

论 著

急性脑梗死患者病灶体积及预后的MRI评价*

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【摘要】目的 探究脑梗死患者MRI表现与病灶体积、神经损害及预后的相关性。方法 纳入辽宁省老年病医院2019年1月~2022年9月收治的脑梗死患者297例，分析其MRI表现，依据MRI检查计算病灶体积，采取Pearson相关分析病灶体积与神经损害(NIHSS评分)的相关性，绘制受试者工作特征(ROC)曲线分析病灶体积对预后的预测价值。结果 45例MRI检查时处于超急性期，常规MRI扫描并未见异常表现，扩散加权成像(DWI)呈高信号，表现扩散系数(ADC)低信号，磁共振灌注成像(PWI)表现为低灌注；另252例急性期患者常规MRI扫描可见T₁WI低信号，T₂WI高信号，液体衰减反转恢复序列(FLAIR)、DWI均呈高信号表达，ADC则呈低信号。脑梗死患者病灶体积与NIHSS评分呈显著正相关($r=0.595$ ， $P<0.01$)，且病灶体积预测脑梗死患者预后不良的曲线下面积为0.821(95% CI: 0.760~0.882)，以8.467 mm³为临界值，敏感度及特异度分别为79.10%、85.30%。结论 脑梗死患者MRI表现可因病程呈差异化，且MRI测得病灶体积与神经功能损伤密切相关，对预后有一定预测价值。

【关键词】脑梗死；磁共振成像；扩散加权成像；
表现扩散系数；磁共振灌注成像；
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MRI Findings in Cerebral Infarction and Relationship between Lesion Volume and Neurological Damage and Prognosis*

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ABSTRACT
Objective To explore the findings of magnetic resonance imaging (MRI) in patients with cerebral infarction and analyze the relationship between lesion volume and neurological damage and prognosis. **Methods** A total of 297 patients with cerebral infarction admitted to the hospital from January 2019 to September 2022 according to the exclusion criteria were included in the study. All included patients were with less than 48h from onset to MRI. The MRI findings were analyzed, and MRI three-dimensional reconstruction was performed, and the lesion volume was calculated according to the Dotian formula, and Pearson correlation was used to analyze the correlation between lesion volume and neurological damage [the National Institutes of Health Stroke Scale (NIHSS)], and receiver operating characteristic (ROC) curve was drawn to analyze the predictive value of lesion volume on prognosis. **Results** 117 patients were in the hyperacute phase at MRI and no abnormalities were observed in conventional MRI scan, and they showed high signal in diffusion weighted imaging (DWI), low signal in apparent diffusion coefficient (ADC) and low perfusion in perfusion-weighted imaging (PWI). And another 180 cases in acute phase showed T₁WI low signal and T₂WI high signal in conventional MRI scan, high signal in fluid-attenuated inversion recovery sequence (FLAIR) and DWI and low signal in ADC. Lesion volume of patients with cerebral infarction was significantly positively correlated with NIHSS score ($r=0.595$, $P<0.01$), and the area under the curve of lesion volume was 0.821 (95% CI: 0.760~0.882) in predicting poor prognosis in patients with cerebral infarction, and the sensitivity and specificity were 79.10% and 85.30% when 8.467mm³ was taken as critical value. **Conclusion** The MRI findings of patients with cerebral infarction may be different due to the course of disease, and the lesion volume measured by MRI three-dimensional reconstruction is closely related to neurological damage and has certain predictive value on prognosis, which is worthy of clinical attention.
Keywords: Cerebral Infarction; Magnetic Resonance Imaging; Diffusion-weighted Imaging; Apparent Diffusion Coefficient; Magnetic Resonance Perfusion Imaging; Lesion Volume; Nerve Damage; Prognosis

