·专题综述·

# 脑微出血对缺血性卒中临床疗效影响研究进展

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【摘要】 随着MRI技术的发展及其分辨率的提高，脑微出血的阳性检出率逐渐增加，其对缺血性卒中临床疗效的影响日益受到关注。本文基于脑微出血与缺血性卒中相关的病理生理学机制，探讨其对缺血性卒中临床诊疗和预后的影响，以为脑微出血作为缺血性卒中治疗效果和预后的影像学标志物奠定基础。

【关键词】 大脑小血管疾病； 脑缺血； 血栓溶解疗法； 血栓切除术； 血小板聚集抑制剂； 综述

## Research progress in the affect of cerebral microbleeds on clinical efficacy of ischemic stroke

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【Abstract】 Advances in MRI technique and its spatial resolution have improved detection of cerebral microbleeds, leading to more focus in the effects of cerebral microbleeds on ischemic stroke in daily clinical practice. Based on the pathophysiologic mechanisms of cerebral microbleeds and ischemic stroke, this article reviews the effects of cerebral microbleeds on prognosis and clinical efficacy of ischemic stroke to lay a foundation for cerebral microbleeds as a marker for the therapeutic effect and prognosis of ischemic stroke.

【Key words】 Cerebral small vessel diseases; Brain ischemia; Thrombolytic therapy; Thrombectomy; Platelet aggregation inhibitors; Review

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脑微出血（CMBs）系红细胞渗漏至脑小血管外使血管周围含铁血黄素沉积所致，直径2～10 mm，MRI表现为微小的圆形信号缺失灶[1]。一项基于国人的流行病学调查显示，脑微出血在50～59岁人群中发生率约为7.6%，60～69岁为18.4%，70～80岁为24.8%[2]。国外研究显示，≥80岁人群脑微出血发生率高达35.7%[3]。目前认为，脑微出血主要是脑小动脉损伤所致，是脑小血管病（CSVD）的表现，与缺血性卒中存在明显关联性。有35%～71%的缺血性卒中患者并发脑微出血[4]，存在脑微出血的患者缺血性卒中发生率和复发率均随脑微出血灶数目的增加而上升[5-6]，且脑出血风险也显著高于无脑微出血的患者[5,7]。与脑出血不同，脑微出血后并不导致明显的急性神经功能缺损，但与远期认知功能障碍和精神行为异常密切相关，影响缺血性卒中患者的神经功能预后。随着脑微出血灶阳性检出率的增加，脑微出血对缺血性卒中患者临床疗效和预后的影响越来越受到关注。本文拟对脑微出血病理生理学机制、影像学评估及其对缺血性卒中临床表现和疗效的影响进行综述。

## 一、脑微出血病理生理学机制

脑微出血的发生机制尚未十分明确，目前假说有血管内皮功能障碍、炎症反应、β-淀粉样蛋白

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(Aβ)沉积、血-脑屏障破坏和基因多态性等。脑微出血的解剖分布不同,病因不同,脑叶微出血主要与Aβ沉积有关,脑深部或混合分布的微出血则多见于高血压性脑血管病[8-10]。年龄和高血压是脑微出血的常见危险因素,衰老与长期高血压可以引起脑小血管玻璃样变和动脉粥样硬化,随着血管结构发生纤维素样坏死,破裂出血的风险增加;同时,管壁脂质沉积致大动脉粥样硬化后血管高度和宽度骤然缩小,搏动性血流使大动脉中膜弹性蛋白层断裂,脑血管反应性(CVR)降低,形成的脉冲波对远端小血管产生较大的纵向剪切力,损伤血管内皮细胞和平滑肌细胞,脑血流自动调节(CA)能力受损,易引起脑血管破裂出血[11-13]。

