

动脉粥样硬化指数对冠状动脉狭窄程度的诊断价值

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【摘要】 目的:探讨动脉粥样硬化指数(atherogenic index, AI)对疑似冠状动脉粥样硬化性心脏病(冠心病)患者冠状动脉狭窄程度的诊断价值。 方法:连续收集 2012 年 7 月至 2014 年 7 月就诊的 610 例冠心病疑似患者,检测其血清总胆固醇(TC)、三酰甘油(TG)、低密度脂蛋白胆固醇(LDL-C)、高密度脂蛋白胆固醇(HDL-C),计算 AI,并通过冠状动脉造影(CAG)明确冠状动脉狭窄程度;评估 AI 判断冠状动脉狭窄严重程度的敏感性 & 特异性。 结果:AI 与冠状动脉狭窄呈正相关,但两者相关性较低($r=0.202$)。AI 对于冠状动脉 50% 狭窄、70% 狭窄的 OR 值分别是 1.66 和 1.99,其预测 CAG 阳性和介入指征的最佳界值分别为 4.55 和 4.99;AI 预测 CAG 阳性曲线下面积(AUC)为 0.560,预测有介入指征的 AUC 为 0.597。 结论:AI 对冠状动脉狭窄程度的诊断价值有限。

【关键词】 冠状动脉粥样硬化性心脏病;动脉粥样硬化指数;冠状动脉造影

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The diagnostic value of arteriosclerosis index in predicting the extent of coronary artery stenosis SHI Weiqi¹, PAN Jiangqi², MA Wenlin¹, LIU Xiaoli³, DENG Liang¹. 1 Department of Cardiology, Tongji Hospital affiliated to Tongji University, Shanghai 200065; 2 Medical School of Tongji University, Shanghai 200092; 3 Department of Internal Medicine, Shanghai Neuromedical Center, Shanghai 200065, China

【Abstract】 Objective: To explore the diagnostic value of atherogenic index (AI) in predicting the extent of coronary artery stenosis in patients with suspected coronary artery disease (CAD). **Methods:** From July 2012 to July 2014, 610 patients with suspected CAD were consecutively enrolled. The serum levels of total cholesterol (TC), total glycerin (TG), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C) were obtained in all patients, and the severity of coronary artery stenosis was evaluated through coronary angiography. The sensitivity and specificity of AI in evaluating the severity of coronary stenosis were explored. **Results:** AI was positively correlated to coronary stenosis, but the correlation was relatively low ($r=0.202$). The optimum thresholds of AI in predicting CAD diagnosis and PCI intervention were 4.55 and 4.99 respectively. The ORs in patients with 50% coronary artery stenosis and for 70% stenosis were 1.66 and 1.99 respectively. Area under curve (AUC) of AI for predicting the diagnosis of CAD was 0.560, and for predicting PCI intervention was 0.597. **Conclusion:** The diagnostic value of AI in evaluating the severity of coronary stenosis is very weak.

【Key words】 Coronary artery disease; Atherogenic index; Coronary angiography

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研究表明,血清总胆固醇(TC)、三酰甘油(TG)、低密度脂蛋白胆固醇(LDL-C)升高和血清高密度脂蛋白胆固醇(HDL-C)降低是冠状动脉粥样硬化性心脏病(冠心病)的危险因素。然而,单一血脂成分异常评价动脉粥样硬化的效果不佳。近年来有学者提出了动脉粥样硬化指数(atherogenic index, AI)的概念,将其定义为 TC 与 HDL-C 的比值。有报道称 AI 与冠状动脉粥样硬化严重程度呈正相关,并且当 $AI > 4$ 时,心脑血管疾病发病率明显增加。本研究通过分析冠心病疑似患者的 AI 和冠状动脉狭窄程度,探讨 AI 对冠状动脉狭窄程度的诊断价值。

1 对象及方法

1.1 研究对象

连续收集 2012 年 7 月至 2014 年 7 月在同济大学附属同济医院心内科住院的 610 例疑似冠心病并在住院期间行冠状动脉造影(CAG)患者,其中男性 315 例(51.64%),平均年龄(64.75 ± 10.93)岁。入选标准:(1)具有心绞痛、胸闷、异常心电图等表现,拟行 CAG 的冠心病疑似患者。(2)住院期间检测 TC、TG、HDL-C、LDL-C。排除标准:(1)入院前曾规律服用降脂药物(他汀类、贝特类、烟酸衍生物及中成药等);(2)肝肾功能不全[谷丙转氨酶、谷草转氨酶 >3 倍正常值,估算的肾小球滤过率(eGFR) $<30 \text{ mL}/(\text{min} \cdot 1.73 \text{ m}^2)$];(3)血流动力学不稳定。

