中性粒细胞与淋巴细胞比值联合磷脂酶 A2 可迅速筛选急诊后循环缺血性卒中的高危人群

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摘要 目的:分析中性粒细胞与淋巴细胞比值(NLR)联合脂蛋白相关磷脂酶 A2(Lp-PLA2)对急诊以单纯头晕为主诉的患者发生后循环缺血性卒中的预测价值。方法:回顾性分析急诊科收治的以单纯头晕为主诉的 408 例患者的临床资料,按是否发生急性后循环脑梗死分为脑梗死组(117 例)和非脑梗死组(291 例),比较 2 组的基本资料和急诊入院资料,采用多因素 logistic 回归分析发生后循环缺血性卒中的独立危险因素,并应用受试者工作特征(ROC)曲线评估 NLR 联合 Lp-PLA2 对急诊单纯头晕患者发生后循环缺血性卒中的预测价值。结果:2 组年龄、高血压及糖尿病史、吸烟史方面比较,差异有统计学意义(P 均 <0.05)。多因素 Logistic 回归分析显示,年龄、高血压及糖尿病史、NLR、Lp-PLA2 是急诊单纯头晕患者新发后循环缺血性卒中的独立危险因素。NLR 预测单纯头晕患者发生后循环缺血性脑卒中的 ROC 曲线下面积(AUC)为 0.810(95% *CI* 0.763~0.856,$P<0.05$),最佳截断值为 2.87,敏感度为 0.812,特异性为 0.732。Lp-PLA2 预测单纯头晕患者发生后循环缺血性脑卒中的 AUC 为 0.840(95% *CI* 0.797~0.884,$P<0.05$),最佳截断值为 203.5 ng/mL,敏感度为 0.761,特异性为 0.804。NLR 联合 Lp-PLA2 预测单纯头晕患者发生后循环缺血性脑卒中的 AUC 为 0.851(95% *CI* 0.808~0.894,$P<0.05$),最佳截断值为 0.620,敏感度为 0.829,特异性为 0.794。结论:NLR 联合 Lp-PLA2 能迅速筛选出单纯头晕为主诉的患者中发生后循环缺血性卒中的高危人群,从而进行积极的血管评估及急诊头颅磁共振来避免漏诊,特别是高龄、合并高血压、糖尿病的患者。

关键词 中性粒细胞与淋巴细胞比值; 磷脂酶 A2; 头晕; 后循环缺血性卒中
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Neutrophil/lymphocyte ratio combined with phospholipase A2 can rapidly screen high-risk individuals for post-circulation ischemic stroke in the emergency department

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Abstract Objective: To analyze the predictive value of neutrophil/lymphocyte ratio (NLR) combined with lipoprotein-associated phospholipase A2 (Lp-PLA2) in the occurrence of post-circulation ischemic stroke in patients with simple dizziness as the main complaint in the emergency department. Methods: The clinical data of 408 patients with simple dizziness as the main complaint in the emergency department were retrospectively analyzed. According to whether acute posterior circulation cerebral infarction occurred, the patients were divided into cerebral infarction group (117 cases) and non-cerebral infarction group (291 cases). The basic data and emergency admission data of the two groups were compared. Multivariate logistic regression was used to analyze the independent risk factors of posterior circulation ischemic stroke, and the receiver operating characteristic (ROC) curve was used to evaluate the predictive value of NLR combined with Lp-PLA2 for posterior circulation ischemic stroke in patients with simple dizziness in the emergency department. Results: There were significant differences in age, history of hypertension, diabetes mellitus and smoking between the two groups (all $P<0.05$). Multivariate logistic regression analysis showed that age, history of hypertension and diabetes, NLR, Lp-PLA2 were independent risk factors for new posterior circulation ischemic stroke in patients with simple dizziness in emergency department. The area under the ROC curve of NLR for predicting posterior circulation ischemic stroke in patients with simple dizziness was 0.810 (95% *CI*:0.763-0.856, $P<0.05$), and the best cutoff point was 2.87, the sensitivity was 0.812, and the specificity was 0.732. The area under the ROC curve of Lp-PLA2 in predicting posterior circulation ischemic stroke in patients with simple dizziness was 0.840 (95% *CI*:0.797-0.884, $P<0.05$), the best cutoff point was 203.5, the sensitivity was 0.761, and the specificity was 0.804. The area under the ROC curve of NLR combined with Lp-PLA2 in predicting posterior circulation ischemic stroke in patients with simple dizziness was 0.851 (95% *CI*: 0.808-0.894, $P<0.05$), the best cutoff point was 0.620, the sensitivity was 0.829, and the specificity was 0.794. Conclusion: NLR combined with Lp-PLA2 can quickly

