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HEAD MRI EXAMINATION PROCEDURE WITH CLINICAL INTRACRANIAL SPACE OCCUPYING LESION AT THE RADIOLOGY INSTALLATION OF DR. HASAN SADIKIN HOSPITAL BANDUNG

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ABSTRACT

Background: MRI is radiological imaging using a magnetic field that can produce transversal, sagittal and coronal images of organs, bones, soft tissue and the nervous system. The use of appropriate MRI parameters can reveal detailed anatomical and pathological images of body tissue. One of the pathologies that can be confirmed using an MRI examination is an intracranial space occupying lesion. Intracranial space occupying lesion is a medical term that describes a lesion that occupies space in the brain which can damage important brain structures and obstruct the flow of cerebrospinal fluid. The aim of this study was to determine the MRI examination procedure for the head with clinical space-occupying intracranial lesions, including patient preparation, preparation of tools and materials, techniques, and sequences used in the Radiology Installation of Dr. Hasan Sadikin Hospital Bandung. ***Method:*** This type of research is descriptive qualitative research with a case study approach. ***Result:*** The results of the study obtained are the MRI examination procedure of the head with clinical space occupying lesion intracranial in the Radiology Installation of Dr. Hasan Sadikin Hospital Bandung, there is a special patient preparation, carried out in the head first position, the sequence used in pre-contrast media includes T1 SE sagittal, T2 tirm transversal dark fluid flair, T2 TSE transversal, T1 SE transversal, T2 FL2D transversal hemorrhagic, T2 TSE coronal, while post-contrast media uses the sequence T1 SE sagittal, T1 SE transversal and T1 SE coronal. ***Conclusion:*** The MRI examination procedure for the head with clinical intracranial space-occupying lesions at the Radiology Installation of Dr. Hasan Sadikin Hospital Bandung, was carried out by paying attention to the pathology and condition of the patient, in order to help establish the diagnosis.

Keywords: Head MRI; Intracranial; Space Occupying Lesion

Introduction

MRI is an imaging modality that uses magnetic fields to produce images [1]. The principle used to obtain MRI images with magnetic resonance of hydrogen atomic nuclei [2].

MRI examination is considered effective for examining the inside of the body because it can establish a detailed, accurate diagnosis and can produce transversal, sagittal and coronal images without much manipulation of the patient's body [1].

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Generally, MRI head examinations are carried out using T1 weighted and T2 weighted sequences. The T1 weighted sequence is considered good for viewing brain anatomy and the T2 weighted sequence is considered good for viewing brain pathology [3].

Routine sequences used in basic MRI brain examinations include, T2 transversal FRFSE, T2 flair transversal FSE, T1 transversal SE, T2 coronal FRFSE, T1 flair sagittal FSE-IR, T1 flair transversal FSE-IR and diffusion transversal EPI [4].

Patient preparation for a basic MRI brain examination includes, patients who are in normal condition are directed to urinate before being examined, explain the examination procedure to the patient, the patient uses ear plugs as ear protection, removes metal accessories and ensures the patient understands the examination procedures given [4].

Basic MRI brain examination techniques include, the patient is arranged to sleep on his back, the head is first entered into the gantry, the head is arranged straight in the coil so that the interpupillary line is parallel to the examination table, the patient is positioned so that the longitudinal alignment light is in the mid line and the horizontal alignment light passes through the nasion, aiming point at the glabella or nasion, the patient is immobilized with straps and pads [4].

Generally MRI brain examinations are carried out in clinical cases of multiple sclerosis, primary or metastatic tumor, autoimmune deficiency syndrome, infarction, hemorrhage, hearing loss, visual disturbances, infection, trauma, unexplained neurological symptoms deficit, preoperative planning, radiation treatment planning, follow up (surgical or treatment) and congenital anomalies [5].

Intracranial space occupying lesion (SOL intracranial) is a lesion in the intracranial space that affects the brain [6]. Intracranial space occupying lesions are intracranial space lesions that consist of various groups of lesions [7]. Space occupying lesion is a pathology that has a high health risk. Space occupying lesions are pathological structures that have a recognizable volume and can affect surrounding structures. The lesion can be a mass or deformity which can be tumoral or non-tumorous [8]. One of the causes of space occupying lesions is brain tumors [9].