大动脉粥样硬化是缺血性卒中的主要病理生理学基础。颅内外大动脉粥样硬化性狭窄患者发生脑微出血的倾向较高[14-15],血-脑屏障破坏可能是脑微出血的始动环节[16-18]。大动脉粥样硬化性狭窄或闭塞可以导致慢性脑低灌注(CCH)或急性缺血性卒中,脑低灌注进一步导致基质金属蛋白酶(MMPs)生成增加[19],后者降解细胞外基质(ECM)以及基底膜的胶原蛋白和弹性蛋白,破坏血-脑屏障紧密连接,增加血-脑屏障通透性,同时还诱导血管新生。血管新生初期血管内皮生长因子(VEGF)和一氧化氮合酶(NOS)催化生成的一氧化氮等使血管舒张[20-21],血管周围间隙(PVS)扩大,血管通透性增加,促使脑微血管破裂和发生出血性转化,从而导致脑微出血。此外,近端大动脉粥样硬化性狭窄使远端小血管血供减少,局部脑血流量(rCBF)减少或脑血管反应性降低[22],导致脑组织Aβ清除障碍,使其沉积于颅内小动脉中-外膜,引起管壁纤维素样坏死,易发生脑叶微出血。尽管部分动脉粥样硬化并未造成管腔狭窄致脑血流动力学改变,但是由于斑块存在薄或破裂的纤维帽、斑块内出血、大的坏死脂质核心等易损特征,亦增加缺血性卒中的发生和复发风险。研究显示,斑块大脂质核心体积与脑微出血及其严重程度相关[23-24],但不稳定型斑块的病理学特征与脑微出血并发缺血性卒中的相关性及其潜在作用机制尚待进一步研究。

近年研究者们开始探讨脑微出血与血管内皮功能障碍和炎症反应的相关机制。血管内皮细胞是血-脑屏障的重要组分之一,其分泌多种细胞因子调节血管稳态。血管内皮损伤后神经血管单元(NVU)完整性破坏,血-脑屏障通透性降低,引发脑微出血。血管内皮细胞在调节血管张力、介导炎症反应、平衡凝血与纤溶以及血管修复和重建中发挥重要作用[20]。有研究显示,多种血管内皮相关炎症反应标志物与脑微出血有关,除外超敏C-反应蛋白(hs-CRP)、白细胞介素-6和18(IL-6和IL-18)[18],细胞间黏附分子(ICAM)、可溶性E-选择素在缺血性卒中伴发脑微出血的患者中亦升高[25-27],提示血管内皮功能障碍和炎症反应均参与脑微出血的发生,但其内在因果关系尚未完全明确,有待进一步研究以为其预防与治疗提供新的途径。

二、脑微出血影像学评估及其对临床表现的影响

脑小血管病通过破坏脑网络和神经可塑性以影响缺血性卒中患者预后,脑微出血作为脑小血管病的主要影像学标志物,除与缺血性卒中后神经功能和病死率相关外[28-31],还严重影响脑卒中后认知功能和精神行为,但临床常用的评估指标如美国国立卫生研究院卒中量表(NIHSS)等对脑卒中后认知功能和精神心理预后的预测效果并不理想,脑微出血作为新的影像学标志物对预测预后有一定的指导意义。

1.脑微出血的影像学评估　临床上通常采用$T_2$*-梯度回波序列(GRE)或磁敏感加权成像(SWI)检测脑微出血,后者的诊断敏感性高于前者[32],SWI使脑微出血的阳性检出率增加,但假阴性率仍有18%~48%[33]。由此可见,影像学检查方法对脑微出血灶数目的低估阻碍其在神经认知领域的深入研究。目前主要通过视觉评估以判断和定量分析脑微出血,包括脑微出血解剖评分量表(MARS)和观察者脑微出血评分量表(BOMBS),前者包含更详细的脑叶解剖以利于脑微出血在认知领域的研究,后者对脑微出血病灶的大小进行分类,但由于多数研究者认为脑微出血灶大小的意义临床较小,故研究中多采用MARS量表[34-35]。然而,上述视觉评估量表对多发性脑微出血的效果较差,尤其对于潜在淀粉样脑血管病(CAA)的患者,仅采用视觉评估量表难以定量分析疾病严重程度。定量磁敏感图(QSM)基于不同组织结构的磁敏感性定量分析其磁化率,且不受回波时间(TE)的影响,可以鉴别脑微出血与钙化[36-37]。同时,计算机自动分析也是目前研究热点[38],可以缩小评估者之间的信度,缩短评估时间,未来有望用于急诊MRI检查。

2.脑微出血对脑卒中后认知功能的影响　约有

50%的脑卒中患者可进展为血管性认知损害(VCI)甚至血管性痴呆(VaD)[39],并发脑微出血的患者脑卒中后认知功能障碍(PSCI)发生率增加。Yatawara等[40]在首次发作的急性轻度缺血性卒中且无痴呆病史的患者中发现,无论梗死灶部位和大小,脑微出血均直接影响脑卒中后认知功能,脑微出血灶≥3个的患者发生脑卒中后痴呆(PSD)的风险是无脑微出血的3.79倍。急性缺血性卒中或短暂性脑缺血发作(TIA)后3~6个月,脑微出血患者常发生多个认知域功能下降,尤其是记忆力和语音流畅性(phonemic fluency)[41],其中,脑叶微出血患者发生延迟记忆障碍的风险是正常对照者的10倍[40]。亦有学者研究发现,脑叶微出血与缺血性卒中后执行功能障碍显著相关[42]。一项随访5.7年的小样本队列研究显示,脑微出血始终与额叶执行功能障碍相关[43],但Yatawara等[40]认为,脑微出血对脑卒中后认知功能的影响是短暂性的,对脑卒中后2年的认知功能已无明显影响。因此,脑微出血对缺血性卒中患者预后和临床结局的长期影响和预测价值尚待更多纵向研究进一步明确。