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screen the high-risk group of posterior circulation ischemic stroke in patients with simple dizziness as the main complaint, so as to carry out active vascular evaluation and emergency cranial magnetic resonance to avoid missed diagnosis, especially in elderly patients with hypertension and diabetes.

Key words Neutrophil/lymphocyte ratio; Lipoprotein-associated phospholipase A2; Dizziness; Posterior circulation ischemic stroke

急性缺血性脑卒中的治疗和时间密切相关,需要急诊对疑似卒中患者进行快速评估,而与前循环缺血性卒中相比,后循环缺血性卒中较少表现出单侧肢体乏力,通常以头晕、精神状态改变和行走不稳等非特异性症状为主[1]。当患者单纯以头晕为主诉就诊时容易被忽视,导致治疗延误和病情加重。缺血性卒中的病理生理被认为是一种炎症过程,中性粒细胞与淋巴细胞比值(neutrophil-to-lymphocyte ratio,NLR)已被报道是炎症的有效标志物[2]。脂蛋白相关磷脂酶 A2(lipoprotein-related phospholipase A2,Lp-PLA2)主要由动脉粥样硬化斑块中的巨噬细胞和淋巴细胞分泌,其水平的升高与动脉粥样硬化相关疾病密切相关,包括冠心病和缺血性卒中[3,4]。急诊常规的全血细胞计数及 Lp-PLA2 检测能在较短时间内获得数值,本文回顾性分析急诊头晕患者就诊时血常规中 NLR 及 Lp-PLA2 对后循环缺血性脑卒中诊断的预测价值。

资料与方法

1. 研究对象:收集 2019 年 1 月至 2021 年 10 月南京大学医学院附属鼓楼医院急诊室就诊发病 24 h 内的单纯头晕患者。纳入标准:①年龄 >18 岁;②以单纯头晕为主诉(可包括视物旋转及恶心、呕吐),症状持续 >60 min,发病时间 <24 h,急诊留观 >48 h 或收治入院;③入院美国国立卫生研究院卒中量表(National Institute of Health Stroke Scale,NHISS)评分为 0 分;④急诊完善头颅平扫排除出血,发病 8 h 内经知情同意后急诊行头颅 CT 血管成像(computed tomography angiography,CTA)+ 灌注成像(computed tomography perfusion,CTP),就诊 48 h内完善头颅磁共振(magnetic resonance imaging,MRI),弥散加权序列上如椎基底动脉供血区域出现高信号考虑为新发后循环缺血性脑梗死[5]。

排除标准:①就诊时已知头晕由非卒中病因引起(如既往明确诊断为前庭功能病变);②存在可能影响外周血白细胞计数及 Lp-PLA2 数值的因素,如 2 周内有急性感染史,有服用抗生素史,既往有血液系统疾病、恶性肿瘤或正在使用免疫抑制剂;③存在急性器官功能不全或合并急性心肌梗死;④既往有脑梗死遗留神经功能缺损;⑤血常规、Lp-PLA2 检测或影像学检查等病史资料不全者。本研究通过医院伦理委员会批准(2021-407-02),患者或家属签署知情同意书。

2. 方法:回顾性分析所有入组患者的临床资料,记录基本信息,包括年龄、性别、入院血压、发病到就诊时间、合并症状(有无恶心呕吐、视物旋转)、入院时血常规、Lp-PLA2 结果及既往有无吸烟史、高血压、糖尿病、冠心病、心房颤动、脑梗死病史等情况。根据 MRI 结果,按是否发生急性后循环脑梗死分为脑梗死组和非脑梗死组,比较 2 组的基本资料和急诊入院资料。

