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论著 ·

## 踝肱指数对轻型缺血性卒中患者预后的预测价值研究

黄林欢, 周厚仕, 林琬, 林麒

**【摘要】** 背景 研究证实, 踝肱指数 (ABI) 与缺血性脑血管疾病的发生、发展密切相关, 但其评估轻型缺血性卒中患者病情及预后的报道较少。目的 探讨 ABI 对轻型缺血性卒中患者预后的预测价值。方法 选择 2018 年 8 月至 2019 年 2 月汕头市中心医院神经内科收治的 78 例轻型缺血性卒中患者作为研究对象。收集所有患者的临床资料, 包括人口学特征 (性别、年龄、受教育年限)、心血管疾病的主要危险因素 (吸烟、饮酒、高血压、糖尿病、高脂血症、颈动脉狭窄)、抗血小板治疗及 ABI。ABI 与轻型缺血性卒中患者颅内动脉狭窄程度的相关性分析采用 Spearman 秩相关分析; 轻型缺血性卒中患者预后的影响因素分析采用多因素 Logistic 回归分析; 绘制受试者工作特征 (ROC) 曲线以评估 ABI 对轻型缺血性卒中患者预后的预测价值。结果 78 例患者中 42 例有颅内动脉狭窄。有颅内动脉狭窄患者 ABI 低于无颅内动脉狭窄患者 ( $P < 0.01$ )。Spearman 秩相关分析结果显示, ABI 与轻型缺血性卒中患者颅内动脉狭窄程度呈负相关 ( $r_s = -0.628, P < 0.05$ )。78 例患者中预后不良 16 例, 占 20.5%。预后不良患者年龄大于预后良好患者, 颈动脉狭窄发生率及 ABI 异常者占比高于预后良好患者 ( $P < 0.05$ )。多因素 Logistic 回归分析结果显示, 年龄 [ $OR = 1.422, 95\%CI(1.137, 1.778)$ ]、颈动脉狭窄 [ $OR = 1.476, 95\%CI(1.055, 2.063)$ ] 及 ABI 异常 [ $OR = 1.303, 95\%CI(1.051, 1.617)$ ] 是轻型缺血性卒中患者预后不良的危险因素 ( $P < 0.05$ )。ROC 曲线分析结果显示, ABI 预测轻型缺血性卒中患者预后的曲线下面积为 0.737 [ $95\%CI(0.614, 0.860)$ ], 最佳截断值为 0.92, 灵敏度、特异度分别为 68.70%、72.60%。结论 ABI 与轻型缺血性卒中患者颅内动脉狭窄程度呈负相关, ABI 对轻型缺血性卒中患者预后具有一定预测价值。

**【关键词】** 轻型缺血性卒中; 踝肱指数; 预后; 预测

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**Prognostic Value of Ankle Brachial Index in Patients with Mild Ischemic Stroke** HUANG Linhuan, ZHOU Houshi, LIN Wan, LIN Qi

Department of Neurology, Shantou Central Hospital, Shantou 515000, China

Corresponding author: HUANG Linhuan, E-mail: [huanglinhuan@hotmail.com](mailto:huanglinhuan@hotmail.com)

**【Abstract】** **Background** Studies have confirmed that ankle brachial index (ABI) is closely related to the occurrence and development of ischemic cerebrovascular diseases, but there are few reports on ABI to evaluate the condition and prognosis of patients with mild ischemic stroke. **Objective** To investigate the prognostic value of ABI in patients with mild ischemic stroke. **Methods** A total of 78 patients with mild ischemic stroke treated in the Department of Neurology, Shantou Central Hospital from August 2018 to February 2019 were selected as the research objects. The clinical data of all patients were collected, including demographic characteristics (gender, age, education years), major risk factors for cardiovascular disease (smoking, drinking, hypertension, diabetes, hyperlipidemia, intracranial artery stenosis), antiplatelet therapy and ABI. Spearman rank correlation analysis was used to analyze the correlation between ABI and the degree of intracranial artery stenosis in patients with mild ischemic stroke; multivariate Logistic regression analysis was used to analyze the influencing factors of prognosis in patients with mild ischemic stroke; the receiver operating characteristic (ROC) curve was drawn to evaluate the prognostic value of ABI in patients with mild ischemic stroke. **Results** Among the 78 patients, 42 patients had intracranial artery stenosis. ABI in patients with intracranial artery stenosis was lower than that in patients without intracranial artery stenosis ( $P < 0.01$ ). Spearman rank

