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MRI EVALUATION OF INTERNAL DERANGEMENT OF KNEE JOINT IN A TERTIARY CARE RURAL INSTITUTE IN TELANGANA

Radio-Diagnosis

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ABSTRACT

Internal derangement of the knee (IDK) is an inclusive term used to indicate certain disorders of knee joint either alone or in combination, including torn menisci, loose bodies in knee joint and damage to collateral and/or cruciate ligaments. The causes of IDK include injury to knee or repeated stress causing gradual damage to knee joint intra-articular structures. The clinical symptoms and signs in a patient having IDK include pain and/or discomfort in knee joint, knee instability and knee locking with or without limited knee flexibility. IDK interferes with normal joint functioning. MRI provides vital role in diagnosing various conditions causing IDK due to its excellent soft tissue and bony resolution, high inherent soft tissue contrast, multiplanar capability and accurate anatomical and morphological delineation of knee joint structures like cruciate and collateral ligaments, menisci and articular cartilage. We performed a detailed retrospective MRI evaluation of about 42 patients between age group of 17 years to 50 years, having IDK signs and symptomatology, between period of June 2023 to September 2023, on a state-of-the-art 1.5 Tesla Siemens Magnetom Sempra MRI scanner. The commonest findings we found associated with IDK in our study were: - meniscal tears (83.34%), followed by anterior cruciate ligament injury (73.8%), collateral ligament injury (49.6%), posterior cruciate ligament injury (23.8%), lateral patellar instability with or without patella alta (11.9%), fractures (11.9%) and miscellaneous findings (38%) like Baker's cysts, ganglion cysts, parameniscal cysts, house-maid's knee, patellar ligament injury, nerve injury, arteriovenous malformation. Knee joint effusion of varying degree of severity was noted in overall 24 cases of IDK out of 42. Pre-existent osteo-arthritis was seen in about 28.6 % cases (12 out of 42 cases). The above percentage figures only suggest that IDK is a combination of two or more individual pathologies and never an isolated pathology leads to IDK, as for example ACL injury is usually associated with meniscal tears and/or collateral ligament injury. Many other important soft tissue and cartilage structures form intra-articular components of knee joint including synovium, ligaments, tendon, synovial fluid that can contribute to IDK like signs and symptoms. We conclude that MRI is very sensitive and tissue specific diagnostic modality, giving vital information of various lesions in knee joint leading to IDK, thereby assisting the referring clinician to plan the mode of treatment. Decision making becomes easy as then the clinician can perform diagnostic or therapeutic arthroscopic procedures, prognosticate the condition and counsel patients accordingly depending on the severity and number of lesions like meniscal tears, ACL or PCL injury, collateral ligament injury and other such conditions vital to the eventual functional status of knee joint.

KEYWORDS

anterior cruciate ligament, posterior cruciate ligament, meniscal tear, graft reconstruction, internal derangement of knee

INTRODUCTION

Internal derangement of the knee (IDK) is a term used to denote certain disorders of knee joint including torn menisci, loose bodies in joint space and damaged collateral and/or cruciate ligaments, due to injury or gradual progressive damage resulting from repeated stress [1, 2, 4]. It presents clinically with signs and symptoms of pain and discomfort in knee joint, limited knee flexibility, knee instability and episodes of knee locking. The various intra-articular knee joint structures located deep in knee joint space like cruciate ligaments, menisci and articular cartilage are best imaged by MRI non-invasively with great minute details precluding use of diagnostic invasive arthroscopy in many clinical situations of IDK [1, 2, 4]. This is possible due to excellent soft tissue contrast resolution, multiplanar capabilities of MRI diagnostic modality as opposed to computed tomography (CT) and/ or ultrasonography (USG) which miss out important surgically relevant anatomical and pathological details [1,2,4,6].

MRI has thus replaced conventional arthrograms in last three decades, which are invasive and have their own drawbacks [2,4]. This development resulted from widely available MRI scanners, dedicated extremity coils, cost-effectiveness of study, open magnet systems, high field strength MRI magnets (1.5 Tesla and 3.0 Tesla magnets) providing better image details with shorter acquisition times [1, 2, 4, 6]. It is complimentary diagnostic tool for orthopedic surgeons prior to diagnostic and therapeutic arthroscopy, to plan the modality of treatment, to plan open-knee surgeries if required depending of degree of damage and functional status of knee post- evaluation by MRI and decide whether cruciate graft reconstruction is necessary in rare circumstances of complete non-functional tears of either anterior cruciate ligament (ACL) or posterior cruciate ligament (PCL) [2,3,4,5,6].