3. 统计学分析:采用 SPSS 23.0 统计学软件进行分析。符合正态分布的计量资料用($\bar{x} \pm s$)表示,组间比较采用独立样本 t 检验,计数资料用例数(%)表示,组间比较采用 χ^2 检验。采用多因素 Logistic回归分析新发后循环缺血性卒中的独立危险因素;依据受试者工作特征(receiver operating characteristic,ROC)曲线下面积评估 NLR、Lp-PLA2 各自单独及两者联合检测对新发后循环缺血性卒中的预测能力,并计算约登指数(敏感性 + 特异性-1)确定最佳截断值。以 $P<0.05$ 为差异有统计学意义。

结 果

1. 一般临床资料:共纳入 408 例患者,其中男性 185 例,女性 223 例,年龄 29 ~ 80 岁,平均年龄(63.46 ± 11.59)岁。MRI 结果提示有新发后循环脑梗死患者共 117 例,发生率为 28.68%。根据有无新发后循环缺血性脑梗死分为脑梗死组(117 例)和非脑梗死组(291 例)。2 组性别、既往冠心病史、心房颤动及脑梗死史、从发病到就诊时间比较,差异无统计学(P 均 >0.05),脑梗死组年龄较非脑梗死组更大,脑梗死组合并高血压、糖尿病及吸烟史的患者比例更多(P 均 <0.05)。2 组患者入院时血压水平、恶心、呕吐及视物旋转等合并症状比较,差异无统计学意义(P 均 >0.05)。脑梗死组入院时血常规中性粒细胞计数、NLR 及 Lp-PLA2 高于非脑梗死组,而淋巴细胞计数低于非脑梗死组(P 均 <0.05),见表 1。

表 1 2 组基本资料及入院情况比较

项目	脑梗死组($n=117$)	非脑梗死组($n=291$)	P 值
年龄(岁,$\bar{x}\pm s$)	72.91±7.94	59.48±10.94	<0.001
男性[例(%)]	62(52.99)	134(46.05)	0.204
高血压史[例(%)]	79(67.52)	98(33.68)	<0.001
糖尿病史[例(%)]	52(44.44)	39(13.40)	<0.001
冠心病史[例(%)]	24(20.51)	72(24.74)	0.362
吸烟史[例(%)]	45(38.46)	54(18.56)	<0.001
心房颤动[例(%)]	10(8.55)	28(9.62)	0.646
脑梗死史[例(%)]	14(11.97)	21(7.21)	0.121
发病到就诊时间(h,$\bar{x}\pm s$)	10.85±5.81	12.14±6.23	0.054
入院时收缩压(mmHg,$\bar{x}\pm s$)	162.33±14.64	147.67±15.04	0.293
入院时舒张压(mmHg,$\bar{x}\pm s$)	90.48±6.67	86.80±7.58	0.148
恶心或呕吐[例(%)]	89(76.07)	232(79.73)	0.415
视物旋转[例(%)]	20(17.09)	76(26.12)	0.052
Lp-PLA2(ng/mL,$\bar{x}\pm s$)	262.30±84.80	159.56±68.99	<0.001
中性粒细胞计数($\times10^9$/L,$\bar{x}\pm s$)	6.22±1.83	4.67±2.02	0.002
淋巴细胞计数($\times10^9$/L,$\bar{x}\pm s$)	1.60±0.33	1.88±0.47	<0.001
NLR($\bar{x}\pm s$)	4.11±1.63	2.40±1.25	<0.001

2. 多因素 Logistic 回归分析:新发后循环缺血性脑卒中为因变量,将单因素分析中有统计学意义的指标进行多因素 Logistic 回归分析显示,年龄、高血压史、糖尿病史、Lp-PLA2、NLR 是预测急诊单纯头晕患者新发后循环缺血性卒中的危险因素(P 均 <0.05),见表 2。根据多因素 Logistic 回归分析参数与回归系数,构建 NLR 联合 Lp-PLA2 模型并生成以下方程式:联合评分模型 = 5.180 + (−0.012) × Lp − PLA2 + (−0.565) × NLR,见表 3。