1.2 研究方法

1.2.1 实验室检查 所有患者均禁食 12 h 以上,于入院次日清晨采集外周静脉血,并在 3 h 内送实验室检测 TC、TG、LDL-C 和 HDL-C。血脂测定参照中华医学会检验学会关于临床血脂测定的建议^[1]。

1.2.2 CAG 所有患者均采用标准 Judkins 法行 CAG,在三支冠状动脉中任意血管狭窄程度 $>50\%$ 为阳性, $>70\%$ 为具有介入治疗指征。

1.3 统计学分析

采用 SPSS20.0 软件进行数据分析。符合正态分布的连续性资料采用均值 \pm 标准差表示。各血脂指标及 AI 对 CAG 阳性及介入指征的诊断价值采用受试者工作特征曲线(receiver operator characteristic curve, ROC)分析。AI 与冠状动脉狭窄程度关系采用 Pearsen 相关性分析。所有 P 值均为双向性,以 $P < 0.05$ 为有统计学差异。

2 结果

2.1 一般资料

入选 610 例患者,其中高血压 195 例(31.9%),糖尿病 154 例(25.2%)。 $AI \geq 4$ 者 388 例,平均年龄(66.72 ± 10.46)岁,男性 294 例; $AI < 4$ 者 222 例,平均年龄(63.63 ± 11.05)岁,男性 142 例。见表 1。

表 1 患者的基本临床资料

项目	数据
年龄/岁	64.75 ± 10.93
男性/例(%)	436(71.5)
体质量指数/ $\text{kg} \cdot \text{m}^2$	24.6 ± 3.4
纽约心功能分级/例	
I	525
II	73
III	12
IV	0
糖尿病/例(%)	154(25.2)
高血压/例(%)	195(31.9)
收缩压/mmHg	129.40 ± 25.42
舒张压/mmHg	78.22 ± 7.24
心率/次 $\cdot \text{min}^{-1}$	77.72 ± 15.43

2.2 TC、TG、LDL-C、HDL-C 和 AI 对 CAG 阳性的诊断价值

TC、TG、LDL-C、HDL-C 和 AI 预测 CAG 阳性的曲线下面积(area under the curve, AUC)分别为 0.494、0.529、0.488、0.578 和 0.560($P < 0.001$),详见表 2。

2.3 TC、TG、LDL-C、HDL-C 和 AI 对介入指征的诊断价值

冠状动脉狭窄 $>70\%$ 可导致冠状动脉灌注减少,是判断行经皮冠状动脉介入治疗(PCI)或冠状动脉旁路移植术(CABG)的重要依据^[2]。TC、TG、LDL-C、HDL-C 和 AI 预测有介入治疗指征的 AUC 分别为 0.528、0.545、0.528、0.591 和 0.597($P < 0.001$)。详见表 2。

2.4 AI 与冠状动脉狭窄程度的 Pearson 相关性分析

进一步分析 AI 与冠状动脉狭窄程度的线性关系,AI 与冠状动脉狭窄程度呈正相关($r = 0.202$, $P < 0.001$),但相关性较低,见图 1。

表 2 TC、TG、LDL-C、HDL-C 和 AI 对冠心病疑似患者冠状动脉狭窄程度的 ROC 分析

指标	冠状动脉狭窄程度	AUC	95% CI(AUC)	OR	95% CI(OR)	最佳诊断界值	敏感性	特异性	P
TC	50%	0.494	0.444~0.545	1.08	1.01~1.15	5.53 mmol/L	0.156	0.911	0.001
	70%	0.528	0.482~0.575	1.20	1.06~1.36	4.58 mmol/L	0.427	0.688	0.001
TG	50%	0.529	0.476~0.582	1.08	1.00~1.15	2.50 mmol/L	0.159	0.904	0.001
	70%	0.545	0.497~0.592	1.20	1.00~1.43	1.27 mmol/L	0.587	0.495	0.001
LDL-C	50%	0.488	0.438~0.538	1.11	1.05~1.18	3.63 mmol/L	0.157	0.938	0.001
	70%	0.528	0.481~0.574	1.16	1.05~1.28	3.05 mmol/L	0.324	0.784	0.001
HDL-C	50%	0.578	0.526~0.631	1.37	1.17~1.59	0.95 mmol/L	0.664	0.551	0.001
	70%	0.591	0.545~0.638	1.42	1.23~1.64	0.94 mmol/L	0.656	0.538	0.001
AI	50%	0.560	0.509~0.611	1.66	1.13~2.43	4.55	0.502	0.623	0.001
	70%	0.597	0.552~0.643	1.99	1.42~2.79	4.99	0.411	0.771	0.001

