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心脏彩超评估高血压左心室肥厚伴左心衰竭患者心功能的临床价值及与NYHA分级的关系研究*

毛银娟[1] 杨 礼[2] 刘保民[3] 谢 莹[1] 孙耀林[4] 周 琦[3△]

（1 陕西省第四人民医院超声医学科 陕西 西安 710043；2 西安市儿童医院超声科 陕西 西安 710003；
3 西安交通大学第二附属医院超声科 陕西 西安 710004；4 陕西省第四人民医院心内科 陕西 西安 710043）

摘要 目的：探讨心脏彩超评估高血压左心室肥厚（LVH）伴左心衰竭患者心功能的临床价值，分析其超声指标与美国纽约心脏病协会（NYHA）分级的相关性。**方法：**选择2017年5月至2018年5月我院收治的127例高血压LVH伴左心衰竭患者为观察组，根据NYHA分级将其分为NYHAⅡ级组（41例）、Ⅲ级组（47例）、Ⅳ级组（39例），另选择100例体检的健康志愿者为对照组。所有受试者均接受心脏彩超获得相关参数[左心房内径（LAD）、左心室舒张末期内径（LVEDD）、左心室收缩末期内径（LVESD）、左心室短轴缩短率（LVFS）、左心室后壁厚度（LVPWT）、室间隔厚度（IVST）、左心室射血分数（LVEF）、左心室舒张早期充盈峰最大充盈速度/舒张晚期充盈峰最大峰值速度（E/A）比值、Tei指数]，分析心脏彩超相关参数与NYHA分级之间相关性。**结果：**观察组患者LAD、LVEDD、LVESD、LVPWT、IVST、Tei指数高于对照组（$P<0.05$），LVFS、LVEF、E/A比值低于对照组（$P<0.05$）。Tei指数随着NYHA分级增高而增高（$P<0.05$），LVFS、LVEF、E/A比值随着NYHA分级增高而降低（$P<0.05$）。Spearman秩相关分析结果显示，Tei指数与NYHA分级呈正相关（rs=0.398，$P<0.05$），LVFS、LVEF、E/A比值与NYHA分级呈负相关（rs=-0.285，-0.442，-0.305，$P<0.05$）。**结论：**高血压LVH伴左心衰竭患者发生明显左室肥厚和左心功能降低，心脏彩超可准确评估高血压LVH伴左心衰竭患者的心功能和病情严重程度，且部分心脏彩超相关参数与NYHA分级相关。

关键词：心脏彩超；高血压；左心室肥厚；左心衰竭；心功能；NYHA分级

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Clinical value of Cardiac Color Doppler Ultrasound in Evaluating Cardiac Function in Patients with Left Ventricular Hypertrophy Combined with Left Ventricular Failure and Its Relationship with NYHA Classification*

MAO Yin-juan[1], YANG Li[2], LIU Bao-min[3], XIE Ying[1], SUN Yao-lin[4], ZHOU Qi[3△]

(1 Department of Medical Ultrasonics, The Fourth People's Hospital of Shaanxi, Xi'an, Shaanxi, 710043, China;
2 Department of Ultrasound, Xi'an Children's Hospital, Xi'an, Shaanxi, 710003, China;
3 Department of Ultrasound, The Second Affiliated Hospital of Xi'an Jiaotong University, Xi'an, Shaanxi, 710004, China;
4 Department of Internal Medicine Cardiovascular, The Fourth People's Hospital of Shaanxi, Xi'an, Shaanxi, 710043, China)