CT scan and MRI imaging of the lesion can show excellent anatomy in transversal, sagittal and coronal sections and can determine the possible character of the lesion. CT scan and MRI modalities are considered to be helpful in establishing early diagnosis and localization of space occupying lesions [7].

Based on the background above, the author is interested in studying in more depth the MRI head examination procedure with clinical intracranial space occupying lesion at the Radiology Installation of Dr. Hasan Sadikin Hospital Bandung.

Methods

This research is observational research carried out by observing the research variables [10]. This type of research is descriptive qualitative research with a case study approach which is used to systematically and accurately describe the original situation regarding the MRI head examination procedure with clinical intracranial space occupying lesion at the Radiology Installation at Dr. Hasan Sadikin Hospital Bandung. The subject of this study was one female patient who underwent a non-contrast MRI of the head. The inclusion criteria were patients undergoing a head MRI with clinical findings of an intracranial space-occupying lesion at the Radiology Department of Dr. Hasan Sadikin Hospital Bandung.

Results and Discussion

Illustration of a case of MRI examination of the head with a clinical intracranial space occupying lesion

The female patient is Mrs. N, 57 years old, has complaints of illnesses including forgetfulness since the last month, difficulty concentrating, incoherent speech, headaches, especially in the back area and tingling. The patient came to the Radiology Installation with a letter requesting an MRI of the head with a diagnosis of an intracranial space occupying lesion.

Head MRI examination procedure with clinical intracranial space occupying lesion

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Patient preparations that need to be made include receiving an explanation of the examination procedures to be carried out, patients are advised to defecate before the examination, remove objects containing metal, fast 3 to 4 hours before the examination, bring the latest serum creatinine examination results (maximum 7 days before the examination), bring previous x-ray/CT scan/MRI/USG/anatomical pathology/laboratory results if any, bring an examination request sheet and questionnaire that has been filled in by the sending doctor.

Based on the literature obtained by the author regarding the MRI head examination procedure, it is known that patient preparations that need to be carried out include receiving an explanation of the examination procedure, the patient defecating before the examination, removing metal objects such as false teeth, hearing aids, hairpins, jewelry, earrings and so on, the patient understand and fill out the questionnaire [11].

Based on the research results obtained at the Radiology Installation of Dr. Hasan Sadikin Hospital Bandung, with the literature according to Moeller & Reif (2003), it is known that the MRI head examination procedures carried out are in line.

Preparation of tools and materials used include 1.5 tesla MRI brand Siemens, consul system, printer, head coil, emergenzy buzzer, ear protectors, blankets, 1 cc syringe, 10 cc syringe, tourniquet, alcohol cotton, plaster and omniscan gadodiamide contrast media.

Equipment that needs to be prepared includes a head coil (quadrature or multi coil/phased array), immobilization pads, straps, earplugs or headphones, cushion or bolster for legs, high performance gradients for EPI, diffusion and perfusion imaging and spectroscopy [5].

Based on the research results obtained at the Radiology Installation of Dr. Hasan Sadikin Hospital Bandung, and the literature according to Wiley & Sons (2022), it is known that the tools used are in line, including the use of head coils, immobilization devices, and ear protectors. However, the implementation described in the research results at the Radiology Installation of Dr. Hasan Sadikin Hospital Bandung, is a contrast head MRI examination procedure, while the implementation described by Wiley & Sons (2022) is a non-contrast head MRI examination procedure.