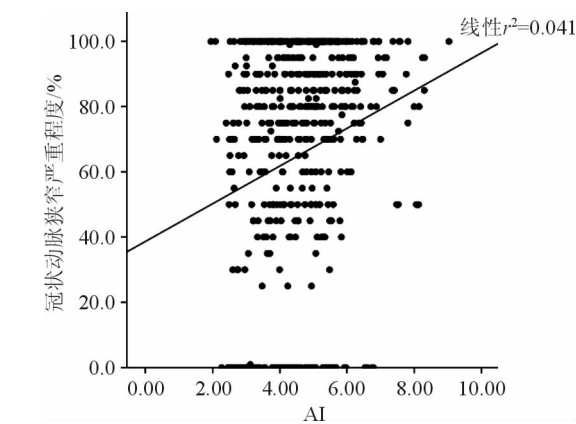


图 1 AI 与冠状动脉狭窄程度的 Pearson 线性相关性分析

3 讨论

既往研究表明, TC、LDL-C 升高及 HDL-C 降低为独立于高血压、肥胖、吸烟、糖尿病等传统危险因素以外的冠心病危险因素^[3]。然而,单一检测血脂指标难以指导冠心病的诊断和治疗。

Higuchi 等^[4]于 1983 年首次提出 AI 概念,并作为预测动脉粥样硬化的指标。研究表明,在糖尿病以及高血压患者中,AI 值与发生冠心病的风险呈正相关。AI 值还与冠心病、2 型糖尿病、高血压和代谢综合征的发生有相关性^[5-8]。AI 与 2 型糖尿病患者或糖耐量受损患者的颈动脉内膜中层厚度密切相关,且 AI 可以反映氧化低密度脂蛋白水平,可作为 2 型糖尿病或糖耐量受损患者发生动脉粥样硬化的危险评估指标^[9]。杨芳等^[10]研究发现,2 型糖尿病患者的 TG 和 AI 均高于健康对照组,且在合并有心血管并发症的患者中 AI 更高,因此 AI 可以作为 2 型糖尿病患者心血管疾病风险的评估指标。

本研究证实 AI 与冠状动脉狭窄呈正相关,但

两者的相关性较低($r = 0.202$)。AI 对于冠状动脉 50%狭窄、70%狭窄的 OR 值分别是 1.66 和 1.99,其在预测 CAG 阳性和介入指征的最佳界值分别为 4.55 和 4.99,显著高于先前的报道。AI 预测 CAG 阳性的 AUC 是 0.560,预测 PCI 干预的 AUC 是 0.597,AI 对冠状动脉狭窄的诊断价值有限。

参 考 文 献

[1] 鄢盛恺,周 新,范 侠,等. 关于临床血脂测定的建议[J]. 中华检验医学杂志, 2003,26(3):182-184.

[2] Philippe K, Stephan W. ESC/EACTS myocardial revascularization guidelines 2014[J]. Eur Heart J, 2014, 35 (46):3235-3236.

[3] National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report[J]. Circulation, 2002, 106 (25):3143-3421.

[4] Higuchi M, Hashimoto I, Yamakawa K, et al. Effect of exercise training on plasma high-density lipoprotein cholesterol level at constant weight[J]. Clin Physiol, 1984, 4 (2): 125-133.

[5] Onat A, Can G, Kaya H, et al. "Atherogenic index of plasma " (log10 triglyceride/high-density lipoprotein-cholesterol) predicts high blood pressure, diabetes, and vascular events[J]. J Clin Lipidol, 2010, 4(2):89-98.

[6] Dobiasová M, Frohlich J. The plasma parameter log (TG/HDL-C) as an atherogenic index: correlation with lipoprotein particle size and esterification rate in apoB-lipoprotein-depleted plasma (FER(HDL))[J]. Clin Biochem, 2001, 34 (7):583-588.

