

心电图对急性肺动脉栓塞和急性非ST段抬高型心肌梗死鉴别诊断的价值

周林海¹, 梁碧荣², 张怀勤¹, 黄伟剑¹, 林捷¹, 计光¹, 胡建琼¹, 虞晓武³

1. 温州医学院附属第一医院心内科, 温州 325000
2. 温州市中西医结合医院影像科, 温州 325000
3. 温州医学院附属第三医院心内科, 瑞安 325200

[摘要] **目的** 研究标准12导联心电图区分急性肺动脉栓塞(APE)和急性非ST段抬高型心肌梗死(NSTEMI)的诊断价值。**方法** 回顾性分析2005年1月至2011年1月间温州医学院附属第一医院呼吸内科和心内科收治的126例患者资料,其中42例确诊为APE(APE组),平均年龄(61±12)岁;84例确诊为NSTEMI(NSTEMI组),平均年龄(72±15)岁。所有患者资料完整、真实,两组患者在年龄、性别分布上具有可比性。分析两组患者标准12导联心电图变化,寻找可用于区分两组的指标。**结果** APE和NSTEMI两组仅有部分患者心电图表现为完全性右束支传导阻滞(RBBB,11.9%和14.3%),S₁Q_{III}T_{III}或S₁S_{II}S_{III}模式(26.2%和15.5%)。II、III、aVF合并V₁~V₃导联T波倒置是APE的重要预测因子[OR(95%CI)值为1.32(1.15,1.69)],预测APE特异性为88%,阳性预测值为82%。V₅~V₆导联T波倒置合并ST段压低是NSTEMI的重要预测因子[OR(95%CI)值为1.85(1.14,3.01)],特异性为89%,阳性预测值为50%。**结论** 心电图的RBBB、S₁Q_{III}T_{III}或S₁S_{II}S_{III}模式不能对鉴别APE和NSTEMI提供帮助;而II、III、aVF合并V₁~V₃导联T波倒置应高度怀疑APE的可能,V₅~V₆导联T波倒置合并ST段压低应考虑NSTEMI的可能。

[关键词] 心电图;急性肺动脉栓塞;非ST段抬高型心肌梗死

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Value of standard 12-lead electrocardiogram in differential diagnosis of acute pulmonary embolism and non-ST elevation myocardial infarction

ZHOU Lin-hai¹, LIANG Bi-rong², ZHANG Huai-qin¹, HUANG Wei-jian¹, LIN Jie¹, JI Guang¹, HU Jian-qiong¹, YU Xiao-wu³

1. Department of Cardiology, First Affiliated Hospital of Wenzhou Medical College, Wenzhou 325000, Zhejiang, China
2. Department of Radiology, Hospital of Chinese and Western Integrative Medicine, Wenzhou 325000, Zhejiang, China
3. Department of Cardiology, Third Affiliated Hospital of Wenzhou Medical College, Ruian 325200, Zhejiang, China

[Abstract] **Objective** To study the values of standard 12-lead electrocardiogram (ECG) in differential diagnosis of acute pulmonary embolism (APE) and non-ST elevation myocardial infarction (NSTEMI). **Methods** A retrospective analysis was conducted on 126 patients who were treated in the First Affiliated Hospital of Wenzhou Medical College during Jan. 2005 to Jan. 2011. The patients included 42 patients with APE (mean age [61±12] year) and 84 with NSTEMI (mean age [72±15] year). The data of all patients were complete and true, and the two groups were comparable in age and sex distribution. The standard 12-lead ECG records on admission were analyzed and the parameters which could be used for differential diagnosis were screened. **Results** Frequencies of right bundle branch block (RBBB) and S₁Q_{III}T_{III} or S₁S_{II}S_{III} pattern were similar in the two groups ([11.9%] APE vs [14.3%] NSTEMI, [26.2%] APE vs [15.5%] NSTEMI patients, respectively). Negative T waves in leads V₁-V₃ together with negative T waves in inferior wall leads II, III, aVF (OR 1.32, 95%CI[1.15-1.69]) yielded a positive predictive value of 88% and specificity of 82% for APE. However, ST depression in leads V₅-V₆ and negative T waves in leads V₅-V₆ (OR 1.85, 95%CI [1.14-3.01]) yielded a positive predictive value of 89% and specificity of 50% for NSTEMI. **Conclusion** RBBB and S₁Q_{III}T_{III} or S₁S_{II}S_{III} pattern may not help to differentiate between APE and NSTEMI. Coexistence of negative T waves in precordial leads V₁-V₃ and inferior wall leads II, III, aVF may suggest APE diagnosis. Coexistence of negative T waves and ST segment depression in precordial leads V₅-V₆ may suggest NSTEMI diagnosis.

