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Analysis Of MRI Knee Joint Examination In Meniscus Tear Case With *STIR* Sequence And T2 *Medic* Sagittal Cut At Radiology Installation Of Balimed Hospital Denpasar

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ABSTRACT. Knee injuries are often encountered in general practice and in hospitals. One injury that can occur is injury to the meniscus which causes a meniscus tear. The meniscus is a fibro cartilage disc which is the content of the knee joint and is divided into two, namely the lateral meniscus and the medial meniscus. To confirm the diagnosis of injured ligaments is by carrying out an MRI examination. MRI examination of the knee joint using T2* Multi Echo Rechalled Gradient Echo can provide optimal images in cases of meniscus tears. MRI examination of the knee joint using MEDIC is very useful for cervical imaging, cartilage, joint and musculoskeletal examination. The advantage of the MEDIC sequence is that it can be used for 2D and 3D imaging and can reduce chemical shift artifacts. Based on the journal taken by the author, the sequence needed to clinically show a meniscus tear on an MRI Knee Joint examination is sagittal STIR and sagittal T2 MEDIC. then the most optimal sequence in clinically showing a meniscus tear is chosen to increase the efficiency of the examination time. The type of research used is qualitative research with a case study approach. The subjects used in this research were 3 Radiology Specialist Doctors and 3 Radiographers. The STIR and T2 MEDIC sequences on the MRI Knee Joint examination have their respective roles in confirming the diagnosis of Tear Meniscus. The STIR sequence plays a role in assessing the Anterior Cruriated Ligament, Posterior Cruriated Ligament, radiologists also want to see edema or swelling that occurs in the patient's genu. The MEDIC T2 sequence plays a role in assessing the medial and lateral meniscus, the radiologist also wants to see blood production in the patient's genu. The STIR and T2 MEDIC sequences in the MRI Knee Joint examination at the Balimed Denpasar Hospital installation are able to confirm the diagnosis, especially in the clinical Tear Meniscus, because with these two sequences, the picture of the Medial Meniscus, Lateral Meniscus, Anterior Cruriated Ligament, Posterior Cruriated Ligament, product blood and edema can be clearly seen.
Keywords: Tear Meniscus, T2 MEDIC, STIR, MRI Knee.

INTRODUCTION

The knee joint is one of the most complex joints in the human body, formed from the femur, patella, tibia and fibula bones which are joined by a complex group of ligaments and work together to provide stability to the knee joint (3). To create stability, the knee joint

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needs cartilage, tendons and meniscus (4). Knee injuries are often encountered in general practice and in hospitals. These injuries are often caused by sports activities that cause severe pain and disability (5). One injury that can occur is injury to the meniscus which causes a meniscus tear. The meniscus is a fibro cartilage disc which is the content of the knee joint and is divided into two, namely the lateral meniscus and the medial meniscus (3). The meniscus is a small C-shaped piece of cartilage, its function is to cushion the knee joint. Meniscus tears occur because one of the pieces of cartilage in the knee is injured and torn. To confirm the diagnosis of injured ligaments is by carrying out an MRI examination, because it can provide a clearer picture to determine soft tissue injuries (ligaments, tendons and joint cushions) with a sensitivity of 95% and a specificity of 88% in establishing the diagnosis (6).

According to Westbrook in 2014, MRI Knee Joint examinations use several protocols, including axial gradient echo T2* or axial FSE PD (Proton Density)/T2 +/- tissue suppression, sagittal GRE T2* or sagittal/oblique PD +/- tissue suppression, coronal FSE PD/T2 +/- tissue suppression, coronal SE/GRE T1, axial FSE PD/T2 +/- tissue suppression, STIR (7).

Making a diagnosis during an MRI Knee Joint examination is very dependent on sequence selection, the aim being to obtain an accurate diagnosis in assessing the anatomical image (8).