表 2 单纯头晕患者新发后循环缺血性卒中的多因素 Logistic 回归分析

因素	OR 值	95% CI	P 值
年龄	1.146	1.091~1.204	<0.001
高血压史	3.431	1.466~8.028	0.004
糖尿病史	4.720	2.016~11.048	<0.001
吸烟史	2.260	0.915~5.583	0.077
Lp-PLA2	0.984	0.981~0.988	<0.001
中性粒细胞	1.032	0.782~1.361	0.825
淋巴细胞	1.581	0.404~6.186	0.511
NLR	2.215	1.390~3.531	0.001

3. Lp-PLA2、NLR 各自单独及联合检测对单纯头晕患者发生后循环缺血性脑卒中的预测价值:ROC 曲线分析显示,NLR 预测单纯头晕患者发生后循环缺血性脑卒中的曲线下面积为 0.810(95% CI 0.763~0.856,$P<0.05$),最佳截断值为 2.870,敏感度为 0.812,特异性为 0.732。Lp-PLA2 预测单纯头晕患者后发生后循环缺血性脑卒中的 ROC 曲线下面积为 0.840(95% CI 0.797~0.884,$P<0.05$),最佳截断值为 203.5,敏感度为 0.761,特异性为 0.804。两者联合预测单纯头晕患者发生后循环缺血性脑卒中的 ROC 曲线下面积为 0.851(95% CI 0.808~0.894,$P<0.05$),最佳截断值为 0.620,敏感度为 0.829,特异性为 0.794,见图 1。

讨 论

快速鉴别单纯以头晕为主诉的患者是否发生后循环缺血性脑卒中非常重要,误诊可能导致严重的致残率和高死亡率,而过度诊断后循环缺血性卒中可导致不必要的检查和药物治疗费用[6]。在所有急性头晕的潜在病因中,缺血性卒中约占 4%~15%,最常见的病变部位是小脑,其次是桥脑[7]。据统计在小脑后下动脉供血区域发生梗死时,16.3% 的患者仅以头晕为唯一临床表现[8]。而在急诊室中,以单纯头晕为表现的患者在初次就诊时大约有 10% 的卒中会被忽视[9]。并非所有患者在急诊时均能在第一时间完成头颅 MRI,寻求一种能早期且快速识别缺血性卒中的方法可以给很多患者带来获益。在大多数情况下,全面的前庭、眼球运动和姿势检查是区分急性头晕是否可能为缺血性卒中的关键,且已有文献提出几种评分标准来帮助鉴别急性头晕的中枢原因,这些评分综合了病史(症状、心血管疾病风险),临床眼动检查(水平甩头试验、眼球震颤)以及某些生物标志物[9]。临床常用于评估短暂性脑缺血发作患者卒中风险的评分量表 ABCD2 评分[由年龄(A)、血压(B)、临床症状(C)、

表 3 Lp-PLA2 和 NLR 与新发后循环缺血性脑卒中相关性的二元 Logistic 回归分析

变量	β 值	*SE* 值	*Wald* χ^2 值	*P* 值	*Exp*/β 值	95% *CI*
Lp-PLA2	-0.012	0.0022	42.96	0.000	0.988	0.984 ~ 0.991
NLR	-0.565	0.102	30.64	0.000	2.232	0.465 ~ 0.694
常量	5.180	0.483	115.214	0.000	177.766	-