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515000 广东省汕头市中心医院神经内科

通信作者: 黄林欢, E-mail: [huanglinhuan@hotmail.com](mailto:huanglinhuan@hotmail.com)

correlation analysis showed that, ABI was negatively correlated with the degree of intracranial artery stenosis in patients with mild ischemic stroke ( $r_s = -0.628$ ,  $P < 0.05$ ). Among the 78 patients, 16 patients had poor prognosis, accounting for 20.5%. The patients with poor prognosis were older than those with good prognosis, and the incidence of intracranial artery stenosis and the proportion of abnormal ABI in patients with poor prognosis were higher than those in patients with good prognosis ( $P < 0.05$ ). Multivariate Logistic regression analysis showed that, age [ $OR = 1.422$ , 95%  $CI$  (1.137, 1.778)], intracranial artery stenosis [ $OR = 1.476$ , 95%  $CI$  (1.055, 2.063)], abnormal ABI [ $OR = 1.303$ , 95%  $CI$  (1.051, 1.617)] were risk factors for poor prognosis in patients with mild ischemic stroke ( $P < 0.05$ ). ROC curve analysis showed that, the area under curve of ABI in predicting the prognosis of patients with mild ischemic stroke was 0.737 [95%  $CI$  (0.614, 0.860)], the best cut-off value was 0.92, and the sensitivity and specificity were 68.70% and 72.60%, respectively. **Conclusion** ABI is negatively correlated with the degree of intracranial artery stenosis in patients with mild ischemic stroke. ABI has a certain predictive value for the prognosis of patients with mild ischemic stroke.

**【Key words】** Mild ischemic stroke; Ankle brachial index; Prognosis; Forecasting

轻型卒中一般指症状轻微、非致残性卒中,其病理机制与脑卒中中相同,是脑卒中中早期进展或远期复发的预警信号。据相关研究报道,轻型卒中患者复发率约为18%<sup>[1-2]</sup>。目前针对轻型卒中患者,临床主要采取双联抗血小板治疗,必要时进行溶栓治疗<sup>[3]</sup>。临床上常采用卒中风险分层工具及影像学检查评估轻型卒中患者预后,但上述方法在患者发病早期(溶栓时间窗内)的应用价值有限<sup>[4]</sup>。踝肱指数(ankle brachial index, ABI)是由WINSOR等提出,最初主要用于诊断下肢周围动脉疾病。现有研究表明,ABI可反映动脉粥样硬化程度<sup>[5]</sup>,与心肌梗死、心血管不良事件的发生有关<sup>[6]</sup>;此外,其还对缺血性脑卒中患者预后具有一定评估价值<sup>[7]</sup>。本研究初步探讨了ABI对轻型缺血性卒中患者预后的预测价值,旨在为轻型缺血性卒中患者的预后评估提供一定参考。

## 1 对象与方法

**1.1 研究对象** 选择2018年8月至2019年2月汕头市中心医院神经内科收治的78例轻型缺血性卒中患者作为研究对象,均符合《中国急性缺血性脑卒中诊治指南2014》<sup>[8]</sup>中的缺血性脑卒中诊断标准,且入院时首次美国国立卫生研究院卒中量表(National Institutes of Health Stroke Scale, NIHSS)<sup>[9]</sup> ≤ 3分。纳入标准:年龄 ≥ 18岁;发病至入院时间 < 72 h;临床资料完整。排除标准:心源性栓塞、血液系统疾病、凝血功能异常导致的轻型缺血性卒中者;发病前存在神经功能缺损者;不能配合完成颅脑影像学检查者;合并严重器质性病变、恶性肿瘤及自身免疫系统疾病者;上肢、下肢截肢或血管造瘘者。本研究经汕头市中心医院伦理委员会审核批准〔批准文号:2018-科研(017)号〕。