[Key words] electrocardiogram; acute pulmonary embolism; non-ST elevation myocardial infarction

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急性肺动脉栓塞(acute pulmonary embolism, APE)是一种相对多发的心血管急症,肺动脉血管床的闭塞可能导致突然的生命危险以及潜在可逆的右室功能衰竭。APE的临床表现主要为胸痛、呼吸困难、晕厥,这些症状没有特异性,与非ST段抬高型心肌梗死(non-ST elevation myocardial infarction, NSTEMI)起始发病症状很相近,易误诊为NSTEMI。APE的心电图表现多样,其心电图特点报道最多的是 $S_I Q_{III} T_{III}$ 或 $S_I S_{II} S_{III}$ 模式、完全性右束支传导阻滞(RBBB)、胸前导联T波倒置、肺型P波^[1-6],但没有一个能对APE做出明确诊断。本研究比较了APE和NSTEMI的标准12导联心电图特征,以期为两者的鉴别诊断提供有价值的信息。

1 资料和方法

1.1 研究对象 回顾性分析2005年1月至2011年1月间温州医学院附属第一医院呼吸内科和心内科收治的126例患者资料。其中42例确诊为APE(APE组),年龄(43~76)岁,平均(61±12)岁;84例确诊为NSTEMI(NSTEMI组),年龄(48~83)岁,平均(72±15)岁,患者资料完整、真实。两组年龄、性别具有可比性。APE通过增强螺旋CT确诊;NSTEMI根据欧洲心脏病学会指南作出诊断[至少有2~3个因素:胸痛、心电图心肌缺血和(或)心肌酶谱(或肌钙蛋白)升高]^[7],患者均经冠状动脉造影确诊,至少有1支或1支以上冠状动脉病变。排除患有慢性阻塞性肺疾病、特发性肺动脉高压、扩张型心肌病、严重心力衰竭(NYHA心功能Ⅲ级或Ⅳ级)、显著的电解质异常的患者。

1.2 研究方法 所有患者入院24h内记录标准12导联心电图。心电图心肌缺血表现为相应部位对应导联的对称性的T波倒置,ST段压低至少大于0.1mV,至少相邻2个导联。RBBB表现为 $QRS>0.12s$, V_1 终末R波 $>0.15mV$ 。 $S_I Q_{III} T_{III}$ 或 $S_I S_{II} S_{III}$ 模式定义为I导联S波和Ⅲ导联Q波 $>0.15mV$,Ⅲ导联T波倒置^[8]。24h内完成急诊肌钙蛋白、心肌酶谱、D-二聚体和CT螺旋增强扫描的检查。同时参照欧洲心脏病学会指南,根据患者入院时的收缩压、心脏超声的右心功能不全、肌钙蛋白的升高指标,把APE分为低风险、中风险、高风险,比较低、中、高风险APE患者的心电图表现。

1.3 统计学处理 使用SPSS 13.0统计软件分析数据。符合正态分布的数据以 $\bar{x}\pm s$ 表示,非正态分布的数据以中位数表示。两组之间的比较采用Student's *t* 检验或Mann-Whitney's *U* 检验,两组以上的比较使用方差分析和Kruskal-Wallis分析,离散变量使用 χ^2 检验。分别选择参数计算敏感性、特异性、阳性预测值(PPV)和阴性预测值(NPV)。在异常心电图,以单因素Logistic回归分析来评估APE或NSTEMI的重要预测因子。检验水平(α)为0.05。

2 结果

2.1 APE组和NSTEMI组患者的临床资料对比 由表1可见,NSTEMI组患者心肌缺血表现比APE组明显($P<0.01$)。在起始临床发病症状中,NSTEMI组患者发病时胸痛明显($P<0.01$),而APE组呼吸困难明显($P<0.001$)。

