·临床研究·

老年急诊缺血性脑卒中患者血压变异性特点及其对预后的影响

杨苗苗*,周朝朝,郭敏,杜妍妍,杨园园,党培
(西安交通大学第二附属医院急诊科,西安 710004)

【摘 要】 **目的** 探讨老年急诊缺血性脑卒中患者血压变异性(BPV)特点,并评估其对预后的影响。**方法** 回顾性分析2022年2月至2024年5月西安交通大学第二附属医院收治的134例老年急性缺血性脑卒中(AIS)患者的临床资料,根据急诊入院时美国国立卫生研究院卒中量表(NIHSS)评分将老年AIS患者分为轻度组(NIHSS<9分,69例)和中重度组(NIHSS≥9分,65例),比较两组患者的基线资料、入院24 h收缩压变异系数(SBPCV)、舒张压变异系数(DBPCV)及昼夜血压节律模式特点。发病后3个月使用改良Rankin量表(mRS)评估老年AIS患者近期预后,根据预后将患者分为预后良好组(mRS≤2分,102例)与预后不良组(mRS>2分,32例),比较两组患者基线SBPCV、DBPCV及昼夜血压节律。采用SPSS 25.0统计软件进行数据处理,根据数据类型分别使用t检验或χ^2检验进行组间比较。使用多因素logistic回归分析评估老年AIS患者近期预后不良的危险因素。**结果** 中重度组与轻度组昼夜血压节律模式均以勺型居多(占比分别为44.62%和55.07%),中重度组与轻度组昼夜血压节律占比、SBPCV、DBPCV及房颤发生率比较,差异均有统计学意义(P<0.05)。134例老年AIS患者近期预后不良发生率为23.88%(32/134),预后不良组与预后良好组房颤发生率、入院时NIHSS评分、SBPCV、DBPCV及昼夜血压节律比较,差异均有统计学意义(P<0.05)。多因素logistic回归分析结果显示,房颤(OR=2.790,95%CI 1.471~5.292;P<0.05)、入院时NIHSS≥9分(OR=8.715,95%CI 4.577~16.592;P<0.05)、SBPCV(OR=5.778,95%CI 3.094~10.790;P<0.05)、DBPCV(OR=5.382,95%CI 2.833~10.222;P<0.05)及反勺型昼夜血压节律(OR=4.773,95%CI 2.505~9.906;P<0.05)均为老年AIS患者近期预后不良的危险因素。**结论** 老年AIS患者急诊入院脑卒中严重者BPV及反勺型昼夜血压节律、房颤占比更高,且房颤、入院时NIHSS、BPV、反勺型昼夜血压节律是近期预后不良的影响因素,可为老年AIS急诊及临床管理工作提供新思路。

【关键词】 老年人;急性缺血性脑卒中;急诊;血压变异性;变异系数;昼夜血压节律
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Blood pressure variability characteristics and its impact on prognosis in elderly emergency patients with acute ischemic stroke

Yang Miaomiao*, Zhou Zhaozhao, Guo Min, Du Yanyan, Yang Yuanyuan, Dang Pei
(Department of Emergency Medicine, Second Affiliated Hospital of Xi'an Jiaotong University, Xi'an 710004, China)

【**Abstract**】 **Objective** To explore the characteristics of blood pressure variability (BPV) in elderly patients at emergency admission for acute ischemic stroke (AIS) and evaluate the influence on prognosis. **Methods** A retrospective analysis was conducted on 134 elderly patients with AIS admitted in the Second Affiliated Hospital of Xi'an Jiaotong University from February 2022 to May 2024. According to the National Institutes of Health stroke scale (NIHSS) score at emergency admission, they were divided into mild group (NIHSS score <9, 69 cases) and moderate-to-severe group (NIHSS score ≥9, 65 cases). Their baseline data, 24-hour systolic blood pressure coefficient of variation (SBPCV), diastolic blood pressure coefficient of variation (DBPCV) and pattern of circadian blood pressure rhythm were compared between the two groups. At three months after onset, modified Rankin scale (mRS) was used to evaluate the short-term prognosis of the patients, and thus they were classified into good prognosis group (mRS score ≤2, 102 cases) and poor prognosis group (mRS score >2, 32 cases). The baseline SBPCV, DBPCV and circadian blood pressure rhythm were compared between the above two groups. SPSS statistics 25.0 was adopted for data processing, and t test or *Chi*-square test was performed for comparison between groups depending on data type. Multivariate logistic regression analysis was applied to identify the risk factors for short-term poor prognosis in elderly AIS patients. **Results** The most common circadian blood pressure rhythm pattern was dipper type in the moderate-to-severe group and mild group (accounting for 44.62% and 55.07%, respectively). There were statistical differences in the proportion