ABSTRACT Objective: To explore the clinical value of cardiac color Doppler ultrasound in evaluating cardiac function in patients with hypertensive left ventricular hypertrophy (LVH) combined with left ventricular failure, and to analyze the correlation between echocardiographic parameters and New York Heart Association (NYHA) classification. **Methods:** 127 patients with hypertensive LVH combined with left ventricular failure who were admitted to our hospital from May 2017 to May 2018 were selected as observation group. They were divided into NYHA class II group (41 cases), class III group (47 cases) and class IV group (39 cases) according to NYHA classification. Another 100 healthy volunteers were selected as control group. All subjects received cardiac color Doppler ultrasound to obtain relevant parameters[left atrial dimension(LAD), left ventricular end-diastolic dimension(LVEDD), left ventricular endsystolic dimension(LVESD), leftventricular fractional shortening(LVFS), left ventricular posterior wall thickness(LVPWT), interventricular septal thickness(IVST), left ventricular ejection fraction(LVEF), maximum filling velocity ratio of left ventricular early diastolic filling peak to late diastolic filling peak (E/A) ratio, Tei index]. The correlation between cardiac color Doppler ultrasound parameters and NYHA classification was analyzed. **Results:** The LAD, LVEDD, LVESD, LVPWT, IVST and Tei index of the observation group were higher than those of the control group ($P<0.05$), and the LVFS, LVEF and E/A ratio were lower than those of the control group ($P<0.05$). Tei index increased with the increase of NYHA classification ($P<0.05$), while LVFS, LVEF and E/A ratio decreased with the increase of NYHA

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作者简介：毛银娟（1980-），女，本科，主治医师，研究方向：心脏血管超声，E-mail: myj109911@163.com

△ 通讯作者：周琦（1966-），女，博士，主任医师，研究方向：超声造影及浅表器官疾病超声诊疗，E-mail: 13909232905@163.com

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classification (P<0.05). Spearman rank correlation analysis showed that Tei index was positively correlated with NYHA classification (rs=0.398, P<0.05). LVFS, LVEF, E/A ratio were negatively correlated with NYHA classification (rs=-0.285, -0.442, -0.305; P<0.05). **Conclusion:** The patients with hypertension LVH combined with left ventricular failure have significant left ventricular hypertrophy and left ventricular dysfunction. Cardiac color Doppler ultrasound can accurately assess the cardiac function and severity of Hypertension LVH patients with left ventricular failure, and some parameters related to color Doppler echocardiography are related to NYHA classification.

Key words: Cardiac color Doppler ultrasound; Hypertension; Left ventricular hypertrophy; Left ventricular failure; Heart function; NYHA classification

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前言

高血压是多种心血管疾病的危险因素，长期高血压可导致心室肥厚、心肌肥厚、射血功能下降等结构和功能改变[1,2]。左心室肥厚（Left ventricular hypertropgy，LVH）是高血压并发症之一，高血压 LVH 是不良心血管事件的独立危险因素，高血压 LVH 患者发生心力衰竭的风险是单独高血压患者的 6～10 倍[3]。早期诊断高血压 LVH 伴左心衰竭并给予及时治疗对预防不良心血管事件具有重要意义[4,5]，影像学检查在心脏疾病诊断、危险分层中具有重要价值，心脏彩超因其具有操作简便、快捷、可动态监测心功能、评估心室重构等优势，在诊断高血压 LVH、心力衰竭等方面应用较广 [6,7]。本研究通过分析 127 例高血压 LVH 伴左心衰竭患者的心脏彩超检查资料，主要探讨心脏彩超对其心功能的评估价值以及心脏彩超指标与心功能分级的关系，旨在为临床高血压 LVH 伴左心衰竭的诊疗提供参考，现报道如下。