3.脑微出血对脑卒中后抑郁的影响 脑微出血可以诱发脑卒中患者的精神障碍,尤其是多发性脑叶微出血与缺血性卒中后抑郁严重程度相关[44],是脑卒中后抑郁(PSD)的独立预测因素,其机制可能与脑微出血致情绪调控相关的白质纤维束结构损伤和潜在的淀粉样脑血管病有关[45],但脑微出血灶数目与抑郁的相关性及其对抑郁进展的影响尚待进一步研究,有望成为脑卒中后抑郁新的干预方向。同时,抗抑郁药物选择性5-羟色胺再摄取抑制剂(SSRI)可以减少血小板聚集,导致颅内出血风险增加,但其对脑微出血的影响尚存争议。横断面研究证实抗抑郁药物与脑微出血无关联性[46]。但一项随访3.9年的纵向研究显示,选择性5-羟色胺再摄取抑制剂尤其是与5-羟色胺转运体(5-HTT)中等亲和力的抗抑郁药物可以增加脑微出血的风险[47]。然而,上述研究所纳入对象的基线均无脑微出血,因此,对并发脑微出血的缺血性卒中患者是否有同样影响以及其潜在作用机制尚待进一步研究。

对缺血性卒中预后的预测一直是临床关注的问题,可以影响患者的个体化临床决策。包含脑微出血的脑小血管病影像学总负荷是缺血性卒中预后预测的研究热点,脑小血管病影像学总负荷与脑卒中后抑郁、步态障碍、神经功能预后不良和脑卒中复发显著相关[48-51]。未来推动定量化影像学技术和规范化评估量表的应用将有助于进一步验证其对缺血性卒中预后的实际预测价值。

三、脑微出血与缺血性卒中疗效

静脉溶栓、血管内机械取栓术和抗栓治疗(包括抗凝治疗和抗血小板治疗)是目前公认的缺血性卒中有效治疗方法,早期颅内出血是其最严重的并发症,因此早期预测颅内出血一直倍受关注,尤其是对于需抗凝治疗的缺血性卒中患者,如何权衡获益与风险是临床医师需要面临的棘手问题。

1.脑微出血对静脉溶栓疗效的影响 并发脑微出血的缺血性卒中患者静脉溶栓后是否增加颅内出血风险仍存争议。多项Meta分析显示,脑微出血可增加静脉溶栓后颅内出血发生率[10,52-54]和静脉溶栓后3~6个月神经功能预后不良发生率[10,53,55-56],但也有研究显示基线脑微出血与静脉溶栓后颅内出血并无关联性[56-57]。目前普遍认为,脑微出血灶>10个的患者静脉溶栓后3个月预后不良发生率显著增加,虽不推荐静脉溶栓前行MRI筛查,但此类患者的获益与风险尚待进一步权衡。Schlemm等[58]首次对这一问题进行探究,发现对于脑微出血灶>10个的患者,出现以下情况时静脉溶栓风险大于获益:(1)年龄≥80岁且NIHSS评分≥15。(2)年龄≥80岁、NIHSS评分≥5且治疗时间延迟≥4小时。(3)年龄≥60岁、NIHSS评分≥15且治疗时间延迟≥2小时。他们认为,有效控制静脉溶栓前急诊MRI检查时间的延迟,有可能使此类患者从筛查中获益。此外,静脉溶栓后可以新增脑微出血。Braemswig等[59]的Meta分析显示,约4%的缺血性卒中患者静脉溶栓后可出现远隔区域新发脑微出血灶,而非梗死灶内出血[10],其中80%位于脑叶,提示潜在的淀粉样脑血管病可能是缺血性卒中患者静脉溶栓后新发脑微出血的主要原因,与病理学研究结果相一致[60];尤其是对于静脉溶栓前>2个脑微出血灶的患者,其新发脑微出血的可能性更高,脑实质出血的风险也相应增加[59]。然而,目前脑微出血并非静脉溶栓的绝对禁忌证,且无证据显示静脉溶栓前需行MRI筛查。2019年,美国心脏协会(AHA)/美国卒中协会(ASA)发布的急性缺血性卒中早期治疗指南指出,既往MRI证实存在>10个脑微出血灶的患者静脉溶栓的获益尚不清楚[61],因此,对于此类患者,需进一步研究以建立临床可行的风险预测模型。同时,这类患者静脉溶栓后行