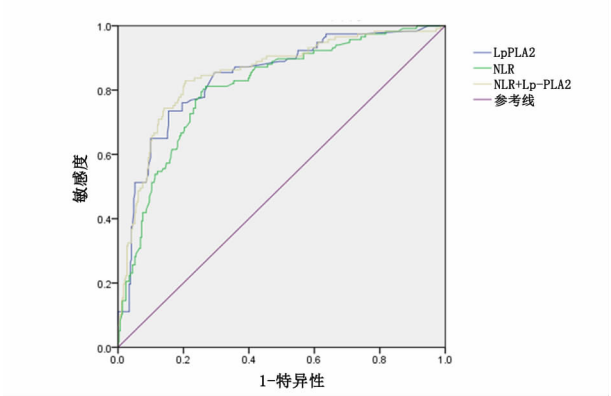

图 1 Lp-PLA2、NLR 各自单独及联合诊断单纯头晕患者发生后循环缺血性脑卒中的 ROC 曲线

症状持续时间(D)、糖尿病(D)5个变量组成的量表]同样有助于诊断后循环卒中[10],ABCD2得分超过 5 分提示约 27% 的中风风险。TriAGe + 评分(一种症状特征、中枢神经系统临床体征和心血管危险因素的组合评分量表)也能预测头晕患者病因是否为后循环卒中,准确性约为 82%[11]。其他一些预测指标包括椎动脉超声等亦有助于诊断后循环卒中[12]。在治疗方面,目前静脉溶栓仍然是缺血性卒中早期最有效的方法,获益呈时间依赖性。为了缩短院内延误,指南提出要将患者入院至静脉溶栓时间即门-针时间(door-to-needle time, DNT)控制在 60 min内[13]。常用的如 NIHSS 评分等溶栓决策量表对于后循环病变的评估能力不足[14],因此急诊医师对于单纯头晕患者容易出现判断错误,导致部分病因为后循环卒中的头晕患者 DNT 时间显著延长,甚至错失溶栓时机也是急诊常见的问题[15]。尽管目前尚无关于后循环缺血性卒中功能预后的大型试验,但先前的病例显示小脑梗死漏诊或未治疗的患者其死亡率较高(30% ~40%)[16]。同时急诊医师需要在有限时间内对病情做出初步判断,在一定程度上限制了上述几种评分系统的应用,而一些简单有效的指标可能更有助于筛选出存在后循环缺血性卒中风险的患者。

脑梗死的发病机制可以认为是一种最终导致脑组织液化坏死的炎症过程[17],细胞因子和粘附分子调节白细胞向梗死区域迁移,炎性细胞除了侵害梗死核心区域外,还会通过攻击缺血半暗加重损伤[18],而中性粒细胞迁移到受损区域是对缺血性脑损伤的第一反应[17]。淋巴细胞同样在炎症及免疫反应中起重要作用,据报道某些淋巴细胞亚型是脑梗死后对缺血性损伤作出反应的脑保护性免疫调节剂,并参与减少梗死体积和改善神经功能[17]。NLR 综合中性粒细胞和淋巴细胞的作用,更能反映炎症和免疫的平衡状态[19]。已有文献报道 NLR 在包括脑血管疾病在内的多种疾病中具有很强的预测作用[20~22],最近的研究表明,NLR 不仅与急性脑梗死面积的大小、死亡率和长期残疾相关[17,23],而且与溶栓后的早期神经功能恶化[24]、动脉粥样硬化斑块失稳和随后的破裂[25]密切相关。

作为缺血性卒中诊断相关的无创性生物标志物,Lp-PLA2 在过去十年中也得到了广泛的研究[26]。一项在 2005 年发表的针对 7 983 名公民长达 6 年的连续观察研究中发现,高 Lp-PLA2 水平与缺血性卒中的发病存在很强的相关性[27],研究同时认为卒中风险的增加与 Lp-PLA2 的促炎特性相关。高水平 Lp-PLA2 参与了动脉粥样硬化斑块的发展[28]和破裂[29],这可能提示高 Lp-PLA2 水平与大动脉闭塞有关。Zhou 等[30]发现不同水平 Lp-PLA2 之间的大血管动脉粥样硬化性脑梗死的比例并没有显著差异,Lp-PLA2 对于不同类型脑梗死的鉴别价值还有待进一步研究。尽管如此,已有多项研究提出 Lp-PLA2 是严重脑卒中的独立预测因子[31,32]。

本研究中缺血性脑卒中的发生率为 28.68%,高于文献中所提到的 4% ~15%,这可能与患者纳入标准有关,本研究中的患者均完善头颅 MRI 明确诊断,避免了漏诊或误诊的可能。本研究显示脑梗死组患者年龄更大,既往高血压、糖尿病及吸烟史的患者比例更多,但 2 组患者入院时血压比较,差异无明显统计学意义,提示缺血性卒中的发生与年龄及基础疾病对血管造成的慢性损害关系更大,而发病时的血压并不能提示疾病的严重程度,更多时候还需考虑口服降压药物及应激状态的影响。脑梗死组的中性粒细胞计数、NLR 及 Lp-PLA2 均高于非脑梗死组,而淋巴细胞计数低于非脑梗死组。进一步二

