

· 论著 ·

# 缺血性脑卒中和出血性脑卒中患者 心肌复极离散度差异研究

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**【摘要】 背景** 急性脑卒中患者常有心电图的改变,而心肌复极离散度的心电标记物可用于鉴别恶性心律失常事件的高风险患者。国外已经开展了关于两者相关性的研究,而国内较少开展。因此探讨不同类型脑卒中患者心肌复极离散度的差异及其与预后的相关性意义重大。**目的** 评估心肌复极离散度指标在急性缺血性脑卒中和出血性脑卒中患者以及颅脑不同病变部位的差异,并探讨其与神经病损程度〔美国国立卫生研究院脑卒中量表(NIHSS)评分〕和残疾程度〔改良Rankin量表(mRS)评分〕的可能关联。**方法** 回顾性收集2017-01-01至2017-12-31在中南大学湘雅医学院附属海口医院海口市人民医院全科医学科、急诊科、神经内科就诊的63例缺血性脑卒中和出血性脑卒中患者的临床资料进行分析。通过入院时标准12导联心电图检查获取心肌复极离散度指标,包括V<sub>5</sub>导联中的Q波开始和T波结束之间的时间离散度(QT离散度)、校正的QT(QTc)离散度、T波峰值与结束时时间间隔的离散度(TpTe离散度)和TpTe/QTc,其他导联中的QT间期最大值、QTc间期最大值和TpTe最大值。比较不同脑卒中类型、颅脑不同病变部位患者中心肌复极离散度指标的差异,采用Spearman秩相关法评价心肌复极离散度指标与出院时NIHSS评分及mRS评分的相关性。**结果** 63例患者中,缺血性脑卒中55例(缺血性脑卒中组),出血性脑卒中8例(出血性脑卒中组);出血性脑卒中组中V<sub>5</sub>导联中TpTe/QTc高于缺血性脑卒中组( $P=0.034$ );颅脑岛叶病变组QT间期最大值较无颅脑岛叶病变组高;无脑干病变组QT间期最大值较有脑干病变组高( $P<0.05$ )。左、右侧颅脑病变患者心肌复极离散度指标比较,差异均无统计学意义( $P>0.05$ )。入院时QT间期最大值与出院时NIHSS、mRS评分间存在相关性( $r_s=0.561, 0.346, P=0.04, 0.02$ )。**结论** 心肌复极离散度指标中,V<sub>5</sub>导联的TpTe/QTc与出血性脑卒中有关,QT间期最大值与颅脑岛叶的病变及出院时神经病损程度、残疾程度相关。

**【关键词】** 脑卒中;心电图描记术;心律失常;心性;心肌复极;脑血管事件;T波峰值和波谷之间的时间;QT延长

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**Difference of Myocardial Repolarization Dispersion in Patients with Acute Ischemic and Hemorrhagic Stroke** LI Minglan\*, PAN Biyun, CHEN Shiyin, WEN Da, WANG Yanying

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**【Abstract】 Background** Patients with acute stroke often have changes in electrocardiogram (ECG) and discrete markers of cardiac repolarization to identify high-risk patients with malignant arrhythmic events. There are studies on the correlation between the two abroad, but few in China. It is of great significance to explore the difference of myocardial repolarization dispersion and its correlation with prognosis in different types of stroke patients. **Objective** To evaluate the myocardial repolarization indexes of cardiac repolarization in patients with acute ischemic stroke and hemorrhagic stroke and different stroke sites, and to explore the possible correlation between myocardial repolarization dispersion indexes and neurological severity (National Institutes of Health Stroke Scale score, NIHSS score) and disability (Modified Rankin Scale score, mRS score). **Methods** The clinical data of 63 patients with acute ischemic and hemorrhagic stroke in the Department of General

Practice, Central South University Xiangya School of Medicine Affiliated Haikou Hospital/Haikou People's Hospital from January 1 2017 to December 31 2017 were retrospectively collected and analyzed. Data of myocardial repolarization dispersion indexes were obtained by 12-lead electrocardiogram at admission, including QT dispersion in  $V_5$  lead, QTc dispersion, TpTe dispersion and TpTe/QTc, the maximum value of QT, QTc and TpTe in other leads. The differences of cardiac muscle repolarization dispersion between different stroke types and different brain lesions were compared, and the correlation between myocardial repolarization dispersion indexes and NIHSS scores at admission and discharge and mRS scores at discharge were evaluated by Spearman rank correlation method. **Results** Among 63 patients, 55 were ischemic stroke (ischemic stroke group) and 8 were hemorrhagic stroke (hemorrhagic stroke group); TpTe/QTc in  $V_5$  lead in hemorrhagic stroke group was higher than that in ischemic stroke group ( $P=0.034$ ); the maximum value of QT in insular lobe lesion group was higher than that in non-insular lobe lesion group; the maximum value of QT in non-brainstem lesion group was higher than that in brainstem lesion group ( $P<0.05$ ). There was no significant difference in myocardial repolarization dispersion between left and right brain lesions ( $P>0.05$ ). There was a correlation between the maximum QT at admission and NIHSS and mRS scores at discharge ( $r_s=0.561, 0.346, P=0.04, 0.02$ ). **Conclusion** Among myocardial repolarization dispersion indices, TpTe/QTc in  $V_5$  lead is associated with hemorrhagic stroke, and the maximum value of QT is associated with insular lesion, neuropathy and disability.

