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磁共振三维稳态进动快速成像序列诊断脑积水的临床价值*

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摘要 目的:分析磁共振三维稳态进动快速成像(3D-FIESTA)序列诊断脑积水的临床价值。**方法:**选择我院 2015 年 3 月~2016 年 3 月收治的手术病理确诊的 120 例脑积水患者,术前均行磁共振常规序列及 3D-FIESTA 序列扫描,比较其检查结果。**结果:**磁共振常规序列提示有 23 例交通性脑积水,有 73 例梗阻性脑积水,其中有 24 例中脑导水管完全梗阻,有 20 例中脑导水管狭窄,有 16 例四脑室流出道梗阻,有 13 例桥前池囊肿阻塞双侧侧室间孔,有 24 例未检出。3D-FIESTA 序列提示有 34 例交通性脑积水,有 83 例梗阻性脑积水,其中有 34 例中脑导水管完全梗阻,有 19 例中脑导水管狭窄,有 18 例四脑室流出道梗阻,有 12 例桥前池囊肿阻塞双侧侧室间孔,有 3 例未检出。3D-FIESTA 序列对脑积水的检出率高于磁共振常规序列,差异有统计学意义($P<0.05$)。**结论:**3D-FIESTA 序列能够客观反映脑脊液循环通路的状态,利于脑积水类型的鉴别,为临床治疗提供更全面、确切的影像学参考。

关键词:脑积水;诊断;磁共振三维稳态进动快速成像序列

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Clinical Value of Magnetic Resonance Three-dimensional Steady-state Precession Fast Imaging Sequences in the Diagnosis of Hydrocephalus*

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ABSTRACT Objective: To analyze the clinical value of magnetic resonance three-dimensional steady-state precession fast imaging (3D-FIESTA) sequences in the diagnosis of hydrocephalus. **Methods:** 120 cases of patients with hydrocephalus who admitted from March 2015 to March 2016 in our hospital and confirmed by surgical pathology were selected and underwent routine magnetic resonance imaging and 3D-FIESTA sequence scanning, the diagnostic results of hydrocephalus between two groups were compared. **Results:** MRI routine sequences suggested that there were 23 cases of communicating hydrocephalus, 73 cases of obstructive hydrocephalus, including 24 cases of complete midbrain aqueduct obstruction, there were 20 cases of the midbrain aqueduct stenosis, 16 cases of fourth ventricular outflow tract obstruction, 13 cases of cyst block the hole between double muscle bridge before the pool, there were 24 cases who were not checked out. 3D-FIESTA sequence prompted 34 cases of communicating hydrocephalus, 83 cases of obstructive hydrocephalus, there were 34 cases of midbrain aqueduct obstruction, 19 cases of the midbrain aqueduct stenosis, 18 cases of the fourth ventricle outflow obstruction, there were 12 cases of cyst block the hole between double muscle bridge before the pool, there are 3 cases who were not checked out. The detection rate of hydrocephalus in 3D-FIESTA sequence was higher than that of the conventional sequence ($P<0.05$). **Conclusion:** 3D-FIESTA sequence could objectively reflect the state of cerebrospinal fluid circulation path, which will help to identify the type of hydrocephalus and provide a more comprehensive and definite imaging reference for the clinical treatment.

Key words: Hydrocephalus; Diagnosis; Magnetic resonance three-dimensional steady-state precession fast imaging

Chinese Library Classification(CLC): R742.7; R445.2 **Document code:** A

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前言

脑积水是因颅脑病变导致脑脊液循环、吸收产生障碍或者过度分泌,增加脑脊液量,而引起蛛网膜下腔或者脑室系统扩大的临床病症^[1,2],可出现视力模糊、恶心呕吐、头痛、眩晕等神经系统的典型症状,且神经系统障碍与脑积水病变程度呈正相关,临床上应尽早诊治^[3]。有关研究显示解除病因、缓解脑室

扩大是脑积水的治疗原则,需综合患者的个体差异采用个性化治疗^[4,5]。可见,脑积水病因及脑脊液梗阻部位的明确是临床治疗的关键。脑积水诊断不仅依靠临床表现,同时需与影像学检查相结合^[6]。本研究旨在分析磁共振三维稳态进动快速成像(3D-FIESTA)序列诊断脑积水中的临床价值。

