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Role of MRI Sequences in Traumatic Knee Injuries

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Abstract

Background: - MRI is a non-invasive medical imaging method used to diagnose severe knee injuries. T1-weighted, T2-weighted, and proton density-weighted MRI sequences provide distinct information regarding knee structures such as bones, cartilage, ligaments, and tendons. T1 pictures indicate anatomical structures, but T2 imaging detects water content, inflammation, and edema. Images with proton density weighting are sensitive to both fluid and cartilage. The use of several MRI sequences allows for a more thorough evaluation of knee injuries and can aid in the selection of appropriate treatment techniques.

Objective: - To study the role of different sequences in traumatic knee injuries & to compare them.

Materials and methods: - This study aimed to investigate the role of different MRI sequences now evaluating traumatic knee injuries. A total of 50 individuals with knee injuries were enrolled and had MRI scans performed in various sequences. The photos were analyzed and compared to establish the most effective sequences for recognizing specific injuries.

Result: - A combination of MRI sequences such as PD, T1W, T2W, and STIR can thoroughly assess traumatic knee injuries. Each sequence has its distinct strengths and can aid in the detection of various types of injuries. However, the PD sequence is a good balance between T1W & T2W as PD images are sensitive to both fluid and fat making them useful for detecting bone marrow edema and useful for detecting ligament & meniscal injuries.

Conclusion: - In conclusion, using MRI sequences, particularly the PD sequence, is critical in properly identifying and managing severe knee injuries. The PD sequence, on the other hand, stands out because it creates a balance between T1W and T2W imaging. Because PD pictures detect both fluid and fat, they are useful for diagnosing bone marrow edoema, ligament injuries, and meniscal tears. This sequencing can detect small anomalies that would otherwise go undetected, boosting diagnostic accuracy and guiding treatment decisions.

Keywords: *ACL, PCL, MM, T1W, T2W, PD, STIR.*

Introduction

History of MRI

Magnetic rotating fields were initially identified by Nikola Tesla in 1882. This discovery was made just 130 years ago, and with the aid of a paper serviette and a frail graduate student, magnetic resonance imaging has grown to be a hugely successful instrument [1]. Both Edward Purcell and Felix Bloch separately developed nuclear magnetic resonance (NMR), the science that forms the basis of magnetic resonance imaging (MRI) technology, in 1946. A portion of the 1952 physics category Nobel Prize went to Edward Purcell and Felix Bloch for their discovery. The next crucial turning point was made when Dr. Raymond Damadian suggested using NMR to recognize cancerous cells. The results of his investigations, which established the viability of his theory, were presented in 1971. In 1971, Paul Lauterbur also put forth a method for employing NMR to image living tissue in two and three dimensions. Using his NMR approach, he looked at two test tubes, one of which contained light water and the other heavy water. He was able to produce an exact cross-sectional image of each test tube. His paper was accepted by Nature and published in 1973. Dr. Raymond Damadian created the first full-body human scanner, dubbed "Indomitable," and performed the first full-body MRI on a human subject by the year 1977. The 1980 release of the first commercial MRI scanner Damadian's business, FONAR [2].

Basics of MRI

MRI is a non-invasive imaging method that employs ionizing radiation to explore the structure and function of the body in both healthy and diseased person. It is quite often used in disease detection, diagnosis and therapy monitoring. It is predicated on cutting-edge that innovation excites and uncovers modifications in protons' rotational axes in biological tissue water. It implements enormous magnets to generate an intense magnetic field that attracts the arrival of protons in human organisms. The protons are accelerated and spin out of equilibrium, once a current induced by is put into the patient pushing against the magnetic field's pull. MRI actuators have the versatility of measuring gaining authority released by protons when they If the RF field is turned off, it resets with the magnetic pole. The sum of electrical energy discharged + the time frame required the span it takes for protons to reunite with the magnetic pole varies depending spent waiting for protons to reunite with the magnetic pole varies relying on the circumstances and chemical formula of the molecules [3].

