· 论　著 ·

心脏彩色多普勒超声和血脂诊断冠心病的临床价值

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[摘要]　目的　探讨心脏彩色多普勒超声、血脂诊断冠状动脉粥样硬化性心脏病（简称冠心病）的临床价值。方法　选择 2013 年 6 月至 2014 年 10 月东南大学附属南京市第二医院心内科因拟诊冠心病入院治疗的 240 例患者。采用 Judkins 法行冠状动脉造影，根据冠状动脉造影结果将患者分为非冠心病组（$n=58$）和冠心病组（$n=182$），再将冠心病组患者分为单支病变亚组（$n=84$）和多支病变亚组（$n=98$）。比较非冠心病组和冠心病组、单支病变亚组和多支病变亚组患者的心脏彩色多普勒超声检查指标及血脂水平。采用 logistic 回归模型对冠心病影响因素行多因素分析。结果　冠心病组舒张早期 E 峰血流速度（E）、E 峰和舒张晚期 A 峰血流速度比值（E/A）均低于非冠心病组，E 峰减速时间（DT）、左心室等容舒张期（IVRT）均长于非冠心病组，左心房内径（LAD）、室间隔厚度（IVS）、左心室后壁厚度（LVPW）、左心室内径（LVD）均大于非冠心病组（P 均<0.05)）；冠心病患者中多支病变亚组 E 高于单支病变亚组，E/A 低于单支病变亚组，DT、IVRT 均长于单支病变亚组，LAD、IVS、LVPW、LVD 均大于单支病变亚组（P 均<0.05）。冠心病组血清总胆固醇（TC）、三酰甘油（TG）、低密度脂蛋白胆固醇（LDL-C）水平均高于非冠心病组，高密度脂蛋白胆固醇（HDL-C）水平低于非冠心病组（P 均<0.05）；冠心病患者多支病变亚组血清 TC、TG、LDL-C 水平均高于单支病变亚组，血清 HDL-C 水平低于单支病变亚组（P 均<0.05）。Logistic 回归分析示年龄、TC、IVRT、LAD、LDL-C 是冠心病的独立危险因素（P 均<0.05）。结论　血脂和左心室舒张功能异常与冠心病的发生、发展密切相关，其异常对冠心病的临床诊断有着重要意义。

[关键词]　冠心病；超声心动描记术；彩色多普勒超声检查；血脂；冠状动脉造影

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Clinical value of echocardiography and blood lipid measurements in diagnosis of coronary heart disease

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[Abstract]　Objective　To evaluate the clinical value of echocardiography and blood lipid level in the diagnosis of coronary heart disease (CAD). Methods　A retrospective analysis was conducted on 240 suspected CAD in-patients who were treated in the Second Hospital of Nanjing, Southeast University from Jun. 2013 to Oct. 2014. The patients were divided into non-CAD group ($n=58$) and CAD group ($n=182$) according to the results of coronary angiography. The patients in CAD group were further divided into single vessel lesion group ($n=84$) and multi-vessel lesion group ($n=98$). The indexes of color Doppler echocardiography and blood lipid levels were compared between non-CAD group and CAD group, and single vessel disease subgroup and multiple vessel disease subgroup. Logistic regression was used to analyze the influencing factors of CAD. Results　E-peak velocity (E) in early diastolic phase and the ratio of E peak velocity to late diastolic phase A-peak velocity (E/A) in CAD group were lower than those in non-CAD group; the E-peak deceleration time (DT) and left ventricular isovolumetric relaxation time (IVRT) were longer than those in non-CAD group; the left atrial diameter (LAD), interventricular septal thickness (IVS) and left ventricular posterior wall thickness (LVPW) were higher than those in non-CAD group; and the left ventricular diameter (LVD) was larger than that of non-CAD group (all $P<0.05$). In patients with CAD, E in multi-vessel lesion subgroup was higher than that in single vessel lesion subgroup; E/A in multi-vessel lesion subgroup was lower than that in single vessel lesion subgroup; DT and IVRT were longer than those in single vessel lesion