1 资料与方法

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1.1 一般资料

选择我院 2015 年 3 月~2016 年 3 月收治的手术病理确诊的 120 例脑积水患者,纳入标准^[7]:① 术前均行磁共振常规序列及 3D-FIESTA 序列检查;② 均伴程度不一的头晕、头痛、呕吐、视力模糊等颅内高压症状。排除经临床确诊患有脑萎缩、心肝肾等重要器官病变,免疫系统及血液系统异常等。120 例患者中男性有 73 例,女性有 47 例;年龄 10~65 岁,平均 (37.68 ± 4.81) 岁。

1.2 方法

1.2.1 参数设置 患者均使用 AT-901 型 MR 扫描仪,8 通道头部线圈行 MR 图像采集,进行磁共振常规序列(矢状位及轴位 T1WI, 冠状位及轴位 T2WI) 及 3D-FIESTA 序列矢状位扫描。常规序列参数设置:轴位 TSET1WI:重复时间为 600 ms、恢复时间为 2.6 ms、矩阵为 $288 \times 224 \text{ mm}^3$ 、层厚为 6 mm、间隔为 0.6 mm、扫描时间为 2 min、采集次数为 3 次;矢状位 TSET1WI:重复时间为 2400 ms、恢复时间为 102 ms、矩阵为 $320 \times 240 \text{ mm}^3$ 、层厚为 5 mm、间隔为 0.5 mm、扫描时间为 2 min、采集次数为 3 次;冠状位 T2WI:重复时间为 2600 ms、恢复时间为 120 ms、矩阵为 $320 \times 320 \text{ mm}^3$ 、层厚为 5 mm、间隔为 0.5 mm、扫描时间为 2 min、采集次数为 3 次;轴位 TSET2WI:轴位 TSET2WI:重复时间为 2400 ms、恢复时间为 102 ms、矩阵为 $320 \times 320 \text{ mm}^3$ 、层厚为 6 mm、间隔为 0.6 mm、扫描时间为 2 min、采集次数为 3 次。3D-FIESTA 序列参数设置:重复时间为 5.6 ms、恢复时间为 2.6 ms、矩阵为 $300 \times 300 \text{ mm}^3$ 、层厚为 0.8 mm、间隔为 0 mm、翻转角度为 60° 、扫描时间为 1.5 min、采集

次数为 3 次。确保 3D-FIESTA 序列可覆盖第四脑室及脑室、脑导水管、枕大池区域,并可于任意平面进行重建。

1.2.2 图像处理与分析 调节各常规序列及 3D-FIESTA 序列图像的窗位及窗宽后保存。由 2 名神经内科专家、神经影像学专家共同对磁共振的常规序列及 3D-FIESTA 序列图像予以分析,评估脑脊液循环通路的状况,辨别脑积水的病理类型。(1)交通性脑积水:脑室内可见膜性梗阻,第四脑室出口或者脑室内无梗阻。(2)梗阻性脑积水:可见第三脑室的宽度在 4 mm 以上,且未见皮层脑沟,其前后隐窝出现扩大,其底部呈向下凸起,侧脑室颞角的宽度在 3 mm 以上,并和其他部位的比值出现增大,两侧脑室额角间宽度在 100° 以下,两侧脑室额角径与颅内径的比值在 0.33 以上。胼胝体可变薄,呈上拉伸,可出现对称性的脑室周围间质水肿^[8]。

1.2.3 诊断结果 手术病理提示有 36 例交通性脑积水,有 84 例梗阻性脑积水,其中有 34 例中脑导水管完全梗阻,有 19 例中脑导水管狭窄,有 18 例四脑室流出道梗阻,有 13 例桥前池囊肿阻塞双侧室间孔。磁共振常规序列提示有 23 例交通性脑积水,有 73 例梗阻性脑积水,其中有 24 例中脑导水管完全梗阻(见图 1),有 20 例中脑导水管狭窄,有 16 例四脑室流出道梗阻,有 13 例桥前池囊肿阻塞双侧室间孔,有 24 例未检出。3D-FIESTA 序列提示有 34 例交通性脑积水,有 83 例梗阻性脑积水,其中有 34 例中脑导水管完全梗阻,有 19 例中脑导水管狭窄(见图 2),有 18 例四脑室流出道梗阻(见图 3),有 12 例桥前池囊肿阻塞双侧室间孔,有 3 例未检出。