**1.2 方法** 收集所有患者的临床资料,包括人口学特征(性别、年龄、受教育年限)、心血管疾病的主要危险因素(吸烟、饮酒、高血压、糖尿病、高脂血症、颈动脉狭窄)、抗血小板治疗情况及ABI。其中ABI检

测方法如下:采用彩色多普勒超声检查仪检测所有患者ABI,探头频率为8~10 MHz,将探头置于患者脉搏搏动位置,与皮肤呈45°~60°角,移动探头直至呈现最清晰的信号,袖带逐渐充气直至压力高出血流信号消失时的20 mm Hg(1 mm Hg=0.133 kPa),然后缓慢放气并检测血流信号重新出现时的血压;测量双臂血压并将较高一侧的收缩压作为上臂收缩压,将同侧胫后动脉、足背动脉平均血压作为踝部收缩压,ABI=踝部收缩压/上臂收缩压,以ABI < 0.9判定为ABI异常。颅内动脉狭窄检测方法:使用Siemens Magnetom Verio 3.0 T磁共振扫描仪或西门子SOMATOM Definition Flash双源CT机进行颅脑影像学检查。正常:颅内动脉主干及分支无信号缺失;轻度狭窄:管径狭窄或信号缺失 < 50%;中度狭窄:管径狭窄或信号缺失50%~69%;重度狭窄:管径狭窄 ≥ 70%或局限性信号缺失<sup>[10]</sup>。

**1.3 随访** 记录所有患者早期神经功能恶化发生情况。以患者发病48~72 h NIHSS评分增加 > 4分判定为早期神经功能恶化<sup>[11]</sup>。所有患者出院后1、3、6、9、12个月进行随访,随访方式为门诊随访及电话随访,并记录患者改良Ranking量表(modified Ranking Scale, mRS)<sup>[12]</sup>评分;统计所有患者随访期间再发卒中、短暂性脑缺血发作、急性冠脉综合征及心力衰竭等心脑血管事件发生情况。本研究以患者出现早期神经功能恶化或mRS评分 ≥ 2分或出现不良心脑血管事件为预后不良。

**1.4 统计学方法** 采用SPSS 19.0统计学软件进行数据处理。计量资料以( $\bar{x} \pm s$ )表示,组间比较采用两独立样本 $t$ 检验;计数资料以相对数表示,组间比较采用 $\chi^2$ 检验;ABI与轻型缺血性卒中患者颅内动脉狭窄程度的相关性分析采用Spearman秩相关分析;轻型缺血性卒中患者预后的影响因素分析采用多因素Logistic回归分析;绘制受试者工作特征(receiver operating characteristic, ROC)曲线以评估ABI对轻型缺血性卒

中患者预后的预测价值。以  $P < 0.05$  为差异有统计学意义。

## 2 结果

**2.1 ABI 与轻型缺血性卒中患者颅内动脉狭窄程度的关系** 78 例患者中 42 例有颅内动脉狭窄, 其中轻度狭窄 28 例、中度狭窄 14 例。有颅内动脉狭窄患者 ABI 为  $(0.90 \pm 0.08)$ , 低于无颅内动脉狭窄患者的  $(0.98 \pm 0.11)$ , 差异有统计学意义 ( $t=3.708, P < 0.01$ )。Spearman 秩相关分析结果显示, ABI 与轻型缺血性卒中患者颅内动脉狭窄程度呈负相关 ( $r_s=-0.628, P < 0.05$ )。