subgroup; and LAD, IVS, LVPW and LVD were larger than those in single vessel lesion subgroup (*P*＜0.05). The levels of serum total cholesterol (TC), triglyceride (TG), and low-density lipoprotein cholesterol (LDL-C) in CAD group were higher than those in non-CAD group, and the level of high-density lipoprotein cholesterol (HDL-C) was lower than that in non-CAD group (all *P*＜0.05). The levels of serum TC, TG and LDL-C in multi-vessel lesion subgroup were higher than those in single vessel lesion subgroup, and the HDL-C level was lower than that in single vessel lesion subgroup (all *P*＜0.05). Logistic regression analysis showed that age, TC, IVRT, LAD and LDL-C were independent risk factors for CAD (all *P*＜0.05), and E and HDL-C were independent protective factors for CAD (both *P*＜0.05). **Conclusion**　Abnormal blood lipid and left ventricular diastolic function are closely related to the development and progression of CAD, and their abnormalities are of great significance for the clinical diagnosis of CAD.

　　[Key words]　coronary disease; echocardiography; color Doppler ultrasonography; blood lipid; coronary angiography

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　　冠状动脉粥样硬化性心脏病（简称冠心病）是指冠状动脉血管发生粥样硬化引起血管腔狭窄或阻塞，从而造成心肌缺血、缺氧或坏死而导致的心脏病[1]。在美国等发达国家，冠心病位列死亡原因的第 1 位，但在控制危险因素和改进治疗措施后，自 20 世纪 60 年代开始冠心病的病死率逐渐呈下降趋势[2]。在我国，随着经济生活水平的提高、饮食结构的改变及人口老龄化，冠心病已逐渐成为危害中老年人健康的主要疾病之一，冠心病的早期诊断和规范化治疗可有效预防心血管事件的发生。目前，冠状动脉造影（coronary angiography，CAG）是诊断冠心病的金标准，但其因费用高、属有创性检查、有相对危险性，难以在临床广泛推广，因此找到一种适合临床、操作简单方便的诊断手段尤为重要。冠心病的病理基础在于动脉粥样硬化，血脂代谢异常是该病发生、发展的主要原因，研究表明血脂异常与冠心病病情呈正相关[3-4]。心脏超声在冠心病的诊断中有费用低、无创、重复性好等优点，易于被患者接受。本研究拟探讨心脏超声和血脂水平异常对冠心病早期诊断的临床价值。

1　资料和方法

1.1　研究对象　选择 2013 年 6 月至 2014 年 10 月东南大学附属南京市第二医院心血管内科因拟诊冠心病而住院治疗的患者 240 例作为研究对象。纳入标准：（1）特征性胸痛；（2）心电图有 ST-T 段改变；（3）心肌酶谱异常；（4）患者临床资料完整。排除标准：(1)对碘或碘造影剂过敏；(2)有严重心肺功能不全不能耐受手术者；(3)既往有冠心病手术治疗史者；(4)严重肝、肾功能不全者；(5)纳入前

使用抗凝、降脂、抗菌药物治疗者。本研究通过东南大学附属南京市第二医院医学伦理委员会审批。

1.2　研究方法

1.2.1　记录一般资料　包括年龄、性别、吸烟史、饮酒史、高血压史、糖尿病史、心血管疾病家族史。

1.2.2　检测生物化学指标　入院次晨采集空腹 8 h 以上静脉血，检测血脂水平，包括总胆固醇（total cholesterol，TC）、三酰甘油（triglyceride，TG）、低密度脂蛋白胆固醇（low-density lipoprotein cholesterol，LDL-C）、高密度脂蛋白胆固醇（high-density lipoprotein cholesterol，HDL-C）。根据《中国成人血脂异常防治指南》[5]，TC＞5.18 mmol/L、LDL-C≥3.37 mmol/L、HDL-C＜1.04 mmol/L 和（或）TG≥1.7 mmol/L 为血脂异常。