元 Logistic 回归分析显示年龄、高血压史、糖尿病史、Lp-PLA2、NLR 是预测急诊单纯头晕患者新发后循环缺血性卒中的危险因素。李渊等[32]分析急诊头晕患者发现,老年组头晕患者病因主要以中枢病变为主,王为强等[33]发现糖尿病、高血压及房颤史是头晕患者发生缺血性卒中的影响因素,但他们未发现年龄在其中的影响。在急诊判断病情时,可能需结合年龄、高血压及糖尿病等多种危险因素综合考虑。有文献在对急诊头颅 CT 阴性的头晕患者进行研究发现,当 NLR 在 > 2.8 时预测后循环脑梗死的最佳灵敏度为 0.857,特异性为 0.780,缺乏水平眼球震颤可增加特异性[34]。本研究通过 ROC 曲线发现 NLR 最佳截断值为 2.87,此时敏感度为0.812,特异性为 0.732,与先前研究结果接近,而 NLR 联合 Lp-PLA2 检测敏感度和特异性更高。这提示急诊 NLR 联合 Lp-PLA2 检测能在一定程度上提高诊断的准确性。

本研究存在一定的局限性,首先 NLR 及 Lp-PLA2也可能受到其他炎症性疾病的影响;其次本研究为回顾性研究,排除了遗留神经功能缺损、病史资料不全及拒绝影像学检查的这部分患者。后续可开展大样本及前瞻性研究进一步评估两者的临床预测意义。

参 考 文 献

1 Oostema JM, Chassee T, Baer W, et al. Educating paramedics on the finger-to-nose test improves recognition of posterior stroke [J]. Stroke, 2019, 50(10): 2941-2943.

2 Emir S, Aydin M, Can G, et al. Comparison of colorectal neoplastic polyps and adenocarcinoma with regard to NLR and PLR[J]. Eur Rev Med Pharmacol Sci, 2015, 19: 3613-3618.

3 谢应业,赖艳红,丁苏,等. 高水平脂蛋白相关磷脂酶 A2 与慢性肾脏病患者发生动脉粥样硬化相关[J]. 内科急危重症杂志, 2021, 27(4): 299-303.

4 Cao J, Yan P, Zhou Y, et al. Clinical utility of the serum level of lipoprotein-related phospholipase A2 in acute ischemic stroke with cerebral artery stenosis[J]. Front Neurol, 2021, 12: 642483.

5 曹学兵,张兆辉,彭小祥. 急性后循环缺血性卒中早期识别与评估专家共识[J]. 卒中与神经疾病, 2021, (2): 245-252.

6 Choi KD, Lee H, Kim JS. Ischemic syndromes causing dizziness and vertigo[J]. Handb Clin Neurol, 2016, 137: 317-340.

7 Zwergal A, Dieterich M. Vertigo and dizziness in the emergency room [J]. Curr Opin Neurol, 2020, 33(1): 117-125.

8 Zwergal A, Möhwald K, Dieterich M. Vertigo and dizziness in the emergency room[J]. Nervenarzt, 2017, 88(6): 587-596.

9 Tarnutzer AA, Lee SH, Robinson KA, et al. ED misdiagnosis of cerebrovascular events in the era of modern neuroimaging: a meta-analysis [J]. Neurology, 2017, 88: 1468-1477.

10 Newman-Toker DE, Kerber KA, Hsieh YH, et al. HINTS outperforms ABCD2 to screen for stroke in acute continuous vertigo and dizziness [J]. Acad Emerg Med, 2013, 20(10): 986-996.

11 Kuroda R, Nakada T, Ojima T, et al. The TriAGe score for vertigo or dizziness: a diagnostic model for stroke in the emergency department [J]. J Stroke Cerebrovasc, 2017, 26: 1144-1153.

12 Nazerian P, Bigiarini S, Pecci R, et al. Duplex sonography of vertebral arteries for evaluation of patients with acute vertigo[J]. Ultrasound Med Biol, 2018, 44: 584-592.

13 Powers WJ, Rabinstein AA, Ackerson T, et al. 2018 Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association[J]. Stroke, 2018, 49(3): e46-e110.

14 Olivato S, Nizzoli S, Cavazzuti M, et al. e-NIHSS: an expanded national institutes of health stroke scale weighted for anterior and posterior circulation strokes[J]. J Stroke Cerebrovasc Dis, 2016, 25: 2953-2957.