MRI also helps in evaluation of other knee joint structures like patellar tendon and quadriceps mechanism, patellar retinacula, collateral ligaments, iliotibial tract, popliteus tendon, bursae, synovium, joint fluid, bony conditions like contusions, fractures, osteochondral injuries, osteonecrosis, any subarticular bony tumors, synovial loose bodies, synovial tumors, muscle injuries, etc. [2, 4, 6, 7, 8, 9, 10, 11, 12]. Post-graft evaluation after ACL or PCL graft repairs can be done easily by MRI for graft integrity, arthrofibrosis, graft impingement, ganglion cyst formation, secondary infection, graft loosening, bony tunnel positioning in tibia and femur [3,5], without much artifacts from metallic implants as most of them are MR compatible and generate less artifacts with advent of newer metal artifact reduction MR sequences like warping.

With appropriate MR safety guidelines being followed, there is no morbidity or risk with MRI evaluation even in pediatric age group as the scan times have considerably reduced in recent decade and SNR ratio has improved, patient acceptability has increased [2,4,6]. Rarely MR contrast is required due to specific diagnosis being available by MRI which is also sensitive to change in soft tissue and bony signal characteristics with newer fat suppressed proton density sequences [1, 6, 11]. Cartilage thickness and integrity is better assessed by these thinner slice acquisition by PD-FS and gradient sequences [1, 6]. The diagnostic accuracy of arthroscopy is quite variable and is operator dependent, and it misses out inaccessible areas like peripheral meniscal tears, undersurface meniscal tears [4]. Here MRI has definite advantages [4]. Grading of cartilage injury or degeneration in patellofemoral and femoro-tibial compartment can be done easily by MRI and also to gauge severity of osteo-arthritis, with decision for further management becoming easier for referring clinician [6]. Early cartilage damage detection prevents further wear and tear of knee joint, thereby avoiding crippling knee joint abnormalities [4,6].

The main purpose of this retrospective MR evaluation of 42 cases of IDK was to find out various conditions or lesions leading to IDK and evaluate the clinical utility of this diagnostic tool in assisting referring clinician in decision making. Other vital thing was to detect the lesion burden in such cases, whether condition/ lesion is causing IDK singly or in combination due to multiplicity as well as complicity of intra-articular and periarticular knee joint structures which all can contribute to symptoms and signs pertaining to internal derangements of knee joint.

Aims And Objectives Of The Present Study

1) To evaluate various conditions of knee joint in patients with IDK.
2) To assess the importance of MRI in morphological delineation of the pathological lesions alone or in combination leading to IDK.
3) To correlate the MRI findings with relevant clinical findings, surgical findings, laboratory and histopathological findings wherever available and indicated.
4) To assess the diagnostic role of MRI in evaluation of ACL or PCL graft status, its integrity, presence of graft-related complications, assessment of bony tunnel positioning in patients having graft in situ (we found three representative cases of graft reconstruction).

MATERIALS AND METHODOLOGY

This retrospective study of MR evaluation of 42 cases of IDK was performed in Department of Radio-diagnosis, Dr Patnam Mahender Reddy Institute of Medical Sciences, Chevella, Rangareddy district, Telangana state (India) during the period of June 2023 to September 2023, on a state-of-the-art MRI 1.5 Tesla scanner of Siemens make, model Sempra (Siemens Healthcare system, Erlangen, Germany). The patients selected for the study had clinical signs and symptomatology of internal derangements of knee joint like pain, discomfort, knee instability, limited knee flexibility or locking of knee. Most of these patients had direct injury to knee due to fall or road traffic accidents, few subset of patient had history of repeated stress in form of athletic activity or farming or physical daily manual labour.

The knee joint was evaluated after ruling out various contraindications for MRI and proper history taking in form of name, age, sex, the side of knee joint right or left being confirmed, past antecedent history, occupational history, social habits, substance abuse, any relevant past surgical history, present clinical signs and symptoms, address and contact details. Basic MR sequences including Turbo spin echo T1 coronal, T2 sagittal, PD-FS in axial, coronal and sagittal planes, STIR coronal, Gradient sequence in sagittal plane were taken after taking localizer in three planes. FOV used was 160 cm, with 512 x 512 matrix, and 3 to 3.5 mm slice thickness. Patient is placed in supine position with slightly extended knee position (15- 20 degrees) and knee slightly flexed (5-10 degrees). This position allows good assessment of ACL and patello-femoral articulation, quadriceps and patellar tendon mechanism. In some cases, 3D sequence for cartilage in sagittal plane was also taken (gradient based). The coil used was dedicated knee extremity phased-array coil with 8 channels.

Image Interpretation and Analysis by Radiologist

Radiologist with experience more than five years in musculoskeletal Radiology viewed the MR images in DICOM format on Osirix software in iMac Apple systems. The interpreter recorded presence or absence of ACL tear, PCL tear, medial meniscal and/or lateral meniscal tear, collateral ligament injury. A cruciate ligament tear was diagnosed when a discontinuity in the ligament was seen with obvious MR signal abnormality. A meniscal grade 3 tear was diagnosed when tear extended upto any articular surface and also normal morphological feature of a meniscus in question was lost [1]. Same morphological grading was applied to collateral ligament injury either medial or lateral as in cruciate ligament injury grading. Articular cartilage injury or degeneration along patella, femur and tibia was also graded into three groups using a modified Noyes grading score [1]. Muscle or musculotendinous strain with injury was also graded into three groups like strain injury, partial tear and complete tear.