**2.2 轻型缺血性卒中患者预后的影响因素分析** 78 例患者中预后不良 16 例, 占 20.5%。预后良好与预后不良患者性别、受教育年限、吸烟率、饮酒率、高血压发生率、糖尿病发生率、高脂血症发生率及抗血小板治疗比较, 差异无统计学意义 ( $P > 0.05$ ); 预后不良患者年龄大于预后良好患者, 颈动脉狭窄发生率及 ABI 异常者占比高于预后良好患者, 差异有统计学意义 ( $P < 0.05$ ), 见表 1。将年龄、颈动脉狭窄及 ABI 作为自变量, 将预后作为因变量 (赋值: 预后良好 =0, 预后不良 =1), 进行多因素 Logistic 回归分析, 结果显示, 年龄、颈动脉狭窄及 ABI 异常是轻型缺血性卒中患者预后不良的危险因素 ( $P < 0.05$ ), 见表 2。

表 1 预后良好与预后不良患者临床资料比较

Table 1 Comparison of clinical data between patients with good prognosis and poor prognosis

临床资料	预后良好 (n=62)	预后不良 (n=16)	$\chi^2 (t)$ 值	P 值
性别 [n (%)]			0.135	0.713
男	38 (61.3)	9/16		
女	24 (38.7)	7/16		
年龄 ( $\bar{x} \pm s$ , 岁)	62.9 $\pm$ 6.9	71.8 $\pm$ 6.9	4.581*	0.001
受教育年限 ( $\bar{x} \pm s$ , 年)	12.7 $\pm$ 3.1	13.1 $\pm$ 3.0	0.439*	0.661
吸烟 [n (%)]	18 (29.0)	6/16	0.428	0.513
饮酒 [n (%)]	15 (24.2)	2/16	1.020	0.312
高血压 [n (%)]	40 (64.5)	10/16	0.022	0.881
糖尿病 [n (%)]	20 (32.3)	6/16	0.157	0.692
高脂血症 [n (%)]	52 (83.9)	14/16	0.129	0.720
颈动脉狭窄 [n (%)]	6 (9.7)	5/16	4.886	0.027
抗血小板治疗 [n (%)]			0.199	0.656
单抗治疗	31 (50.0)	9/16		
双抗治疗	31 (50.0)	7/16		
ABI [n (%)]			5.225	0.022
异常	8 (12.9)	6/16		
正常	54 (87.1)	10/16		

注: ABI= 踝臂指数; \* 表示  $t$  值

**2.3 ABI 对轻型缺血性卒中患者预后的预测价值** ROC 曲线分析结果显示, ABI 预测轻型缺血性卒中患者预

表 2 轻型缺血性卒中患者预后影响因素的多因素 Logistic 回归分析  
Table 2 Multivariate Logistic regression analysis of prognostic factors in patients with mild ischemic stroke

变量	赋值	$\beta$	SE	Wald $\chi^2$ 值	P 值	OR (95%CI)
年龄	实测值	0.352	0.114	9.534	0.002	1.422 (1.137, 1.778)
颈动脉狭窄	无 =0, 有 =1	0.389	0.171	5.175	0.023	1.476 (1.055, 2.063)
ABI	正常 =0, 异常 =1	0.265	0.110	5.804	0.016	1.303 (1.051, 1.617)

后的曲线下面积为 0.737 [95%CI (0.614, 0.860)], 最佳截断值为 0.92, 灵敏度、特异度分别为 68.70%、72.60%, 见图 1。

## 3 讨论

ABI 具有简便、无创等特点, 最早用于筛查下肢动脉栓塞性疾病。动脉粥样硬化是一种全身性疾病, 当机体某一血管发生动脉粥样硬化时, 下肢血管也可能发生动脉粥样硬化。正常情况下, 机体下肢踝部动脉收缩压高于上肢, 而下肢发生动脉粥样硬化时其血压降低, 故 ABI 可能降低 [13-14]。国外研究表明, ABI 与缺血性脑卒中患者颅内动脉狭窄程度呈负相关, 且 ABI 对颅内动脉狭窄具有一定诊断价值 [15]; 国内也有研究证实, ABI 与脑梗死微出血相关 [16]。本研究结果显示, 有颅内动脉狭窄患者 ABI 低于无颅内动脉狭窄患者, 且 ABI 与轻型缺血性卒中患者颅内动脉狭窄程度呈负相关。