脑梗死作为一个动态发生发展的过程，指脑部血液供应障碍引起局限性脑组织坏死或软化而出现的对应的神经系统症状，缺血性脑卒中的总称，是临床相对常见的脑血管疾病，具高致死、致残率^[1-4]。磁共振成像(magnetic resonance imaging, MRI)作为诊断脑梗死的重要影像学辅助检查手段，其诊断脑梗死效能确切，但在评估神经损伤程度，尤其是评估预后方面的优势仍不确切^[5-8]。近年报道证实MRI进行病灶体积测量或能在一定程度上反映神经损害程度，但与之相关临床报道少见^[9-12]。鉴于此，本研究采集资料，对脑梗死MRI表现进行分析，并着重探究MRI所测得的病灶体积与神经损害、预后的关系，旨在进一步补充及完善MRI在脑梗死中的临床应用价值。

1 资料与方法

1.1 一般资料 研究对象为本院自2019年1月至2022年9月收治的脑梗死患者。
纳入标准：符合脑梗死诊断要求^[13]；MRI检查前未接受脑梗死相关治疗；MRI影像学资料完整；研究通过医院伦理委员会审核。排除标准：脑出血患者；颅脑外伤患者；既往有脑血管病变或颅脑外伤病史；既往有脑出血病史；合并颅内肿瘤患者。最终纳入297例脑梗死患者，其中男174例，女123例，年龄29~74岁，平均(49.12±8.67)岁，梗死部位如下：皮质下白质85例，基底节区91例，半卵圆中心36例，放射冠24例，丘脑47例，脑干10例，小脑4例；高血压34例，糖尿病28例，高脂血症16例。
1.2 方法 MRI设备型号为Ingenia3.0磁共振；T₁WI：1R TR 2000ms，TE 20ms，频率编码340，相位编码201，NSA 1；T₂WI：TSE序列扫描，TR 4000ms，TE 107ms，频率编码384，相位编码384，NSA 1；FLAIR：TR 9000ms，TE 125ms，频率编码352，相位编码136，NSA 2；DWI：SE-EPI TR 2473ms，TE 97ms，频率编码152，相位编码122，NSA 1。扫描范围为延髓至顶叶皮层。将采集所得数据上传至配套后处理工作站进行处理，由两位高年资MRI影像学医师采用双盲法阅片。依据侧脑室旁、基底节、半卵圆中心、额叶、顶叶、颞叶、丘脑等病灶部位的数据计算病灶体积，若为多发病灶则病

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灶体积为所有病灶体积之和。取统一意见为最终结果,若不统一则可与上级医师商讨后统一。

1.3 神经损害情况评价 采用美国国立卫生院神经功能缺损评分(national institutes of health stroke scale, NIHSS)^[14]评价,该评分包括意识水平、凝视、视野、面瘫、左上肢运动、右上肢运动、左下肢运动、右下肢运动、肢体共济失调、感觉、语言、构音障碍、消退和不注意等多个维度,共计0~42分,分值与神经功能损害正相关。评价时间为入院时。

1.4 预后评价 Rankin修订量表评分(modified rankin scale, mRS)^[15]评价,该评分按0~5分对应完全无症状~严重残疾, mRS ≥ 3 分提示预后不良,神经损害严重,不能独立行走,需他人帮助才能满足自身需要或卧床、失禁,需持续护理关注。

1.5 统计学分析 统计学分析软件为SPSS 25.0,病灶体积、NIHSS评分等资料均用($\bar{x} \pm s$)表示, t检验;若不符合正态性且方差不齐则行Mann-Whitney U检验;病灶体积与NIHSS评分的关系采用Pearson相关性分析法,病灶体积对预后的预测价值采用受试者工作特征(receiver operating characteristic, ROC)曲线分析。 $P < 0.05$ 为差异具有统计学意义。

2 结果

2.1 脑梗死患者的MRI表现 297例患者中,45例行MRI检查时处于超急性期,常规MRI扫描并未见异常表现,加行DWI呈高信号,表现扩散系数(apparent diffusion coefficient, ADC)低信号,磁

共振灌注成像(perfusion-weighted imaging, PWI)则表现为低灌注;另252例为急性期,常规MRI扫描可见T₁WI低信号, T₂WI高信号, FLAIR、DWI均呈高信号表达, ADC则呈低信号。

2.2 脑梗死患者病灶体积及神经损害情况 297例脑梗死患者病灶体积为4.12~13.41mm³, 平均(8.44 $\pm$ 2.15)mm³;神经功能缺损评分7~24分, 平均(15.47 $\pm$ 3.06)分。