The data of patients was collected and put on Microsoft excel sheet, and the statistical analysis was done using percentage method to study disease burden and burden of individual lesions and their role in causing internal derangements of knee whether in isolation or in combination.

RESULTS

In our retrospective MR evaluation of 42 cases with IDK, we found commonest lesions as follows: - 1) meniscal grade 3 tears in 83.3% cases (35 out of 42 cases) 2) anterior cruciate ligament (ACL) injury in 31 cases (73.8%) 3) posterior cruciate ligament (PCL) injury in 23.8% cases, 4) lateral patellar instability with patella alta (23.8 % cases), 5) collateral ligament injury in 47 % cases, 7) Baker's cyst in 11.9 % cases (5 cases), 8) undisplaced fractures- 11.9 % cases (total 5 cases) : proximal tibial fractures (4 cases) and fracture patella (01 case) and 9) chondromalacia patellae in 10 cases (23.8 % cases).

Other miscellaneous conditions formed 38 % cases, which included – Neuropraxic nerve injury, infective erosive arthritis, arteriovenous malformation involving proximal tibia, patellar ligament injury/ degeneration, ganglion cysts complicating ACL, PCL tear and ACL graft tears and parameniscal cysts associated with lateral meniscal tears. Pre-existing degenerative osteo-arthritis was present associated with IDK in about 12 cases (28.6% cases).

From these figures given in percentage form for various individual conditions causing IDK, we can deduce that it is but combination of various conditions that lead to IDK due to obvious reasons that multiple complex intra-articular structures are present in knee joint proper with many periarticular structures that contribute to signs and symptoms pertaining to IDK. All these structures get affected by direct or indirect injury and are prone to gradual damage due to repeated stress from sports, manual physical labour or farming related activities, which we come across this area being surrounded by rural villages all around.

Specific injuries combined together to cause IDK and usually in knee injury they form common associations. Knee joint effusion was seen associated with conditions causing IDK in about 24 cases out of 42 cases. 13 cases had mild effusion, 08 cases had moderate knee joint effusion whereas 03 cases had severe grade effusion. Of all 42 cases of IDK, preexisting femoro-tibial OA changes were seen in 12 cases and another 02 cases had patellofemoral OA changes, contributing to total 14 cases of degenerative OA.

Baker's cyst formation was seen associated with 05 cases of IDK, out of which two cases had ruptured Baker's cyst with pointed inferior margins and surrounding soft tissue and muscle plane edema. Rest three cases had round convex inferior contour without surrounding edema.

Bone marrow contusions seen associated with history of road traffic accidents and history of fall presenting with IDK was noted in about 07 cases, out of which 05 cases had fractures: - fracture of proximal tibia (04 cases) and fracture patella (01 case).

Prepatellar and superficial infrapatellar bursal inflammation was seen in 05 out of total 42 cases of IDK with three cases associated with knee joint injury due to fall or road traffic accidents. Other two were seen in two young females doing household chores- housemaid's knee.

Two cases of pes Anserinus bursitis was noted along with other IDK conditions.

Single case of arterio-venous malformation was seen involving proximal tibia with its origin from tibialis anterior muscle, presenting with knee pain in a young unmarried female, who had previous history of resection of AVM of muscle concerned few months back. Intra-articular knee joint structures were normal.

DISCUSSION

The main object of this MRI evaluation of knee joint with internal derangement of knee joint was to diagnose various lesions leading to IDK, whether in combination or alone, and to assess what was the pattern of combination of various lesions [1]. For example, a case of road traffic accident with knee injury having ACL tear usually had associated meniscal tear and / or collateral ligament injury in varying degree of proportions [2, 4, 6]. In our study the commonest cause of IDK presenting for MRI evaluation was road traffic accidents with history of fall and direct injury to knee joint, second was physical activity with repeated stress in farming and manual physical labour and few had history of sports related injury.

The main advantage of MRI is its non-invasive nature and absence of ionizing radiation, and its immense diagnostic value in obviating the need of unnecessary invasive diagnostic arthroscopy, due to higher soft tissue and bony structural and pathological details in MRI with higher degree of soft tissue contrast resolution [2, 4, 6, 9, 11, 12]. Meniscal tears

along inferior articular surfaces and along peripheral aspects which are missed by arthroscopy are better evaluated by MRI, and in such cases where meniscal or cruciate ligament tears were seen, patients were guided accordingly to further therapeutic arthroscopic procedures depending upon degree of severity of tears and the functional status of knee joint in such cases [2,4]. Triaging of patients was easy. There is better acceptance and compliance on the part of patients for noninvasive MRI studies in preference to invasive diagnostic arthroscopic procedures [2,4]. Clinicians too prefer MRI prior to arthroscopy or any type of intervention and also to triage out patients for conservative management.