Anatomy of knee

One of the cartilages is the knee strongest joint in the body, allowing body weight to be transmitted to the leg. Movement over the knee aids in daily actions such as walking, sitting, and standing. Traumatic knee injuries are most common and often caused by sports activity leading ads to severe pain. The knee imaging needs a modality that provides high resolution and can image small structures, which can be provided by Magnetic Resonance Imaging (MRI). MRI is a well-preferred modality in imaging and locating pathology in most patients with knee complaints. MRI is used in trauma knee to compare conjointly with additional joints and operates as an insightful diagnostic tool equipment that helps in menisci and ligament, osseous structures, articular surface, and tendons MRI is the technique of choice for evaluating bone marrow because of its greater capacity to create high-resolution images with perfect soft tissue contrast. The production of bone marrow edema is aided by an increase in interstitial water content and hyper perfusion. The phrases bone bruise, bone contusion are widely utilized for describing describe an unbeknownst-to-bone deterioration that is oedematous and haemorrhagic as a result of trabecular microfractures caused by a direct blow to the bone, The implantation of compressive loads to adjacent bones, subsequently followed by the collision mechanism, as well as the effect of a torsional force and traction, stresses on the bone below the vertebral column caused by Ligament, tendon, or cortical intrusion [4]. Marrow, oedema might be identifiable in a patient variety of conditions an infectious disease, temporary osteoporosis of the hip bone marrow, and neoplasm all constitute avenues Frequently a somewhat extremely active T2 signal and a less intense T1 signal, however, the clinical history and location of the damage usually allow the right diagnosis to be recognized [5]. On T2 W (MR) images, bone marrow oedema defined as ill-defined exaggeration in bone marrow picked up by routine image analysis revealed nonspecific osteopenia or normal findings [6]. Trabecular contusion appears as bone marrow oedema on MR imaging. Although bone marrow oedema is nonspecific and can mimic inflammation. and neoplastic conditions in appearance, a traumatic cause is usually obvious based on the location of edema and the presence of other trauma-related findings. Following in the occasion of a knee injury, bone-marrow oedema tends to occur subchondral [7]. With its multiplanar capabilities and good soft tissue contrast, magnetic resonance imaging (MRI) has established itself as the dominant technique for the non-invasive evaluation of sports knee injuries [8]. In the diagnostic workup of patients with knee symptoms, magnetic resonance imaging is a well-accepted imaging modality that has virtually superseded diagnostic arthroscopy [9]. It is recognized as the best imaging and diagnostic tool for the knee joint due to its ability to evaluate a wide spectrum of anatomy and pathology ranging from ligamentous injuries to articular cartilage diseases. The imaging of the knee demands exceptional contrast, high resolution, and the capacity to see extremely minute structures, all of which MR imaging can give. The development of sophisticated diagnostic MR imaging techniques for joints is becoming more clinically important, as musculoskeletal imaging is a fast-increasing topic in MR imaging applications [10]. The menisci, or meniscus, are crescent-like fibrocartilage wedges that form the medial and lateral sides of the tibial plateau. Each disc splits into an anterior and posterior horn, a body, and an outside horn. They work to stabilize the knee joint, disperse axial strain, absorb tension, and give hydration and nutrition to the joint. A meniscal tear is signified by an angular intra-meniscal signal that engages the meniscus's outer or inner articular surface, or by a flaw in the meniscus's normal organization [11]. The ACL emerges beneath the medial rim of the posterior lateral femoral condyle beneath the intercondylar notch and descends into the tibial eminence when the knee is extended, with fibres oriented aligned to the ceiling of the intercondylar notch. It takes the form of 2 distinct bundles: the anteromedial and posterolateral bundles. MRI is quite accurate in detecting full ACL rupture. There is swelling within the ligament with acute, full-thickness ACL injury, as well as focal total discontinuity of fibres and often aberrant orientation [12]. The PCL starts on the lateral face of the medial femoral condyle within the anterior intercondylar notch and inserts distally onto the posterior tibial intercondylar fossa near the root of the medial meniscus. It is splits into two sections: the bigger anterolateral bundle and the smaller posteromedial bundle. The anterolateral bundle is tautest in flexion, whereas the posteromedial bundle is tautest in extension. The PCL serves to inhibit posterior tibial translation as well as external tibial rotation [13]. The MCL is the predominant posteromedial knee stabilizer and is composed of superficial and deep layers. The superficial MCL develops dorsal and proximal to the medial femoral epicondyle and attaches to the semimembranosus vein and the tibial posteromedial crest. The profound MCL is a thickening of the medial joint capsule with meniscofemoral and monoidal aspects. The superficial MCL is the major valgus force and tibial rotation stabilizer; the deep MCL limits secondary valgus force and acts as a tibial internal rotation constraint. Knee dislocations are rare; however, they frequently result in multi-ligamentous injuries involving the CL and either the MCL or the PLC [14] . The knee has several joint recesses, including the suprapatellar, infrapatellar, medial, lateral, and intercondylar recesses. Trauma, infection, and several rheumatological diseases can all create a joint effusion or an excess of fluid inside these recesses. On T2W images, simple joint fluid is smoothly hyperintense, while T1W images are hypointense, with just an inadequate band of enrichment on post-contrast T1W FS photography [15] .

Magnetic resonance imaging sequences

Magnetic resonance imaging (MRI) can be used to evaluate your knee using an abundance of pulse sequence shifts and combos. Ligaments, tendons, and menisci all have exceptionally organized collagen structures that impede hydrogen molecule transportation via magnetization in standard MRI pulse sequences; as a result, they on traditional MRI pulse sequences, the signal is uniformly low (dark or hypointense). Degeneration or shredding of these structures disrupts collagen homogeneity, resulting in increased signal intensity in damaged locations. Because of its high sensitivity in detecting fibrocartilage signals, proton density sequences are predominantly employed to analyse the menisci. A fluid-sensitive sequence (FS T2-W or IR sequence) is particularly useful in detecting acute damage because it allows the visualization of marrow and soft tissue oedema; at least one plane of imaging should use a fluid-sensitive sequence. The 3.0T magnets offer a far greater signal-to-noise ratio than the 1.5T magnets, allowing for higher resolution techniques to image the structures in the knee. MRI protocols for the knee typically include three orthogonal imaging planes of section (axial/coronal and sagittal) and a combination of fluid-sensitive sequences, either T2-weighted & (T2WFS) or T1-weighted (T1WNFS) imaging and (PDW) FS sequences. PDW sequences in the corona and caudal aircraft have higher Amplitude and spatial resolution than T2W episodes and are more prone to meniscal disease; most regimens will include at least one high-resolution PDW sequence that can be done in either the sagittal or coronal planes. T2W sequences may reveal soft-tissue and bone-specific oedema-like signal shifts. They might even be beneficial in that describe the subsequent to surgery meniscus. T1W images are often obtained without fat saturation to evaluate bone marrow fat for marrow replacement methods or to figure out fracture lines, meanwhile T1W FS images are obtained after injectable or intra-articular contrast the shipment to detect gadolinium [16] .