MEDIC (Multi Echo Data Imaging Combination) on Siemens or, MARGE on GE or M-FFE on Philips which is a derivative of the Gradient Echo sequence which produces T2 weighted images. The basis of this sequence is the repetition of gradient frequency encoding, one gradient echo can be generated from different TE values so that the multiple echoes obtained in one measurement are combined into an image. MEDIC is very useful for cervical imaging, cartilage, joint and musculoskeletal examination (9) . The advantage of the MEDIC sequence is that it can be used for 2D and 3D imaging and can reduce chemical shift artifacts. The disadvantage of MEDIC is that it is sensitive to small movements and the scan time is relatively long (10).

According to Vinsensius (2021), MRI examination of the knee joint using T2* Multi Echo Rechalled Gradient Echo can provide optimal images in cases of meniscus tear and ligament rupture, because the SNR and CNR on T2*MERGE are higher, it can be said that this sequence can provide results. optimal (11). Meanwhile, according to De Smet in 2012 (12) Short Tau Inversion Recovery (STIR) is a technique used to reduce fat signal intensity, so that bone marrow abnormalities and organ abnormalities surrounded by fat can be identified clearly and well. Apart from that, STIR also produces an image with high and clear lesion contrast. STIR can be used on all types of MRI aircraft, both low and high Tesla.

According to Ahmed in 2017, (13) the sequence to identify anatomy and pathology in MRI Knee Joint examination with meniscus injury uses fat suppression techniques, either STIR or T2 weighted fast spin echo with specific suppressed fat sequences (T2 & T2 FSE Fat-Sat). This is the reference sequence for the analysis of intra-articular lesions such as joint effusion, edematous infiltration, ligament or tendon tears, bone contusions, subchondral bone edema, muscle lesions, and meniscus lesions.

Based on the author's observations, the number of Tear Meniscus cases during the last 3 months from March to May was 14.2%. In March it was 4.7%, in April it was 4.7% and in May it was 4.7%. Knee Joint MRI sequence at the Radiology Installation of Balimed Hospital Denpasar based on the SOP using the sequence Pd_fs_tra, Pd_fs _cor, Pd_fs_sag, Pd_fse_tra, Pd_fse_cor, Pd_fse_sag, Stir_fse_sag, T1_fse_cor, T2_ fse_sag, T2_geti_sag.

Based on various journals taken by the author, the sequence needed to clinically show a meniscus tear on an MRI Knee Joint examination is sagittal STIR and sagittal T2 MEDIC. The procedure carried out at Balimed Denpasar Hospital uses these two sequences. This sequence has almost the same scanning time, but if the overall scanning is carried out it will take longer, so the most optimal sequence is chosen in clinically showing a meniscus tear to increase the efficiency of the examination time.

Based on the background description above, researchers are interested in conducting research with the title "Analysis of MRI Knee Joint Examination in Meniscus Tear Cases with STIR Sequence and T2 MEDIC Sagittal Section at the Radiology Installation of Balimed Hospital Denpasar".

METHOD

The type of research used is qualitative research with a case study approach. The subjects used in this research were 3 Radiology Specialist Doctors and 3 Radiographers. Data collection and processing was carried out by observation, interviews and documentation. The collected data is analyzed using an interactive model.

RESULTS AND DISCUSSION

This research was conducted in April-August 2023, by adding T2 MEDIC and STIR sequences to 3 patients who underwent an MRI Knee Joint examination with Tear Meniscus clinical examination, after completing the examination, interviews were then conducted with respondents to obtain the results of this study.

In the MRI Genu examination in the case of Tear Meniscus at the Radiology Installation of Balimed Hospital Denpasar, patient preparation was carried out the same as preparation for MRI examinations in general, the radiographer also screened the patient by filling in the form provided, instructing the patient to go to the toilet before the examination, the patient must remove all metal accessories, change the patient into the clothes provided, explain the procedure to the patient, including what the patient will undergo, screen the patient regarding the use of implants such as pacemakers, prosthetic implants, wires, dentures.