15 Sarraj A, Medrek S, Albright K, et al. Posterior circulation stroke is associated with prolonged door-to-needle time[J]. Int J Stroke, 2015, 10: 672-678.

16 Savitz SI, Caplan LR, Edlow JA. Pitfalls in the diagnosis of cerebellar infarction[J]. Acad Emerg Med, 2007, 14: 63-68.

17 Tokgoz S, Kayrak M, Akpinar Z, et al. Neutrophil lymphocyte ratio as a predictor of stroke[J]. J Stroke Cerebrovasc Dis, 2013, 22(7): 1169-1174.

18 Huang J, Upadhyay UM, Tamargo RJ, et al. Inflammation in stroke and focal cerebral ischemia[J]. Surg Neurol, 2006, 66(3): 232-245.

19 Balta S, Demirkol S, Unlu M, et al. Neutrophil to lymphocyte ratio may be predict of mortality in all conditions [J]. Br J Cancer, 2013, 109(12): 3125-3126.

20 Bhat T, Teli S, Rijal J, et al. Neutrophil to lymphocyte ratio and cardiovascular diseases: a review [J]. Expert Rev Cardiovasc Ther, 2013, 11(1): 55-59.

21 Mei ZB, Shi L, Wang B, et al. Prognostic role of pretreatment blood neutrophil-to-lymphocyte ratio in advanced cancer survivors: a systematic review and meta-analysis of 66 cohort studies [J]. Cancer Treat Rev, 2017, 58: 1-13.

22 Yan W, Liu C, Li R, et al. Usefulness of the neutrophil-to-lymphocyte ratio in predicting adverse events in elderly patients with chronic heart failure[J]. Int Heart J, 2016, 57: 615-621.

23 Qun S, Tang Y, Sun J, et al. Neutrophil-To-Lymphocyte ratio predicts 3-month outcome of acute ischemic stroke[J]. Neurotox Res, 2017, 31(3): 444-452.

24 Gong P, Xie Y, Jiang T, et al. Neutrophil-lymphocyte ratio predicts post-thrombolysis early neurological deterioration in acute ischemic stroke patients[J]. Brain Behav, 2019, 9(10): e01426.

25 Chung D, Lee KO, Choi JW, et al. Blood Neutrophil/Lymphocyte ratio is associated with cerebral large-artery atherosclerosis but not with cerebral small-vessel disease [J]. Front Neurol, 2020, 11: 1022.

26 Jickling GC, Russo TL. Predicting stroke outcome: role of a biomarker panel[J]. Neurology, 2019, 92: 157-158.

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参 考 文 献

1 Edriss H, Denega T, Test V, et al. Pulmonary vein stenosis complicating radiofrequency catheter ablation for atrial fibrillation: A literature review[J]. Respir Med, 2016, 117: 215-222.

2 Rostamian A, Narayan SM, Thomson L, et al. The incidence, diagnosis and management of pulmonary vein stenosis as acomplication of atrial fibrillation ablation[J]. J Interv Card Electrophysiol, 2014, 40(1): 63-74.

3 Fink T, Schlüter M, Heeger CH, et al. Pulmonary vein stenosis or occlusion after catheter ablation of atrial fibrillation: long-term comparison of drug-eluting versus large bare metal stents[J]. Europace, 2018, 20(10): e148-e155.

4 Samuel M, Khairy P, Mongeon FP, et al. Pulmonary vein stenosis after atrial fibrillation ablation: insights from the ADVICE trial[J]. Can J Cardiol, 2020, 36(12): 1965-1974.

5 Holmes DR Jr, Monahan KH, Packer D. Pulmonary vein stenosis complicating ablation for atrial fibrillation: clinical spectrum and interventional considerations[J]. JACC Cardiovasc Interv, 2009, 2(4): 267-276.

6 Teunissen C, Velthuis BK, Hassink RJ, et al. Incidence of pulmonary vein stenosis after radiofrequency catheter ablation of atrial fibrillation [J]. JACC Clin Electrophysiol, 2017, 3(6): 589-598.

7 Sigurdsson G, Troughton RW, Xu XF. Detection of pulmonary vein stenosis by transesophageal echocardiography: comparison with multidetector computed tomography[J]. Am Heart J, 2007, 153 (5): 800-806.