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通信作者: 杨苗苗, E-mail: YANGmm975@163.com

of circadian blood pressure rhythm, SBPCV, DBPCV and incidence of atrial fibrillation between the two groups ($P<0.05$). In the 134 elderly AIS patients, the incidence of short-term poor prognosis was 23.88% (32/134). Significant differences were observed between the poor prognosis group and good prognosis group in terms of incidence of atrial fibrillation, NIHSS score at admission, SBPCV, DBPCV and circadian blood pressure rhythm ($P<0.05$). Multivariate logistic regression analysis indicated that atrial fibrillation ($OR=2.790$, 95%*CI* 1.471-5.292; $P<0.05$), NIHSS score ≥9 at admission ($OR=8.715$, 95%*CI* 4.577-16.592; $P<0.05$), SBPCV ($OR=5.778$, 95%*CI* 3.094-10.790; $P<0.05$), DBPCV ($OR=5.382$, 95%*CI* 2.833-10.222; $P<0.05$) and reverse dipper circadian blood pressure rhythm ($OR=4.773$, 95%*CI* 2.505-9.906; $P<0.05$) were risk factors for short-term poor prognosis in elderly AIS patients. **Conclusion** In elderly patients with emergency ischemic stroke, those with severe stroke are characterized by high BPV, reverse dipper circadian blood pressure rhythm and atrial fibrillation. Atrial fibrillation, NIHSS score at admission, BPV and reverse dipper circadian blood pressure rhythm are influencing factors of short-term poor prognosis, and may provide new ideas for emergency and clinical management of elderly AIS patients.

【Key words】 aged; acute ischemic stroke; emergency; blood pressure variability; coefficient of variation; circadian blood pressure rhythm

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Corresponding author: Yang Miaomiao, E-mail: YANGmm975@163.com

脑卒中是我国居民死亡的首要病因,好发于中老年人群,随着老龄化在我国的快速进展,老年脑卒中患病人数显著增多[1]。急性缺血性脑卒中(acute ischemic stroke,AIS)是最常见的脑卒中类型,积极再灌注治疗、控制脑卒中危险因素是AIS的主要治疗手段,优化管理危险因素也被认为是减少脑卒中复发、改善预后的重要手段[2]。高血压是脑卒中常见的高危因素,优化血压管理是AIS治疗及预后转归的重要措施,随着对高血压与AIS研究的深入,发病早期过高的血压及剧烈的血压波动均被认为能造成AIS患者不良预后[3]。近年有报道指出,血压变异性(blood pressure variability,BPV)作为评估血压波动的客观指标,能评估机体神经体液系统适应外界刺激的动态调节情况[4]。也有研究发现,观察AIS发病早期BPV特点,不仅对指导临床血压管理有利,也能辅助预测患者预后转归情况,在AIS疾病管理中具有重要作用[5]。基于此,本研究对老年AIS患者急诊入院后BPV对病情严重程度及早期预后的影响进行分析,为老年AIS临床管理提供新思路。

1 对象与方法

1.1 研究对象

回顾性分析西安交通大学第二附属医院2022年2月至2024年5月收治的134例老年AIS患者的临床资料。纳入标准:(1)符合《中国急性缺血性脑卒中诊治指南2018》[6]中AIS诊断标准;(2)发病至急诊入院时间≤24 h;(3)年龄≥60岁;(4)入院后接受动态血压监测;(5)随访时间≥3个月;(6)实验室检查、医疗仪器检查等资料完整。排除标准:(1)发病时间不明;(2)发病至入院前自行用药;(3)发病前存在肢体功能障碍或认知障碍、视听功能障碍;(4)合并血液系统疾病或全身感染性疾病;(5)既往脑外伤或头颅外科手术治疗史。患者及家属对研究内容知情并签署知情同意书。本研究通过医院医学伦理委员会批准(批号:202410-EK-02)。

