内膜下强化更为常见。此外，T1 像对比增强扫描可用于评估扩张型心肌病患者的弥漫性非缺血性心肌纤维化，T2 像上还可以区别心肌损伤与心肌水肿。LGE-CMR 检查还可通过评价心肌纤维 - 脂肪化区域内瘢痕组织的程度来预测心功能受损患者 VT/SCD 的发生，LGE 程度越严重则 VT/SCD 的发生率越高，提示患者的预后不良。

CMR 心肌标记技术(myocardial tagging)常用于评估左心室不同步程度，分析整个心脏失同步情况，确定左心室最晚激动区，并根据心肌纤维化程度、位置及其起搏器导线的关系寻找 CRT 左心室导线植入位置，以规避心室心肌瘢痕组织并置于左心室最晚激动区内获得最大的血流动力学收益，为心力衰竭患者心脏再同步化治疗(CRT)提供可靠信息。左心室圆周均匀比估算指数 (circumferential uniformity ratio estimate，CURE)可预测患者的 CRT/CRT-D 应答及远期临床预后。CURE 介于 0(绝对同步)和 1(绝对失同步)之间，CURE＜0.75 预测 CRT 预后患者心功能改善准确率为 90%。可见，基于 CMR 心肌标记技术可评价左室不同步情况，用于筛选适宜的心衰患者接受 CRT/CRT-D 治疗，并能较准确地预测其心功能的改善情况及预后。

4 心脏 CT

近年来，多层计算机断层扫描(MDCT)能无创性评估左心室(LV)功能与冠状动脉疾病(CAD)，为临床诊治提供有价值的诊断和预后指标。随着 MDCT 空间和时间分辨率的提高，MDCT 技术能够提供可靠和可重复性评估舒张末左室容积、心肌梗死面积、梗死体积、心脏功能[16,17]、存活心肌延迟对比增强[18-20]和心肌血流量[21-23]。MDCT 能够通过检测急性和慢性梗死瘢痕延迟对比增强区分存活和非存活心肌，在静脉注射后，碘造影剂积聚在心肌梗死的受损的心肌组织之间。这种差别存在于存活心肌和无活性的心肌之间造成 X 线衰减值增加，MDCT 能够检测梗死区的碘分子的积累。延迟对比增强 MDCT 目前提供的最高空间分辨率梗死疤痕特征。因此，量化 MDCT 梗死面积和梗死体积可能是一个有价值的成像方式[24]，能够为心力衰竭患者病因学诊断提供参考。作为一种新型的评价左心功能、心肌存活性成像技术，在 MRI 的无法实施时，如存在心脏

起搏器，除颤器和假肢及其他植入性金属器材甚至幽闭恐惧症患者，MDCT 提供了一种新的选择。

5 心导管术

心导管检查术(简称心导管术)是诊断、鉴别诊断及治疗心血管疾病、监护心脏手术和危重患者病情变化、研究心脏循环系统血流动力学的重要方法[25]，其中漂浮导管是带气囊漂浮的心导管，亦称导管。心导管送入肺小动脉末梢处，测定 " 毛细血管压 "，可估计其心功能及协助诊断单纯性二尖瓣狭窄的程度。应用气囊导管顺血流进入腔静脉、心房、心室、肺动脉等部位并测定其压力，计算心排血量、心排血指数、射血分数等，对危重病例如心源性休克、急性心肌梗死并发泵衰竭、心脏手术后循环功能不稳定等进行心功能鉴别，以指导用药及判断其预后。Swan-Ganz 漂浮导管可以客观地评价心脏功能，测定中心静脉压(CVP)、肺动脉压(PAP)、肺毛细血管压(PCWP)，计算 CI、SV、左室每搏做功指数(LVSWI)，是最有价值的血流动力学检测手段。徐向辉等[26]论述的 Swan-Ganz 导管监测技术作为一个重大进步，极大地促进了围手术医学、危重病医学等学科的发展，提高了危重患者的抢救成功率。吴强等研究认为对于严重的急性左心衰患者，漂浮导管监测 PCWP 最为及时、精确。由此可见，利用漂浮导管可迅速准确地测量心脏血流动力学改变，评价心脏功能，更好地指导临床药物治疗，以缩短住院时间，节约医疗资源。

综上所述，多种物理检查均有助于正确诊断心力衰竭，但其均有独特的优势及局限性。我们应该充分灵活的利用各项物理检查措施，充分发挥各项物理检查的功能，同时为患者节省不必要的费用，并结合生化检查及患者症状、体征更好地为心力衰竭患者的确诊及完善治疗提供便利。

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