ACL injury was seen associated with: - 1) PCL injury in 7 cases (22.6 % cases), 2) meniscal tear in 25 cases- total 80.6 % cases (medial meniscal tear- 13 and lateral meniscal tear in 12 cases) 3) concomitant collateral ligament injury in 16 cases- about 51.6 % cases (medial collateral ligament [MCL] injury in 11 cases, lateral collateral ligament injury [LCL] in 05 cases). Ganglion cyst formation complicated ACL tears in about 03 cases. All proximal tibial fractures cases (total 4 cases) had ACL tear with high grade severity including complete tears in few, and a single fracture patella case too had ACL high grade partial tear. [FIGURES 4, 5, 6 and 7]

The grading of ACL tear/ injury which we came across was as follows: - 1) Grade 1 ACL sprain with intact ACL- 07 cases 2) Grade 2 partial tear (total 17 cases) out of which low grade ACL partial tear cases were 09, and high grade near-complete partial ACL tear cases were 08. 3) Complete grade 3 ACL tear was seen in 03 cases. All cases of complete ACL tear had undisplaced fracture proximal tibia. These findings correlated with the study conducted by Sharana Basappa G M. January year 2020 [4].

Mucoid degeneration of ACL was seen in a single case. [Figure 9]

ACL graft partial tear of grade 2 severity with laxity and bowing associated with arthrofibrosis & graft impingement was seen in a female patient of 33 years in right knee joint who underwent graft repair with semitendinosus graft two years back after episode of trauma [FIGURE 15 and 16]. Abnormal tibial bony tunnel placement was seen in this case with anterior placement of tunnel with reference to MRI equivalent of Blumensaat's line. Ganglion cysts were seen in widened tibial bony tunnel along the graft with extension along anterior knee joint line. The findings of graft related conditions correlated well with the study done by Arthur B Meyers et al year 2010 [3]

PCL injury/ tears were noted in 10 cases (23.8%), and the grading of PCL injury we found was: 1) Grade 1 sprain- 02 cases 2) Grade 2 partial tear total- 06 cases (low grade PCL tear- 05 cases and high grade near-complete PCL tear- 01 case), 3) Grade 3 complete tear – Nil. But we found one interesting case of intact PCL graft in left knee done three years back for infected torn PCL tear in middle aged adult male. In this case, PCL graft was intact with normal bony tunnel positioning in femur and tibia. However mild arthrofibrosis was seen along anterior knee joint line. [FIGURE 13, 14]

Ganglion cyst formation complicated PCL injury in 02 cases [Figure 8]. Mostly all cases of high grade tears of ACL had buckling of PCL with or without buckling of patellar ligament. These findings in PCL graft related status correlated well with findings as discussed by study done by Andrea Alcala Galiano et al year 2014 [5].

Meniscal grade 3 tears were noted in 35 out of 42 cases (83.3% cases), in our study; with medial meniscal tears seen in 17 cases (40.5 % of total cases of IDK) and about 12 cases (28.6 %) had lateral meniscal tears [FIGURES 1, 2 and 3]. Remaining six cases (14.3 % cases of total 42 cases) had combined grade 3 lateral as well as medial meniscal tears. Parameniscal cyst formation with prominent sizes was seen associated with 02 cases of lateral meniscal tears.

Collateral ligament injuries were found in 20 cases out of 42 cases (47.6% cases), out of which 09 cases (21.4 % cases) had LCL injury and 06 cases (14.2 % cases) had MCL injury. Remaining five cases (11.9 % cases) had both medial as well as lateral collateral ligament injury. In LCL injury, mostly it was conjoint tendon portion of LCL and anterior oblique band that were injured, whereas iliotibial tract injury was seen only in few cases. So also popliteal tendon and muscle injury was seen in few cases, with Grade 2 avulsion of popliteus muscle and tendon noted in a postoperative case of resection of osteochondroma of proximal fibula who presented with knee pain and foot drop two months after surgery. Probably the tumor was adherent to popliteus tendon and muscle belly. This particular teenager also had common peroneal nerve injury with perineural edema- Neuropraxic grade 1 nerve injury, which must be causing symptoms of foot drop [FIGURE 17]. Anti-inflammatory agents with leg elevation was suggested in this case by the clinician.