Figure 1. 1.5 tesla MRI

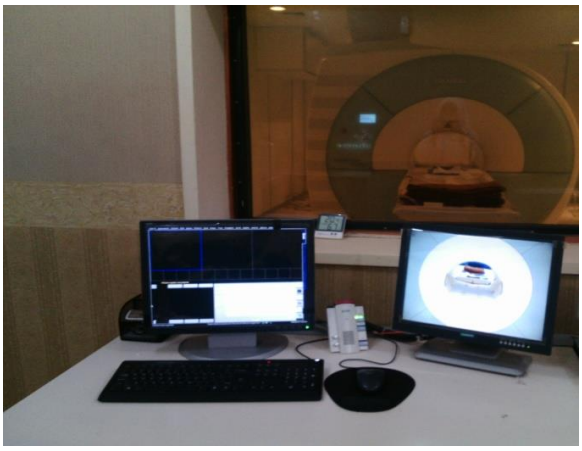

Figure 2. Consul System

Figure 3. Printer

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Figure 4. Coil Head

The examination technique used includes having the patient skin tested with 0.1 cc of omniscan gadodiamide contrast media first subcutaneously to find out whether the patient is allergic to contrast media. The patient is positioned lying on his back on the examination table with a head coil attached to his head. Arrange your head and body position in the center of the examination table so that the mid sagittal plane is in line with the center line of the table and the indicator light. The head is given a support for fixation so that the patient does not move during the examination. Arrange both hands next to the body, then cover with a blanket. Move the inspection table towards the gantry, then set the indicator light in the middle of the head coil and the middle of the indicator light at national level. Insert the inspection table into the gantry. Then close the MRI room door tightly to avoid entering frequencies from outside.

The examination technique used includes positioning the patient supine with the head near the gantry or head first. Set your head straight so that the interpupillary line (IPL) is parallel to the examination table and your head is straight. Head alignment is regulated with the longitudinal alignment light in the mid line and the horizontal alignment light through the nasion and external auditory meatus (EAM). For fixation, use straps and foam pads. Place pads under the patient's feet for comfort [5].

Based on the research results obtained at the Radiology Installation of Dr. Hasan Sadikin Hospital Bandung, with literature according to Wiley & Sons (2022), it is known that for the supine patient position with the head position near the gantry or head first and the indicator light is set at nasion height.

Enter patient data into the MRI consul system such as name, ID, date of birth, gender, body weight, type of examination and patient position, then select exam.

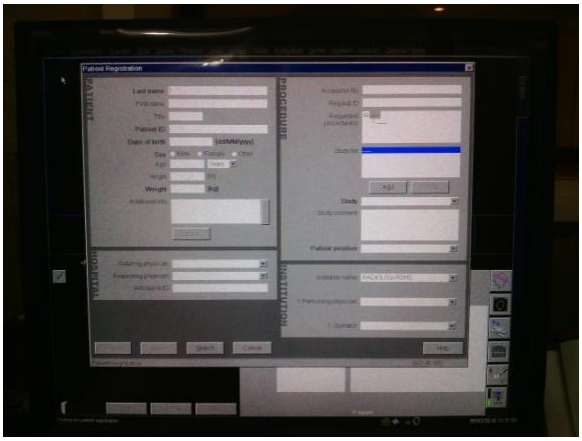

Figure 5. Patient Data Registration

The sequences used in MRI head examinations with clinical intracranial space occupying lesion pre-contrast media include T1 SE sagittal, T2 tirm transversal dark fluid flair, T2 TSE transversal, T1 SE transversal, T2 FL2D transversal hemoragic and T2 TSE coronal.

The sequences used include T2 weighted TSE transversal, T1 weighted SE transversal, proton density weighted transversal, FLAIR coronal and T2 weighted TSE sagittal [11].

Based on research results obtained at the Radiology Installation of Dr. Hasan Sadikin Hospital Bandung, and literature according to Moeller & Reif (2003), it is known that the same sequences are T2 TSE transversal and T1 SE transversal. While the use of other sequences can be adjusted to the pathology and condition of each patient.