T1 weighted and T2 weighted

T1-weighted MRI increases the signal of fatty tissue while decreasing the signal of water. The water signal is enhanced by T2-weighted MRI. All the information offered by these modalities is useful for MRI image interpretation and diagnosis. T1-W and T2-W scans are the most common MRI sequences. Short TE and TR timings are used to generate T1-weighted pictures. The image's contrast and brightness are mostly governed by the T1 characteristics of the tissue. T2-weighted pictures, on the other hand, are created via extending the TE and TR spans. The lustre and hue of these images mostly governed the T2 characteristics the tissue. T1 and T2-Weighted images may generally be distinguished by scrutinizing the CSF. T1-weighted examination conveys dark CSF, whilst T2-Weighted imaging reveals vivid CSF [17] .

STIR (Short Tau Inversion Recovery)

The STIR sequence, which was designed to reduce fat signal, also improves signal from tissue with lengthy T1 and T2 relaxation durations, such as neoplastic and inflammatory tissue. The time of the pulse sequence used inhibits signal from fatty tissues, resulting in ONLY WATER being visible in STIR (Short Tau Inversion Recovery) images. To measure the quantity of fat or water within a bodily part, a combination of typical T1 pictures and STIR images can be contrasted [18] .

PD (Proton Density)

When an MRI cycle is customized to produce a PD-weighted image, the tissues with the highest abundance or count of radicals (hydrogen atoms) emit the most powerful messages and exhibit finest on the graphic. The look of an MRI picture the most straightforward technique to identify PD-weighted photos is to compare the fluid signal to the fat signal. Fluids have a greyish-white colour, almost identical to fat in the body. Proton density (PD), which quantifies each voxel's reported intent of water's protons (mobile protons atoms), is the most fundamental MRI metric [19].

Fig. 1.1. Phillips Multiva 1.5T

The study is being conducted using a super-specialized MR machine, the Philips Multiva 1.5Tesla. To obtain data for this investigation, an MRI machine placed at SGT Hospital was employed. MRI Philips Multiva 1.5T is the model's name of the MRI machine. The weight of the Philips Multiva 1.5T machine magnet is 2900 kg, with a bore diameter of 60cm, a maximum FOV of 53cm, and an ultra-compact zero boil-off magnet. This unit has 16 channels with a width of 300MHz per channel. It has direct digital sampling and all RF coils have specialized low noise amplifiers for optimal signal to noise ratio. Philips Multiva 1.5T has a superior resolution parameter with a maximum scan matrix and a maximum number of slices of 2048x1024 correspondingly. The output power of the RF transmitter is 18Kv. The amplitude resolution is 16 bits, and the length, diameter, and patient aperture flare are all 60cm. This unit also has wireless physiological synchronization, various acoustic noise reduction solutions, and a patient transport system with a packable patient trolley with a weight capacity of up to 250kg.

1.1. Purpose of the study

To evaluate the role of each sequence for each pathology and compare the sequences.

1.2. Hypothesis

We hypothesized that the diagnosis and treatment of traumatic knee injuries can benefit greatly from the information achieved from various MRI sequences. T1-weighted, T2-weighted, and proton thickness pictures can uncover the degree of tissue harm, while specific arrangements like fat concealment can assist with identifying unobtrusive wounds and work on generally symptomatic exactness.

AIM & OBJECTIVES

Aim

To study the role of MRI sequences in traumatic knee injuries.

Objectives:

1. To study the role of different sequences in traumatic knee injuries & to compare them.
2. To evaluate the efficacy of MR sequences of the knee.

Materials & METHODS

4.1. Source of data:

A prospective study was carried forward for 2 years in the Department of Radio-Diagnosis of Shree Guru Gobind Singh Tricentenary (SGT) hospital and Research Institute for MRI examination of knee with traumatic injuries and complaints.

4.2. Study duration:

This study was carried out over a period of 2 year. The data was collected from October 2022 to March 2023 in the Department of Radio-Diagnosis of SGT Medical College and Hospital and Research Institute, Budhera, Gurugram.

4.3. Study type and design:

Prospective study with minimum 50 patients was taken in this study in which male and female both patients was included, all age group patients were included in this study.

4.4. Study area:

MRI area of Department of Radio-Diagnosis of SGT Medical College and Hospital and Research Institute, Gurugram.

4.5. Inclusion criteria:

1. The study will include 50 patients of traumatic knee injuries.
2. The patients of all genders(male/female/other).
3. Pain in the knee with or without swelling.

4.6. Exclusion criteria:

Any absolute contraindication for MRI.

4.7. Sample size:

A convenient sample of 50 patients of all age group.