**【Key words】** Stroke; Electrocardiography; Arrhythmias, cardiac; Myocardial repolarization; Cerebrovascular events; T peaks to end; QT prolongation

在无心脏瓣膜病变的脑卒中或蛛网膜下腔出血患者中, 90% 在急性期有心电图改变<sup>[1]</sup>, 即使既往无任何心电图异常, 仍有高达 25% 的患者发生新的心律失常<sup>[2]</sup>。交感神经系统和副交感神经系统的激活是引起心律失常的主要原因, 其与脑血管事件的不良预后相关<sup>[3]</sup>。颅脑岛叶和脑干的病变, 以及与其他皮质部位的连接会损害自主心血管调节, 从而导致心电图发生变化<sup>[4]</sup>。在急性脑血管事件患者中, 心电图上的 Q 波开始和 T 波结束之间的时间离散度 (QT 离散度) 会延长<sup>[5]</sup>, 而 QT 离散度又代表了心肌复极异质性的量度。SEONG 等<sup>[6]</sup> 研究报道了 QT 离散度延长与严重室性心律失常、心脏猝死和心功能不良之间有显著的关系。最近, T 波峰值与结束时时间间隔的离散度 (TpTe 离散度) 与 TpTe/校正的 QT 间期 (TpTe/QTc) 在缺血性脑卒中患者中被用以识别恶性心律失常事件<sup>[7]</sup>。基于此, 本研究旨在评估心肌复极离散度指标在出血性脑卒中和缺血性脑卒中、颅脑不同病变患者中的差异, 并探讨其与美国国立卫生研究院脑卒中量表 (NIHSS) 评分以及改良 Rankin 量表 (mRS) 评分之间的相关性。

## 1 资料与方法

**1.1 研究对象** 回顾性收集 2017-01-01 至 2017-12-31 在中南大学海口市人民医院全科医学科、急诊科、神经内科就诊的 97 例缺血性脑卒中和出血性脑卒中患者的临床资料进行分析。患者均在入院后 24~36 h 行颅脑 CT 检查。如果颅脑 CT 检查提示无缺血性病变则再行颅脑 MRI 检查。所有患者入院后 72 h 内接受心电监护。纳入标准: (1) 经颅脑 CT 或 MRI 检查确诊为脑卒中; (2) 有完整的标准 12 导联心电图和心脏彩超结果; (3) 无颅内占位性病变; (4) 患者知情同意。排除标准: 患有急性冠脉综合征或冠状动脉疾病, 先天性长 QT 综

合征, 目前使用 QT 间期延长药物 (即抗心律失常或抗精神病药物), 心脏起搏器植入, 完全性束支传导阻滞, 严重左房室瓣和主动脉瓣疾病及电解质紊乱的患者。

**1.2 观察指标** 依据脑卒中类型将患者分为出血性脑卒中组和缺血性脑卒中组。比较两组患者入院时、出院时神经病损程度 (NIHSS 评分) 及出院时残疾程度 (mRS 评分); 比较有、无颅脑岛叶病变, 有、无脑干病变, 左、右颅脑病变患者的心肌复极离散度指标的差异; 分析心肌复极离散度指标与脑卒中患者出院时 NIHSS 评分、mRS 评分的相关性。

入院时和出院时采用 NIHSS 评分来评估神经病损程度, 评分范围为 0~42 分, 评分越高对应的神经受损越严重<sup>[8]</sup>。出院时采用 mRS 评分来评估残疾程度, 0 分: 完全无症状; 1 分: 有症状, 但无功能障碍; 2 分: 轻度残疾, 但可生活自理; 3 分: 中度残疾, 生活不能完全自理, 但可独立行走; 4 分: 重度残疾, 无法独立行走; 5 分: 卧床; 6 分: 死亡<sup>[8]</sup>。

