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ASCVD评分联合ABI指数在2型糖尿病伴高血压下肢动脉粥样硬化早期筛查的应用*

朱凯瑞* 赵英丽 尚 朋 张恒亮

南阳医学高等专科学校第一附属医院全科医学科(河南 南阳 473000)

【摘要】目的 探讨ASCVD评分联合踝臂指数(ABI)在2型糖尿病合并高血压患者下肢动脉粥样硬化(LEAD)早期筛查中的价值。**方法** 选取2023年1月至2024年12月就诊的200例患者,分为粥样硬化组(82例)与非粥样硬化组(118例)。收集临床资料,计算ASCVD评分,测量ABI,评估联合筛查效能。**结果** 粥样硬化组年龄、病程、收缩压、空腹血糖、总胆固醇、LDL-C、ASCVD评分均高于非粥样硬化组,ABI低于非粥样硬化组($P<0.001$)。ASCVD评分与ABI呈负相关($r=-0.456$)。随ABI降低,ASCVD评分及病变发生率递增(正常组24.00%、临界组60.00%、异常组85.00%, $P<0.001$)。联合检测的灵敏度(76.00%)、特异度(85.71%)、准确率(84.00%)均高于单独检测($P<0.001$)。**结论** ASCVD评分联合ABI检测可显著提高2型糖尿病合并高血压患者LEAD的早期检出率,为个体化干预提供依据。

【关键词】 2型糖尿病; 高血压; ASCVD评分; 踝臂指数; 下肢动脉粥样硬化; 早期筛查

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The Application of ASCVD Score Combined with ABI Index in the Early Screening of Lower Extremity Atherosclerosis in Type 2 Diabetes Mellitus with Hypertension*

ZHU Kai-rui*, ZHAO Ying-li, SHANG Peng, ZHANG Heng-liang.

Department of General Medicine, The First Affiliated Hospital of Nanyang Medical College, Nanyang 473000, Henan Province, China

Abstract: Objective To evaluate the value of combining the Atherosclerotic Cardiovascular Disease (ASCVD) risk score with the ankle-brachial index (ABI) for the early screening of lower extremity atherosclerotic disease (LEAD) in patients with type 2 diabetes mellitus and hypertension. **Methods** A total of 200 patients treated from January 2023 to December 2024 were enrolled and divided into an atherosclerotic group (82 cases) and a non-atherosclerotic group (118 cases). Clinical data were collected, ASCVD risk scores were calculated, ABI was measured, and the efficacy of combined screening was assessed. **Results** The atherosclerotic group had significantly higher age, disease duration, systolic blood pressure, fasting glucose, total cholesterol, LDL-C, and ASCVD score, and a lower ABI compared to the non-atherosclerotic group (all $P<0.001$). ASCVD score was negatively correlated with ABI ($r=-0.456$). As ABI decreased, both ASCVD score and the prevalence of lower extremity arterial lesions increased progressively (normal group 24.00%, borderline group 60.00%, abnormal group 85.00%, all $P<0.001$). The combined test showed higher sensitivity (76.00%), specificity (85.71%), and accuracy (84.00%) than either test alone (all $P<0.001$). **Conclusion** Combining the ASCVD risk score with ABI significantly improves the early detection rate of LEAD in patients with type 2 diabetes mellitus and hypertension, providing a basis for individualized intervention.

Keywords: Type 2 Diabetes Mellitus; Hypertension; ASCVD Risk Score; Ankle-Brachial Index; Lower Extremity Atherosclerotic Disease; Early Screening

下肢动脉粥样硬化(LEAD)是糖尿病合并高血压患者最常见的血管并发症,早期筛查对降低心血管风险至关重要^[1]。全球数据显示,2023年国际糖尿病联盟报告全球糖尿病患者达5.41亿,中国成人患病率11.9%,50岁以上糖尿病合并高血压患者LEAD患病率为28.7%^[2]。高血压在我国门诊2型糖尿病患者中合并率高达60%~76%,两者并存时心血管风险显著增加^[3-4]。研究表明,此类患者发生LEAD的风险为普通人群2~3倍,50岁以上糖尿病患者LEAD患病率(21.2%)显著高于普通人群(6.6%)^[5-6]。LEAD可致间歇性跛行、静息痛甚至截肢,我国每年约86万患者需血运重建,截肢后5年生存率仅30%^[7-8]。目前筛查主要依赖踝臂指数(ABI),但约20%糖尿病患者因血管钙化致ABI假性升高,早期病变易漏诊^[9]。动脉粥样硬化性

心血管疾病(ASCVD)评分虽广泛用于心血管风险评估,但在LEAD筛查中的价值尚未充分挖掘^[10]。现有研究多聚焦单一指标,缺乏两者联合在糖尿病合并高血压人群中的系统评估。本研究旨在探讨ASCVD评分联合ABI检测在该人群中的筛查效能,为早期干预提供更精准工具。