4.8. Methods:

This study shall be carried out in the department of radio-diagnosis and imaging of SGT Medical College, Hospital & Research Institute, Gurugram, Haryana. Informed written consent will be taken from patient before the study. After imaging all the sequences are compared to conclude their role of each sequence in imaging.

4.9. Setting and resources:

The project is set in SGT hospital located in a rural area of Gurugram district, Haryana SGT hospital is equipped with an MRI scanner (phillips1.5 Tesla Multiva).

RESULT

Table 5.1: Injuries of the knee on MRI

MRI	Normal	Abnormal
Anterior Cruciate Ligament	18 (36.0%)	32 (64.0%)
Posterior Cruciate Ligament	33 (66.0%)	17 (34.0%)

MRI	Normal	Abnormal
Medial Meniscus	17 (34.0%)	33 (66.0%)
Lateral Meniscus	34 (68.0%)	16 (32.0%)
Medial Collateral Ligament	43 (86.0%)	7 (14.0%)
Lateral Collateral Ligament	47 (94.0%)	3 (6.0%)
Femur	46 (92.0%)	4 (8.0%)
Tibia	40 (80.0%)	10 (20.0%)
Fibula	50 (100.0%)	0 (0.0%)
Patella	50 (100.0%)	0 (0.0%)
Femoral Condyles	44 (88.0%)	6 (12.0%)
Tibial Plateau	41 (82.0%)	9 (18.0%)
Patellar Articular Surface	49 (98.0%)	1 (2.0%)
Joint Effusion	22 (44.0%)	28 (56.0%)
Condition Of Synovium	49 (98.0%)	1 (2.0%)

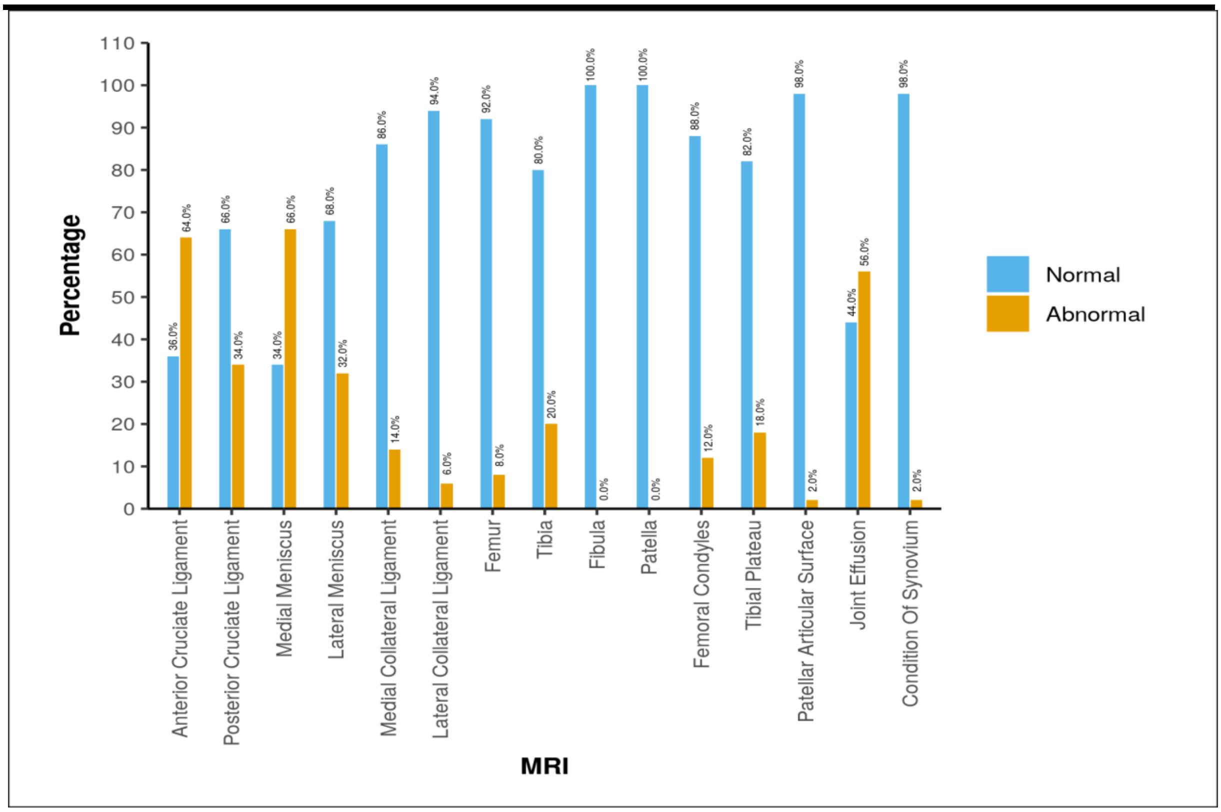

Fig.5.1. Medical impressions recorded among patients

Age	Frequency	Percentage
≤20 Years	10	20.0%
21-30 Years	17	34.0%
31-40 Years	18	36.0%
41-50 Years	5	10.0%
Total	50	100.0%

Table 5.2: Distribution of the Participants in Terms of Age (n = 50)

20.0% of the participants had Age: ≤20 Years. 34.0% of the participants had Age: 21-30 Years. 36.0% of the participants had Age: 31-40 Years. 10.0% of the participants had Age: 41-50 Years.