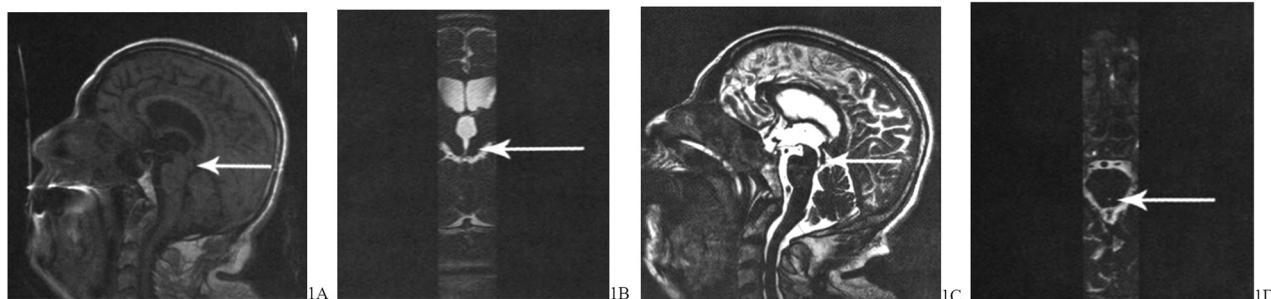


图 1 磁共振 T1WI 与 3D-FIESTA 序列提示中脑导水管通畅情况

Fig.1 MRW T1WI and 3D-FIESTA sequence prompted the smooth aqueduct in the situation

A: In the conventional sequence scan:the cerebral aqueduct was not obstructive; B:The cup expansion Wag revealed in the upper of cerebral aqueduct through 3D-FIESTA (coronal); C:The cerebral aqueduct wag obstructed by cystic lesion through 3D-FIESTA scan(sagittal),so the diagnosis Wag obstructive hydrocephalus; D:The cerebral aqueduct Wag almost obstructive in the 3D-FIESTA scan(axial).

1.3 统计学分析

选择 SPSS18.0 行数据统计,计数资料用 $[(n)\%]$ 表示,用 χ^2 检验比较, $P < 0.05$ 为差异有统计学意义。

2 结果

磁共振常规序列提示有 23 例交通性脑积水,有 73 例梗阻性脑积水,其中有 24 例中脑导水管完全梗阻,有 20 例中脑导水管狭窄,有 16 例四脑室流出道梗阻,有 13 例桥前池囊肿阻塞双侧室间孔,有 24 例未检出。3D-FIESTA 序列提示有 34 例交通性脑积水,有 83 例梗阻性脑积水,其中有 34 例中脑导水管完全梗阻,有 19 例中脑导水管狭窄,有 18 例四脑室流出道

梗阻,有 12 例桥前池囊肿阻塞双侧室间孔,有 3 例未检出。3D-FIESTA 序列对脑积水的检出率高于磁共振常规序列,差异有统计学意义($P < 0.05$),见表 1。

3 讨论

脑积水可按病理分为交通性及梗阻性,其中交通性脑积水是因脑脊液于脑室外的循环通路受阻或者吸收异常所致,梗阻性脑积水则指脑室系统内或者周围的病变,导致脑室系统的脑脊液循环产生障碍,是最为常见的脑积水类型^[9]。脑积水可产生多种临床症状,从而对患者的身心健康构成危害,临床上需及时、正确诊断脑积水,为患者的后续治疗创造有利基础^[10]。

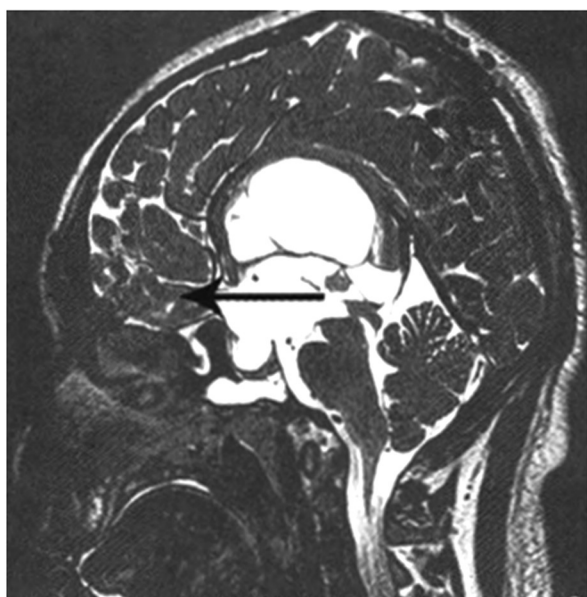


图2 3D-FIESTA 序列扫描提示幕上可见梗阻性脑积水,脑导水管显著狭窄,第三脑室可见室底下陷

Fig.2 3D-FIESTA sequence scans suggest obstructive hydrocephalus on the screen, a significant narrowing of the brain aqueduct, the third ventricle visible bottom ble narrow hole