1.2.3　心脏超声检查　使用荷兰 Philips 公司 SONOS 7500 型彩色多普勒超声诊断仪、采用 2.5～5.0 MHz 弧形探头进行心脏超声检查。按常规在胸骨旁左心室长轴切面测量左心房内径（left atrial diameter，LAD）、左心室内径（left ventricular diameter，LVD）、室间隔厚度（ventricular septal thickness，IVS）、左心室后壁厚度（left ventricular posterior wall thickness，LVPW），于心尖四腔心切面利用辛普森法测左心室射血分数（left ventricular ejection fraction，LVEF）；获得左房室瓣血流频谱图，将取样容积置于左房室瓣口左心室侧 1.0 cm 处，尽量使其与血流平行或夹角控制在 20°以内，在呼气末测量舒张早期 E 峰血流速度（early diastolic blood flow speed of E-peak，E）、E 峰减速时间（E-peak deceleration time，DT）、舒张晚期 A 峰的血流速度（late diastolic blood flow speed of A-peak，A）、

E 峰和 A 峰血液速度比值（E/A），以及左心室等容舒张期时间（isovlumetric relaxation time，IVRT）。各参数均测量 3 次取平均值。

1.2.4　左心室舒张功能（left ventricular diastolic function，LVDF）异常的超声表现判断　Ⅰ级舒张功能减低：主动脉松弛功能障碍，左心室顺应性尚好；左房室瓣血流频谱示 E/A＜1.0，DT＞240 ms，IVRT＞90 ms，Valsalva 动作后 E/A＜1.0。Ⅱ级舒张功能减低：假性充盈"正常"；左房室瓣血流频谱示 E/A 为 1～1.5，DT 为 160～200 ms，IVRT 70～90 ms，Valsalva 动作后 E/A＜1.0。Ⅲ级舒张功能减低：可逆性限制型舒张功能障碍；左房室瓣血流频谱示 E/A＞2.0，DT＜160 ms，IVRT＜70 ms，Valsalva 动作后 E/A 降至正常或 E/A＜1。Ⅳ级舒张功能减低：不可逆性限制型舒张功能障碍；左房室瓣血流频谱示 E/A＞2.0，DT＜160 ms，IVRT＜70 ms，Valsalva 动作后 E/A 略减低或无变化。

1.2.5　CAG 检查　采用 Judkins 法行冠状动脉造影，根据 CAG 结果将患者分为非冠心病组和冠心病组，再将冠心病组患者分为单支病变亚组和多支病变亚组。左主干、左前降支、左回旋支和右冠状动脉及其主要分支中任何 1 支狭窄≥50%判定为有意义病变，即确诊为冠心病。仅 1 支分支狭窄为单支病

变，任意 2 支及 2 支以上分支狭窄为多支病变。

1.3　统计学处理　应用 SPSS 24.0 软件进行数据处理。计量资料以 $\bar{x}\pm s$ 表示，两组间比较采用独立样本 t 检验；计数资料以例数和百分数表示，两组间比较采用 χ^2 检验。采用 logistic 回归进行多因素分析。检验水准（α）为 0.05。

2　结　果

2.1　患者一般资料比较　本研究共纳入患者 240 例，男 126 例、女 114 例。非冠心病组 58 例，其中男 32 例、女 26 例，平均年龄为（62.53±8.32）岁，有高血压史者 93 例、糖尿病史者 66 例、吸烟史者 65 例；冠心病组 182 例，其中男 94 例、女 88 例，平均年龄为（66.89±9.63）岁，有高血压病史者 20 例、糖尿病史者 12 例、吸烟史者 12 例。非冠心病组与冠心病组年龄、高血压史、糖尿病史、吸烟史差异均有统计学意义（P 均＜0.05），而性别、饮酒史、心血管疾病家族史差异均无统计学意义（P 均＞0.05）。冠心病组单支病变亚组 84 例（男 27 例、女 57 例），多支病变亚组 98 例（男 67 例、女 31 例），两亚组间性别、高血压史、糖尿病史、吸烟史、饮酒史、心血管疾病家族史差异均有统计学意义（P 均＜0.01）。见表 1。