Specific injuries combined together to cause IDK and usually in knee injury they form common associations. For example, in our cases of knee impact injury with bone contusions which had high grade ACL tears were found always associated with either meniscal tears and/or collateral ligament tears [2, 4, 6]. Patellar maltracking with lateral patellar instability had cartilage injury in patella and trochlea, patella alta, injury related ACL or PCL tears, meniscal tears and always injury of patellar retinacula [12]. ACL graft- related situations have graft tears with laxity, meniscal tears, synovial thickening and always some form of focal arthrofibrosis [3, 5]. Fractures of tibia always had high grade or complete ACL tears with meniscal tears [2, 4, 6, 11]. Moderate to severe joint effusions most of the times led to formation of Baker's cyst as was noted in our study. Previous history of trauma or RTA leading to internal derangements, most of the time led to secondary osteoarthritis changes as seen in most of our cases having knee injuries. The degenerative changes were quite premature compared to the age of patient. These correlate with the findings of studies done by Ji Hyun Lee et al year 2017, Venkateshwara Arumugam and others year 2015, Sharana Basappa G M year 2020 [1, 2, 4]. So all the individual lesions are closely inter-related with one another due to common causative factor and/ or predisposition of other structures in and around knee joint proper by main causative injury like that of bone, cruciate ligament or meniscal injury.

Lateral patellar instability was seen in 05 cases (11.9 % cases) and was mostly associated with high riding patella (patella alta). This condition predisposes to recurrent knee injury due to instability caused as a result of patellar maltracking [12]. Patellar maltracking occurs as a result of imbalance of relationship between patella and trochlea secondary to anatomic morphologic abnormality. It presents with anterior knee pain. Young women particularly suffer from this disorder[12]. In this condition, MRI plays a vital role in patellar maltracking along with structural damage like articular cartilage loss or injury, osteochondral defects, and damage to medial patellar retinaculum. There are features of femoral trochlear dysplasia assessed by trochlear depth, lateral trochlear inclination, trochlear facetal asymmetry, in axial cuts taken 3 cm above knee joint line [12]. We calculate Insall Salvatti ratio to determine presence of high riding patella/ long patellar tendon. The lateralization of tibial tuberosity is assessed by tibial tuberosity – trochlear groove distance (TT: TG distance) [FIGURES 10, 11], and high values greater than 15 or 18 mm lead to lateral pressure on patella during extension of knee leading to patellar subluxation during extension [12]. Lateral patellar tilt can be assessed by patellar tilt angle and patellofemoral angle [12]. Hoffa's fat pad is edematous in patellar maltracking as detected on MRI PD-FS sequences [12]. So also medial patellar ligament injury is common. Chondral injuries are commonly seen, rarely osteochondral defects may be seen [9,10,11,12].

In our five cases of patellar maltracking, all had ACL injury, PCL injury as well as meniscal tears, with all of them having chronic grade 1/2 sprain injury of lateral patellar retinaculum with thickening. In all these cases, TG: TT distance was abnormal: greater than 15 mm in 02 cases, greater than 18 mm in 03 cases. Femoral trochlear facetal dysplasia with disparity in size of medial and lateral articular facets was noted along with lateral patellar tilt and angulation in these 5 cases.

Chondromalacia patellae was noted in 10 cases out of 42 cases (23.8 % cases of total cases of IDK), cause being injury (02 cases), patella alta (03 cases), lateral patellar instability (03 cases), and remaining two cases secondary to degenerative patellofemoral OA changes. Most of these cases had grade 1 or 2 cartilage injury changers whereas 03 cases had grade 3 or 4 cartilage injury with secondary bony changes.

Knee joint effusion was seen associated with conditions causing IDK in about 24 cases out of 42 cases (57.1 % cases out of 42 cases), out of which one typical case in 33 years old male patient had synovial hypertrophy with secondary infection with large infected Baker's cyst formation in popliteal fossa. 13 cases had mild effusion, 08 cases had moderate knee joint effusion whereas 03 cases had severe grade effusion.

Of all 42 cases of IDK, preexisting femoro-tibial osteo-arthritis (OA) changes were seen in 12 cases and another 02 cases had patello-

femoral OA changes, contributing to total 14 cases of degenerative OA- forming about 33.3 % cases of total 42 cases with IDK (mostly primary OA, some few had premature secondary OA due to previous episode of trauma with IDK). All these cases with primary or secondary OA changes either in patello-femoral or femoro-tibial compartment or both, had always some degree of cartilage degeneration or injury (chondromalacia) with or without underlying bony edema and/ or subchondral geode formations.

Baker's cyst formation with homogeneous MR fluid signal intensity was seen associated with 05 cases of IDK – about 11.9 % cases of IDK, out of which two cases had ruptured Baker's cyst with pointed inferior margins and surrounding soft tissue and muscle plane edema. [FIGURES 5 and 12] Rest three cases had convex inferior contour without surrounding edema. All of these conditions had moderate to severe knee joint effusion for some IDK related causative factor like bony trauma, cruciate ligament or meniscal injury. All of them had typical communication with knee joint synovial space with narrow neck like connection passing between interspace of semimembranosus and lateral head of gastrocnemius tendons along popliteal fossa.