轻型卒中患者脑卒中发生风险较高, 故评估轻型卒中患者短期及远期预后具有重要意义。本组患者预后不良者占 20.5%, 高于冯海霞等 [17] 报道的轻型卒中患者治疗后 90 d 内预后不良 (mRS 评分  $> 2$  分) 者占 12.1%。李海霞等 [18] 研究报道, 80~88 岁轻型卒中患者

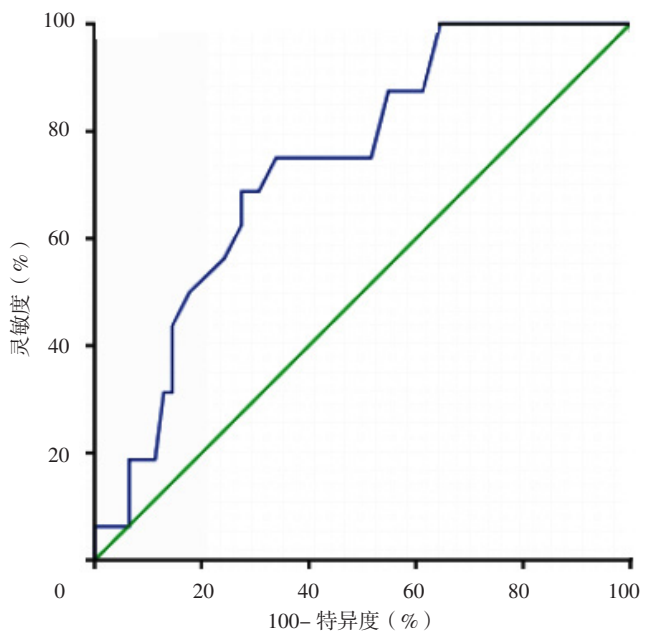


图 1 ABI 对轻型卒中患者预后的预测价值

Figure 1 Prognostic value of ABI in patients with mild ischemic stroke

中临床不良转归者占比高达 63.4%，而 60~79 岁轻型卒中患者中临床不良转归者占 48.0%。本研究与上述研究结果存在差异的原因可能与随访时间、临床预后判定标准及患者年龄不同有关。轻型卒中作为一种临床症状轻微的脑血管疾病，其预后受多种因素影响。ABI 可间接反映动脉粥样硬化严重程度，其值越低则动脉粥样硬化程度、血管狭窄程度越严重，心脑血管事件发生风险越高，预后不良风险越高。本研究结果显示，调整年龄、颈动脉狭窄后，ABI 异常仍是轻型缺血性卒中患者预后不良的危险因素。LEE 等<sup>[19]</sup>开展的针对社区人群动脉硬化风险的研究证实，在调整年龄、种族、性别后，ABI 与缺血性脑卒中发生率呈负相关；李雯等<sup>[20]</sup>研究证实，ABI 可辅助评估老年人缺血性心脑血管事件发生风险；熊小平等<sup>[21]</sup>研究结果显示，短暂性脑缺血发作后继发脑梗死患者 ABI 低于短暂性脑缺血发作后未继发脑梗死患者，ABI 评估短暂性脑缺血发作后继发脑梗死风险的曲线下面积为 0.72 [95%CI (0.60, 0.84)]。本研究 ROC 曲线分析结果显示，ABI 预测轻型缺血性卒中患者预后的曲线下面积为 0.737，提示 ABI 对轻型缺血性卒中患者预后具有一定预测价值。ABI 具有无创、快速检测等优点，可为早期评估轻型缺血性卒中患者病情及预后提供参考。

综上所述，ABI 与轻型缺血性卒中患者颅内动脉狭窄程度呈负相关，ABI 对轻型缺血性卒中患者预后具有一定预测价值。但本研究仍存在一定局限性：样本量较小，观察指标较少，可能存在未调整的混杂因素，故本研究结论仍有待扩大样本量、增加观察指标进一步证实。