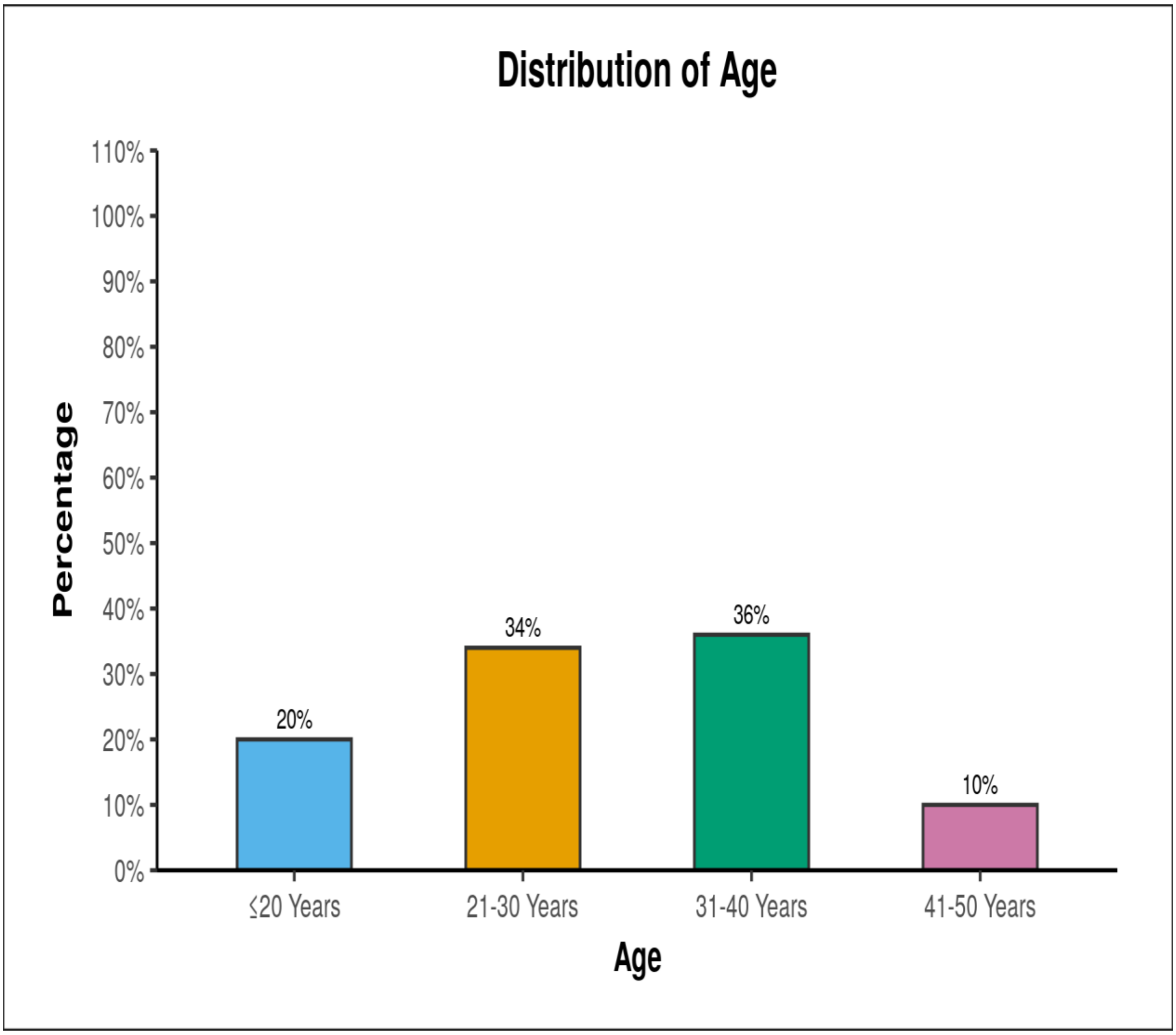

Fig.5.2. Traumatic knee injuries among different age groups

Gender	Frequency	Percentage
Male	39	78.0%
Female	11	22.0%
Total	50	100.0%

Table 5.3: Distribution of the Participants in Terms of Gender (n = 50)

78.0% of the participants had Gender: Male. 22.0% of the participants had Gender: Female.