1 资料与方法

1.1 临床资料

选择 2017 年 5 月至 2018 年 5 月我院收治的 127 例高血压 LVH 伴左心衰竭患者作为观察组，纳入标准：① 符合《中国高血压防治指南 2010》中高血压诊断标准[8]；② 男性左心室后壁厚度（Left ventricular posterior wall thickness，LVPWT）或室间隔厚度（Interventricular septal thickness，IVST）≥ 1.1cm，女性 LVPWT 或 IVST≥ 1.0 cm[9]；③ 符合 2014 版《中国心力衰竭诊断和治疗指南》中关于左心衰竭的诊断标准[10]，美国纽约心脏病协会（New York Heart Association，NYHA）分级为Ⅱ、Ⅲ、Ⅳ级；④ 均行心脏彩超检查。排除标准：① 继发性高血压、合并恶性肿瘤；② 先天性心脏病、心肌梗塞、心肌扩张、瓣膜关闭不全、主动脉夹层等其它心脏病；③ 既往接受抗心力衰竭治疗者；④ 近 3 个月接受心脏外科手术者。其中男 78 例，女 49 例，年龄 57～69 岁，平均（62.35± 3.19）岁，高血压病程 8～20 年，平均（11.25± 3.19）年，收缩压 135～160 mmHg，平均（142.35± 6.59）mmHg，舒张压 95～110 mmHg，平均（99.35± 8.52）mmHg；NYHA 分级：Ⅱ级 41 例（Ⅱ级组），Ⅲ级 47 例（Ⅲ级组），Ⅳ级 39 例（Ⅳ级组）。另选择 100 例于我院体检的健康志愿者为对照组，均排除高血压、冠心病等心血管系统疾病。其中男 65 例，女 35 例，年龄 55～70 岁，平均（63.02± 3.35）岁。两组受试者性别、年龄比较无统计学差异（P>0.05），具有可比性。本研究获得我院伦理委员会批准，患者及其家属均知情同意且签署同意书，诊疗过程严格遵循伦理学原则，保障患者隐私和安全。

1.2 方法

美国 Vivi7 型心脏彩色多普勒超声诊断仪，探头频率 2.0～5.0 MHz。患者取左侧卧位，平静呼吸，连接同步心电图，先于胸骨旁左室长轴切面、心尖四腔、心尖两腔、心尖左室长轴切面进行二维超声和组织多普勒技术扫描，观察心脏形态、结构、血流有无异常，再于心尖方向测量左心房内径（Left atrial dimension，LAD）、左心室舒张末期内径（Left ventricular end-diastolic dimension，LVEDD）、左心室收缩末期内径（Left ventricular endsystolic dimension，LVESD）、左心室短轴缩短率（Left-ventricular fractional shortening，LVFS）、LVPWT、IVST，双平面 Simpson 法测量左心室射血分数（Left ventricular ejection fraction，LVEF）。于心尖两腔、四腔切面启动组织多普勒模式，测量左心室舒张早期充盈峰最大充盈速度（E 值）和舒张晚期充盈峰最大峰值速度（A 值），计算 E/A 比值和左心室 Tei 指数，Tei 指数计算公式为（左心室等容收缩时间 + 左心室等容舒张时间）/ 射血时间。以上均由我院彩超室具有 3 年以上心脏彩超工作经验的住院医师完成，取 3-5 个心动周期平均值。

1.3 统计学分析

采用 SPSS 25.0 进行数据分析，心脏彩超指标等计量资料经 Kolmogorov-Smirnov 和 levene 检验均符合正态分布、具备方差齐性，以（$\bar{x}\pm s$）表示，多组间比较采用单因素方差分析，组间两两对比采用 LSD-t 检验，两组间比较采用独立样本 t 检验。计数资料以率（%）表示，采用 χ^2 检验。Spearman 秩相关分析心脏彩超指标与 NYHA 分级之间相关性。所有统计均采用双侧检验，检验水准α=0.05。

2 结果

2.1 两组心脏彩超指标比较

观察组患者 LAD、LVEDD、LVESD、LVPWT、IVST、Tei 指数高于对照组（P<0.05），LVFS、LVEF、E/A 比值低于对照组（P<0.05），见表 1。

2.2 不同 NYHA 分级高血压 LVH 伴左心衰竭患者心脏彩超指标比较

Tei 指数随着 NYHA 分级的增高而增高（P<0.05），LVFS、LVEF、E/A 比值随着 NYHA 分级的增高而降低（P<0.05），NYHA Ⅲ级组、Ⅳ级组 LAD、LVEDD、LVESD、LVPWT、IVST 高于 NYHA Ⅱ级组（P<0.05），但 NYHA Ⅲ级组、Ⅳ级组之间比较无统计学差异（P>0.05），见表 2。

表 1 高血压 LVH 伴左心衰竭患者、对照组心脏彩超指标比较($\bar{x}\pm s$)

Table 1 Comparison of cardiac color Doppler ultrasound parameters between patients with hypertensive LVH combined with left ventricular failure and control group($\bar{x}\pm s$)