表 1　两组患者一般资料比较
Tab 1　Comparison of general data between the two groups

Characteristic	Non-CAD $N=58$	CAD			Statistic[a]	P value[a]	Statistic[b]	P value[b]
		Total $N=182$	Single vessel lesion $N=84$	Multi-vessel lesion $N=98$				
Male/female n	32/26	94/88	27/57	67/31	$\chi^2=0.219$	0.640	$\chi^2=23.767$	＜0.01
Age (year), $\bar{x}\pm s$	62.53±8.32	66.89±9.63	66.14±9.01	67.53±10.12	$t=3.096$	0.002	$t=-0.970$	0.334
Hypertension n (%)	20 (34.5)	93 (51.1)	13 (15.4)	80 (81.6)	$\chi^2=4.874$	0.027	$\chi^2=79.222$	＜0.01
Diabetes n (%)	12 (20.7)	66 (36.3)	5 (5.9)	61(62.2)	$\chi^2=4.863$	0.027	$\chi^2=62.012$	＜0.01
Smoking n (%)	12 (20.7)	65 (35.7)	4 (4.8)	61 (62.2)	$\chi^2=4.557$	0.033	$\chi^2=65.096$	＜0.01
Drinking n (%)	17 (29.3)	58 (31.9)	0	58 (59.2)	$\chi^2=0.134$	0.714	$\chi^2=72.968$	＜0.01
Family history n (%)	14 (24.1)	48 (26.4)	0	48 (49.0)	$\chi^2=0.115$	0.735	$\chi^2=55.881$	＜0.01

[a]: CAD group vs non-CAD group; [b]: Single vessel lesion subgroup vs multi-vessel lesion subgroup. CAD: Coronary heart disease

2.2　心脏彩色多普勒超声检查结果　冠心病组 E、E/A 均低于非冠心病组，DT、IVRT 均长于非冠心病组，LAD、IVS、LVPW、LVD 均大于非冠心病组，差异均有统计学意义（P 均＜0.01）。冠心病患者多支病变亚组 E 高于单支病变亚组，E/A 低于单支病变亚组，DT、IVRT 均长于单支病变亚组，LAD、IVS、LVPW、LVD 均大于单支病变亚组，

差异均有统计学意义（P 均＜0.05）。见表 2。

2.3　血脂结果　冠心病组血清 TC、TG、LDL-C 水平均高于非冠心病组，HDL-C 低于非冠心病组，差异均有统计学意义（P 均＜0.01）。冠心病患者多支病变亚组血清 TC、TG、LDL-C 水平均高于单支病变亚组，血清 HDL-C 低于单支病变亚组，差异均有统计学意义（P 均＜0.01）。见表 3。

表 2 各组患者心脏彩色多普勒超声检查结果比较

Tab 2 Cardiac color Doppler ultrasound examination results of patients in each group

$\bar{x}\pm s$

Index	Non-CAD n=58	CAD			t value[a]	P value[a]	t value[b]	P value[b]
		Total n=182	Single vessel lesion n=84	Multi-vessel lesion n=98				
E v/(m·s^{-1})	0.79±0.21	0.64±0.16	0.61±014	0.68±0.17	−4.79	<0.01	3.03	0.003
E/A	1.23±0.20	1.00±0.45	1.12±0.30	0.90±0.53	−5.53	0.001	−3.35	0.001
DT t/ms	196.93±31.78	216.93±50.44	208.84±47.13	223.86±52.37	3.56	<0.01	2.03	0.043
IVRT t/ms	69.10±7.47	76.51±17.39	72.95±19.36	79.56±14.95	4.57	0.01	2.59	0.010
LAD d/cm	3.23±0.47	3.64±0.34	3.45±0.28	3.82±0.29	6.15	<0.01	8.69	<0.01
IVS d/cm	0.97±0.13	1.03±0.14	1.00±0.13	1.06±0.15	2.92	0.004	2.63	0.009
LVPW d/cm	0.93±0.11	0.99±0.11	0.95±0.11	1.03±0.11	3.59	<0.01	4.77	<0.01
LVD d/cm	4.60±0.50	4.73±0.40	4.65±0.45	4.80±0.34	1.96	0.051	2.57	0.011
LVEF	0.67±0.06	0.65±0.06	0.66±0.06	0.64±0.04	−1.87	0.063	−2.72	0.007