1.2 方法

1.2.1 脑卒中严重程度评估 急诊入院时使用美国国立卫生研究院卒中量表(National Institute of Health stroke scale,NIHSS)[7]评估患者脑卒中严重程度,得分越高,脑卒中越严重。根据NIHSS评分将老年AIS患者分为轻度组(NIHSS<9分,69例)及中重度组(NIHSS≥9分,65例)。

1.2.2 动态血压监测 在老年AIS患者急诊入院后,使用动态血压监测仪(美国SunTech公司,型号:Oscar 2)持续监测24 h的血压变化,日间定时30 min自动检测1次,夜间(22:00点~次日6:00点)1 h自动检测1次,以变异系数(动态血压标准差/动态血压平均值)[8]计算患者入院24 h收缩压变异系数(systolic blood pressure coefficient of variation,SBPCV)和舒张压变异系数(diastolic blood pressure coefficient of variation,DBPCV),并以昼夜血压差占日间血压平均值的百分比描述昼夜血压节律[9]。健康人群的动态血压呈勺型曲线,日间血压较高,夜间血压呈下降趋势,即具有“两峰一谷”的特征。百分比=(日间血压平均值-夜间血压平均值)/日间血压平均值×100%,10%≤百分比<20%被称为勺型,百分比<0%为反勺型,0%≤百分比<10%为非勺型,百分比≥20%为深勺型。

1.2.3 资料收集 查阅医院门急诊电子病历系统,获得患者一般人口学资料、既往史、基线实验室数据等资料,基线实验室数据由全自动生化分析仪

(日本Olympus Corporation,AU2700)检测。

1.2.4 预后评估 在老年 AIS 患者发病后 3 个月,使用改良 Rankin 量表(modified Rankin scale, mRS)[10]评估患者近期预后,分值范围为 0~5 分,得分越高残疾程度越高,以此将 134 例老年 AIS 患者分为预后良好组(mRS≤2 分,102 例)与预后不良组(mRS>2 分,32 例)。

1.3 统计学处理

采用 SPSS 25.0 统计软件进行数据分析。计量资料以均数±标准差($\bar{x}\pm s$)表示,组间比较采用 t 检验。计数资料以例数(百分率)表示,组间比较采用 χ^2检验。使用多因素 logistic 回归分析评估老年 AIS 患者近期预后不良的危险因素。$P<0.05$ 为差异有统计学意义。

2 结 果

2.1 中重度组与轻度组患者临床资料比较

中重度组患者房颤发生率明显高于轻度组($P<0.05$;表 1)。

2.2 中重度组与轻度组患者 BPV 及昼夜血压节律模式特点比较

中重度组与轻度组患者昼夜血压节律模式均以勺型居多,昼夜血压节律占比、SBPCV 及 DBPCV 比较,差异均有统计学意义($P<0.05$;表 2)。

表 1 中重度组与轻度组患者临床资料比较

Table 1 Comparison of clinical data between moderate-to-severe group and mild group