**1.3 心肌复极离散度指标** 比较不同脑卒中类型, 颅脑不同病变部位患者中心肌复极离散度指标的差异, 心肌复极离散度指标包括:  $V_5$  导联中的 QT 离散度、QTc 离散度、TpTe 离散度和 TpTe/QTc, 以及其他导联中的 QT 间期最大值 (在 12 个导联中测量的最长 QT), QTc 间期最大值 (在 12 个导联中计算的最长 QTc) 和 TpTe 最大值 (在 12 个导联中测量的最长 TpTe)。使用标准 12 导联心电图机进行心电图检测, 纸速为 25 mm/s, 测量并计算 QT 间期、校正 QT 间期、QT 离散度、TpTe、TpTe 离散度、TpTe/QTc 的最大值。

QT 间期定义为 QRS 复合波起始和 T 波结束之间的时间。校正 QT 间期使用 Bazett 公式计算。QT 离散度是指 QT 间期最大值和最小值的差值。TpTe 的测量: 确

定T波顶点Tp(直立T波的最高峰上缘垂直与等电位线上缘的交点,或者倒置T波的最低谷下缘垂直与等电位线下缘的交点),Te是下降支与等电位线的交点,如有U波时取U波与T波之间的相交点,直接测量Tp与Te之间的距离。TpTe离散度定义为心前区导联中最大和最小TpTe间期之间的差值。TpTe/QT:TpTe与相应的QT间期的比值。TpTe/QTc的最大值=TpTe最大值/QTc间期最大值。正常窦性心律患者计算连续3次心脏搏动获得数据的平均值,心房颤动患者计算连续5次心脏搏动获得数据的平均值。由2例副主任医师独立获得测量数据,如果每次测量的差异>20ms,则通过第3例副主任医师判断。

1.4 统计学方法 采用SPSS 22.0软件进行数据分析。计量资料以( $\bar{x} \pm s$ )表示,两组间比较采用两独立样本t检验。采用Spearman秩相关分析心肌复极离散度指标与出院时NIHSS评分、mRS评分的相关性。以 $P < 0.05$ 为差异有统计学意义。

## 2 结果

2.1 基本情况 97例患者中,10例电解质紊乱,9例使用了延长QT间期的药物,9例有完全性束支传导阻滞,4例安装了起搏器,2例有严重的左房室瓣和主动脉瓣疾病,最终纳入63例患者,其中55例为缺血性脑

卒中,8例出血性脑卒中。在55例缺血性脑卒中患者中,12例颈动脉粥样硬化,11例心源性脑卒中,6例小血管闭塞,4例颈动脉夹层,22例未明确脑卒中病因。32例患者左侧颅脑病变,23例患者右侧颅脑病变,无双侧病变患者。14例患者有颅脑岛叶病变,8例患者有脑干病变。32例缺血性脑卒中患者进行静脉溶栓,4例患者进行机械性血栓清除术。

2.2 出血性脑卒中组和缺血性脑卒中组NIHSS评分、mRS评分及心肌复极离散度指标比较 出血性脑卒中组和缺血性脑卒中组入院时和出院时NIHSS评分、出院时mRS评分比较,差异有统计学意义( $P < 0.05$ );两组心肌复极离散度指标中仅 $V_5$ 导联TpTe/QTc比较,差异有统计学意义( $P = 0.034$ ,见表1)。

2.3 不同病变部位患者的心肌复极离散度比较 颅脑岛叶病变患者QT间期最大值较无颅脑岛叶病变患者高,无脑干病变患者QT间期最大值较有脑干病变患者高,差异有统计学意义( $P < 0.05$ );其余指标比较,差异无统计学意义( $P > 0.05$ ,见表2、3)。左、右侧颅脑病变患者心肌复极离散度指标比较,差异均无统计学意义( $P > 0.05$ ,见表4)。

2.4 心肌复极离散度指标与出院时NIHSS评分、mRS评分的相关性分析 心肌复极离散度指标中,仅入院

表1 缺血性脑卒中组和出血性脑卒中组NIHSS评分、mRS评分及心肌复极离散度指标比较( $\bar{x} \pm s$ )

Table 1 Comparison of scores of NIHSS, mRS, and dispersion of myocardial repolarization between ischemic stroke group and hemorrhagic stroke group

