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非增强磁共振静脉成像技术对盆腔深静脉疾病的诊断价值

沈祖根¹, 蒋黛蒂^{1*}, 范隆华², 刘坚军²

1. 复旦大学附属中山医院青浦分院放射科, 上海 201700

2. 复旦大学附属中山医院青浦分院血管外科, 上海 201700

[摘要] **目的** 探讨非增强磁共振静脉成像(MRV)技术对盆腔深静脉疾病的诊断价值。**方法** 选取临床可疑盆腔及下肢静脉疾病患者50例,行下肢血管2D-TOF MRV(two-dimensional time-of-flight MR venography)检查。技术参数:回波时间5~7 ms,重复时间35~45 ms,翻转角35°~45°。检查范围包括下腔静脉下段至腘静脉水平,图像质量经评定分级。MRV检查结果与B超或DSA结果进行对比。**结果** 50例患者图像均能清晰显示下腔静脉下段至腘静脉及其分支,图像质量评分结果诊断率达96.0%;其中25例能清晰显示下腔静脉、髂总静脉、髂内外静脉、股总静脉、股深股浅静脉、腘静脉723条,其符合率为96.4%。50例患者中MRV提示9例下腔静脉下段至髂外静脉段血栓形成,而B超检查无法清晰完整显示及诊断。10例患者同时进行DSA检查,9例MRV结果与DSA符合,1例MRV提示髂总静脉起始段血栓者DSA造影显示正常。

结论 MRV诊断盆腔及下肢静脉疾病具有无创、扫描范围大、对比度高、图像准确直观等优点,值得临床推广。

[关键词] 下肢静脉;盆腔深静脉;深静脉血栓;磁共振成像;诊断

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Diagnosis value of non-enhanced magnetic resonance venography for deep pelvic vein disease

SHEN Zu-gen¹, JIANG Dai-di^{1*}, FAN Long-hua², LIU Jian-jun²

1. Department of Radiology, Qingpu Branch, Zhongshan Hospital, Fudan University, Shanghai 201700, China

2. Department of Vascular Surgery, Qingpu Branch, Zhongshan Hospital, Fudan University, Shanghai 201700, China

[Abstract] **Objective** To evaluate the diagnostic value of non-enhanced magnetic resonance venography (MRV) for deep pelvic vein disease. **Methods** A total of 50 patients highly suspicious of pelvic and lower extremity vein disease were enrolled in the present study, and they were subjected to lower extremity vascular 2D-TOF MRV (two-dimensional time-of-flight MR venography) examination with the following technical parameter: echo time 5-7 ms, repetition time 35-45 ms, and flip angle 35°-45°. The MRV range included the scanning from low segment of inferior vena cava (IVC) to the popliteal vein (PV); the image quality was scaled into grades, and the results of MRV were compared with those of ultrasound and DSA. **Results** The images of all 50 patients clearly showed the scanning from low segment of IVC to the PV and its branches, with the diagnostic accuracy reaching 96.0%. The images of 25 patients clearly showed a total of 723 veins, including IVC, common iliac vein (CIV), internal iliac vein, external iliac vein (EIV), common femoral vein, deep femoral vein, superficial femoral vein and PV, with a consistent rate of 96.4%. Thrombosis from inferior segment of IVC to EIV was shown on MRV images of 9 patients, while it could not be clearly and completely manifested by B-ultrasound. Ten patients received DSA simultaneously, and the MRV results of 9 were in accord with those of DSA findings. MRV of one patient with thrombosis at initial segment of CIV was shown normal on DSA. **Conclusion** MRV for diagnosis of lower extremity vascular lesions has the advantage of non-trauma, greater scanning range, high grade contrast, excellent image delineation and intuitive convincement, making it worth popularizing in clinic.

