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冠状动脉磁共振血管成像和CT对可疑冠心病患者心脏事件的预测价值的比较研究*

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摘要 目的：探讨与比较冠状动脉核磁共振(MR)血管成像和CT对可疑冠心病患者心脏事件的预测价值。**方法：**2018年4月到2020年10月选择在本院诊治的103例可疑冠心病患者作为研究对象，所有患者都给予冠状动脉MRI血管成像与64层螺旋CT冠状动脉成像检查，记录影像学特征。随访患者的预后并进行预测价值分析。**结果：**103例可疑冠心病患者随访到2021年4月1日，发生心血管不良终点事件23例(不良事件组)，发生率为22.3%。不良事件组的MRI血管成像显示右冠状动脉血管长度与内径都低于非不良事件组(P<0.05)。不良事件组的CT显示斑块率、斑块性质等与非不良事件组对比差异有统计学意义(P<0.05)，两组斑块位置对比差异无统计学意义(P>0.05)。多因素Cox回归分析显示斑块性质、斑块率、右冠状动脉血管长度与内径都为导致心血管不良终点事件的重要因素(P<0.05)。**结论：**冠状动脉MRI血管成像和CT都可有效预测可疑冠心病患者心脏事件发生情况，能满足临床诊断可疑冠心病与预测预后的要求。

关键词：冠状动脉；核磁共振血管成像；64层螺旋CT冠状动脉成像；心脏事件；预测价值

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Comparative Study of Coronary MRI and CT in Predicting Cardiac Events in Patients with Suspected Coronary Heart Disease*

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ABSTRACT Objective: To explore and compare the predictive value of coronary artery magnetic resonance (MR) angiography and CT in predicting cardiac events in patients with suspected coronary heart disease. **Methods:** From April 2018 to October 2020, 103 cases of patients with suspected coronary heart disease diagnosed and treated in our hospital were selected as the research objects. All patients were given coronary MRI angiography and 64-CTCA examination, recorded the imaging features. Followed up the prognosis of patients and analyzed the predictive value. **Results:** Followed up to April 1, 2021, there were 23 cases of adverse cardiovascular endpoint events were occurred in the 103 cases (adverse event group), the incidence rates were 22.3%. MRI angiography in the adverse event group showed that the length and inner diameter of the right coronary artery were lower than those in the non-adverse event group (P<0.05). The CT of the adverse event group showed that there were statistically significant differences in plaque rate and plaque properties compared with the non-adverse event group (P<0.05). There were no statistically significant difference in the position of plaque compared between the two groups (P>0.05). Multivariate Cox regression analysis showed that the nature of plaque, the rate of plaque, the length and inner diameter of the right coronary artery were all important factors leaded to adverse cardiovascular end points (P<0.05). **Conclusion:** Both coronary MRI angiography and CT can effectively predict the occurrence of cardiac events in patients with suspected coronary heart disease, and can meet the requirements of clinical diagnosis of suspected coronary heart disease and prediction of prognosis.

Key words: Coronary artery; Magnetic resonance image; 64-slice spiral CT coronary imaging; Cardiac events; Predictive value

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前言

冠心病具有发病率高、死亡率高等特点，已成为临床上的公共卫生问题[1,2]。可疑冠心病是指患者未经冠状动脉造影确诊，但是临床上与冠心病的临床特征非常相似，比如胸骨中下段胸痛等[3,4]。随着医学技术的发展，当前无创心血管影像学检查技术得到了快速应用，也为临床医生评估可疑冠心病提供了有力的手段。目前临床上无创心血管影像学方法比较多，包括单光子发射计算机断层成像(SPECT)、多层螺旋计算机断层成像(MSCT)、正电子发射计算机断层成像(PET)、电子束计算机断层成像(EBCT)、核磁共振成像(MRI)、单光子发射计算机断层成像(SPECT)等[5-7]。当前 MRI 在胸腹大血管、头颅、颈部和四肢血管成像方面取得了很好的效果，其能有效抑制心跳和呼吸运动伪影的干扰，具有很高的成像空间与时间分辨率[8-10]。64 层螺旋 CT 冠状动脉成像可对冠状动脉病变做出排除性诊断，能同时评价冠状动脉、心脏结构和功能，具有很高的诊断效果[11-13]。本文比较与探讨了冠状动脉 MRI 血管成像和 CT 对可疑冠心病患者心脏事件的预测价值，以促进临床上无创心血管影像学方法的应用。