MRI检查新发脑微出血是否可以为后续降压、抗血小板和抗凝治疗提供个体化指导尚待临床研究的证实。

2.脑微出血对血管内治疗效果的影响 对于颅内大动脉闭塞致缺血性卒中患者,降低血管内机械取栓术后症状性颅内出血的发生率始终是研究者们关注的焦点。术前脑微出血是否影响血管内机械取栓术预后、增加术后颅内出血发生率尚无定论。Choi等[62]的研究显示,存在脑微出血特别是≥5个脑微出血灶和脑叶微出血是血管再通后3个月临床预后不良的危险因素,并增加症状性颅内出血发生率,但与血管再通不成功患者的临床预后并无关联性,这可能与缺血-再灌注损伤致血-脑屏障破坏有关,而非侧支代偿能力损伤所致[63]。Wu等[64]的Meta分析显示,脑微出血对术后颅内出血无明显影响,即使脑微出血灶≥5个也并未增加颅内出血发生率。Shi等[65]认为,无论是单纯血管内机械取栓术还是静脉溶栓桥接血管内机械取栓术,虽然基线脑微出血使术后新发脑微出血的风险增加4倍,但新发脑微出血并未影响出血性转化率、住院率、病死率和神经功能预后。近期一项回顾性研究亦证实,脑微出血与术后颅内出血风险和术后3个月神经功能预后均无关联性,而且并未降低血管再通率[66]。因此目前多认为,术前脑微出血未明显增加术后颅内出血风险和预后不良发生率,脑微出血负荷和部位均非单纯血管内机械取栓术或静脉溶栓桥接血管内机械取栓术的禁忌证,尚待进一步研究。同时,脑微出血对动脉溶栓预后的影响尚缺乏临床试验数据。

3.脑微出血对抗血小板治疗效果的影响 缺血性卒中患者长期服用抗血小板药物的出血风险是亟待解决的问题,并发脑微出血的患者更易发生颅内出血[67],且与其负荷呈正相关。服用抗血小板药物还可新增脑微出血[68-69],尤其是基线存在脑微出血的患者可增加脑叶微出血的风险[70],而非脑深部和幕下微出血[67],提示相较高血压,淀粉样脑血管病可能是脑微出血的更强有力危险因素。目前,对于多发性脑微出血的抗血小板治疗方案尚无明确推荐意见。Lau等[71]发现,存在≥5个脑微出血灶的患者,短暂性脑缺血发作或者急性缺血性卒中发病1年内缺血性卒中和心血管事件风险超过颅内出血和严重颅外出血,应坚持抗血小板治疗,但发病1年后颅内出血风险有可能超过获益,应酌情改变治疗方案。对于高危短暂性脑缺血发作或轻度缺血性卒中患者,氯吡格雷联合阿司匹林治疗3个月并未较单纯阿司匹林增加脑微出血的风险[72]。但低剂量阿司匹林较常规剂量能否在不增加缺血性卒中复发的情况下降低脑出血风险,相关研究正在进行中——AIM(Low-dose Aspirin Therapy in Patients with Ischemic Stroke and Microbleeds)研究(clinicaltrials.gov;试验编号:NCT04504864)。新型抗血小板药物较传统药物更具优势,在亚洲人群中进行的CASISP(Cilostazol vs Aspirin for Secondary Ischemic Stroke Prevention)研究显示,西洛他唑和阿司匹林均可新增脑微出血,但前者严重颅内出血发生率显著降低[73]。PICASSO(PreventIon of CArdiovascular Events in iSchemic Stroke Patients with High Risk of Cerebral HemOrrhage)研究的亚组分析显示,对于≥2个脑微出血灶的患者,西洛他唑安全性(出血事件和脑卒中复发)优于阿司匹林,但在有颅内出血病史的患者中二者无明显差异[74],与既往研究得出的西洛他唑更适合脑小血管病患者的结论相一致,可能与西洛他唑舒张小血管、保护血管内皮细胞和血-脑屏障的作用相关[75],但是其对≥5个脑叶微出血灶患者的安全性有待商榷。此外,探究脑微出血患者是否存在抗血小板药物抵抗也有利于个体化治疗。国外研究显示,脑小血管病患者阿司匹林抵抗的发生率约为26%[76],但缺少脑微出血与抗血小板药物抵抗之间的研究。基于现有大样本随机对照试验的数据,脑微出血并未改变抗血小板治疗对临床结局的影响,且不同种类抗血小板药物和治疗方案(单抗或双联抗血小板)对新发脑微出血并无明显影响[72-73,77]。目前仅并发脑微出血不限制抗血小板药物的应用,然而对于既往存在反复脑叶出血或多发脑叶微出血的患者,则应慎重考虑。未来脑微出血能否真正为临床决策提供更准确的指导尚待进一步研究证实。