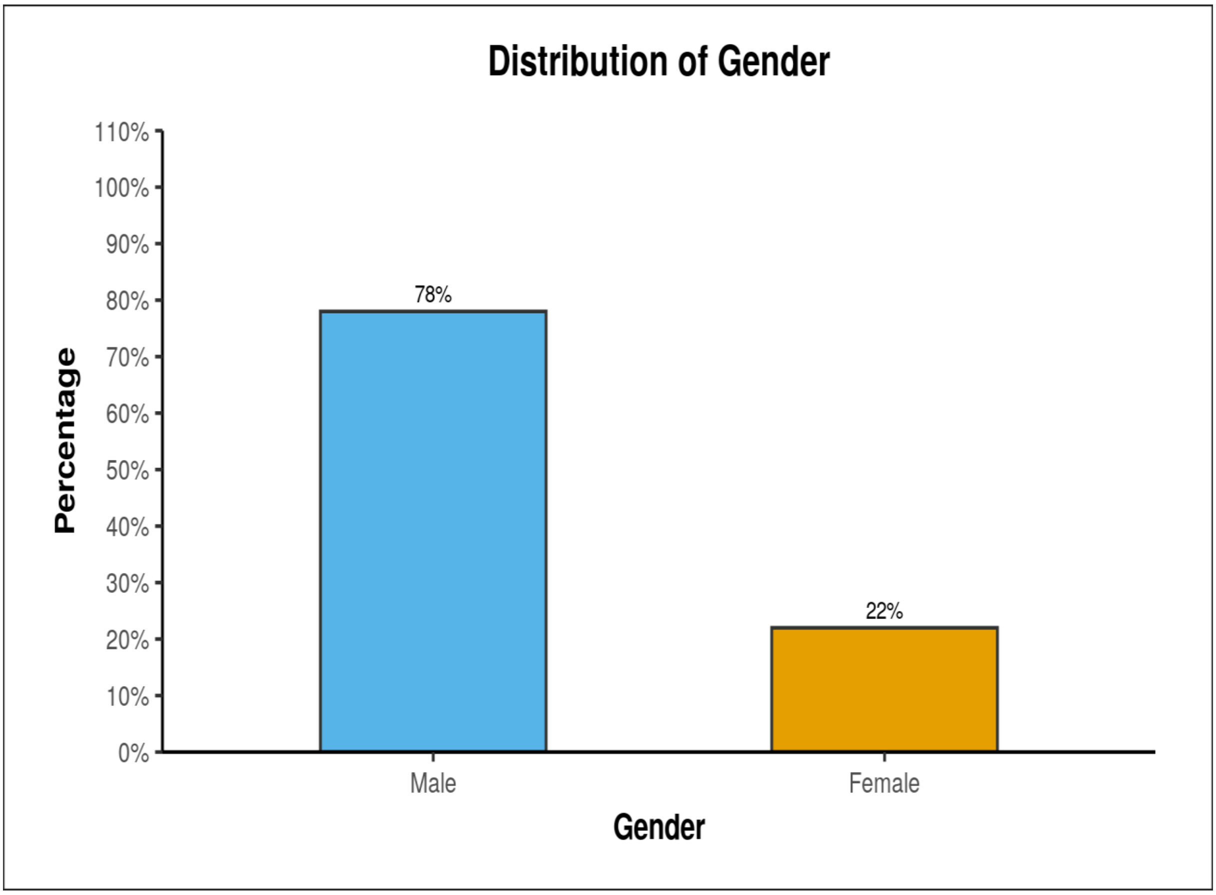

Fig.5.3. The severity of traumatic knee injuries in male and female

Distribution of sequences in terms of injuries

T1w=In knee trauma, the T1W sequence shows injuries to various structures such as tendons, bones, and cartilage. T1W sequences detecting femur, tibia bone fractures, ligament and tendon tears, and meniscal injuries.

Figure 5.4 (A &B) MRI right knee in 34 years -old male after RTA

A. Sagittal T1 W image shows fracture of lateral tibial plateau with minimal displacement. (arrow)

B. Sagittal PDFS image shows partial disruption of ACL fibers with fuzzy outline suggestive of partial tear of ACL. (arrow)

Note is made of hyperintense signal in Hoffa's fat pad (Post traumatic) (Thin arrow)

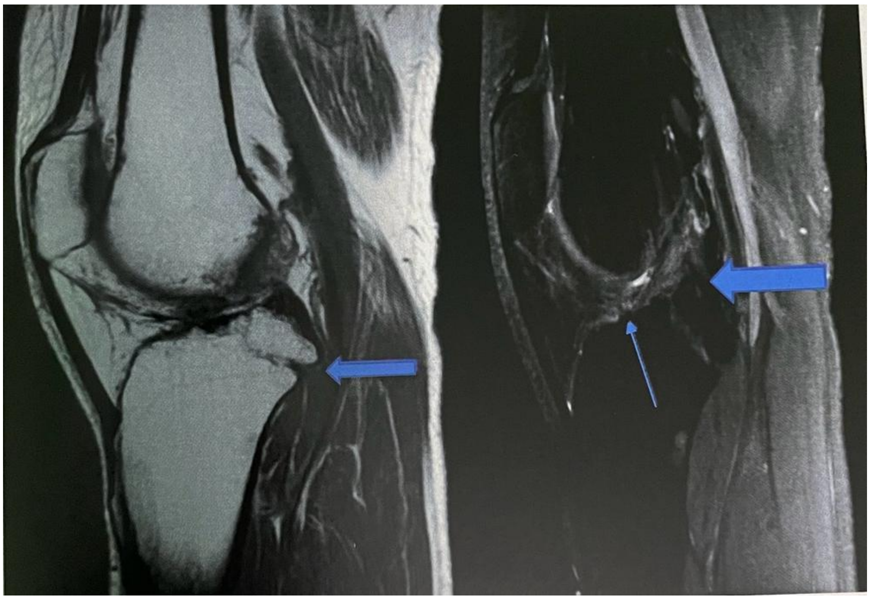

Fig.5.4 A & B. Comparing PD with T1W

T2w=T2W sequences are more sensitive to the presence of fluid, edema, which makes them useful for identifying a range of knee injuries, including ACL, PCL, MCL, LCL, and MM, LM tear, joint effusions, bone marrow edema, and fractures.