Bone marrow contusions / edema were seen associated with history of injury with IDK in about 07 cases (16.6 % cases), out of which 05 cases (11.9 % cases) had fracture of proximal tibia (04 cases) and fracture patella (01 case) [2.3 % case]. All 04 cases of fracture tibia had either high grade or complete ACL tear with grade 3 meniscal tears and collateral ligament [FIGURE 19]. Fracture patella single case had grade 2 high grade ACL tear with Grade 2 PCL tear [FIGURE 18].

Prepatellar and superficial infrapatellar bursal inflammation was seen in total 05 of cases of IDK (11.9 % cases) with three of them associated with knee joint injury due to fall or road traffic accidents. Other two were seen in two young females doing household chores- housemaid's knee. Hoffa's pad of fat was inflamed to some extent in few of these bursal inflammatory conditions. Two cases of pes Anserinus bursitis was noted along with other IDK conditions.

Single case of residual/ recurrent large arterio-venous malformation was seen involving proximal tibial bony region with its origin from adjoining tibialis anterior muscle in proximal third leg region, presenting with knee pain in a young unmarried female, who had previous history of resection of AVM involving the concerned muscle few months back. Intra-articular knee joint structures were normal on MRI study, suggesting the knee pain was bony in origin arising from edematous marrow seen in involved proximal tibia.

SUMMARY AND CONCLUSION

In our study of MRI evaluation of 42 cases of internal derangement of knee joint, in patients with age ranging from 17 to 50 years, on 1.5 tesla Siemens Sempra MRI scanner over a period of four months, the common abnormalities or conditions we detected were:- 1) meniscal injuries (83.3%), 2) ACL injuries (73.8 %) 3)Collateral ligament injuries (47 %), 4) PCL injury (23.8%) 5) Chondromalacia patellae (23.8%), 6) lateral patellar instability with patella alta (23.8%) and 7) undisplaced fractures of tibia and patella (11.9%).

Bakers cyst was associated with conditions causing IDK in 11.9% cases, knee joint effusion in 24 out of 42 cases (57.1 % cases) whereas osteoarthritis of knee joint including patellofemoral joint was pre-existent with conditions causing IDK in about 14 cases (33.3 % cases).

Other miscellaneous cases which we found associated with clinical signs and symptoms of IDK formed about 38 % cases and included diverse cause such as arteriovenous malformation including proximal tibia with extension from tibialis anterior muscle, infective erosive arthritis of knee joint, neuropraxic injury of common peroneal nerve after resection of fibular osteochondroma, housemaid's knee, patellar ligament injury / degeneration, ganglion cysts complicating either ACL or PCL tear or ACL graft tear, parameniscal cyst with lateral meniscal tear.

Right knee was evaluated in about 24 out of 42 cases, whereas left knee was evaluated in rest of 18 patients. The male: female sex ratio was 29: 13.

Special note is made of three representative cases of cruciate ligament graft: two cases of ACL semitendinosus graft reconstruction and one case of PCL graft reconstruction. The male patient who was a laboratory technician in our hospital, aged 28 years had intact ACL graft with normal positioning of bony tibial and femoral tunnels. The other female patient aged 33 years had abnormal ACL graft with grade 2 low grade tear and bowing, laxity of graft with graft impingement due to anteriorly placed tibial bony tunnel positioned just anterior to MRI equivalent of Blumensaat's line. There was presence of arthrofibrosis along anterior knee joint line and also few prominent ganglion cysts were seen in widened tibial bony tunnel along ACL graft extending into knee joint space. Synovial thickening was seen in this case, a residue of secondary infection just two months after ACL graft. The third male patient of 48 years with PCL graft done three years back had intact PCL graft with normally positioned tibial and femoral bony tunnels in left knee, however he had mild arthrofibrosis with lateral meniscal grade 3 tear, associated with secondary OA changes due to previous trauma. Synovial thickening with plicae formation were also noted. These three interesting cases led to much efforts to review literature to ascertain the reference normal positioning of tibial and femoral bony tunnels in right and left knee separately in case of ACL as well as PCL reconstruction on coronal planes. And Blumensaat's MRI equivalent line in evaluation of femoral and tibial tunnel placement in sagittal planes was also utilized to determine the positioning of bony tunnels to reference normal cases in available literature.

Patellar ligament degeneration/ injury was noted in four cases out of which two had prepatellar bursitis (housemaid's knee) in female young patients and other two were secondary to direct trauma.

Another great learning lesson to us was evaluation of patellar maltracking with lateral patellar instability & patella alta/ long patellar tendon which led to predisposition to injury to knee joint due to patellar maltracking. We used TG:TT ratio, calculated the Insall Salvatti ratio, measured discrepancy between lateral and medial femoral trochlear facets to confirm the findings. The patella had lateral tilt or angulation with respect to trochlear facetal surface.