Item	Moderate-to-severe group($n=65$)	Mild group($n=69$)	χ^2/t	P value
Gender[n(%)]			0.318	0.573
Male	38(58.46)	37(53.62)		
Female	27(41.54)	32(46.38)		
Age(years, $\bar{x}\pm s$)	69.14±5.29	68.15±5.13	1.100	0.274
Body mass index(kg/m^2, $\bar{x}\pm s$)	23.01±2.08	23.14±2.25	0.347	0.729
Hypertension[n(%)]	46(70.77)	45(65.22)	0.473	0.491
Diabetes mellitus[n(%)]	9(13.85)	7(10.14)	0.436	0.509
Hyperlipidemia[n(%)]	20(30.77)	19(27.54)	0.170	0.681
Ischemic heart disease[n(%)]	8(12.31)	4(5.80)	1.740	0.187
Atrial fibrillation[n(%)]	10(15.38)	3(4.35)	4.654	0.031
Smoking[n(%)]	25(38.46)	27(39.13)	0.006	0.937
Alcohol drinking[n(%)]	17(26.15)	16(23.19)	0.159	0.690
Etiology[n(%)]			3.347	0.341
Large artery atherosclerosis type	29(44.62)	38(55.07)		
Cardiogenic embolism type	12(18.46)	6(8.70)		
Small vessel occlusion type	16(24.61)	15(21.74)		
Other definite etiological type	8(12.31)	10(14.49)		
Ischemic lesion site[n(%)]			3.174	0.366
Cerebral lobe	25(38.46)	26(37.68)		
Basal ganglia region	12(18.46)	21(30.44)		
Cerebral lobe with basal ganglia region	19(29.23)	14(20.29)		
Brainstem	9(13.85)	8(11.59)		
Time from onset to admission(h, $\bar{x}\pm s$)	4.05±0.77	4.16±0.84	0.789	0.432
Systolic blood pressure at admission(mmHg, $\bar{x}\pm s$)	148.16±9.05	146.24±8.49	1.267	0.207
Diastolic blood pressure at admission(mmHg, $\bar{x}\pm s$)	87.96±6.19	86.08±7.12	1.627	0.106
Fasting blood glucose(mmol/L, $\bar{x}\pm s$)	6.30±1.06	6.28±1.14	0.105	0.917
Total cholesterol(mmol/L, $\bar{x}\pm s$)	4.41±0.87	4.24±0.74	1.221	0.224
Triglyceride(mmol/L, $\bar{x}\pm s$)	1.78±0.39	1.69±0.33	1.445	0.151

1 mmHg=0.133 kPa.

表 2 中重度组与轻度组患者患者 BPV 及昼夜血压节律模式特点比较

Table 2 Comparison of BPV and circadian blood pressure rhythm pattern characteristics between moderate-to-severe group and mild group

Item	Moderate-to-severe group($n=65$)	Mild group($n=69$)	χ^2/t	P value
SBPCV(%, $\bar{x}\pm s$)	11.01±2.08	8.96±1.95	5.889	<0.001
DBPCV(%, $\bar{x}\pm s$)	11.34±2.02	9.47±1.94	5.466	<0.001
Circadian blood pressure rhythm[n(%)]			8.236	0.016
Dipper type	29(44.62)	38(55.07)		
Non-dipper type	18(27.69)	25(36.23)		
Reverse dipper type	18(27.69)	6(8.70)		
Deep-dipper type	0(0.00)	0(0.00)		

BPV: blood pressure variability; SBPCV: systolic blood pressure coefficient of variation; DBPCV: diastolic blood pressure coefficient of variation.

2.3 预后不良组与预后良好组患者临床资料比较

134例老年AIS患者中近期预后不良有32例(23.88%)。预后不良组与预后良好组房颤发生率、入院时NIHSS评分、SBPCV、DBPCV及昼夜血压节律比较,差异均有统计学意义($P<0.05$;表3)。

表3 预后不良组与预后良好组患者临床资料比较

Table 3 Comparison of clinical data between poor prognosis group and good prognosis group