Fig. 5.5.A.T2W - Axial

Fig. 5.5.B.T2W - Coronal

Fig. 5.5.C. PD

Fig.5.5 A & C MRI left knee in a 30-year-old patient following the history of trauma A & B. Axial and coronal PDFS images show radial tear of the medial meniscus with knee joint effusion. The hyperintense signal is seen involving the lateral condyle of the femur suggestive of bone contusion. (arrow) The note is made of a tiny para meniscal cyst. (Thin arrow) Oblique T2W image shows Double PCL sign in set handle tear of the medial meniscus (arrow)

PDW F. S=PDW sequence is showing, MM, LM tears, ACL, PCL, MCL, and LCL injuries. The F.S. sequence is very beneficial for diagnosing soft tissue injuries such as ligament sprains, and tendinitis. As a result, in MRI evaluations of knee trauma, PDW and F.S. sequences are frequently utilized in conjunction to offer comprehensive information regarding the amount and location of the injury.

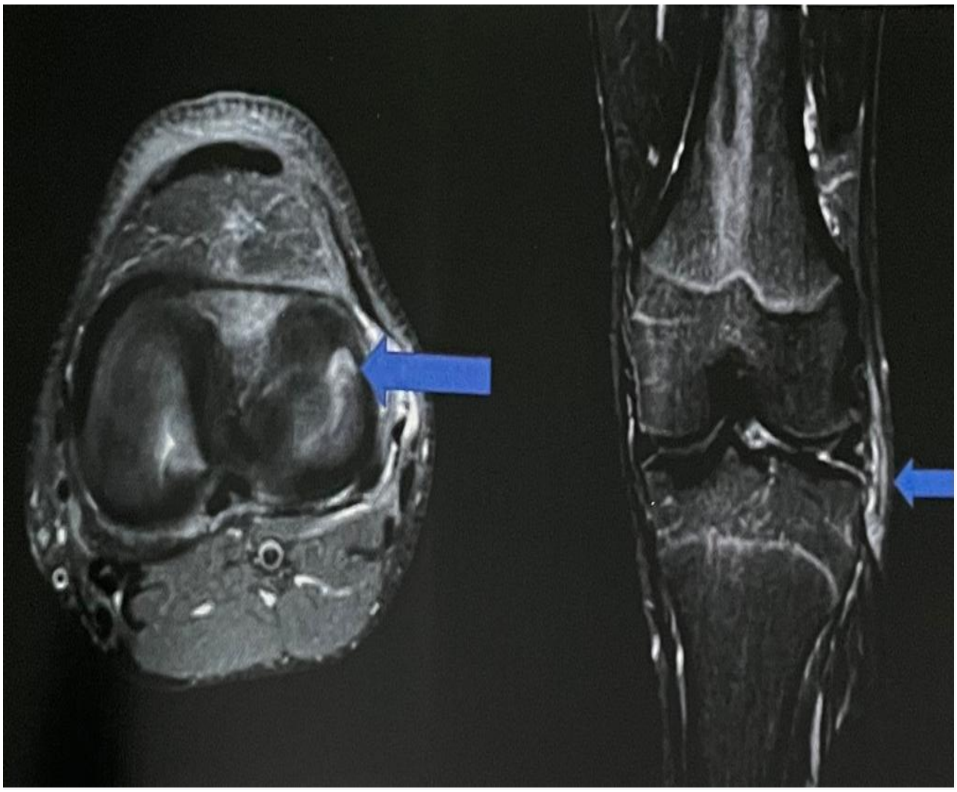

Fig.5.6. A & B Comparing PDFS and STIR

Figure 5.6 (A & B) MRI left knee in a 18 year old male following sports injury

A. Axial PDFS shows parrot beak tear of medial meniscus with hyperintense signal along lateral collateral ligament. (arrow)

B. Coronal STIR image shows hyperintense signal along lateral collateral ligament suggestive of sprain of LCL. (arrow)

STIR= The STIR sequence is used to assess knee trauma, particularly bone marrow edema. the STIR sequence is sensitive to the presence of fluid, which can be seen in areas of bone marrow edema. Other soft tissue injuries in the knee, such as ligament or meniscal tears, are identified using the STIR sequence.

Overall, a combination of MRI sequences such as PD, T1W, T2W and STIR can offer a thorough assessment of traumatic knee injuries. Each sequence has its own distinct strengths and can aid in the detection of various types of injuries. But the PD sequence is a good balance between T1W & T2W as PD images are sensitive to both fluid and fat making them useful for detecting bone marrow edema and useful for detecting ligament & meniscal injuries.