Patient preparation for the MRI Genu examination in the case of Tear Meniscus at the Radiology Installation at Balimed Hospital Denpasar is in accordance with theory (Westbrook, 2014), reinforced by the SOP and the results of interviews with respondent R1.

Preparation of equipment for MRI Genu examination in Meniscus Tear cases at the Radiology Installation at Balimed Hospital Denpasar, namely: MRI plane, Flex Coil, Sponge/foam for fixation, Emergency button, Blanket, Earphones. There are several equipment preparations that are not included in Westbrook's (2014) theoretical recommendations, such as coils, this is due to equipment limitations, knee coils are replaced with flex coils, but this does not reduce the doctor's assessment of the image, confirmed by the results of interviews with respondent R1.

Genu MRI examination in cases of Tear Meniscus at the Radiology Installation of Balimed Hospital Denpasar uses several sequences, namely: Pd_fs_tra, Pd_fs _sag, Pd_fs_cor, Pd_fse_tra, Pd_fse_cor, Pd_fse_sag, T1_fse_cor, T1_fse_sag, T2_ fse_sag, T2_geti_sag, Stir_fse_ cor.

According to Westbrook (2014), the sequence used in genu MRI examinations is axial PD / coherent T2* GRE, sagittal coherent GRE T2*/ T2/ T2 Fatsat, coronal PD FSE/ PD Fatsat/ T2/ T2 Fatsat Coronal SE/incoherent (spoiled) GRE T1, axial FSE T2/ T2 Fatsat/ PD Fatsat.

The STIR and T2 MEDIC sequences are additional sequences used in Genu MRI examinations in Meniscus Tear cases at the Radiology Installation at Balimed Hospital Denpasar, this is in accordance with the direction of the radiologist so that it can help in confirming the diagnosis.

MRI examination of the genu in cases of Tear Meniscus at the Radiology Installation of Balimed Hospital Denpasar uses an additional STIR sequence, in accordance with the Radiologist's recommendation, because the doctor wants to see more clearly the Anterior Cruriated Ligament and Posterior Cruriated Ligament, the doctor also wants to assess the edema or swelling that occurs in the genu patient.

MRI examination of the genu in cases of Tear Meniscus at the Radiology Installation of Balimed Hospital Denpasar uses an additional T2 MEDIC sequence, this is also a recommendation from the radiologist, because the radiologist wants to assess the medial meniscus and lateral meniscus, the radiologist also wants to see the blood production in the patient's genu.

The STIR and T2 MEDIC sequences can help doctors in making a diagnosis, but must be supplemented with other sequences as support to make them more accurate, reinforced by the results of the interview with A3.

CONCLUSION

1. The MRI genu examination procedure in cases of Tear Meniscus at the Radiology Installation at Balimed Hospital Denpasar is carried out by preparing the patient and screening the patient. The sequences used are: Pd_fs_tra, Pd_fs _sag, Pd_fs_cor, Pd_fse_tra, Pd_fse_cor, Pd_fse_sag, T1_fse_cor, T1_fse_sag, T2_ fse_sag, T2_geti_sag, Stir_fse_cor. The Stir_fse_cor and T2_geti_sag sequences are additional sequences that radiologists need to help in making a diagnosis.
2. The STIR and T2 MEDIC sequences in the MRI Knee Joint examination have their respective roles in establishing the diagnosis of Tear Meniscus. The STIR sequence plays a role in assessing the Anterior Cruriated Ligament, Posterior Cruriated Ligament, radiologists also want to see edema or swelling that occurs in the patient's genu. The MEDIC T2 sequence plays a role in assessing the medial and lateral meniscus, the radiologist also wants to see blood production in the patient's genu.
3. The STIR and T2 MEDIC sequences in the MRI Knee Joint examination at the Balimed Denpasar Hospital Installation have been able to confirm the diagnosis, especially in the clinical Tear Meniscus, because with these two sequences, images of the Medial Meniscus, Lateral Meniscus, Anterior Cruriated Ligament, Posterior Cruriated Ligament, product blood and edema can be clearly seen.

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