In this study, MRI evaluation of knee joint in IDK has led us to constellation of diverse findings which in combination led to internal derangement of the concerned knee joint. There was no isolated lesion which led to IDK. We thus could diagnose confidently various knee joint structure related conditions due to high contrast soft tissue resolution in MRI images, better bony and soft tissue structural and pathological details being evaluated by various MRI sequences and more particularly the proper visualization of morphological characteristics of articular cartilage injury in such cases by MRI. It has proved useful to referring clinician to triage the patients based on severity and degree of injury to specific ligaments, menisci, cartilage, tendons, etc. and plan conservative or surgical management. The decision making to go ahead with diagnostic or therapeutic arthroscopy was easier. MRI has a pivotal role in evaluation of cruciate ligament graft integrity and to determine the various complications associated with graft placement like graft laxity, graft impingement, presence of arthrofibrosis, ganglion cyst formation, bony tunnel positioning with reference lines etc.

Figure 1:- PD- FS sagittal image of knee showing normal bowtie configuration of lateral meniscus.

Figure 2:- PD- FS sagittal image of knee showing Grade 2 meniscal degeneration (shown by white arrow) in anterior horn of lateral meniscus.

Figure 3:- PD –FS sagittal image of knee joint showing Grade 3 meniscal tear (shown by white arrow) involving posterior horn of lateral meniscus.

Figure 4:- PD-FS sagittal MRI image of knee joint showing normal configuration of anterior cruciate ligament (shown by white arrow).

Figure 5:- PD-FS sagittal MRI image of knee joint reveals partial high grade 2 tear of ACL (shown by white arrow) with large Baker's cyst (marked with asterisk) in the popliteal fossa.

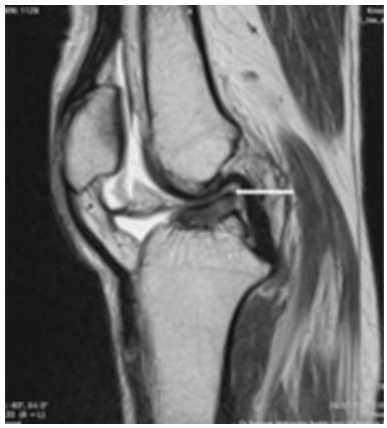

Figure 6:-T2 sagittal MRI image of knee joint showing complete tear of ACL (shown by white arrow) along with knee joint effusion.

Figure 7:- Another case of complete ACL tear (shown by white arrow) with moderate knee joint effusion (marked with asterisk) and severe bone marrow contusion in tibia.

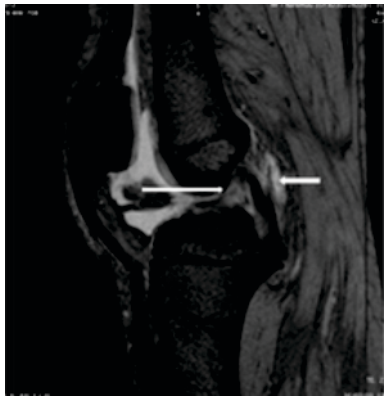

Figure 8:- Gradient sagittal MRI image of knee joint showing partial tears of ACL (shown by long white arrow) and PCL associated with small ganglion cysts posterior to PCL (shown by short white arrow).

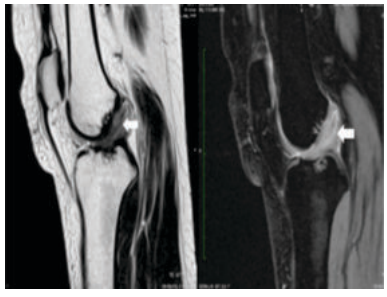

Figure 9:- T2 sagittal and PD-FS MRI images showing mucoid degeneration of ACL (h/o trauma 2 months back)

Figure 10:- Normal TG: TT distance of 5.3 mm, the green line being extrapolated from tibial tuberosity, measurements being taken in axial plane 3 cm cranial to knee joint line.

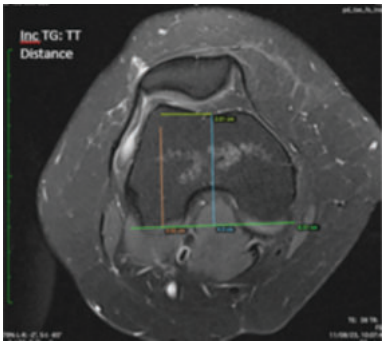

Figure 11:- Increased TG: TT distance (20.3 mm) measured in a case of lateral patellar instability in right knee joint

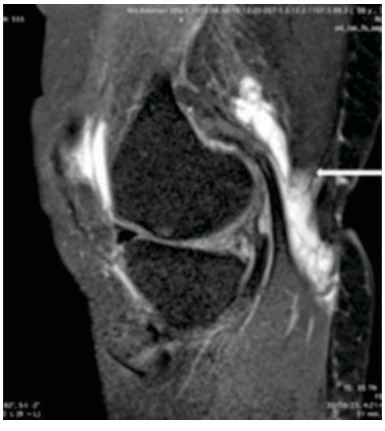

Figure 12:- Sagittal knee joint MRI image revealing large ruptured Baker's cyst with pointed inferior margin in popliteal fossa.