表1 APE和NSTEMI患者的临床资料

Tab 1 Clinical characteristics of APE patients and NSTEMI patients

Index	APE (N=42)	NSTEMI (N=84)	P value
Age (year, $\bar{x}\pm s$)	61±12	72±15	<0.001
Gender (male/female, n/n)	19/23	37/47	>0.05
History of ischemic heart disease n(%)	13(31.0)	62(73.8)	<0.001
History of myocardial infarction n(%)	0(0)	0(0)	
History of pulmonary embolism n(%)	0(0)	0(0)	
Onset of symptoms n(%)			
Chest pain	18(42.9)	60(71.4)	<0.01
Dyspnea	36(85.7)	37(44.0)	<0.001
Syncope	10(23.8)	13(15.5)	>0.05

APE: Acute pulmonary embolism; NSTEMI: Non-ST elevation myocardial infarction

2.2 APE组和NSTEMI组患者异常心电图比较 由表2可见,两组患者心电图异常表现中,NSTEMI组心电图V₅~V₆导联ST段压低合并T波倒置比APE组明显(P<0.05),APE组心电图V₁~V₃导联ST段压低和T波倒置比NSTEMI

组明显(P<0.001,P<0.01),II、III、aVF和V₅~V₆导联ST段压低两组差异无统计学意义(P>0.05),RBBB和S₁Q_{III}T_{III}或S₁S_{II}S_{III}模式在两组间差异也无统计学意义(P>0.05)。

表2 APE和NSTEMI患者异常心电图比较
Tab 2 ECG abnormalities in APE patients and NSTEMI patients

ECG abnormality	APE (N=42)	NSTEMI (N=84)	P value
ST depression (>1 mm) in leads II, III, aVF	13(31.0)	23(27.4)	>0.05
ST depression in leads V ₁ -V ₃	21(50.0)	17(20.2)	<0.001
ST depression in leads V ₅ -V ₆	17(40.5)	42(50.0)	>0.05
Negative T waves in leads II, III, aVF	11(26.2)	13(15.5)	>0.05
Negative T waves in leads II, III, aVF with ST depression	7(16.7)	12(14.3)	>0.05
Negative T waves in leads V ₁ -V ₃	20(47.6)	19(22.6)	<0.01
Negative T waves in leads V ₁ -V ₃ with ST depression	7(16.7)	22(26.2)	>0.05
Negative T waves in leads V ₅ -V ₆	2(4.8)	10(11.9)	>0.05
Negative T waves in leads V ₅ -V ₆ with ST depression	6(14.3)	25(29.8)	<0.05
Right bundle branch block (RBBB)	5(11.9)	12(14.3)	>0.05
S ₁ Q _{III} T _{III} or S ₁ S _{II} S _{III}	11(26.2)	13(15.5)	>0.05
Atrial fibrillation	6(14.3)	13(15.5)	>0.05

APE: Acute pulmonary embolism; NSTEMI: Non-ST elevation myocardial infarction; ECG: Electrocardiogram

2.3 APE组和NSTEMI组患者异常心电图敏感性、特异性、阳性预测值和阴性预测值比较 通过从表2中选择合适的参数,进一步计算心电图不同参数预测APE和NSTEMI的敏感性、特异性、阳性预

测值和阴性预测值,发现II、III、aVF和V₁~V₃导联T波倒置对预测APE具有较高的特异性(88%)和较高的阳性预测值(82%),V₅~V₆导联T波倒置合并ST段压低对NSTEMI特异性接近90%(表3)。

表3 心电图对APE和NSTEMI敏感性和特异性的预测
Tab 3 Sensitivity, specificity, and predictive values of chosen electrocardiographic parameters for for APE patients and NSTEMI patients

Predictor	Sensitivity	Specificity	PPV	NPV
Predictor for APE				
Negative T waves in leads V ₁ -V ₃	65.4	52.5	77.4	42.2
ST depression in leads V ₁ -V ₃	45.3	81.3	54.1	78.5
Negative T waves in leads V ₁ -V ₃ and II, III, aVF	32.1	88.2	82.4	37.2
Predictor for NSTEMI				
Negative T waves in leads V ₅ -V ₆	38.1	83.3	49.1	76.4
Negative T waves in leads V ₅ -V ₆ with ST depression	28.3	89.1	50.1	75.2