组别	例数	入院时 NIHSS评分(分)	出院时 NIHSS评分(分)	出院时 mRS评分(分)	$V_5$ 导联 QT离散度(ms)	$V_5$ 导联 QTc离散度(ms)	$V_5$ 导联 TpTe离散度(ms)	$V_5$ 导联 TpTe/QTc (ms)	QT间期 最大值 (ms)	QTc间期 最大值 (ms)	TpTe 最大值 (ms)
缺血性脑卒中组	55	7 $\pm$ 5	4 $\pm$ 3	2 $\pm$ 1	58.9 $\pm$ 28.4	63.2 $\pm$ 28.4	58.5 $\pm$ 17.6	0.20 $\pm$ 0.04	429.8 $\pm$ 37.2	471.7 $\pm$ 28.9	117.3 $\pm$ 11.3
出血性脑卒中组	8	12 $\pm$ 7	9 $\pm$ 6	4 $\pm$ 1	62.5 $\pm$ 33.2	68.7 $\pm$ 38.1	59.3 $\pm$ 20.6	0.24 $\pm$ 0.03	438.7 $\pm$ 25.8	477.0 $\pm$ 41.5	118.1 $\pm$ 15.7
t值		-2.625	-2.414	-3.366	-0.423	-0.321	-0.08	-2.173	-0.858	-0.455	-1.19
P值		0.011	0.044	0.001	0.674	0.749	0.936	0.034	0.394	0.651	0.239

注:NIHSS=美国国立卫生研究院量表,mRS=改良Rankin量表,QT离散度=Q波开始和T波结束之间的时间离散度,QTc离散度=校正的QT间期离散度,TpTe离散度=T波峰值与结束时时间间隔的离散度

表2 颅脑岛叶病变组和无颅脑岛叶病变组心肌复极离散度指标比较( $\bar{x} \pm s$ )

Table 2 Comparison of myocardial repolarization dispersion indices between insular lesion group and non-insular lesion group

病变部位	例数	$V_5$ 导联QT 离散度(ms)	$V_5$ 导联QTc 离散度(ms)	$V_5$ 导联TpTe 离散度(ms)	$V_5$ 导联 TpTe/QTc	QT间期最 大值(ms)	QTc最大值 (ms)	TpTe最大值 (ms)
颅脑岛叶病变	14	61.84 $\pm$ 37.10	65.64 $\pm$ 32.51	62.19 $\pm$ 18.71	0.19 $\pm$ 0.03	452.24 $\pm$ 26.69	478.62 $\pm$ 20.07	118.16 $\pm$ 9.32
无颅脑岛叶病变	49	58.46 $\pm$ 25.87	63.57 $\pm$ 28.49	57.56 $\pm$ 17.76	0.21 $\pm$ 0.04	420.49 $\pm$ 39.33	468.67 $\pm$ 24.29	117.74 $\pm$ 13.87
t值		0.389	0.232	0.851	-2.004	2.831	1.399	0.132
P值		0.699	0.817	0.398	0.054	0.006	0.167	0.896

表3 脑干病变组和无脑干病变组的心肌复极离散度指标比较( $\bar{x} \pm s$ )

Table 3 Comparison of myocardial repolarization dispersion indices between brainstem lesion group and non-brainstem lesion group

病变部位	例数	$V_5$ 导联QT 离散度(ms)	$V_5$ 导联QTc 离散度(ms)	$V_5$ 导联TpTe 离散度(ms)	$V_5$ 导联 TpTe/QTc	QT间期最 大值(ms)	QTc最大值 (ms)	TpTe最大值 (ms)
脑干病变	8	55.94 $\pm$ 23.06	64.87 $\pm$ 44.33	61.24 $\pm$ 10.68	0.19 $\pm$ 0.02	404.33 $\pm$ 22.95	472.16 $\pm$ 39.14	113.84 $\pm$ 13.32
无脑干病变	8	59.11 $\pm$ 27.03	65.17 $\pm$ 29.62	58.21 $\pm$ 17.68	0.21 $\pm$ 0.04	437.47 $\pm$ 35.80	477.55 $\pm$ 30.65	118.86 $\pm$ 10.86
t值		-0.315	-0.025	0.470	-1.310	-2.534	-0.448	-1.187
P值		0.754	0.980	0.640	0.195	0.014	0.655	0.240



表4 左侧颅脑病变组和右侧颅脑病变组的心肌复极离散度指标的比较 ( $\bar{x} \pm s$ )

Table 4 Comparison of myocardial repolarization dispersion indices between left craniocerebral lesion group and right craniocerebral lesion group