作者贡献：黄林欢、林琬进行文章的构思与设计；周厚仕进行研究的实施与可行性分析；黄林欢、周厚仕、林麒进行数据收集、整理、分析；黄林欢进行结果分析与解释，负责撰写、修订论文，负责文章的质量控制及审校，并对文章整体负责、监督管理。

本文无利益冲突。

#### 参考文献

- [1] PURROY F, VICENTE-PASCUAL M, ARQUE G, et al. Sex-related differences in clinical features, neuroimaging, and long-term prognosis after transient ischemic attack [J]. *Stroke*, 2021, 52 (2): 424-433. DOI: 10.1161/STROKEAHA.120.032814.
- [2] HOTTER B, GALINOVIC I, KUNZE C, et al. High-resolution diffusion-weighted imaging identifies ischemic lesions in a majority of transient ischemic attack patients [J]. *Ann Neurol*, 2019, 86 (3): 452-457. DOI: 10.1002/ana.25551.
- [3] 马晨晨, 耿子暘, 朱士光, 等. TOAST 分型联合 Lp-PLA2 在前循环短暂性脑缺血发作及轻型卒中早期复发缺血性脑血管病中的预测价值 [J]. *中风与神经疾病杂志*, 2020, 37 (3): 242-246. DOI: 10.19845/j.cnki.zfysjbjzz.2020.0312.
- MA C C, GENG Z Y, ZHU S G, et al. The predictive value of TOAST and Lp-PLA2 for early recurrence of ischemic cerebrovascular disease after transient ischemic attack and minor ischemic stroke of anterior circulation [J]. *Journal of Apoplexy and Nervous Diseases*, 2020, 37 (3): 242-246. DOI: 10.19845/j.cnki.zfysjbjzz.2020.0312.
- [4] 黎洁洁, 谷鸿秋, 彭玉晶, 等. 血脂谱对急性轻型卒中/短暂性脑缺血发作患者抗血小板治疗后出血风险的影响: CHANCE 研究的亚组分析 [J]. *中华内科杂志*, 2018, 8 (10): 723-730. DOI: 10.3760/cma.j.issn.0578-1426.2018.10.006.
- LI J J, GU H Q, PENG Y J, et al. The association of lipid profile and bleeding in patients with minor stroke or transient ischemic attack on antiplatelet therapy: subgroup analysis of CHANCE [J]. *Chinese Journal of Internal Medicine*, 2018, 8 (10): 723-730. DOI: 10.3760/cma.j.issn.0578-1426.2018.10.006.
- [5] TRAN K, DOSSABHOY S, SORONDO S, et al. Bicycle exercise ankle-brachial index recovery time as a novel metric for evaluating the hemodynamic significance of external iliac endofibrosis in competitive cyclists [J]. *J Vasc Surg*, 2021, 73 (3): 50. DOI: 10.1016/j.jvs.2020.12.045.
- [6] PARK H W, KIM H R, KANG M Y, et al. Predictive value of the combination of brachial-ankle pulse wave velocity and ankle-brachial index for cardiovascular outcomes in patients with acute myocardial infarction [J]. *Coron Artery Dis*, 2020, 31 (2): 157-165. DOI: 10.1097/MCA.0000000000000777.
- [7] ABOUD H, MONTEIRO TAVARES L, LABREUCHE J, et al. Impact of low ankle-brachial index on the risk of recurrent vascular events [J]. *Stroke*, 2019, 50 (4): 853-858. DOI: 10.1161/STROKEAHA.118.022180.
- [8] 中华医学会神经病学分会, 中华医学会神经病学分会脑血管病学组. 中国急性缺血性脑卒中诊治指南 2014 [J]. *中华神经科杂志*, 2015, 48 (4): 246-257. DOI: 10.3760/cma.j.issn.1006-7876.2015.04.002.
- [9] NOGUEIRA R G, LUTSEP H L, GUPTA R, et al. Trevo versus Merci retrievers for thrombectomy revascularisation of large vessel occlusions in acute ischaemic stroke (TREVO 2): a randomised trial [J]. *Lancet*, 2012, 380 (9849): 1231-1240. DOI: 10.1016/S0140-6736(12)61299-9.
- [10] 董强, 孙葳, 谭泽峰, 等. 症状性动脉粥样硬化性颅内动脉狭窄中国专家共识 [J]. *中国神经精神疾病杂志*, 2012, 38 (3): 129-145.
- [11] KAKKOS S K, TSOLAKIS I A. Clopidogrel with aspirin in minor stroke or transient ischemic attack [J]. *N Engl J Med*, 2013, 369 (14): 1375. DOI: 10.1056/NEJMc1309713.
- [12] YORK S N. Modified Rankin Scale [J]. *Encycl Clin Neuropsychol*, 2011, 40 (3): 438.
- [13] 王耀玲, 戚本玲, 刘丽华, 等. 老年综合评估相关项目与踝肱指数的关系研究 [J]. *中国全科医学*, 2021, 24 (17): 2163-2168. DOI: 10.12114/j.issn.1007-9572.2021.00.124.
- WANG Y L, QI B L, LIU L H, et al. Relationship of related items