[Key words] lower extremity veins; deep pelvic veins; deep vein thrombosis; magnetic resonance imaging; diagnosis

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[作者简介] 沈祖根, 主治医师。E-mail: joesheng@hotmail.com

* 通信作者 (Corresponding author)。Tel: 021-69719190, E-mail: jiangdd2003@163.com

目前国内外针对盆腔深静脉疾病的研究尚不多,盆腔深静脉疾病主要表现为静脉血栓形成、血管狭窄、肿瘤等,其中以盆腔及下肢静脉血栓最为常见^[1-2],本研究以深静脉血栓(deep venous thrombosis, DVT)作为主要研究对象。骨科盆腔及下肢骨折术后、妇科盆腔术后、高凝状态及下肢静脉曲张等高危人群易形成DVT,其中髂静脉和股静脉最易受累^[3-4]。髂-股静脉血栓有22%~29%并发肺栓塞(pulmonary embolism, PE),50%以上遗留DVT后遗症,DVT年发病率为0.93%,PE年发病率为0.50%,并呈逐年上升趋势^[1-2]。因此,DVT的早发现、早治疗显得尤为重要。然而,目前临床常用的B超、CT静脉造影(CT venography, CTV)等检查对DVT的诊断仍有较大的局限性。因此,本研究采用最新的非增强2D-TOF磁共振静脉成像(magnetic resonance venography, MRV)技术^[3-6]对下肢静脉血栓及狭窄疾病进行诊断,探讨其诊断价值,为其临床应用提供参考。

1 资料和方法

1.1 一般资料 2012年10月至2013年8月复旦大学附属中山医院青浦分院血管外科怀疑静脉疾病的患者50例,均行盆腔及下肢静脉MRV检查。其中男性21例,女性29例,年龄38~75岁,平均年龄(58.2±15.3)岁。2例为骨科股骨粗隆间骨折术后患者,1例为妇科全子宫切除术后患者,余47例无既往手术史。临床表现为下肢肿胀、疼痛、跛行及下肢静脉曲张。

1.2 MRV检查 采用GE 1.5T扫描机。患者取仰卧位头先进,用大体部线圈,并予以腹带加压固定,整个过程患者体位保持不变,检查范围为下腔静脉下段至腘静脉,以2D-TOF法连续扫描。技术参数:回波时间(echo time, TE)=5~7 ms,重复时间(repetition time, TR)=35~45 ms,翻转角35°~45°,层距3 mm,层厚3 mm,使用呼吸补偿(RC)技术^[7],获取原始图像。

1.3 图像后处理 收集原始图像后经过3D MIP(最大密度投影)进行后处理操作,以使图像给人以立体感,容易被接受和认知。但3D MIP的后处理图像会夸大病变,因此如怀疑为阳性病例应增加多平面重建(multiple planar reconstruction, MPR)。MPR是将原始图像忠实地保持到结果图像上,图像质量与事实相符。

1.4 图像质量评价 由3名放射科主治医师后处

理图像并书写报告,2名放射科副主任医师及1名血管外科主治医师审核。评价标准:5分,图像质量非常好,清晰显示盆腔、下肢静脉及分支结构,没有伪影,能够作出精确诊断;4分,图像质量好,能清楚显示盆腔及下肢静脉结构,分支静脉模糊显示,有少量伪影和噪声,能够作出诊断;3分,图像质量尚可,盆腔及下肢静脉能模糊显示,分支静脉显示不清,有伪影和噪声,基本不影响诊断;2分,图像质量较低,盆腔及下肢静脉结构难以显示,伪影多,噪声大,诊断可信度降低;1分,图像质量差,不能作出诊断。

2 结果

2.1 MRV图片质量及检查结果 50例患者图像均能清晰显示下腔静脉下段至腘静脉及其分支,其中25例以相同扫描参数延伸至足背血管,统计共显示下腔静脉、髂总静脉、髂内外静脉、股总静脉、股深股浅静脉、腘静脉723条,其符合率为96.4%。盆腔深静脉及下肢静脉分支血管众多,这里仅作清晰显示、模糊显示及未见显示统计;将图像质量进行评分(表1),评分3分及以上基本可以作出诊断,其诊断率达96.0%(48/50)。

2.2 MRV检查结果与B超对比 50例患者均进行B超检查,MRV提示20例股总至腘静脉段血栓形成,13例静脉曲张,检查结果与B超所示病变部位、范围、程度基本一致;MRV提示9例下腔静脉下段至髂外静脉段血栓形成,MRV能清晰显示病变部位范围、程度及周围侧支情况(图1A),而B超检查无法清晰完整显示及诊断(图1B),其中B超提示1例为范围不全,8例为阴性。8例MRV与B超均提示阴性。

2.3 MRV检查结果与DSA对比 10例患者同时进行DSA检查,MRV提示6例髂总静脉血栓形成,2例髂外静脉血栓,1例髂外静脉狭窄,检查结果与DSA所示病变部位、范围、程度完全一致;1例MRV提示髂总静脉起始段血栓,DSA造影显示正常(图2)。

