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Brain Magnitude Resonance Imaging Examination Protocol in Epilepsy Patients: A Narrative Literature Review

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A B S T R A C T

MRI is becoming the choice for performing high-resolution structural imaging in epilepsy. Selection of brain MRI sequences with appropriate clinical epilepsy is very important to show abnormalities clearly so that the diagnosis can be made. The epilepsy protocol includes T1 and T2 weights, as well as fluid-attenuated inversion recovery (FLAIR). This literature review aims to describe the protocol for brain MRI examination in epilepsy patients. There is one special sequence that is used as a parameter for brain MRI examination in cases of epilepsy, namely fast spin-echo inversion recovery (FSE-IR), which is a modification of conventional inversion recovery and is used to suppress signals from certain tissues associated with T2 weighting. The coronal T2 propeller sequence is the sequence for showing pathology in the hippocampus. Coronal FSE-IR is useful for evaluating the hippocampus from the coronal side by eliminating the white signal to increase the contrast between white matter and gray matter. In conclusion, each sequence in the MRI examination protocol has a specific goal, namely to reveal pathology on the MRI slice and establish a diagnosis.

1. Introduction

The pathological features of epilepsy can be visualized much more sensitively and accurately with magnitude resonance imaging (MRI) than with CT scans.[1,2] MRI is becoming the choice for performing high-resolution structural imaging in epilepsy. Selection of brain MRI sequences with appropriate clinical epilepsy is very important to show abnormalities clearly so that the diagnosis can be made. The features of epilepsy in the form of atrophy of the hippocampus, chaotic internal structure, and hyperintensity on the T2 sequence need to be observed on the MRI examination. Hippocampal atrophy is the most common feature found in MRI evaluation of epilepsy patients.[3-5]

Brain MRI examination in cases of epilepsy includes the entire brain at T1 weighting with the isotropic acquisition. The examination protocol used thin, high-resolution slices, and in the temporal lobe, slices were used parallel to the longitudinal plane of the hippocampus.[6] The epilepsy protocol includes T1 and T2 weights, as well as fluid-attenuated inversion recovery (FLAIR).[7] Then there is a special sequence that is used as a parameter for brain MRI examination in cases of epilepsy, namely fast spin-echo inversion recovery (FSE-IR), which is a modification of conventional inversion recovery that is used to suppress signals from certain tissues associated with T2 weighting.[8] This literature review aims to describe the protocol for brain MRI examination in epilepsy patients.

Patient preparation before MRI

Prior to the procedure, the patient must fast for 4-6 hours before the examination and screening of metals or objects made from ferromagnetism. Ferromagnetic materials are materials that are easily attracted by magnets and easily turn into magnets when magnetized, for example, steel, iron, nickel, and cobalt.[9-10] The equipment used for brain MRI is a 1.5 tesla MRI machine, head coil, underpad, soft bag for fixation, blankets, and contrast media gadopentetate dimeglumine (Gd-DTPA) for patients who perform examinations using contrast media.

Inspection protocol

Before the examination begins, identify the patient by entering the examination number, patient medical record number, patient name, gender, date of birth, weight, date of examination, clinical description, and examination protocol. When the patient enters the MRI room, the patient is positioned supine with the head in the head coil and close to the gantry. The position of the legs is straight, and both hands are beside the body. Patients are given earplugs to help muffle the noise caused by the MRI plane. The patient is given a pillow on the head for fixation, and then the center is placed right on the nasion. The contrast medium used was Gd-DTPA 5 mmol/kg with a volume of 10 mL, which was administered intravenously.[11,12] Contrast medium was inserted after the FSE-IR coronal sequence. Table 1 presents the protocol for brain MRI examination in epilepsy patients.

Table 1. Brain MRI examination protocol.

Sequence	TR/TE/T1 (ms)	FOV	Matrix	Slice thickness/gap (mm)	Scan time
Localizer	2500/83	30x30	320x192	10/9	00:54
Sagital flair	2500/143/2200	24x24	320/160	5/1.5	02:25
Axial DWI	5200/81.4	24x24	128x128	5/1.5	01:13
Axial FLAIR	9000/143/2200	24x24	320x160	5/1.5	02:25
Axial T2 prop	5291/90.5	24x24	384x384	5/1.5	02:28
Axial T1 FSE	356/8.1	24x24	256x256	5/1.5	00:46
Axial GRE	420/10.3	24x24	288x192	5/1.5	01:24
Axial FSE-IR	5075/20.7/300	18x18	320x160	3/0.3	01:52
Coronal T2 propeller	5772/107	22x16.5	320x320	5/1.5	02:13
Coronal FSE-IR	5075/20.9/300	18x24	320x160	3/0.3	01:52
3D TOF MRA	21/3.1	22x16.5	320x160	-	03:42
3D vel venous	11.3/5.1	26x19.5	320x160	-	03:17
Axial T1+ SE contrast	511/7.8	24x21	256x192	5/1.5	02:01

The first sequence performed was the FLAIR sagittal. This sequence is useful for evaluating the brain parenchyma from the sagittal side. Axial DWI is a sequence that is performed to determine areas blocked by a pathology (restricted area) in the brain with a short scan time. DWI axial sequences are useful for evaluating molecular motion. The FLAIR axial sequence was used to assess the brain parenchyma and determine the type of lesion present. The axial T2 propeller sequence is a routine sequence in every brain MRI examination that is used to see pathology that appears in the brain from the axial side.[13]

Like the T2 propeller axial sequence, the T1 FSE axial sequence is also a routine sequence in every MRI examination, especially brain MRI. This sequence aims to evaluate the overall brain anatomy from an axial view. The GRE axial sequence is the sequence used to detect bleeding that occurs. The GRE axial sequence is included in the brain MRI protocol for epilepsy cases for bleeding in lesions seen in previous sequences. The GRE axial sequence is actually a routine sequence for evaluating the head with clinical stroke. If the epilepsy is due to infection or infarction, a calcified appearance will be seen on the axial GRE sequence.[14]

Axial FSE-IR 3 mm is a sequence to evaluate the hippocampus and brain parenchyma. This sequence is a modification of FLAIR with a shorter time inversion (TI). The coronal T2 propeller sequence is the sequence for showing pathology in the hippocampus. Coronal FSE-IR is useful for evaluating the hippocampus from the coronal side by eliminating the white signal to increase the contrast between white matter and gray matter. 3D time of flight (TOF) sequences are useful for viewing the reconstructed structure of the arteries in the head in three dimensions. Meanwhile, 3D vel venous is a 3D TOF reconstruction to evaluate the veins in the head in 3D. Axial sequence T1 and SE contrast are sequences that are performed when an MRI examination uses Gd-DTPA contrast media.[12-14] The contrast medium serves to accentuate the lesions seen in the previous sequences.

2. Conclusion

Each sequence in the MRI examination protocol has a specific goal, namely to reveal pathology on the MRI slice and establish a diagnosis.

3. References

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