Item	Poor prognosis group($n=32$)	Good prognosis group($n=102$)	χ^2/t	P value
Gender[n(%)]			0.198	0.657
Male	19(59.38)	56(54.90)		
Female	13(40.62)	46(45.10)		
Age(years, $\bar{x}\pm s$)	69.21±5.34	68.45±4.98	0.740	0.460
Body mass index(kg/m^2, $\bar{x}\pm s$)	22.98±2.19	23.11±2.24	0.288	0.774
Hypertension[n(%)]	25(78.13)	66(64.71)	2.013	0.156
Diabetes mellitus[n(%)]	6(18.75)	10(9.80)	1.101	0.294
Hyperlipidemia[n(%)]	10(31.25)	29(28.43)	0.094	0.759
Ischemic heart disease[n(%)]	5(15.63)	7(6.86)	1.345	0.246
Atrial fibrillation[n(%)]	7(21.88)	6(5.88)	5.403	0.020
Smoking[n(%)]	13(40.63)	39(38.14)	0.059	0.809
Alcohol drinking[n(%)]	9(28.13)	24(23.53)	0.277	0.599
Etiology[n(%)]			5.505	0.138
Large artery atherosclerosis type	13(40.63)	54(52.94)		
Cardiogenic embolism type	8(25.00)	10(9.80)		
Small vessel occlusion type	8(25.00)	23(22.55)		
Other definite etiological type	3(9.37)	15(14.71)		
Ischemic lesion site[n(%)]			2.500	0.475
Cerebral lobe	10(31.25)	41(40.20)		
Basal ganglia region	8(25.00)	25(24.51)		
Cerebral lobe with basal ganglia region	11(34.38)	22(21.57)		
Brain stem	3(9.38)	14(13.72)		
Time from onset to admission(h, $\bar{x}\pm s$)	4.06±0.79	4.12±0.82	0.364	0.716
NIHSS at admission[n(%)]			18.044	<0.001
<9 points	6(18.75)	63(61.76)		
≥9 points	26(81.25)	39(38.24)		
Systolic blood pressure at admission(mmHg, $\bar{x}\pm s$)	148.46±9.13	146.77±8.36	0.976	0.331
Diastolic blood pressure at admission(mmHg, $\bar{x}\pm s$)	88.22±6.38	86.61±7.05	1.152	0.252
Fasting blood glucose(mmol/L, $\bar{x}\pm s$)	6.32±1.09	6.28±1.15	0.174	0.862
Total cholesterol(mmol/L, $\bar{x}\pm s$)	4.46±0.82	4.28±0.79	1.114	0.267
Triglyceride(mmol/L, $\bar{x}\pm s$)	1.80±0.37	1.71±0.35	1.252	0.213
SBPCV(%, $\bar{x}\pm s$)	11.23±2.05	9.55±1.96	4.184	<0.001
DBPCV(%, $\bar{x}\pm s$)	11.49±2.09	10.03±1.89	3.717	<0.001
Circadian blood pressure rhythm[n(%)]			8.425	0.015
Dipper type	11(34.38)	56(54.90)		
Non-dipper type	10(31.25)	33(32.35)		
Reverse dipper type	11(34.38)	13(12.75)		
Main treatment methods after admission[n(%)]				
Antihypertensive drug	22(68.75)	62(60.78)	0.661	0.416
Antiplatelet drug	29(90.63)	91(89.22)	0.011	0.917
Statins	30(93.75)	93(91.18)	0.009	0.925
Anticoagulant drug	3(9.38)	10(9.80)	0.073	0.787
Endovascular therapy	4(12.50)	11(10.78)	0.003	0.958
Intravenous thrombolysis	7(21.88)	21(20.59)	0.024	0.876

NIHSS: National Institute of Health stroke scale; SBPCV: systolic blood pressure coefficient of variation; DBPCV: diastolic blood pressure coefficient of variation.

2.4 老年 AIS 患者近期预后不良危险因素的多因素 logistic 回归分析

以发病后 3 个月预后不良为因变量,以单因素分析中差异有统计学意义的指标为自变量并赋值(房颤:无 = 0,有 = 1;入院时 NIHSS:<9 分 = 0,≥9 分 = 1;SBPCV:实测值;DBPCV:实测值;昼夜血压节律:勺型 = 0,非勺型 = 1,反勺型 = 2),其中昼夜血压节律为多变量,以勺型作为参考类别设置哑变量,行多因素 logistic 回归分析,结果显示房颤、入院时 NIHSS≥9 分、SBPCV、DBPCV 及反勺型昼夜血压节律均为老年 AIS 患者近期预后不良的危险因素(P<0.05;表 4)。