2.3 脑梗死患者病灶体积与神经损害的相关性分析 经Pearson相关性分析,脑梗死患者病灶体积与神经损害程度(NIHSS评分)显著正相关, $r = 0.595$, $P < 0.01$ 。

2.4 脑梗死患者病灶体积对预后的预测价值 297例脑梗死患者中, mRS预后评分0分43例, 1分70例, 2分49例, 提示预后良好162例; 3分61例, 4分58, 5分16例, 提示预后不良135例, 以mRS评分为状态变量, 病灶体积为检验变量, 其预测脑梗死患者预后不良的曲线下面积值为0.821(95%CI: 0.760~0.882), 约登指数0.644, 最佳敏感阈值为8.467mm³, 对应敏感度及特异度分别为79.10%、85.30%。

2.5 典型病例MRI表现 (1)左侧半卵圆中心脑梗死急性期磁共振影像: T₁WI呈低信号; T₂WI、FLAIR呈高信号; DWI呈高信号, ADC相应位置为低信号, MRA提示左侧颈内动脉全程未显影, 见图3。(2)左侧侧脑室后角脑梗死超急性期MRI影像: 常规T₁WI、T₂WI扫描及FLAIR扫描均未见明显异常信号(图A~C), DWI可在病灶区域见高信号(图D), ADC亦可见同样区域出现低信号(图E), MRA在左侧大脑中动脉M1段局限性狭窄(图F), 见图。