4.脑微出血对抗凝治疗效果的影响 对于伴发房颤的缺血性卒中患者,口服抗凝药是预防复发性和系统性栓塞事件最有效的措施,但>30%的房颤患者存在脑微出血[78]。研究显示,脑微出血与抗凝治疗后颅内出血相关[79-83],且脑微出血灶数目在预测颅内出血方面较HAS-BLED和CHA2DS2-VASc评分更敏感[79-80],未来可以考虑将其纳入临床评估工具中以提高其预测效能,仍有待大样本临床研究的证实。CROMIS-2(Cerebral Microbleeds and

Intracranial Haemorrhage Risk in Patients Anticoagulated for Atrial Fibrillation after Acute Ischaemic Stroke or Transient Ischaemic Attack)研究以及和一项纳入38项队列研究的Meta分析结果均显示,房颤致缺血性卒中复发和血管事件死亡的概率远高于抗凝治疗相关颅内出血发生率[79,84]。MOASIS - AF (Impact of Cerebral Microbleeds on Outcomes in Asian Patients with Acute Ischemic Stroke and Atrial Fibrillation Taking Anticoagulants)研究显示,脑微出血灶≥5个与缺血性卒中风险增加呈正相关[85],但既往相关研究则认为脑微出血与缺血性卒中复发之间的正相关趋势并无统计学意义[7,79,81,86-87],可能与MOASIS-AF研究纳入对象中高负荷脑微出血比例较高有关。除脑微出血负荷外,病变部位对抗凝治疗效果亦有影响,MOASIS-AF研究显示,脑微出血部位并不影响抗凝治疗后不良心脑血管事件发生率,但脑叶微出血更易发生颅内出血[85]。HERO(Intracerebral Hemorrhage Due to Oral Anticoagulants: Prediction of the Risk by Magnetic Resonance)研究结果显示,脑深部和混合分布的微出血更易发生颅内出血,但差异并未达到统计学意义[81]。不同类型抗凝药对脑微出血的影响不同。多发性脑微出血患者应用传统抗凝药时应慎重。Soo等[80]针对中国人群的首次前瞻性研究显示,脑微出血灶≤4个时华法林治疗2年后缺血性卒中发生风险高于颅内出血,而≥5个时颅内出血风险则高于缺血性卒中。与维生素K阻断剂相比,新型抗凝药可能更适用于脑微出血患者。MOASIS-AF研究显示,新型口服抗凝药组患者不良心脑血管事件发生率低于华法林组[85]。CMB-NOW(The Cerebral Microbleeds as a Predictor of Future Intra - Cerebral Hemorrhage during NOACs or Warfarin Therapy in NVAF Patients with Acute Ischemic Stroke)研究的初步结果显示,与华法林相比,新型口服抗凝药不易新增脑微出血[88],与Cheng等[89]的Meta分析结果相一致。然而,HERO研究和CROMIS-2研究均显示抗凝药种类对颅内出血的风险并无影响[79,81]。因此尚待多中心大样本临床研究进一步验证。对于合并非瓣膜性房颤的缺血性卒中患者,并发脑微出血时缺血性卒中复发的绝对风险高于无脑微出血[79,84],因此,目前尚无法限制此类患者的抗凝治疗,脑微出血高负荷或病变位于皮质,可选择出血风险较小的新型口服抗凝药或左心耳封堵术,但其风险获益比的临界值尚待更多随机对照试验提供新的证据。