2.4 典型病例介绍 患者,男性,62岁,2012年4月因外伤致右股骨粗隆间骨折,于本院骨科就诊行右侧股骨粗隆间内固定术。术后半年余长时间卧床,患者出现双下肢肿胀不适并逐渐加重,近期患者伴有胸闷咳嗽不适,转至血管外科就诊。下肢MRV检查显示下腔及下肢静脉内多发血栓伴侧支循环形成(图3),B超检查显示下肢多发血栓(图4A),胸部CT血管成像(CT angiography, CTA)示双侧肺动脉血栓(图4B、4C)。诊断明确后收治入院,予以溶栓活血治疗。

表 1 50 例患者盆腔及下肢 MRV 图像质量评定

Tab 1 Imaging quality evaluation on MRV of pelvises and lower limbs in 50 patients

Score	Venous display	Number of cases
5	Inferior segment of IVC, CIV, IIV, EIV, CFV, DFV and SFV with their branches clearly shown	11
4	Inferior segment of IVC, CIV, IIV, EIV, CFV, DFV and SFV were clearly shown, but branches were vaguely shown	30
3	Inferior segment of IVC, CIV, IIV, EIV, CFV, DFV and SFV with their branches vaguely shown	7
2	Inferior segment of IVC, CIV, IIV, EIV, CFV, DFV and SFV were vaguely shown, but branches were not shown	2
1	Inferior segment of IVC, CIV, IIV, EIV, CFV, DFV and SFV with their branches not shown	0

MRV: Magnetic resonance venography; IVC: Inferior vena cava; CIV: Common iliac vein; IIV: Internal iliac vein; EIV: External iliac vein; CFV: Common femoral vein; DFV: Deep femoral vein; SFV: Superficial femoral vein

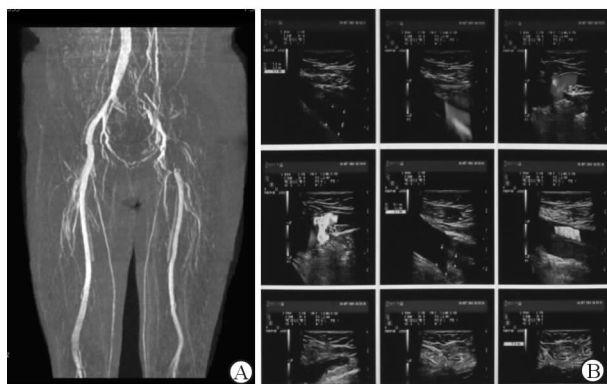


图 1 下腔静脉下段至髂外静脉段血栓形成 MRV(A)及 B 超(B)图像对比

Fig 1 Comparison of MRV (A) and B-ultrasound (B)

findings of thrombosis from inferior segment of IVC to EIV

A: MRV showed thrombosis of left CIV, EIV, and initial segment of CFV, and peripheral collateral vessel formation; B: Ultrasound showed thrombosis of left EIV and superior segment of CFV. MRV: Magnetic resonance venography; IVC: Inferior vena cava; EIV: External iliac vein; CFV: Common femoral vein

3 讨论

DVT 是目前最常见的盆腔深静脉疾病, 严重者可导致肺梗死, 更甚者威胁患者生命。对 DVT 高危人群的预防应高度重视, 包括: 骨折或术中对血管的损伤、术后患者卧床不动、高凝状态、下肢静脉回流速度下降等^[8-9]。因此, 本研究采用非增强 2D-TOF MRV 对下肢静脉疾病患者进行检查, 探讨其潜在临床价值。

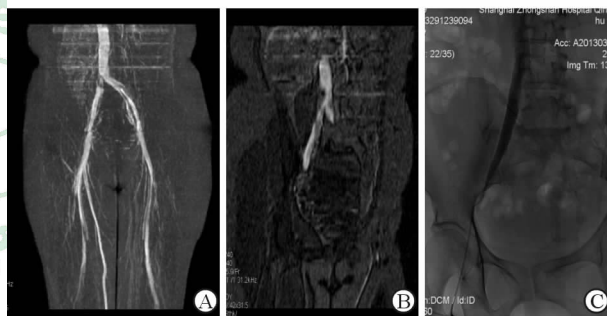


图 2 右髂总静脉附壁血栓患者 MRV 及 DSA 图像对比

Fig 2 Comparison of MRV and DSA findings of mural thrombosis of right CIV

A: MRV showed filling-defect of initial segment of right CIV; B: MPR showed mural thrombus of right CIV; C: DSA showed normal right CIV. MRV: Magnetic resonance venography; MPR: Multiple planar reconstruction; CIV: Common iliac vein