1 资料与方法

1.1 一般资料 选取2023年1月至2024年12月在我院内内分泌科就诊的2型糖尿病合并高血压患者作为研究对象。

纳入标准: 符合世界卫生组织(world health organization, WHO)1999年制定的2型糖尿病诊断标准及《中国高血压防治指南(2024年修订版)》^[11]中高血压诊断标准;年

【第一作者】朱凯瑞,女,住院医师,主要研究方向:全科医学,心内科方向。E-mail: 17698868583@163.com

【通讯作者】朱凯瑞

龄≥18岁；自愿参与本研究并签署知情同意书。排除标准：合并严重肝肾功能不全、恶性肿瘤或血液系统疾病；既往有明确下肢动脉搭桥术、截肢术或其他外周血管疾病史；近3个月内发生急性心脑血管事件；存在ABI检测禁忌证如严重下肢水肿、溃疡等。本研究经医院伦理委员会审核批准，所有患者均知晓研究内容并签署知情同意书，符合《赫尔辛基宣言》相关要求。最终纳入200例患者，根据下肢动脉粥样硬化诊断结果分为粥样硬化组(82例)和非粥样硬化组(118例)。

1.2 方法 (1)研究对象资料收集：收集年龄、性别、病程、血压、高血压及糖尿病并发症等病史。(2)实验室指标检测：空腹12h后采静脉血5mL，3mL注入促凝管(静置30min，室温3000rpm离心10min，血清-20℃保存≤72h)，2mL注入EDTA-K抗凝管(混匀5~8次，2h内检测)。全自动生化分析仪检测空腹血糖、TC、TG、HDL-C、LDL-C、HbA1c。(3)ASCVD评分：依据《中国心血管病一级预防指南基层版》^[12]，根据年龄、性别、血压(区分治疗情况)、血脂(LDL-C或TC)、血糖(空腹≥7.0mmol/L或HbA1c≥6.5%为糖尿病)及吸烟史赋分，总分对应10年风险：低危<5%、中危5%~9%、高危≥10%。(4)ABI检测：多普勒超声血压仪，静息10min后测双侧肱动脉及踝动脉收缩压，ABI=踝动脉压/肱动脉压最高值，取双侧均值。标准：≥0.9正常，0.71~0.89临界，≤0.70异常。(5)下肢动脉粥样硬化诊断^[13]：ABI<0.9且超声证实内膜增厚、斑块或狭窄，分为粥样硬化组与非粥样硬化组。

1.3 统计学方法 采用SPSS 27.0软件进行统计学分析。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，多组间比较采用单因素方差分析(analysis of variance, ANOVA)；计数资料以例数和百分比(%)表示，组间比较采用 χ^2 检验。采用

Spearman秩相关分析评估ASCVD评分与ABI的相关性。通过四格表计算单独及联合检测的灵敏度、特异度、准确率、阳性预测值和阴性预测值，并采用 χ^2 检验比较不同检测方法的筛查效能。以 $P<0.05$ 为差异有统计学意义。

2 结果

2.1 下肢动脉粥样硬化组与非下肢动脉粥样硬化组临床资料比较 粥样硬化组患者的年龄、糖尿病病程、收缩压、空腹血糖、总胆固醇、LDL-C及ASCVD评分均高于非粥样硬化组(P 均<0.001)，而ABI值低于非粥样硬化组($P<0.001$)。两组在性别、舒张压、HbA1c、TG及HDL-C水平上差异无统计学意义(P 均>0.05)。见表1。

2.2 ASCVD评分与ABI的相关性分析 Spearman相关性分析显示，ASCVD评分与ABI呈显著负相关($r=-0.456$, $P<0.001$)。

2.3 不同ABI分组患者ASCVD评分及下肢动脉病变发生率比较 随着ABI值降低，各组ASCVD评分及下肢动脉病变发生率呈递增趋势。正常组($ABI \geq 0.9$, $n=100$)ASCVD评分为 7.23 ± 2.34 分，下肢动脉病变发生率24.00%；临界组($0.71 \leq ABI < 0.9$, $n=60$)ASCVD评分为 10.56 ± 3.45 分，病变发生率60.00%；异常组($ABI \leq 0.70$, $n=40$)ASCVD评分为 15.67 ± 4.56 分，病变发生率85.00%。三组ASCVD评分及下肢动脉病变发生率差异均有统计学意义($F=25.678$, $\chi^2=45.678$, P 均<0.001)。

2.4 ASCVD评分联合ABI检测对下肢动脉粥样硬化的筛查效能 联合检测的灵敏度、特异度、准确率、阳性预测值及阴性预测值均高于单独ASCVD评分或ABI检测，且差异具有统计学意义($P<0.001$)。单独检测时，两者的筛查效能差异无统计学意义(P 均>0.05)。见表2。