Table 1. T1 SE Sagittal Parameters

T1 SE Sagittal	
FoV	230 mm
Slice thickness	5,0 mm
Time repetition (TR)	450 ms
Time echo (TE)	9,3 ms
Orientation	sagittal

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Figure 6. Head MRI Image T1 SE Sagittal

Table 2. T2 Tirm Transversal Dark Fluid Flair Parameters

T2 Tirm Transversal Dark Fluid Flair	
FoV	230 mm
Slice thickness	5,0 mm
Time repetition (TR)	9000 ms
Time echo (TE)	87,0 ms
Orientation	transversal

Table 3. T2 TSE Transversal Parameters

T2 TSE Transversal	
FoV	230 mm
Slice thickness	5,0 mm
Time repetition (TR)	5000 ms
Time echo (TE)	90 ms
Orientation	transversal

Table 4. T1 SE Transversal Parameters

T1 SE Transversal	
FoV	230 mm
Slice thickness	5,0 mm
Time repetition (TR)	585 ms
Time echo (TE)	10 ms
Orientation	transversal

Table 5. T2 FL2D Transversal Hemoragic Parameters

T2 FL2D Transversal Hemoragic	
FoV	230 mm
Slice thickness	5,0 mm
Time repetition (TR)	800 ms
Time echo (TE)	26,00 ms
Orientation	transversal

Figure 7. Head MRI Image T2 FL2D Transversal Hemoragic

Table 6. T2 TSE Coronal Parameters

T2 TSE Coronal	
FoV	220 mm
Slice thickness	5,0 mm
Time repetition (TR)	4300 ms
Time echo (TE)	93 ms
Orientation	coronal

Then insert gadolinium contrast media, omniscan gadodiamide brand intravenously. Then the examination continued with post contrast media using T1 SE sagittal, T1 SE transversal and T1 SE coronal sequences.

Table 7. T1 SE Sagittal Parameters

T1 SE Sagittal	
FoV	230 mm
Slice thickness	5,0 mm
Time repetition (TR)	450 ms
Time echo (TE)	9,3 ms
Orientation	sagittal

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Figure 8. Head MRI Image T1 SE Sagittal

Table 8. T1 SE Transversal Parameters

T1 SE Transversal	
FoV	230 mm
Slice thickness	5,0 mm
Time repetition (TR)	585 ms
Time echo (TE)	10 ms
Orientation	transversal

Table 9. T1 SE Coronal Parameters

T1 SE Coronal	
FoV	230 mm
Slice thickness	5,0 mm
Time repetition (TR)	340 ms
Time echo (TE)	11 ms
Orientation	coronal

The results of the expertise of MRI examination of the head with clinical space occupying lesion intracranial in Mrs. N

Multiple intracranial metastases in the left cerebellum area, in the cortical subcortical area of the left frontal lobe, left parietal and bilateral temporal lobes accompanied by perifocal edema.

Conclusion

The MRI head examination procedure with clinical intracranial space occupying lesion at the Radiology Installation of Dr. Hasan Sadikin Hospital Bandung, requires special patient preparation. The inspection is carried out using 1.5 tesla MRI. The examination is carried out in the patient's supine and head first position. The examination is carried out by scanning pre-contrast media and post-contrast media. Sequences used in pre-contrast media include T1 SE sagittal, T2 tirm transversal dark fluid flair, T2 TSE transversal, T1 SE transversal, T2 FL2D transversal hemoragic, T2 TSE coronal, while post contrast media uses sequences T1 SE sagittal, T1 SE transversal and T1 SE coronal. Scanning is performed with and without contrast media to examine the patient's pathological condition, such as determining the type, location, and size of space-occupying intracranial lesions in detail. This also applies to the selection of the sequence used, which, in addition to being adapted to commonly used sequences, also takes into account the pathology and individual condition of each patient.

The examination is carried out using a sequence T1 which aims to look at anatomy and T2 which aims to see pathology. Sequence SE, TSE, FL2D dan tirm transversal dark fluid flair used according to the anatomy being examined, the type of pathology and the location of the pathology with the aim of being able to show details of the body part because the right parameters can reveal a detailed anatomical and pathological picture of body tissue. The transversal, sagittal and coronal sections used are aimed at viewing tomographic images that can be used to diagnose disease. The use of contrast media is expected to detect the smallest pathology and provide information on the exact location of the pathology.

Therefore, the use of scanning without or with contrast media and the selection of sequences need to be adjusted to the pathology and condition of each patient in order to establish a diagnosis.

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