3.1 B 超检查 B 超检查因为操作方便快捷及使用成本低, 目前应用比较普及^[10]。但 B 超受操作者经验水平及盆腔内肠道气体干扰而影响诊断, 主要体现在下腔静脉至髂内静脉段血管不能清晰显示及诊断。本研究中有 8 例 DVT 患者, 单侧下肢水肿, B 超诊断阴性, 通过 MRV 检查可发现髂静脉血栓形成, 并能清晰显示病变部位及范围, B 超的假阴性率高达 16%。还有 1 例 MRV 显示下腔静脉下段至腘静脉段多发血栓形成, 而 B 超不能完全诊断血栓范围。同时超声检查也不能给临床提供更可靠且直观的图像, 且在检查过程中 B 超探头的加压使得静脉血栓有脱落的风险, 故 B 超检查仍具有一定的局限性。

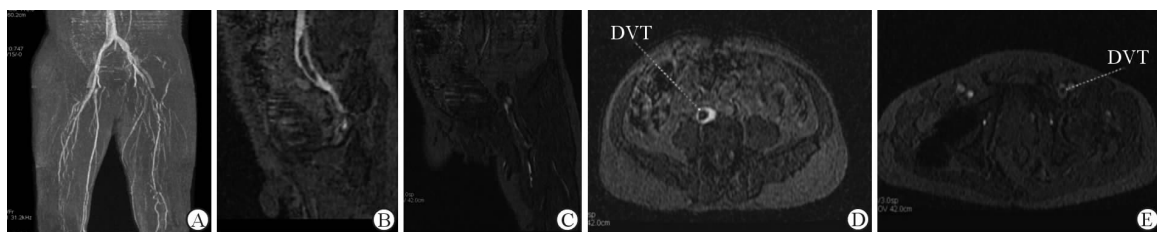


图 3 右股骨粗隆间骨折内固定术后患者下肢 MRV 图像

Fig 3 Lower limb MRV of a patient with femoral intertrochanteric fracture after internal fixation

A: MRV showed thrombosis and collateral vessels formation of right femoral post-operation; B: MPR showed thrombosis of inferior segment of IVC and right CIV; C: MPR showed thrombosis of left CIV and left CFV; D: Axial section showed thrombus of inferior segment of IVC; E: Axial section showed thrombus of left CIV. DVT: Deep venous thrombosis; MRV: Magnetic resonance venography; MPR: Multiple planar reconstruction; IVC: Inferior vena cava; CIV: Common iliac vein; CFV: Common femoral vein