[a]: CAD group vs non-CAD group; [b]: Single vessel lesion subgroup vs multi-vessel lesion subgroup. CAD: Coronary heart disease; E: Early diastolic blood flow speed of E-peak; DT: E-peak deceleration time; IVRT: Isovolumic relaxation time; LAD: Left atrial diameter; IVS: Ventricular septal thickness; LVPW: Left ventricular posterior wall thickness; LVD: Left ventricular diameter; LVEF: Left ventricular ejection fraction

表 3 各组患者血脂水平比较

Tab 3 Blood lipid levels of patients in each group

$c_B/(mmol·L^{-1})$, $\bar{x}\pm s$

Index	Non-CAD n=58	CAD			t value[a]	P value[a]	t value[b]	P value[b]
		Total n=182	Single vessel lesion n=84	Multi-vessel lesion n=98				
TC	4.48±0.74	4.81±0.82	4.58±0.74	5.02±0.83	2.85	0.005	3.77	<0.01
TG	1.37±0.47	1.82±0.90	1.61±0.77	2.00±0.96	4.97	<0.01	2.97	0.003
HDL-C	1.29±0.26	1.18±0.28	1.25±0.27	1.12±0.28	−2.72	0.008	−3.04	0.003
LDL-C	2.69±0.46	2.99±0.74	2.82±0.72	3.14±0.72	3.88	<0.01	2.97	0.003

[a]: CAD group vs non-CAD group; [b]: Single vessel lesion subgroup vs multi-vessel lesion subgroup. CAD: Coronary heart disease; TC: Total cholesterol; TG: Triglyceride; HDL-C: High-density lipoprotein cholesterol; LDL-C: Low-density lipoprotein cholesterol

2.4 冠心病影响因素的多因素 logistic 回归分析 以冠心病为因变量，表 1、表 2、表 3 中差异有统计学意义的指标为协变量，行 logistic 回归多因素分析，结果（表 4）显示年龄、TC、IVRT、LAD、LDL-C 是冠心病的独立危险因素（P 均<0.05），E、HDL-C 是冠心病的独立保护因素（P 均<0.05）。

表 4 冠心病影响因素的多因素 logistic 回归分析

Tab 4 Multivariate logistic regression analysis of influencing factors of coronary heart disease

Variable	B	SE	Wald	P value	OR (95% CI)
Age	0.040	0.180	5.030	0.003	1.064 (1.027, 1.102)
TC	0.552	0.257	4.627	0.031	1.737 (1.050, 2.874)
E	−5.459	1.108	24.292	<0.01	0.004 (0.000, 0.037)
IVRT	0.037	0.016	5.357	0.021	1.038 (1.006, 1.070)
LAD	2.466	0.519	22.580	<0.01	11.779 (4.259, 32.575)
LDL-C	0.590	0.248	5.660	0.017	1.804 (1.110, 2.932)
HDL-C	−1.375	0.600	5.245	0.022	0.270 (0.078, 0.820)

TC: Total cholesterol; E: Early diastolic blood flow speed of E-peak; IVRT: Isovolumic relaxation time; LAD: Left atrial diameter; LDL-C: Low-density lipoprotein cholesterol; HDL-C: High-density lipoprotein cholesterol; B: Regression coefficient; SE: Standard error; OR: Odds ratio; CI: Confidence interval

3　讨　论

冠心病发病与年龄、高血压史、糖尿病史、吸烟史有关，本研究中 logistic 多因素回归分析结果表明年龄越大冠心病的患病风险越高。随着年龄增长机体器官不断衰老，新陈代谢功能减退，增加了冠心病的发病风险。