3 讨 论

高血压是脑卒中最常见的危险因素之一,研究发现卒中前高血压患病率常随年龄的升高而增加,75 岁及以上的老年脑卒中患者约有 80% 发病前患有高血压病,因此良好的血压管理在老年脑卒中治疗中占据重要地位[11]。良好的血压控制不仅需要维持一定水平的平均血压,还需要减少异常血压波动及维持正常的昼夜血压节律。动态血压监测不仅可以监测 BPV,还可以评估昼夜血压节律特点,近年已在临床广泛应用[12]。已有不少报道指出,高水平的 BPV 与心脑血管疾病患者靶器官损害危险性密切相关,其机制可能与血压的大幅度波动造成对血管壁的剪切力升高有关,剪切力冲击血管内壁,诱导血管内皮功能障碍,增加靶器官损伤风险[13,14]。对于 AIS 患者,发病早期较高的 BPV 常提示脑血流量的自我调节功能严重受损,高水平的 BPV 又能增加患者血管内皮功能损伤,对此,有学者提出,BPV 可独立于血压均值作为 AIS 的预后影响因素[15]。本研究中,中重度组患者入院 24 h 的 SBPCV 及 DBPCV均高于轻度组,而两组收缩压及舒张压均值并无显著差异,多因素 logistic 回归分析也显示,SBPCV及 DBPCV 是老年 AIS 患者近期预后不良的危险因素,提示相较于血压均值,BPV 指标——SBPCV及 DBPCV,评估 AIS 急诊入院早期的病情严重程度价值更高,且可辅助预测老年 AIS 患者近期预后。分析其原因可能为 AIS 急性期脑组织对血流量、血氧及营养物质的获取完全依赖全身血压,脑血管调节能力减弱,较大的 BPV 冲击脑血管,损伤血管内皮功能,增加血栓事件风险,影响 AIS 患者脑组织再灌注情况,且潜在的缺血半暗带对血压波动敏感,BPV 较高可减少再灌注机会,易遗留神经功能缺损相关后遗症而预后不佳[16]。

另外,健康人群的动态血压呈勺型曲线,即具有“两峰一谷”的特征,日间血压较高,夜间血压呈下降趋势,然而自主神经功能障碍者昼夜节律失调,可表现为与健康人群相反的节律,即反勺型昼夜血压节律[17]。本研究中,中重度组反勺型昼夜血压节律占比明显高于轻度组,且入院时 NIHSS≥9 分与反勺型昼夜血压节律同为老年 AIS 患者近期预后不良的危险因素,提示除了入院时脑卒中严重程度,反勺型昼夜血压节律也能影响老年 AIS 预后。昼夜血压节律为反勺型提示患者存在自主神经功能障碍,血压调节能力进一步受损,导致老年 AIS 患者更易因血压波动产生的血管内剪切力发生血管内皮损伤,影响颅内再灌注情况,这可能是导致患者预后不良的原因[18]。

本研究中,中重度组房颤发生率明显高于轻度组,房颤也为老年 AIS 近期预后不良的危险因素。究其原因可能为合并房颤的老年 AIS 患者常具有起病急、缺血范围大等特点,并常伴慢性心脏炎症反应,疾病发展迅速[19]。此外,合并房颤者溶栓后出血风险较非房颤者更高,更易出现不良结局[20]。然而,本研究为单中心小样本量研究,代表性与可靠性有所欠缺,未来还需联合其他医疗机构开展多中心大样本量研究,对本研究结果加以验证。

综上所述,房颤、入院时 NIHSS≥9 分、高 BPV 及反勺型昼夜血压节律均为老年 AIS 患者近期不良预后的重要影响因素,急诊入院后可通过监测动态血压辅助预测不良预后,指导临床治疗。

表 4 老年 AIS 患者近期预后不良危险因素的多因素 logistic 回归分析

Table 4 Multivariate logistic regression analysis of risk factors for poor short-term prognosis in elderly AIS patients

Factor	β	SE	$Wald\ \chi^2$	P value	OR	95%CI
Atrial fibrillation	1.026	0.336	9.324	0.002	2.790	1.471-5.292
NIHSS score at admission ≥9 points	2.165	0.598	13.107	<0.001	8.715	4.577-16.592
SBPCV	1.754	0.521	11.334	0.001	5.778	3.094-10.790
DBPCV	1.683	0.515	10.680	0.001	5.382	2.833-10.222
Reverse dipper circadian blood pressure rhythm	1.563	0.491	10.133	0.001	4.773	2.505-9.906

AIS: acute ischemic stroke; NIHSS: National Institute of Health stroke scale; SBPCV: systolic blood pressure coefficient of variation; DBPCV: diastolic blood pressure coefficient of variation.

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