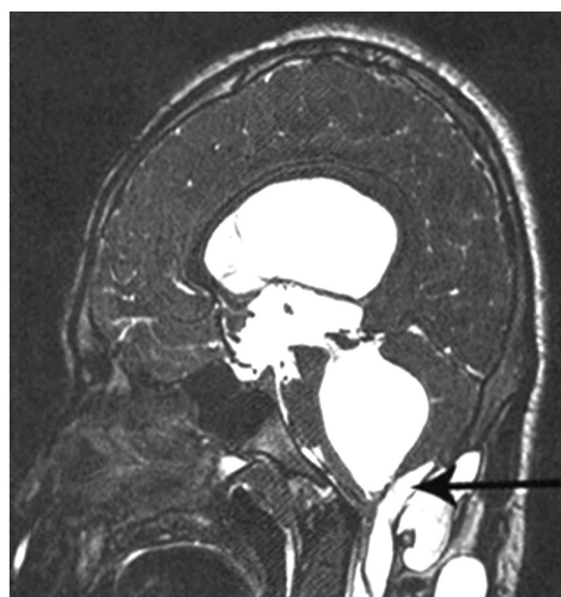


图3 3D-FIESTA 序列扫描提示第四脑室以上可见梗阻性脑积水,第四脑室正中孔可见狭窄

Fig.3 3D-FIESTA sequence scan suggest that the fourth ventricle above visible obstructive hydrocephalus, the fourth ventricle visi

表 1 磁共振常规序列与 3D-FIESTA 序列对脑积水的诊断结果比较[例(%)]

Table 1 Comparison of the diagnostic results of hydrocephalus between routine magnetic resonance sequences and 3D-FIESTA sequences[n(%)]

Groups	not detected	Detection	Detection rate
Conventional sequence	24	96	96(80.00)
3D-FIESTA sequence	3	117	117(97.50) ^a

Note: Compared with conventional sequence ^aP<0.05.

目前临床上多依靠于影像学检查,超声检查存在价格低廉、操作简单、无辐射等优势,可反映侧脑室及两侧额角的形状和大小,但无法提示枕骨大孔、第三脑室、中脑导水管及颅窝的具体情况,存在一定的局限性^[1]。CT可直观反映脑室周围水肿、梗阻部位及脑室系统扩大程度等脑积水的征象,可间接观察梗阻类型,可重复性高,能够动态关注脑积水的变化,可为临床疗效与预后评估提供一个有利、客观指标,但CT存在一定的辐射,且无法清晰显示脑室内部的微小结构^[12,13]。MRI存在无辐射、高分辨率,多种扫描序列,多种平面重建等优势,对于脑积水诊断、病因、分类等方面均优于CT,是脑积水检查的可靠方式^[14]。常规MRI能够客观反应脑室有无出血、占位、扩大等脑积水征象,同时对于脑积水合并的间质性脑水肿有较高的检出率,但由于容积效应及层厚限制的影响导致其仍无法有效反映脑室系统的细微结构^[15,16]。

3D-FIESTA序列属于水成像,是快速成像梯度回波的新型序列,可对残存横向磁化起到充分利用,即于回波采集后沿相位及频率编码方向分别予以一个方向相反、大小相同的梯度场,抑制横向磁化与梯度场的去相位反应,确保横向磁化的固定幅度,从而维持稳态^[17,18]。3D-FIESTA序列中恢复及重复时间极短,且具有一种流动补偿性技术,使液体流动产生的失相位程度比较轻微,能够最大程度的降低运动伪影,同时可使流动水、脑脊液等T2/T1高比率组织信号增强,从而和其他组织信号产生一个鲜明的比较^[19,20]。且3D-FIESTA序列可使扫描层厚

降低,导致对比度增强,从而导致组织空间的分辨率提高,且可结合多平面重建完成平面任意重组图像,更客观的显示解剖学结构,临床上多用于大血管、胆囊、心脏等成像,鲜有关于脑积水诊断中的报道^[21,22]。由于3D-FIESTA序列能够导致脑脊液与血管、神经等组织产生一个明显对比,脑脊液的波动对其影响甚小,可准确辨别脑脊液通路的相关解剖结构^[23,24]。因此3D-FIESTA序列能够识别常规MRI序列难以显现的脑脊液循环通路,从而使脑积水的检出率提高。本研究显示,3D-FIESTA序列对脑积水的检出率显著高于常规MRI序列。但本研究由于研究周期比较短,样本量相对较小,因此研究结果可存在一定的偏差,仍有待进一步改进。

综上所述,3D-FIESTA序列能够客观反映脑脊液循环通路的状态,利于脑积水类型的鉴别,为临床治疗提供更全面、确切的影像学参考。

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