Indexes	Observation group(n=127)	Control group(n=100)	t	*P*
LAD(mm)	52.51± 9.52	39.25± 5.61	12.340	0.000
LVEDD(mm)	53.62± 12.54	45.26± 10.17	2.822	0.005
LVESD(mm)	56.35± 13.07	44.25± 9.12	7.870	0.000
LVFS(%)	23.51± 4.65	31.25± 5.21	11.805	0.000
LVPWT(mm)	12.35± 2.65	8.52± 1.37	13.133	0.000
IVST(mm)	11.35± 3.54	7.52± 2.47	9.197	0.000
LVEF(%)	50.21± 5.41	66.35± 9.57	16.034	0.000
E/A ratio	0.85± 0.35	1.35± 0.49	8.959	0.000
Tei index	0.79± 0.25	0.51± 0.13	10.167	0.000

表 2 不同 NYHA 分级高血压 LVH 伴左心衰竭患者心脏彩超指标比较($\bar{x}\pm s$)

Table 2 Comparison of cardiac color Doppler ultrasound indicators in patients with hypertension LVH combined with left ventricular failure with different NYHA classification($\bar{x}\pm s$)

Indexes	Class Ⅱ group(n=41)	Class Ⅲ group(n=47)	Class Ⅳ group(n=39)	F	*P*
LAD(mm)	49.51± 9.52	53.13± 10.25[◦]	54.92± 10.84[◦]	12.340	0.000
LVEDD(mm)	48.65± 9.85	55.21± 10.35[◦]	56.93± 10.47[◦]	2.822	0.005
LVESD(mm)	51.35± 11.25	58.24± 12.92[◦]	59.33± 13.25[◦]	7.870	0.000
LVFS(%)	29.32± 6.37	23.05± 5.17[◦]	17.96± 4.08[◦◦]	11.805	0.000
LVPWT(mm)	10.92± 2.73	12.76± 2.95[◦]	13.36± 3.24[◦]	13.133	0.000
IVST(mm)	9.05± 3.54	12.35± 3.71[◦]	12.56± 3.98[◦]	9.197	0.000
LVEF(%)	54.42± 6.85	50.21± 5.78[◦]	45.78± 4.73[◦◦]	16.034	0.000
E/A ratio	1.06± 0.42	0.84± 0.39[◦]	0.64± 0.35[◦◦]	8.959	0.000
Tei index	0.65± 0.24	0.79± 0.27[◦]	0.94± 0.31[◦◦]	10.167	0.000

Note: Compared with class II group, [◦] *P*<0.05; Compared with class III group, [◦] *P*<0.05.

2.3 心脏彩超指标与 NYHA 分级的相关性分析

Spearman 秩相关分析结果显示，Tei 指数与 NYHA 分级呈正相关（*P*＜0.05），LVFS、LVEF、E/A 比值与 NYHA 分级呈负相关（*P*＜0.05），LAD、LVEDD、LVESD、LVPWT、IVST 与 NYHA 分级无明显相关性（*P*＞0.05），见表 3。

表 3 心脏彩超指标与 NYHA 分级的相关性分析

Table 3 Analysis of correlation between cardiac color Doppler ultrasound and NYHA classification

Indicators	NYHA classification	
	r_s	*P*
LAD	0.119	0.120
LVEDD	0.135	0.113
LVESD	0.164	0.106
LVPWT	0.106	0.175
IVST	0.112	0.133
Tei index	0.398	0.001
LVFS	-0.285	0.016
LVEF	-0.442	0.000
E/A ratio	-0.305	0.007