Discussion

The study's goal was to investigate the role of MRI in assessing knee joint-related sports injuries. The study involved twenty patients. MRI has been demonstrated to be an extremely useful diagnostic technique, delivering comprehensive images of soft tissue structures, cartilage, ligaments, and bone. It aided in the diagnosis of numerous sports injuries such as ligament tears, meniscal injuries, and bone fractures. The information gathered of the MRI aided in the precise diagnosis, allowing for suitable treatment planning and rehabilitation tactics. The study emphasized the importance of MRI in the therapy of sports-related knee injuries, which contributed to better patient outcomes [20]. Fat-suppressed PD-weighted TSE-sequences were compared to arthroscopy in detecting ACL/PCL abnormalities. The researchers wanted to see how accurate MRI was at detecting ACL/PCL tears. When compared to arthroscopy, fat-suppressed PD-weighted TSE-sequences displayed a high sensitivity and specificity for detecting such lesions. This suggests that imaging MRI can be a viable non-invasive method for identifying ACL/PCL injuries, giving useful information for treatment planning and decision-making in orthopaedics [21]. The function of MRI has incrementally grown, and it now serves as the primary line of evaluation for most knee pathologies. It is also being used as a primary investigation for pre-and post-operative evaluation. Other modalities such as conventional radiography, arthrography, CT, and USG were not able to completely diagnose lesions of traumatic knee injuries. MRI sequences are essential in the diagnosis of a knee injury. The MRI sequence results can provide important information on the integrity of the knee ligaments, menisci, bones, and cartilage. The analysis of age distribution in this study showed that the maximum number of patients was in the age group of 30 to 40 years. 20.0% of the participants had Age: 520 Years.34.0% of the participants had Age: 21-30 Years. 36.0% of the participants had Age: 31-40 Years. 10.0% of the participants had Age: 41-50 Years. All of those participating in our study were of an active age group who indulged in a variety of daily workout, rendering them vulnerable to a knee injury. Our study also showed that 78 percent of participants were male and 22 percent were female. The present study showed that left knee injury was more common (56 percent) closely followed by right knee injury (44 percent). In combined involvement, ACL and medial meniscus tear were more common than any other combination. This was followed by ACL- LM involvement (20%). The MRI sequences in the data are used to evaluate various knee structures such as the ACL, PCL, MM, LM, collateral ligaments, femur, tibia, fibula, patella, femoral condyles, tibial plateau, joint effusion, and synovium. Regarding MRI findings of the study group: the MM is the commonest finding in our study and the patellar articular surface is the least to be injured. The most often utilized MRI sequences for examining the ACL are T1W, T2W, and PD. These sequences can assist identify a complete or partial tear of the ACL, as well as any concomitant injuries such as bone bruising, meniscal tears, or collateral ligament injuries.T1W, T2W, and PDW F.S imaging can also be used to assess PCL injuries. These sequences can aid in the identification of a complete or partial PCL tear, as well as any concomitant injuries such as bone bruising or meniscal tears. PDW F.S images are the most extensively utilized MRI sequences for evaluating MM, LM, MCL, and LCL injuries. These sequences can aid in the identification of tears as well as any related injuries such as bone bruising or ligament rips. on various sequences of MRI of the knee, the medial and lateral menisci can be detected. However, the PD sequences are the most widely utilized to visualize the menisci. Due to their low signal intensity, the femur, tibia, and fibula are often visualized as hypointense in T1-weighted sequences. T1-weighted sequences can provide detailed anatomical information on bone structures. T1W MRI sequence offers detailed anatomical information on the bones and is especially beneficial for diagnosing fractures in the femur, tibia, and fibula bones. A PD sequence with fat suppression is the most utilized sequence to visualize femoral condyles, tibial plateau, and patellar articular surface injuries. This sequence serves to highlight the soft tissues and fluid within the joint, making the bones and other components easier to recognize. A combination of MRI sequences such as PD, T1W, T2W, and STIR can provide a comprehensive assessment of traumatic knee injury. Each sequence has specific strengths and can help detect various types of ailments. However, the PD sequence is an excellent compromise of T1W and T2w since PD images are sensitive to both fluid and fat, making them effective for diagnosing bone marrow edema as well as ligament and meniscal injuries.

Summary & Conclusion

Summary:

To summarize, each sequence has strengths and disadvantages, and the sequence chosen is determined by the unique clinical indication and probable pathology. The PD sequence, on the other hand, is an ideal compromise of T1W and T2w images since they are sensitive to both fluid and fat, making them useful for identifying bone marrow edema as well as ligament and meniscal injuries. A combination of sequences is usually employed to offer a full examination of knee pathology.

Conclusion:

The present study was conducted to establish the role of MRI Sequences in traumatic knee injuries. The present study was carried out at SGT Medical College, Hospital & Research Institute, budhera, Gurugram on 50 patients who were clinically suspected of traumatic knee injuries. In conclusion, using MRI sequences is crucial in accurately diagnosing and managing severe knee injuries. T1W, T2W, PDW F.S., and STIR imaging are all useful MRI sequences for assessing various elements of the knee joint. But the PD sequence is a good balance between T1W & T2W as PD images are sensitive to both fluid and fat making them useful for detecting bone marrow edema and useful for detecting ligament & meniscal injuries. To conclude, Clinical examinations could detect the majority of injuries. However, MRI not only confirmed the clinically suspected injuries but detected other subtle findings. MRI also showed a high detection rate in posterolateral complex injuries. Hence, this study signifies that MRI is more precise in the detection of lesions or injuries by using a reliable sequence procedure that can help in the diagnosis, treatment, and management of severe knee injuries.

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