病变部位	V <sub>5</sub> 导联 QT 离散度 (ms)	V <sub>5</sub> 导联 QTc 离散度 (ms)	V <sub>5</sub> 导联 TpTe 离散度 (ms)	V <sub>5</sub> 导联 TpTe / QTc	QT 间期最大值 (ms)	QTc 最大值 (ms)	TpTe 最大值 (ms)
左侧颅脑病变	60.57 ± 29.52	63.38 ± 28.14	59.83 ± 19.29	0.21 ± 0.06	428.80 ± 31.19	478.02 ± 29.79	118.87 ± 11.25
右侧颅脑病变	61.96 ± 27.14	68.10 ± 25.54	59.86 ± 16.42	0.21 ± 0.03	431.90 ± 32.69	475.03 ± 36.59	115.42 ± 16.10
<i>t</i> 值	0.178	0.637	0.005	-0.086	0.356	-0.334	-0.938
<i>P</i> 值	0.859	0.527	0.996	0.932	0.724	0.740	0.352

时 QT 间期最大值与出院时 NIHSS 评分 ( $r_s=0.561$ ,  $P=0.04$ ) 和出院时 mRS 评分 ( $r_s=0.346$ ,  $P=0.02$ ) 相关 (见表 5)。

表5 心肌复极离散度指标与出院时 NIHSS 评分和 mRS 评分的相关性分析 ( $r_s$ )

Table 5 Correlation analysis of myocardial repolarization dispersion indices with NIHSS score and mRS score at discharge

心肌复极离散度指标	出院时 NIHSS 评分	出院时 mRS 评分
V <sub>5</sub> 导联 QT 离散度 (ms)	0.024	0.012
V <sub>5</sub> 导联 QTc 离散度 (ms)	0.085	0.074
V <sub>5</sub> 导联 TpTe 离散度 (ms)	-0.079	0.052
V <sub>5</sub> 导联 TpTe / QTc	-0.252	0.238
QT 间期最大值 (ms)	0.561*	0.346*
QTc 间期最大值 (ms)	0.068	-0.223
TpTe 最大值 (ms)	-0.179	0.088

注: \* 为  $P<0.05$

### 3 讨论

据报道,急性脑血管事件后患者存在多种心电图异常,包括 QT 间期延长、ST 段和 T 波的改变<sup>[9]</sup>。本研究表明,V<sub>5</sub> 导联中的 TpTe/QTc 在出血性脑卒中患者中显著升高,而 QT 间期最大值在颅脑岛叶病变患者和无脑干病变患者中显著升高,QT 间期最大值与出院时 NIHSS 评分和 mRS 评分密切相关。

QT 离散度是 20 多年前提出的一种间接测量心室复极不均匀性的方法<sup>[10]</sup>。已经报道了 QT 离散度在急性心肌梗死和急性脑卒中后的预后价值<sup>[11]</sup>。JOHNSON 等<sup>[12]</sup>研究表明,QT 离散度增高与出血性脑卒中有关。另一项研究显示,与对照组相比,缺血性脑卒中患者的 TpTe/QT 和 TpTe 更高<sup>[13]</sup>。本研究发现出血性脑卒中和缺血性脑卒中患者 V<sub>5</sub> 导联中 TpTe 和 TpTe/QTc 比较,有统计学差异,分析原因为与缺血性脑卒中相比,出血性脑卒中病变更严重和广泛,因此,出血性脑卒中可能会导致更多的、不同区域的自主神经系统紊乱<sup>[14]</sup>。BRAUN 等<sup>[15]</sup>的研究已经报道了 TpTe 间期延长和高 TpTe/QTc 与脑卒中患者猝死密切相关,这可能是由于在脑卒中患者中心室复极引起的心律失常的敏感性增加。ANDERSSON 等<sup>[16]</sup>评价 QT 间期与脑卒中严重程度的相关性发现:在只进行静脉溶栓治疗的患者中 QT 间期的变化与脑卒中严重程度之间有显著关联。

本研究发现 QT 间期最大值在颅脑岛叶病变和无脑干病变患者中较高。WHITE 等<sup>[17]</sup>研究所示,脑卒中后岛叶的损伤可能在脑源性 QT 间期延长的发病机制中起主要作用。REINKE 等<sup>[18]</sup>的一项研究显示,出血性脑卒中患者存活者 QT 间期最大值和 QTc 间期最大值增加与住院时间存在相关性。由于样本量有限,所以本研究结果应谨慎看待。基于此,需要在更大样本研究中进行验证和对患者进行临床随访,如开展更大规模的长期随访数据研究,以了解心电图参数改变对结果的影响。

综上,本研究发现 V<sub>5</sub> 导联中的 TpTe/QTc 与出血性脑卒中有关,QT 间期最大值与颅脑岛叶病变有关,QT 间期最大值与神经受损严重程度和残疾程度相关。

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本文无利益冲突。

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