APE: Acute pulmonary embolism; NSTEMI: Non-ST elevation myocardial infarction; PPV: Positive predictive value; NPV: Negative predictive value

2.4 异常心电图单因素 Logistic 回归分析 在APE和NSTEMI异常心电图的比较中,进一步通过Logistic回归分析发现,V₁~V₃导联ST段压低和V₁~V₃导联T波倒置合并II、III、aVF导联T波倒置是APE的重要预测因子,而V₅~V₆导联T波倒置和ST段压低合并V₅~V₆导联T波倒置是

NSTEMI的重要预测因子(表4)。

2.5 心电图异常对APE低、中、高风险的预测 在异常心电图的表现对APE低、中、高风险的预测中,发现除了S₁Q_{III}T_{III}或S₁S_{II}S_{III}模式在不同低、中、高风险间差异有统计学意义外,其他心电图不同表现在不同风险分层间差异无统计学意义(表5)。

表 4 APE 和 NSTEMI 患者心电图异常的 OR 值比较

Tab 4 Comparison of odds ratio(OR) for APE and NSTEMI in ECG abnormal patients

ECG abnormality	OR(95%CI)	P value
ECG abnormality predicting APE		
Negative T waves in leads V ₁ -V ₃	1.27(0.99,1.62)	0.06
ST depression in leads V ₁ -V ₃	2.26(1.35,3.45)	<0.01
Negative T waves in leads V ₁ -V ₃ and II, III, aVF	1.32(1.15,1.69)	<0.01
ECG abnormality predicting NSTEMI		
Negative T waves in leads V ₅ -V ₆	2.01(1.34,3.28)	<0.01
Negative T waves in leads V ₅ -V ₆ with ST depression	1.85(1.14,3.01)	<0.01

APE: Acute pulmonary embolism; NSTEMI: Non-ST elevation myocardial infarction; ECG: Electrocardiogram

表 5 根据心电图异常对 APE 患者分组低、中、高风险的预测

Tab 5 ECG abnormalities in patients with low, intermediate, and high risk of APE

ECG abnormality	Low-risk (N=15)	Intermediate risk (N=23)	High-risk (N=5)	P value
ST depression in leads II, III, aVF	4	9	1	0.81
ST depression in leads V ₁ -V ₃	3	7	1	0.78
ST depression in leads V ₅ -V ₆	5	10	2	0.73
Negative T waves in leads II, III, aVF	2	6	1	0.72
Negative T waves in leads II, III, aVF with ST depression	1	5	0	0.77
Negative T waves in leads V ₁ -V ₃	5	12	1	0.68
Negative T waves in leads V ₁ -V ₃ with ST depression	2	3	0	0.76
Negative T waves in leads V ₅ -V ₆	0	1	0	0.96
Negative T waves in leads V ₅ -V ₆ with ST depression	0	5	0	0.28
Right bundle branch block (RBBB)	1	2	1	0.41
S _I Q _{III} T _{III} or S _I S _{II} S _{III}	4	5	4	0.005
Atrial fibrillation	1	4	0	0.97

APE: Acute pulmonary embolism; ECG: Electrocardiogram

3 讨论

APE 是最常见威胁生命的心血管疾病之一,其预后取决于及时诊断和恰当的治疗。在临床上, APE 主要表现为胸痛、呼吸困难、晕厥,心电图经常表现为 T 波倒置或 ST-T 改变,易误诊为 NSTEMI。寻找 APE 和 NSTEMI 心电图表现的差异性,有助于为两者的鉴别诊断提供参考信息。