1 材料与方法

1.1 研究对象

2018 年 4 月到 2020 年 10 月选择在本院诊治的 103 例可疑冠心病患者作为研究对象，纳入标准：有胸骨中下段胸痛症状；心电图、运动平板检查结果异常；患者生命体征稳定，在自愿条件下签署了知情同意书；本院伦理委员会批准了此次研究；年龄 20-75 岁。排除标准：肝肾功能异常者；合并恶性肿瘤者；妊娠与哺乳期妇女；经皮冠状动脉介入治疗或冠状动脉搭桥术术后患者。

1.2 冠状动脉 MRI 血管成像检查

使用荷兰皇家飞利浦公司 3.0 T MRI 设备，应用屏气下脂肪抑制技术采集二维快速梯度回波序列，在心室舒张早期末至舒张中期采集冠状动脉血流信号。采用双筒高压注射器，经肘前静脉团注非离子型对比剂优维显 370 mgI/mL。第一时相注射造影剂 50 mL左右，第二时相注射生理盐水 30 mL 左右，注射速率 4.0-5.5 mL/s。患者取俯卧位，屏气 15-20s，心前区置于脊柱表面线圈中央，沿冠状动脉解剖走行作平行 / 切线位连续切层。序列参数：层厚 5 mm，时间分辨率为 100-158 ms，空间分辨率为 1.1-1.3 mm× 1.1 mm，时间分辨率为 100-158 ms，记录冠状动脉的血管长度与内径。

1.3 CT 检查

采用德国西门子股份有限公司 64 排 CT，检查前控制患者心率低于 70 次 /min，使用心电门控，采用电流调制技术。扫描参数：螺距 11.2-13.2，机架转速 0.35s，管电压 120-135 kV，电流 350-450 mA，准直 0.5 mm× 64，采集时间窗 30%-80%。描范围均由气管分歧部至膈肌水平，将感兴趣区置于主动脉根部，阈值设为 100 HU，达到阈值后延迟 6s 触发扫描。记录冠状动脉斑块发生、位置、类型等。斑块为冠状动脉轴位和(或)冠状动脉 CPR 图像上血管内隆起至少 >1 cm^2，且能够区别于血管壁和血管周围组织。斑块位置部位分为冠状动脉近段、中段、远段。斑块类型：钙化斑块：CT 值 >130 HU，钙化成分 > 整个斑块的 50%；纤维斑块，斑块成分 CT 值 < 增强的冠状动脉管腔的 CT 值，CT 值 <130 HU；混合斑块，两者共存，钙化成分 < 整个斑块的 50%。

1.4 预后随访

所有患者预后随访到 2021 年 4 月 1 日，记录患者该段时间患者心血管不良事件(心肌梗死、心绞痛、恶性心律失常、心源性休克、心力衰竭等)发生情况。

1.5 统计方法

选择 SPSS19.00 进行数据分析，计量资料以($\bar{x}\pm s$)表示(行 t 检验)，计数资料以(%)表示(行 x^2 检验)，采用 COX 回归曲线评价预测能力，计算风险率(OR)及其置信区间，检验水准为 α=0.05。

2 结果

2.1 心血管不良终点事件发生情况

103 例可疑冠心病患者随访到 2021 年 4 月 1 日，发生心血管不良终点事件 23 例(不良事件组)，发生率为 22.3%。

2.2 一般资料对比

不良事件组一般资料各项与非不良事件组对比差异无统计学意义(P>0.05)。

表 1 一般资料

Table 1 General information

Groups	n	Gender (M/F)	Age (years)	Heart rate (sub/min)	Blood glucose (mmol/L)	Body mass index(kg/m²)	Triglyceride (mmol/L)	Total cholesterol (mmol/L)
Adverse event group	23	12/11	54.62± 0.68	65.33± 2.55	5.76± 0.29	22.47± 1.34	1.83± 0.23	4.91± 0.36
Non- Adverse Event Group	80	42/38	54.82± 1.11	65.29± 3.17	5.78± 0.33	22.18± 2.18	1.84± 0.31	4.94± 0.44

2.3 MRI 冠状动脉血管长度与内径对比

不良事件组的 MRI 血管成像显示右冠状动脉血管长度与内径都低于非不良事件组(P<0.05)。

2.4 CT 斑块特征对比

不良事件组的 CT 显示斑块率、斑块性质等与非不良事件组对比差异有统计学意义(P<0.05)，两组斑块位置对比差异无统计学意义(P>0.05)。

表 2 两组右冠状动脉血管长度与内径对比(mm,$\bar{x}\pm s$)

Table 2 Comparison of the length and diameter of the right coronary between the two groups (mm, mean ± standard deviation)

Groups	n	Length of vessel(mm)	Vascular diameter(mm)
Adverse event group	23	81.11± 2.18*	2.98± 0.22*
Non- adverse event group	80	84.22± 3.29	3.44± 0.38

Note: Compared with the non- adverse event group, *P<0.05.