综上所述,随着老龄化进程的加剧,脑微出血的预防与治疗及其对相关治疗效果的影响越来越受到关注,但现有的临床试验证据并不能改变缺血性卒中的治疗方案。脑微出血的发病机制和有效的干预措施仍不明确,目前治疗大多集中于血管危险因素的处理和对症治疗,尚缺乏针对脑微出血早期预防与治疗的相关试验。未来研究可基于脑微出血的病因,在基础研究中探寻适宜的靶向药物和非药物治疗方法;在影像学技术上开发更智能化、标准化、定量化的评估系统以用于预测临床预后;在临床实践中开展更多大样本随机对照试验和长期纵向研究以阐明脑微出血与缺血性卒中常规治疗之间的相互作用,完善目前基于颅内大动脉的缺血性卒中诊疗系统;同时为预防无症状性脑血管病患者的认知功能障碍、精神行为异常、步态障碍以及缺血性和出血性卒中事件的发生提供新的思路。脑微出血有可能为预测心脑血管事件提供新的途径,并成为评估临床疗效的影像学标志物。

**利益冲突** 无

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·小词典·

## 中英文对照名词词汇（一）

阿尔茨海默病 Alzheimer's disease（AD）
斑点免疫结合试验 dot immunobinding assay（DIBA）
壁内动脉周围引流 intramural peri-arterial drainage（IPAD）
标准化摄取值 standardized uptake value（SUV）
标准化摄取值率 standard uptake value rate（SUVR）
表观扩散系数 apparent diffusion coefficient（ADC）
表皮生长因子 epidermal growth factor（EGF）
表皮生长因子受体 epidermal growth factor receptor（EGFR）
表皮生长因子样重复序列
epidermal growth factor-like repeats（EGFr）
不明原因 stroke of undetermined etiology（SUE）
部分体积校正 partial volume correction（PVC）
常见物体分类测验 Common Objects Sorting Test（COST）
常染色体显性遗传性脑动脉病伴皮质下梗死和白质脑病
cerebral autosomal dominant arteriopathy with subcorticalinfarcts and leukoencephalopathy（CADASIL）
出血性转化 hemorrhagic transformation（HT）
磁共振波谱 magnetic resonance spectrum（MRS）
磁化传递成像 magnetization transfer imaging（MTI）
磁化率映射 susceptibility mapping（SM）
磁敏感加权成像 susceptibility-weighted imaging（SWI）
促甲状腺激素 thyroid stimulating hormone（TSH）
错误发现率 false discovery rate（FDR）
搭火柴测验 Stick Test（ST）
大动脉粥样硬化 large artery atherosclerosis（LAA）
单核苷酸多态性 single nucleotide polymorphism（SNP）
单腿站立测验 One-Leg Standing Test（OLST）
胆碱 choline（Cho）
低密度脂蛋白胆固醇
low-density lipoprotein cholesterol（LDL-C）
电压门控性钾离子通道
voltage-gated potassium channel（VGKC）
β-淀粉样蛋白 amyloid β-protein（Aβ）
淀粉样脑血管病 cerebral amyloid angiopathy（CAA）
淀粉样脑血管病相关炎症
cerebral amyloid angiopathy-related inflammation（CAA-RI）
β-淀粉样前体蛋白 amyloid β-protein precursor（APP）
定量磁敏感图 quantitative susceptibility mapping（QSM）
多发性硬化 multiple sclerosis（MS）
多分辨率-多模态分辨率-恢复
multiresolution-multimodal resolution-recovery（MM-RR）
4',6-二脒基-2-苯基吲哚
4',6-diamidino-2-phenylindole（DAPI）
C-反应蛋白 C-reactive protein（CRP）
反应时间 reaction time（RT）
泛素羧基末端水解酶L1
ubiquitin carboxy-terminal hydrolase L1（UCH-L1）
非甾体抗炎药 non-steroid anti-inflammatory drug（NSAID）
分布体积比 distribution volume ratio（DVR）
3氟-4氨基吡啶 3-F-4-aminopyridine（3-F-4-AP）
复杂图形测验 Complex Figure Test（CFT）
副肿瘤综合征 paraneoplastic syndrome（PNS）
傅里叶变换红外光谱
Fourier transform infrared spectroscopy（FTIR）
改良Rankin量表 modified Rankin Scale（mRS）
干燥综合征 Sjögren's syndrome（SS）
甘油三酯 triglycerides（TG）
肝素结合性表皮生长因子
heparin-binding epidermal growth factor（HB-EGF）
高密度脂蛋白胆固醇
high-density lipoprotein cholesterol（HDL-C）
高温需求因子A1
high-temperature requirement protein A1（HTRA1）
观察者脑微出血评分量表
Brain Observer MicroBleed Scale（BOMBS）