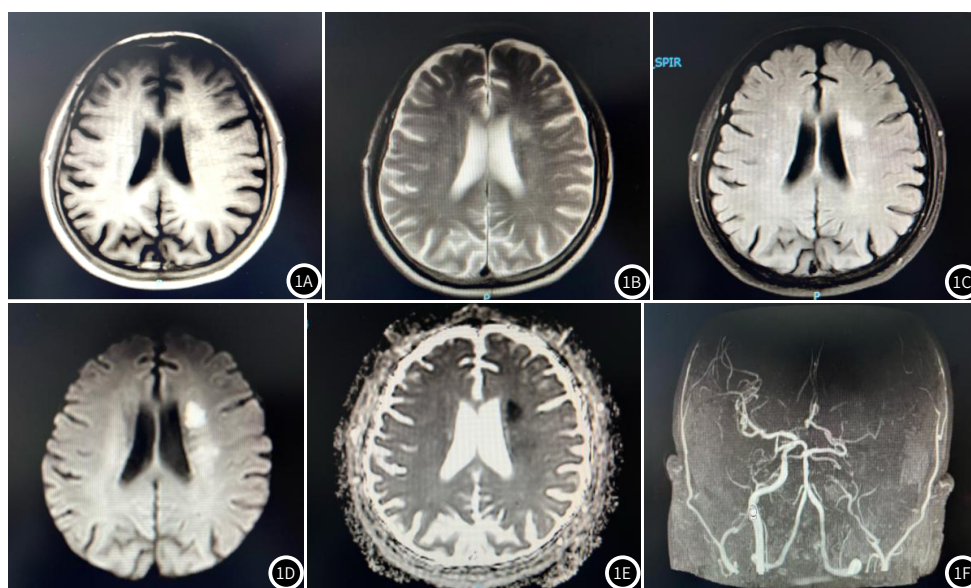


图1A-图1F 左侧半卵圆中心脑梗死急性期MRI表现

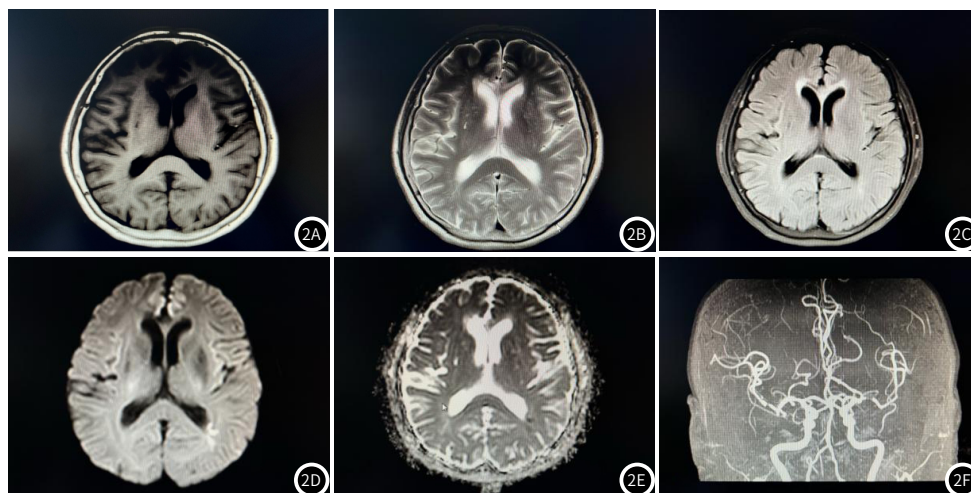


图2A-图2F 左侧侧脑室后角脑梗死超急性期MRI表现

3 讨论

随着影像学技术的发展,脑梗死的影像学表现愈渐被重视^[16-19]。本研究显示,297例患者中45例行MRI检查时处于超急性期,常规MRI扫描并未见异常表现,分析或因常规MRI扫描包括T₁WI、T₂WI主要反映组织形态学改变,超急性期脑梗死患者虽可出现细胞毒性水肿等表现,但组织细胞内外水分子并无明显增加现象^[20-23]。同时,一般来说,组织功能改变要早于组织形态学改变,细胞毒性水肿的发生可引起组织弥散系数下降,DWI则可见异常高信号表达^[24-26]。本研究亦显示,超急性期脑梗死患者DWI呈高信号,基于既往研究报道^[27-29]DWI高信号亦可能是T2穿透效应所致,为避免高信号假象,本研究同时对比ADC,结果显示ADC低信号,与既往报道^[30-33]结论一致,ADC与DWI呈负指数关系。另252例急性期脑梗死常规MRI扫描T₁WI、T₂WI、FLAIR等反应组织形态学改变的序列均可见明显异常,分析或因此时细胞内外水分含量明显增加有关^[33-35],而DWI则仍表现为高信号达,ADC低信号。

MRI在脑血管疾病中的定位、定性中的临床应用价值已然明确,但MRI亦存在一定局限性,如未能提供量化数据,易受医师主观医师及经验等影响,MRI则可有效避免这一局限性,其可对所采集影像进行分析后获取量化的、客观的病灶体积,为病情、预后评估提供参考文献^[36-40]。本研究显示,脑梗死患者病灶体积与NIHSS评分显著正相关,提示病灶体积越大,神经功能损害越严重,提示基于MRI所测得病灶体积值与神经损害密切相关。为进一步探究病灶体积对神经损害的预测效能,本研究将其用于脑梗死患者预后评估,用mRS评分评价预后,该评分同样能在一定程度反应神经损害程度,与神经损害程度正相关^[13-14],结果显示其预测脑梗死患者预后不良的曲线下面积值为0.821,最佳敏感阈值8.467mm³,对应敏感度及特异度分别为79.10%、85.30%,所得病灶体积敏感阈值与Wang等^[41]的报道的8.5mm³相一致,皆提示病灶体积与神经损害密切相关,病灶体积越大,神经损害越严重,也意味着预后不良风险更高。但本研究也存在一定局限性,如研究对象均为本院患者,数据代表性欠佳,且存在一定混杂因素影响,未剔除病灶位置、合并症等因素对神经功能损害的影响。鉴于此,笔者认为脑梗死病灶体积与神经损害的关系仍有极大深入探究空间,拟持续采集大范围样本率后展开多中心研究予以进一步补充及完善。

脑梗死MRI表现可因疾病发作时间呈不同表现,但无论超急性期或急性期,DWI等反应组织功能的MRI序列扫描均具高价值定位、定性价值,且基于MRI测得病灶体积与神经损害显著正相关,用于脑梗死患者预后评估同样存在优势预测价值。

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