表 3 两组 CT 斑块特征对比(n,%)

Table 3 Comparison of CT plaque characteristics between the two groups (n,%)

Groups	n	Plaque rate	plaque nature			Plaque location		
			Calcified plaque	Fibrous plaque	Mixed plaque	Near segment	Middle segment	Far segment
Adverse event group	23	19(82.6%)	3(13.0%)	14(60.9%)	2(8.7%)	6(26.1%)	7(30.4%)	6(26.1%)
Non- adverse event group	80	22(27.5%)	13(16.3%)	4(5.0%)	5(6.3%)	7(8.8%)	8(10.0%)	7(8.8%)
x^2		21.458	12.941			0.001		
P		0.000	0.002			1.000		

2.5 多因素分析

在 103 例患者中，以心血管不良终点事件作为因变量，以冠状动脉 MRI 血管成像和 CT 特征作为自变量，多因素 Cox 回归分析显示斑块性质、斑块率、右冠状动脉血管长度与内径都为导致心血管不良终点事件的重要因素(P<0.05)。

表 4 多因素分析(n=103)

Table 4 Multivariate analysis(n=103)

Index	OR	95%CI
Plaque nature	14.586	8.751-24.313
Plaque rate	2.624	2.275-3.027
Artery length of right coronary	1.648	1.204-2.257
Artery diameter of right coronary	2.444	1.372-3.471

3 讨论

本研究显示 103 例可疑冠心病患者随访到 2021 年 4 月 1 日，发生心血管不良终点事件 23 例，发生率为 22.3%。当前临床上对可疑冠心病患者的治疗主要依赖于临床评估，对高危险患者应进行冠状动脉造影检查，对于低危险患者应帮助其打消疑虑或继续临床观察[14,15]。但多数门诊患者属于中度危险患者，对其预后预测缺乏明确的依据[16]。随着医学技术的发展，临床上已有多种无创心血管影像学检查技术可应用于可疑冠心病患者的诊断与预后预测[17]。不过冠状动脉管腔细小，空间解剖结构较复杂，对影像学图像质量要求较高[18,19]。本研究显示不良事件组的 MRI 血管成像显示右冠状动脉血管长度与内径均显著低于非不良事件组(P<0.05)。冠状动脉 MRI 血管成像能够显示足够长范围的冠状动脉血管及其分支解剖状况，能提高图像信噪比与图像质量，能减少常规 MRI 设备导致的磁场不均匀性问题，有利于完成冠状动脉血管解剖成像[20,21]。特别是本研究的 MRI 呈现采用快速梯度回波技术，可避免心跳运动伪影的干扰，可提高成像的时间分辨率和空间分辨率[22,23]。

螺旋 CT 成像在冠状动脉病变诊断方面有很高的精确性，已成为诊断冠心病的重要检查手段[24]。本研究显示不良事件组的 CT 显示斑块率、斑块性质等与非不良事件组对比差异有统计学意义(P<0.05)，两组斑块位置对比差异无统计学意义(P>0.05)。当前有研究表明 CT 能精确发现具有明显血液动力学改变的冠状动脉病变情况，其发现≥ 50%冠状动脉狭窄总敏感性>80.0%，敏感性较低的主要原因是 CT 显示血管长度还不够，在一定程度上无法达到临床诊断要求[25,26]。本研究分析结果显示：斑块性质、斑块率、右冠状动脉血管长度与内径都为导致心血管不良终点事件的重要因素 (P<0.05)。当前有研究显示 CT 显示冠状动脉狭窄者发生血管不良终点事件的可能性升高，且冠状动脉狭窄程度、冠状动脉斑块成分均与血管不良终点事件有关，与本研究结果一致[27]。另外，还有研究显示：特别是冠状动脉中重度病变或管腔狭窄≥ 50%者预后比较差，冠状动脉轻微病变或管腔狭窄 <50%者预后相对较好，而在冠状动脉 CT 完全正常者中，心血管不良终点事件的年发生率低于 1.0%，冠状动脉狭窄 <50%者心血管不良终点事件年发生率大于 5.0%，而狭窄≥ 50%者心血管不良终点事件年发生率约大于 10.0%，

与本研究结论一致[28-30]。其中冠状动脉易损斑块易引起心血管不良终点事件，纤维斑块的数量是影响患者预后的一项独立的预测因子[31]。当前有研究显示在同一方向、角度作多次 MRI 或 CT 平行重叠连续扫描，能消除容积效应，可更有效反映冠状动脉解剖状态的真实情况[32]。

总之，冠状动脉 MRI 血管成像和 CT 都可有效预测可疑冠心病患者心脏事件发生情况，能满足临床诊断可疑冠心病与预测预后的要求。

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