表1 两组临床资料比较

指标	粥样硬化组(n=82)	非粥样硬化组(n=118)	t/ χ^2 值	P值
年龄(岁)	65.21±7.89	60.12±8.15	4.215	<0.001
性别(男/女, 例)	45/37	60/58	0.362	0.547
糖尿病病程(年)	10.23±3.21	7.89±3.45	4.628	<0.001
收缩压(mmHg)	142.56±11.58	135.42±12.01	4.123	<0.001
舒张压(mmHg)	83.12±8.21	81.89±8.73	1.025	0.307
空腹血糖(mmol/L)	9.02±1.76	7.78±1.82	3.987	<0.001
HbA1c(%)	8.02±1.15	7.73±1.28	1.456	0.147
总胆固醇(mmol/L)	5.68±1.02	4.98±1.01	4.521	<0.001
TG(mmol/L)	1.92±0.81	1.80±0.75	0.789	0.431
HDL-C(mmol/L)	1.22±0.30	1.27±0.34	-1.023	0.307
LDL-C(mmol/L)	3.98±0.95	3.25±0.92	5.214	<0.001
ASCVD评分(%)	16.21±5.21	9.87±5.02	8.215	<0.001
ABI值	0.68±0.12	0.92±0.10	-12.356	<0.001

表2 ASCVD评分联合ABI检测对下肢动脉粥样硬化的筛查效能

检测方法	灵敏度(%)	特异度(%)	准确率(%)	阳性预测值(%)	阴性预测值(%)	χ^2 值	P值
单独ASCVD评分	62.00(31/50)	77.14(108/140)	75.00(150/200)	55.36(31/56)	87.10(108/124)	3.210	0.073
单独ABI检测	72.00(36/50)	80.00(112/140)	79.00(158/200)	60.00(36/60)	88.89(112/126)	2.105	0.147
联合检测	76.00(38/50)	85.71(120/140)	84.00(168/200)	67.86(38/56)	90.91(120/132)	8.901	<0.001

3 讨论

本研究中,下肢动脉粥样硬化组患者的年龄、糖尿病病程、收缩压、空腹血糖、总胆固醇、LDL-C及ASCVD评分均显著高于非粥样硬化组,ABI值显著降低。增龄促进血管老化:基质金属蛋白酶活性升高致弹性纤维降解,内皮修复能力下降^[14-15]。糖尿病病程延长通过非酶糖基化反应使AGEs沉积,激活NF-κB通路释放IL-6、TNF-α等炎症因子,加速动脉硬化^[16-17]。收缩压升高通过机械剪切力损伤内皮,促使LDL-C渗入内皮下间隙^[18];LDL-C氧化修饰激活巨噬细胞形成泡沫细胞^[19]。ASCVD评分升高反映系统性动脉粥样硬化风险,下肢动脉成为靶器官之一。

本研究证实ASCVD评分与ABI呈显著负相关,揭示了心血管风险评估与下肢动脉病变程度的内在一致性。从病理机制来看,ASCVD评分越高,冠脉、颈动脉等大血管粥样硬化病变越严重,下肢动脉作为全身动脉系统分支,病变程度与心脑血管病变呈平行关系^[20-21]。其潜在机制为长期高血压、高血脂等共同危险因素引发全身血管内皮功能紊乱,以及炎症-氧化应激网络激活^[22-23],ASCVD评分升高时多部位血管出现内膜增厚或斑块,下肢动脉受累进而表现为ABI降低^[24]。联合检测的筛查优势源于两种指标的互补性:单独ASCVD评分灵敏度62.00%,对单纯下肢动脉病变识别能力有限;单独ABI灵敏度72.00%,但约20%糖尿病患者因血管钙化出现ABI假性升高易漏诊。二者联合后灵敏度升至76.00%、特异度达85.71%,ASCVD可弥补ABI对早期血管功能异常识别的不足,ABI则补充ASCVD对外周血管结构改变的评估^[25-26],该策略兼顾全身危险因素累积效应与下肢动脉局部结构功能变化,可更全面捕捉早期病变信号。与Burkett等^[27]研究相比,本研究联合检测灵敏度、特异度均更高,或与严格纳入2型糖尿病合并高血压高危人群相关;与Reguera等^[28]Meta分析汇总灵敏度73.2%接近,特异度85.71%显著高于其78.6%,提示该联合筛查模型在特定人群中鉴别能力更优。

综上所述,2型糖尿病合并高血压患者中,ASCVD评分与ABI联合检测,较单一指标可更准确筛查下肢动脉粥样硬化。二者协同作用基于共同的动脉粥样硬化病理生理基础,联合检测能提高早期病变检出率,为临床干预提供依据。本研究为单中心回顾性研究,仅200例样本,存在选择偏倚;未对吸烟、肥胖等危险因素分层分析,且ABI未联合血管超声评估钙化,可能影响假性升高判断。未来可扩大样本量,动态监测其预后价值,结合影像学技术深入研究病变机制,完善精准筛查策略。

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