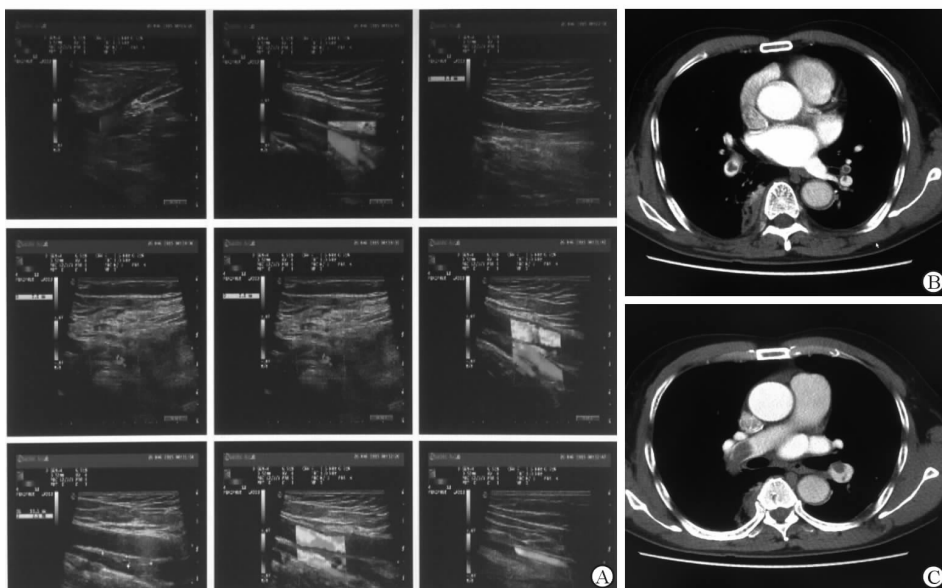


图 4 右股骨粗隆间骨折内固定术后患者下肢 B 超及肺动脉 CTA 图像

Fig 4 Lower limb B-ultrasound and pulmonary CTA of a patient with femoral intertrochanteric fracture after internal fixation

A: Lower limb B-ultrasound; B: CTA of the left and right pulmonary artery thrombosis; C: CTA of the left and main pulmonary artery thrombosis. CTA: CT angiography

3.2 常规下肢静脉造影及 CTV 常规下肢静脉造影从足背静脉注入造影剂,在透视下观察静脉,其优点是能了解静脉瓣功能情况,缺点是往往到了下腔静脉至股总静脉段内造影剂浓度不够,血管显影偏淡,影响诊断。因此,盆腔深静脉检查不适用常规下肢静脉造影。CTV 检查从单肘或双足背静脉团注造影剂,延迟至盆腔深静脉显影期进行扫描,再后处理图像(图 5A)。由于其分辨率高,三维图像清晰,目前应用较广,但是延迟时间较难把握,后处理中动静脉分离较困难,通常只显示大静脉,而其分支静脉无法显示清晰,对诊断及临床应用的要求还存在一定的差距。同时以上两种方法还有 X 线辐射、

注射造影剂的风险。

3.3 DSA DSA 是目前血管疾病诊断的金标准。本研究 50 例中有 10 例同时做了 DSA 检查,其中 9 例 MRV 报告血栓的部位、范围及程度与 DSA 显示完全符合,1 例 MRV 报告为右侧髂总静脉起始段附壁血栓形成,DSA 造影显示为正常静脉。回顾这例病例,可能是由于血管短距离内的生理性收缩扭曲所致,MRV 及后处理 MPR 的图像无法将这复杂的空间结构显示清楚而产生伪影,并夸大这部分血管的病变程度,导致 MRV 得出假阳性的结论。尽管 DSA 具有较高的分辨率,因其创伤性及操作复杂性,目前仍无法普及应用。



图 5 正常患者盆腔及下肢静脉 CTV 及 MRV 检查

Fig 5 CTV and MRV of a normal pelvis and lower limb

A: CTV of a normal pelvis and lower limb; B: MRV of a normal pelvis and lower limb. White arrow: Unable to remove the artery. CTV: CT venography; MRV: Magnetic resonance venography

3.4 非增强 MRV 本研究所采用的非增强 2D-TOF MRV 成像技术具有显示范围大、对比度高、图像准确且直观的优点,是目前最常用的盆腔及下肢血管成像技术。2D-TOF 法采用较短 TR 和较大翻转角,背景组织信号抑制较好。单层采集,层面内血流饱和较轻,有利于显示静脉慢血流,能清楚显示直径约 2~3 mm 的小血管(图 5B),特别是侧支循环小血管显影的间接征象,对诊断尤为重要。MRV 能清晰显示下腔及下肢静脉内多发血栓伴侧支循环形成,能将病变的范围及周围血管情况清晰显示^[1]。50 例病例中,MRV 共显示下腔静脉、髂总静脉、髂内外静脉、股总静脉、股深股浅静脉、腘静脉 723 条,符合率为 96.4%;除去因静脉血栓而完全闭塞的 9 条静脉,其符合率高达 98.8%;未显示的血管主要为健侧大隐静脉,这还是由于静脉血管内血液回流速度太慢所致。因此,除了完善个体差异的参数条件及熟练掌握并提高后处理水平外,加快盆腔下肢静脉内血流速度、缩短 2D-TOF MRV 检查时间,也将有利于提高 MRV 成像技术的图像质量和诊断准确率。

综上所述,非增强 MRV 成像技术对诊断盆腔深静脉疾病具有较高的诊断价值,优于其他的传统检查,对盆腔静脉的显示能力强,可作为盆腔段下肢静脉成像的首选方法^[12-13],值得临床推广使用。

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