- of comprehensive geriatric assessment with ankle brachial index [J]. *Chinese General Practice*, 2021, 24 (17): 2163-2168. DOI: 10.12114/j.issn.1007-9572.2021.00.124.
- [14] 丁旭, 满新贺, 李力宏, 等. 踝肱指数与CT血管造影在外周动脉疾病诊断的对比研究[J]. *中华血管外科杂志*, 2019, 4(1): 51-53. DOI: 10.3760/cma.j.issn.2096-1863.2019.01.012.
- [15] ZWARTBOL M H T, GEERLINGS M I, GHAZNAWI R, et al. Intracranial atherosclerotic burden on 7T MRI is associated with markers of extracranial atherosclerosis: the SMART-MR study [J]. *AJNR Am J Neuroradiol*, 2019, 40 (12): 2016-2022. DOI: 10.3174/ajnr.a6308.
- [16] 李传游, 肖婧, 丁彩霞, 等. 踝肱指数和急性脑梗死患者脑微出血的相关性研究 [J]. *医学研究生学报*, 2017, 30 (1): 57-60. DOI: 10.16571/j.cnki.1008-8199.2017.01.012.
- LI C Y, XIAO J, DING C X, et al. Low ankle-brachial index predicts cerebral microbleeds in patients with ischemic stroke [J]. *Journal of Medical Postgraduates*, 2017, 30 (1): 57-60. DOI: 10.16571/j.cnki.1008-8199.2017.01.012.
- [17] 冯海霞, 丘红燕, 任力杰, 等. 轻型急性缺血性卒中rt-PA静脉溶栓的疗效和安全性研究 [J]. *中风与神经疾病杂志*, 2019, 36 (3): 223-228. DOI: 10.19845/j.cnki.zfysjbjzz.2019.03.007.
- FENG H X, QIU H Y, REN L J, et al. Efficacy and safety of intravenous thrombolysis with rt-PA for mild acute ischemic stroke [J]. *Journal of Apoplexy and Nervous Diseases*, 2019, 36 (3): 223-228. DOI: 10.19845/j.cnki.zfysjbjzz.2019.03.007.
- [18] 李海霞, 孟范文, 崔荣太, 等. 高龄老年轻型缺血性卒中患者临床特点和中期预后分析 [J]. *中华老年医学杂志*, 2019, 38 (8): 852-855. DOI: 10.3760/cma.j.issn.0254-9026.2019.08.007.
- LI H X, MENG F W, CUI R T, et al. Analysis of clinical characteristics and medium-term prognosis of advanced elderly patients with mild ischemic stroke [J]. *Chinese Journal of Geriatrics*, 2019, 38 (8): 852-855. DOI: 10.3760/cma.j.issn.0254-9026.2019.08.007.
- [19] LEE K N, CHOU L P, LIU C C, et al. Predictive value of ankle-brachial index for long-term events of ischemic stroke in hemodialysis patients [J]. *Vascular*, 2021, 29 (1): 119-125. DOI: 10.1177/1708538120925954.
- [20] 李雯, 陈朔华, 赵剑秋, 等. 颈动脉斑块和低踝臂指数联合作用增加老年人缺血性心脑血管事件的发生风险 [J]. *中华心血管病杂志*, 2021, 49 (3): 263-268. DOI: 10.3760/cma.j.cn112148-20200401-00272.
- LI W, CHEN S H, LI J Q, et al. Increased risk of cardiovascular disease in elderly population with carotid plaque and low ankle brachial index [J]. *Chinese Journal of Cardiology*, 2021, 49 (3): 263-268. DOI: 10.3760/cma.j.cn112148-20200401-00272.