3 讨论

高血压是严重危害全球公共卫生健康的慢性疾病,据报道全球约 9.72 亿高血压患者,预计 2075 年增加至 15.6 亿,我国老年人高血压患病率高达 49.1%[12]。高血压病程长,长期高血压得不到有效控制可引起外周循环阻力增加,左心室后负荷增加,左心室代偿性做功增加收缩力以克服外周血管阻力,逐渐引起左心室肥厚、左心房扩大、舒张功能障碍、二尖瓣反流等高血压 LVH 表现[13-15]。受长期高血压影响,心脏后负荷过重引起左心室泵血能力降低,同时心肌肥厚可抑制心室收缩能力,最终出现心排出量降低、心腔不断扩大、心室心房压力升高、静脉回流障碍等一系列心力衰竭临床症状。高血压 LVH 伴左心衰竭临床发病率约 0.4%,老年患者患病率达 3.0%[16]。心力衰竭进一步加重心肌损害和左室重构,形成恶性循环,临床猝死率极高[17-19]。早期、准确评估高血压 LVH 伴左心衰竭患者心功能有助于指导临床治疗,降低患者病死率。

心电图对高血压 LVH 伴左心衰竭诊断阳性率偏低,对早期心脏结构改变患者不易检出[20,21],冠脉造影具有有创性和辐射性,价格昂贵,限制在临床的应用[22]。心脏彩超是临床诊断心脏疾病最常用的影像手段,是目前唯一能动态观察心脏结构、搏动、血流动力学的无辐射诊断方法[23]。心脏彩超无绝对禁忌症,适应范围广,价格低廉,适合高血压 LVH 伴左心衰竭患者心功能评估。多普勒超声技术具有分辨率高、快速成像、定量分析血流动力学信息的优势,结合二维超声可评估心脏各房室内径大小、室壁厚度、整体运动节律性、瓣膜、心血管、房室间隔等病变以及上述改变引起的血流路径和动力学改变,与常规心电图比较,具有更高的灵敏度和准确性[24,25]。本研究显示观察组患者 LAD、LVEDD、LVESD、LVPWT、IVST、Tei 指数高于对照组,LVFS、LVEF、E/A 比值低于对照组,说明高血压 LVH 伴左心衰竭患者已经出现明显的左室重构以及左心室射血功能的降低,与高血压 LVH 合并左心衰竭病理改变相吻合,这与多数研究结果一致[7,26]。本研究通过进一步观察不同 NYHA 分级患者心脏彩超指标的差异,发现 Tei 指数随着 NYHA 分级的增高而增高,而 LVFS、LVEF、E/A 比值随着 NYHA 分级的增高而降低,而 LAD、LVEDD、LVESD、LVPWT、IVST 在 NYHA 分级Ⅲ级、Ⅳ级之间不存在统计学差异,说明随着高血压 LVH 伴左心衰竭患者心功能的降低,左心射血功能逐渐降低,左心重构有加重倾向,但是 NYHA 分级Ⅲ级、Ⅳ级之间并不明显,提示 NYHA 分级Ⅲ级、Ⅳ级高血压 LVH 合并左心衰竭患者左心室肥厚程度接近,左心室重构在达到一定程度时进程逐渐减慢,高血压 LVH 伴左心衰竭对左心室射血功能的影响更为明显。本研究相关性分析发现 Tei 指数与 NYHA 分级呈正相关,LVFS、LVEF、E/A 比值与 NYHA 分级呈负相关,其中 Tei 指数、LVEF 与 NYHA 关联性最强。Tei 指数是反映左心射血指数的敏感指标,不受心律、心脏负荷和形状影响,是心力衰竭患者诊断、病情严重程度和预后预测的有效指标[27,28]。伴左室肥厚的左心室舒张功能不全患者 Tei 指数明显高于无左室肥厚患者,说明 Tei 指数可有效反映左室肥厚引起的左心功能不全[29]。LVEF 直接反映左心室射血功能,2016 年欧洲心脏病学会将 LVEF40%～49%定义为心力衰竭 [30]。因此采用心脏彩超评估 Tei 指数、LVEF 可更好地反映高血压 LVH 伴左心衰竭患者心功能。

综上,高血压 LVH 伴左心衰竭患者左心房扩大、左心射血功能下降明显,且随着患者 NYHA 分级的增高,左室收缩功能下降更为明显,Tei 指数、LVFS、LVEF、E/A 比值与 NYHA 分级均存在密切关系,是评估高血压 LVH 伴左心衰竭患者心功能的重要指标。心脏彩超可准确评估高血压 LVH 伴左心衰竭患者心功能和病情严重程度,具有较高的临床应用价值。

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