以往研究发现,急性 APE 的心电图变化具有以下特征: RBBB、S_I Q_{III} T_{III} 或 S_I S_{II} S_{III} 模式、顺钟向转位、电轴右偏等特点^[9-10],这些心电图异常表现可以用来预测诊断。本研究发现 RBBB、S_I Q_{III} T_{III} 或 S_I S_{II} S_{III} 模式并不能用来鉴别 APE 和 NSTEMI, APE 患者 RBBB(11.9%)和 S_I Q_{III} T_{III} 或 S_I S_{II} S_{III} (26.2%)发生率比较低,与 NSTEMI 比较差异无统计学意义。Daniel 等^[11] 建立了一个可以在 2 min 内完成的心电图评分标准,认为胸前导联 T 波倒置是 APE 最常见的心电图异常表现。另一些学者进一步认为,T 波倒置和 APE 的严重程度有关^[12-14]。本

研究在 APE 和 NSTEMI 对比中发现,两者在胸前 V₁~V₃ 导联 ST-T 改变差异具有统计学意义($P < 0.01$),该结果能够得到以上 APE 的病理生理学的支持。Kosuge 等^[15] 研究发现 T_{III} 和 T_{V₁} 同时倒置可以用来区分 APE 和 NSTEMI,急性冠状动脉综合征患者在 III 和 V₁ 导联出现 T 波倒置仅为 1%, III 和 V₁ 导联 T 波同时倒置诊断急性 APE 的敏感性为 88%,特异性为 99%,阳性预测值为 97%,阴性预测值为 95%。本研究的数据也支持他们的结论,虽然 V₁~V₃ 导联 T 波倒置区分 APE 和 NSTEMI 无统计学意义($P = 0.06$),但结合 II、III、aVF 导联 T 波倒置,那么区分两者就有统计学意义了($P < 0.01$)。

本研究进一步发现,V₁~V₃ 导联心电图 ST 段压低[OR(95%CI)值为 2.26(1.35,3.45)]和 V₁~V₃ 合并 II、III、aVF 导联 T 波倒置[OR(95%CI)值为 1.32(1.15,1.69)]是 APE 的重要预测因子。而 V₅~V₆ 导联 T 波倒置[OR(95%CI)值为 2.01(1.34,3.28)]与 ST 段压低合并 V₅~V₆ 导联 T 波

倒置 [OR (95% CI) 值为 1.85 (1.14, 3.01)] 是 NSTEMI 的重要预测因子。该结果能够得到临床病理生理学的支持: APE 主要影响右心系统(循环阻力增加,肺动脉高压,右室后负荷过重,右心室扩张,右心功能不全),表现为 $V_1 \sim V_3$ 导联 ST-T 压低倒置。最后,本研究对 APE 进行低、中、高不同程度的分层,结果发现除了 $S_1 Q_{III} T_{III}$ 或 $S_1 S_{II} S_{III}$ 模式在不同低、中、高风险间差异有统计学意义外,其他心电图不同表现在不同风险分层间差异无统计学意义,说明病情的严重程度在心电图未能反映出来。Prasad 等^[16]认为心电图仅反映了急诊患者心电状况,而对于 APE 严重程度的诊断既无敏感性也无特异性。Brown 等^[17]通过汇总资料分析,得出结论:虽然心电图改变在 APE 中是常见的表现,但单独的心电图对于病情的诊断或排除并无充分的敏感性与特异性。《欧洲心脏病学会 APE 诊断和治疗指南》中指出,右心室负荷过重的心电图表现可能有助于 APE 的诊断,但这种改变通常与严重的 APE 无关联,且在各种原因导致的右心室劳损时均可出现^[18]。因此,本研究认为心电图改变对于鉴别 APE 和 NSTEMI 具有一定的参考价值,但对 APE 的严重程度不能做进一步的鉴别。

APE 是一种难识别的疾病,诊断比较困难,目前确诊的方法有赖于肺动脉造影、CT 肺动脉造影、磁共振肺动脉造影、核素肺显像等。尽管单独心电图检查不能确诊肺动脉栓塞,但正确掌握肺动脉栓塞常见心电图表现,同时结合临床以及其他辅助的检查结果,在一定程度上可以减少肺动脉栓塞的漏诊、误诊,尤其在一些没有条件进行肺动脉造影以及核素肺通气/灌注扫描检查的基层医院,心电图检查显得更为重要。值得注意的是,35%左右的 APE 患者心电图表现正常^[5],故对怀疑 APE 的患者切勿因心电图正常而轻易排除诊断。

4 利益冲突

所有作者声明本文不涉及任何利益冲突。

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