Figure 13:- Coronal T1WI of a case of PCL graft reconstruction in right knee joint showing normally positioned femoral and tibial tunnels.

Figure 14:- Same case as in figure 13 showing tibial bony tunnel with intact PCL graft seen in situ on coronal T1 WI. Graft was done after torn PCL got infected 2 months after trauma.

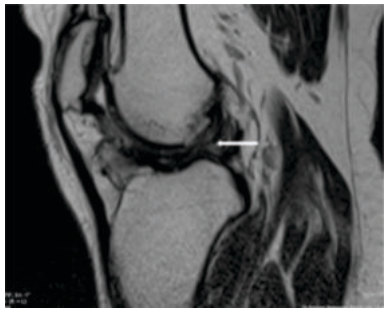

Figure 15:- Case of ACL graft in right knee showing laxity with partial low grade tear in T1 sagittal MR image, scan done two months after semitendinosus graft reconstruction.

Figure 16:- Same case of ACL graft as in Figure 16, showing tibial bony tunnel (shown by short white arrow) with small degenerative ganglion cysts (shown by black long arrows) within along the ACL graft and also extending into anterior knee joint line with areas of arthrofibrosis anteriorly marked with long white arrow

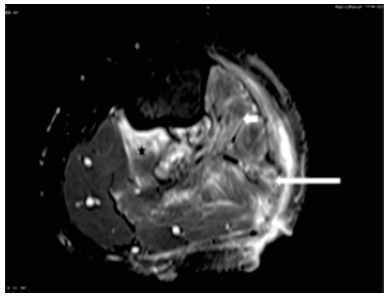

Figure 17:- Axial PD-FS image of left knee joint at level of neck of fibula (fibula not seen being resected along with osteochondroma arising from proximal fibula) showing significant perineural / nerve sheath edema shown by white arrow, patient presenting with foot drop two months later after resection surgery.

Figure 18:- PD- FS sagittal MRI image of knee joint showing patellar fracture with overlying significant prepatellar soft tissue swelling.

Figure 19:- T2 WI sagittal MRI image showing undisplaced small fracture of posteromedial corner of tibial plateau (shown by short white arrow) associated with knee joint effusion (marked with asterisk)

REFERENCES

1) Ji Hyun Lee et al. Diagnosis of Internal derangement of the knee: Volume isotropic Turbo spin-echo acquisition MRI with fast suppression versus without fat suppression: AJR 2017:208; 1304-11
2) Venkateshwara Arumugam, Ganesan Ram Garson, Parthipan Natarajan. MRI Evaluation of acute internal derangement of knee: Open Journal of Radiology; 2015; 5:6671.
3) Arthur B Meyers et al. Imaging of Anterior cruciate ligament repair and its complications: AJR 2010; 194: 476:484
4) Sharana Basappa G. M. Study on evaluation of MRI in Internal derangements of knee joint: International Journal of Radiology; Jan 2020; 13 (1): 01-06.
5) Andrea Alcala Galiano et al. Imaging of posterior cruciate ligament (PCL) reconstruction with normal postsurgical appearance and complications: Skeletal Radiol (2014) 43:16359-1668.
6) Nicolae V Bolog, Gustav Andreisik, Erika J Ulbrich; MRI of the knee: Springer International publishing, Switzerland 2015.
7) Jeremy W R Young, Skeletal trauma chapter in Textbook off Radiology and Imaging by David Sutton, Volume 2, 7th edition, 2016; Churchill Livingstone publication.
8) Robert S D Campbell et al. Internal derangements of joints, chapter from Grainger and Allison's textbook of Diagnostic Imaging, Volume 1, Editors Andreas Adam et al; 7th edition, Elsevier publication.
9) John R Haaga, David T Boll, CT and MRI of the whole body, 6th edition, Volume 2, 6th edition, Elsevier publication.
10) Greenspan Adam, Javier Beltran. Textbook of Orthopedic imaging, 7th edition, 2021 year, Wolter Klowers publication.
11) Donna G Blankenbaker, Kirkland W Davis. Textbook of Diagnostic imaging series: Musculoskeletal imaging; 3rd edition; 2021year, Elsevier publication.
12) Zaid Jibri et al, Patellar maltracking: an update on the diagnosis and treatment strategies: Insights into Imaging: (2019)10:65. https://doi.org/10.1186/s13244-019-0755-1