冠状动脉粥样硬化是冠心病发病的主要病理基础，冠状动脉血管内壁脂肪沉积形成脂肪条纹，永久附着于动脉血管内壁，在高血压、吸烟、血脂异常等因素导致的血管内皮细胞损伤部位，脂质颗粒易于聚集，这些脂肪沉积物可逐渐被组织纤维包裹使动脉粥样化变硬，并生长形成纤维斑块凸出到动脉血管中心，纤维斑块破裂进一步形成血栓，从而导致冠状动脉狭窄或完全阻塞[6-8]。大量研究证实，血脂代谢紊乱是影响动脉粥样硬化发生、发展的重要环节，冠心病的发生、发展与脂质代谢异常有关。血清 TC 水平升高引起全血黏度增高、血流阻力增加，并可引起血小板膜组成改变，使血小板反应性增强，对血管壁黏附性增加，引起血栓形成。血清低密度脂蛋白（low-density lipoprotein，LDL）作为胆固醇的重要运输形式，其因颗粒小易进入动脉内膜下层而被氧化，由巨噬细胞吞噬转变为泡沫细胞，进而聚集形成脂肪条纹，破裂后释放出大量胆固醇，因此其致动脉粥样硬化的作用最强[9-12]。血清 TG 水平升高可导致 LDL 和高密度脂蛋白（high-density lipoprotein，HDL）颗粒缩小，LDL 变小致动脉粥样硬化作用变强，HDL 变小引起清除加快，将胆固醇从周围组织转运到肝脏的作用减弱。而 HDL 是唯一具有抗动脉粥样硬化的脂质颗粒，能将外周组织如血管壁内胆固醇转运至肝脏进行分解代谢，形成胆汁酸排出体外从而起到抗动脉粥样硬化的作用。因此血清 TC、TG 及 LDL 水平升高和 HDL 水平降低均为冠状动脉粥样硬化发生、发展的危险因素。

本研究中，冠心病组血清 TC、TG、LDL-C 水平均高于非冠心病组（P 均＜0.05），冠心病患者多支病变亚组血清 TC、TG、LDL-C 水平均高于单支病变亚组（P 均＜0.05）；而冠心病组血清 HDL 水平低于非冠心病组（P＜0.05），冠心病患者多支病变亚组 HDL 水平低于单支病变亚组（P＜0.05），进一步证实高 TC、TG、LDL-C 和低

HDL-C 均是冠心病发生、发展的危险因素，且冠心病多支病变患者血脂异常较单支病变患者更严重。

冠状动脉粥样硬化好发部位依次为左前降支、右冠状动脉、左回旋支及左冠状动脉主干，心脏超声检查可显示室壁运动异常、室壁收缩期增厚改变及左心功能改变等。而心脏超声中 LVDF 异常已越来越受到重视，当冠状动脉粥样硬化导致血管狭窄、心室壁增厚、左心室充盈压增高时，冠状动脉灌注不足，从而影响心室舒张功能。心肌缺血时可首先影响 LVDF，LVDF 异常多发生于左心室收缩功能降低之前，故 LVDF 异常在反映心肌缺血性改变方面更灵敏。冠心病患者左心功能监测对提前干预、评估病情及预后、判断治疗效果均有重要意义[13-14]。E/A、DT、IVRT、LAD 等心脏彩色多普勒超声检查指标能很好地评价 LVDF 障碍。本研究发现，冠心病组 E、E/A 均低于非冠心病组，而 DT、IVRT 均长于非冠心病组，LAD、IVS、LVPW、LVD 均大于非冠心病组；冠心病患者中多支病变亚组 E 及 E/A 均有变化，且 DT、IVRT 均长于单支病变亚组，LAD、IVS、LVPW、LVD 均大于单支病变亚组。这些结果表明，冠心病的发生、发展受冠状动脉硬化影响，冠状动脉管径有不同程度的变化。LVDF 受损时血液流入心室受阻、流速减低，影响 E、E/A、DT、IVRT 等指标，因此心脏彩色多普勒超声检查对于诊断冠心病有重要意义。

大量流行病学调查研究显示，脂质代谢紊乱导致大量脂质颗粒沉积于动脉壁内膜是动脉粥样硬化唯一不可缺少的发病机制，血脂代谢异常是导致冠心病最重要的环节之一[15-16]。目前彩色多普勒超声是公认的评价 LVDF 的可靠指标，具有无创性且被广泛应用于临床，而 LVDF 可从功能上反映更早期的动脉粥样硬化。本研究还对冠心病患者和非冠心病患者的血脂水平、心脏彩色多普勒超声检查指标进行多因素 logistic 回归分析，结果显示 TC、IVRT、LAD、LDL-C 是冠心病的独立危险因素，E、HDL-C 是冠心病的独立保护因素。

综上所述，心脏彩色多普勒超声检查、血脂异常与冠心病的发生密切相关，二者对冠心病的诊断有指导意义。

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