8 Drubach LA, Jenkins KJ, Stamoulis C, et al. Evaluation of primary pulmonary vein stenosis in children: comparison of radionuclide perfusion lung scan and angiography[J]. AJR Am J Roentgenol, 2015, 205(4): 873-877.

9 Calkins H, Hindricks G, Cappato R, et al. 2017 HRS/EHRA/ECAS/APHRS/SOLAECE expert consensus statement on catheter and surgical ablation of atrial fibrillation[J]. Heart Rhythm, 2017, 14(10): e275-e444.

10 Suntharos P, Prieto LR. Treatment of congenital and acquired pulmonary vein stenosis[J]. Curr Cardiol Rep, 2020, 22(11): 153.

11 Vanderlaan RD, Rome J, Hirsch R, et al. Pulmonary vein stenosis: treatment and challenges[J]. J Thorac Cardiovasc Surg, 2021, 161 (6): 2169-2176.

12 Lu HW, Wei P, Jiang S, et al. Pulmonary vein stenosis complicating radiofrequency catheter ablation: five case reports and literature review [J]. Medicine (Baltimore), 2015, 94(34): e1346.

13 Fender EA, Widmer RJ, Hodge DO, et al. Severe pulmonary vein stenosis resulting from ablation for atrial fibrillation: presentation management and clinical outcomes[J]. Circulation, 2016, 134 (23): 1812-1821.

14 Padala SK, Ellenbogen KA. Pulmonary vein stenosis after atrial fibrillation ablation: an latrogenic problem larger than the primary problem [J]. Circ Arrhythm Electrophysiol, 2018, 11(5): e006461.

15 Fender EA, Widmer RJ, Mahowald MK, et al. Recurrent pulmonary vein stenosis after successful intervention: prognosis and management of restenosis[J]. Catheter Cardiovasc Interv, 2020, 95(5): 954-958.

16 Suntharos P, Prieto LR. Treatment of congenital and acquired pulmonary vein stenosis[J]. Curr Cardiol Rep, 2020, 22(11): 153.

17 Raeisi-Giglou P, Wazni OM, Saliba WI, et al. Outcomes and management of patients with severe pulmonary vein stenosis from prior atrial fibrillation ablation[J]. Circ Arrhythm Electrophysiol, 2018, 11(5): e006001.

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27 Oei HH, van der Meer IM, Hofman A, et al. Lipoprotein-associated phospholipase A2 activity is associated with risk of coronary heart disease and ischemic stroke: the Rotterdam Study[J]. Circulation, 2005, 111(5): 570-575.

28 Esenwa CC, Elkind MS. Inflammatory risk factors biomarkers and associated therapy in ischaemic stroke [J]. Nat Rev Neurol, 2016, 12 (10): 594-604.

29 Burchardt P, Zurawski J, Zuchowski B, et al. Low-density lipoprotein, its susceptibility to oxidation and the role of lipoprotein-associated phospholipase A2 and carboxyl ester lipase lipases in atherosclerotic plaque formation[J]. Arch Med Sci, 2013, 9(1): 151-158.

30 Zhou F, Liu YK, Shi HC, et al. Relation between lipoprotein-associated phospholipase A2 mass and incident ischemic stroke severity[J]. Neurol Sci, 2018, 39(9): 1591-1596.

31 Li XY, Xu L, Xu ZX. The diagnostic and prognostic performance of Lp-PLA2 in acute ischemic stroke[J]. Med Clin (Barc), 2021, 156 (9): 437-443.

32 李渊, 姚丹林. 256 例急诊头晕患者临床特点分析[J]. 中外医学研究, 2016, 16: 106-107.

33 王为强, 宇辉, 朱瑞昉. TriAGe + 评分对头晕患者脑卒中的诊断价值研究[J]. 中国全科医学, 2018, 21(19): 2303-2307.

34 Lee SH, Yun SJ, Ryu S, et al. Utility of Neutrophil-to-Lymphocyte Ratio (NLR) as a predictor of acute infarction in New-onset acute vertigo patients without neurologic and computed tomography abnormalities [J]. J Emerg Med, 2018, 54(5): 607-614.

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