- (Platelet Inhibition and Patient Outcomes) PLATELET substudy[J]. J Am Coll Cardiol, 2010, 56(18): 1456-1462.
- [9] 马颖艳, 王艳霞, 徐白鸽, 等. 替格瑞洛用于经皮冠状动脉介入治疗后患者抗血小板治疗短期内的有效性和安全性研究[J]. 中国介入心脏病学杂志, 2014, 22(6): 380-383.
- [10] Yao J, Zhao L, Zhao Q, et al. NF- κ B and Nrf2 signaling pathways contribute to wogonin-mediated inhibition of inflammation-associated colorectal carcinogenesis [J]. Cell Death Dis, 2014, (5):1283.
- [11] Vrijens B, Claeys MJ, Legrand V, et al. Projected inhibition of platelet aggregation with ticagrelor twice daily vs. clopidogrel once daily based on patient adherence data (the TWICE project) [J]. Br J Clin Pharmacol, 2014, 77(5): 746-755.
- [12] Bliden KP, Tantry US, Storey RF, et al. The effect of ticagrelor versus clopidogrel on high on-treatment platelet reactivity: combined analysis of the ONSET/OFFSET and RESPOND studies [J]. Am Heart J, 2011, 162(1):160-165.
- [13] Tantry US, Bliden KP, Wei C, et al. First analysis of the relation between CYP2C19 genotype and pharmacodynamics in patients treated with ticagrelor versus clopidogrel: the ONSET/OFFSET and RESPOND genotype studies[J]. Circ Cardiovasc Genet, 2010, 3(6):556-566.
- [14] Howard BM, Kornblith LZ, Redick BJ, et al. The effects of alcohol on coagulation in trauma patients: interpreting thrombelastography with caution[J]. J Trauma Acute Care Surg, 2014, 77(6):865-871.
- [15] O'Gara PT, Kushner FG, Ascheim DD, et al. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines[J]. Circulation, 2013, 127(4): 362-425.
- [16] Levine GN, Bates ER, Blankenship JC, et al. 2011 ACCF/AHA/SCAI guideline for percutaneous coronary intervention. A report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines and the Society for Cardiovascular Angiography and Interventions [J]. J Am Coll Cardiol, 2011, 58(24): 44-122.
- [17] Gurbel PA, Kevin P, Kathleen B, et al. Response to ticagrelor in clopidogrel nonresponders and responders and effect of switching therapies: The RESPOND study [J]. Circulation, 2010, 121(10):1188-1199.
- [18] Serebruany VL, Tomek A, Pokov AN, et al. Clopidogrel, prasugrel, ticagrelor or vorapaxar in patients with renal impairment: do we have a winner [J]. Expert Rev Cardiovasc Ther, 2015, 13(12):1333-1344.
- [19] Andell P, James SK, Cannon CP, et al. Ticagrelor versus clopidogrel in patients with acute coronary syndromes and chronic obstructive pulmonary disease: An analysis from the Platelet Inhibition and Patient Outcomes (PLATO) Trial [J]. J Am Heart Assoc, 2015, 4(10): e002490.
- [20] Hagström E, James SK, Bertilsson M, et al. Growth differentiation factor-15 level predicts major bleeding and cardiovascular events in patients with acute coronary syndromes: results from the PLATO study [J]. Eur Heart J, 2016, 37(16):1325-1333.
- [21] Anderson JL, Adams CD, Antman EM, et al. 2012 ACCF/AHA focused update incorporated into the ACCF/AHA 2007 guidelines for the management of patients with unstable angina/non-ST-elevation myocardial infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines [J]. J Am Coll Cardiol, 2013, 61(23):e179-347.
- [22] 马莉, 程国杰, 郭丽敏, 等. 应用血栓弹力图评价糖尿病对急性冠状动脉综合征患者血小板抑制率的影响[J]. 中国心血管病杂志, 2013, 18(6):105-107.
- [23] 李丹丹, 任艺虹, 杨庭树. 血栓弹力图法与比浊法在冠心病患者血小板功能检测中的比较[J]. 中国循环杂志, 2013, 28(4):318-320.
- [24] Hamsten A. The hemostatic system and coronary heart disease [J]. Thromb Res, 1993, 70(1):1-38.

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- [7] Dobiášová M. Atherogenic index of plasma [log (triglycerides/HDL-cholesterol)]: theoretical and practical implications[J]. Clin Chem, 2004, 50(7):1113-1115.
- [8] Dobiášová M. AIP-atherogenic index of plasma as a significant predictor of cardiovascular risk: from research to practice[J]. Vnitr Lek, 2006, 52(1):64-71.
- [9] 王小林, 胡晓舟, 张捷. 血浆致动脉硬化指数(log[TG/HDL-C])对评价糖尿病患者并发动脉粥样硬化机制的探讨[J]. 中国实验诊断学, 2005, 9(5):748-750.
- [10] 杨芳, 陈纯娴, 王庭俊. 血浆致动脉硬化指数与 2 型糖尿病患者大血管病变的关系[J]. 中华高血压杂志, 2006, 14(1):43-45.

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