- [21] 熊小平, 张艳芳, 闵丽. 踝肱指数对短暂性脑缺血发作患者继发脑梗死的诊断价值 [J]. *中华老年心脑血管病杂志*, 2016, 18 (2): 165-167. DOI: 10.3969/j.issn.1009-0126.2016.02.015.
- XIONG X P, ZHANG Y F, MIN L. Value of ankle-brachial index in diagnosis of secondary cerebral infarction in transient ischemic attack patients [J]. *Chinese Journal of Geriatric Heart Brain and Vessel Diseases*, 2016, 18 (2): 165-167. DOI: 10.3969/j.issn.1009-0126.2016.02.015.
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- LI S J, ZHANG X, ZHAO C Y, et al. Effect of impulse magnetotherapy combined rehabilitation training on patients with rotator cuff injury following arthroscopic surgery [J]. *Academic Journal of Chinese PLA Medical School*, 2019, 40 (10): 947-949, 953. DOI: 10.3969/j.issn.2095-5227.2019.10.010.
- [10] 李梦雪. 交变磁场治疗对老年卒中睡眠障碍患者血清褪黑素和睡眠质量的影响 [J]. *中国老年学杂志*, 2020, 40 (24): 5242-5245. DOI: 10.3969/j.issn.1005-9202.2020.24.028.
- [11] 张欣. 稳态磁场对血流、骨骼和疼痛的影响 [J]. *物理*, 2020, 49 (6): 373-380. DOI: 10.7693/wl20200603.
- ZHANG X. Effects of static magnetic fields on blood flow, bone and pain [J]. *Physics*, 2020, 49 (6): 373-380. DOI: 10.7693/wl20200603.
- [12] SALINAS-ASENSIO M M, RÍOS-ARRABAL S, ARTACHO-CORDÓN F, et al. Exploring the radiosensitizing potential of magnetotherapy: a pilot study in breast cancer cells [J]. *Int J Radiat Biol*, 2019, 95 (9): 1337-1345. DOI: 10.1080/09553002.2019.1619951.
- [13] DEGTYAREV V K, ALEKSANDROV A V, SHILOVA L N, et al. Assessment of long-term results of low-frequency magnetic therapy method on sanatorium stage of regenerative treatment of patients with articular pathology [J/OL]. *Modern Problems of Science and Education*, 2016. [2021-06-25]. [https://www.researchgate.net/publication/309168003\\_ASSESSMENT\\_OF\\_LONG-TERM\\_RESULTS\\_OF\\_LOW-FREQUENCY\\_MAGNETIC\\_THERAPY\\_METHOD\\_ON\\_SANATORIUM\\_STAGE\\_OF\\_REGENERATIVE\\_TREATMENT\\_OF\\_PATIENTS\\_WITH\\_ARTICULAR\\_PATHOLOGY](https://www.researchgate.net/publication/309168003_ASSESSMENT_OF_LONG-TERM_RESULTS_OF_LOW-FREQUENCY_MAGNETIC_THERAPY_METHOD_ON_SANATORIUM_STAGE_OF_REGENERATIVE_TREATMENT_OF_PATIENTS_WITH_ARTICULAR_PATHOLOGY). DOI: 10.17513/spno.25274.
- [14] RYBAKOV Y L, GUKASOV V M, GUDKOV A G, et al. Low-energy complex magnetotherapy in oncology [J]. *Biomed Eng*, 2018, 51 (5): 373-375. DOI: 10.1007/s10527-018-9751-x.
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