ISSN:0975-3583,0976-2833 VOL12,ISSUE05,2021

The Role of Radiological Techniques for Diagnosis and Treatment of Knee Pain Severity

Basil Ahmad Hajji Mohammad[1*], YasserAlyassin[2], Mukesh Kuppusamy[3], Fisal Riyad Haritani[4] and Soubhi Zitouni[5]

[1*]Specialist Radiologist, Al Waab Health Center, Primary Health Corporation, Doha, Qatar
[2]Specialist Radiologist, Muaither Health Center, Primary Health Care Corporation, Doha, Qatar
[3]Specialist Radiologist, Al Wajbah Health Center, Primary Health Care Corporation, Doha, Qatar
[4]Specialist Radiologist, Muaither Health Center, Primary Health Care Corporation, Doha, Qatar
[5]Specialist Radiologist, Abu Baker Al Siddiq Health Center, Primary Health Care Corporation, Doha, Qatar
[*]Corresponding author Email ID:dr.basilhajji@hotmail.com; Ph No: +97430078777

Abstract
A recent surge in the knee replacement among the US population was attributed to the obesity and aging. The alarming increase has spurred the research community for early diagnosis of knee pain and staging its severity for better management. Particularly, radiological equipment provides deeper insights on the reason for knee pain to provide treatment accordingly. In this review, the severity and various dysfunction of knee anatomy responsible for the pain is listed and the ways of diagnosis is discussed. Emphasis on the radiological technique was disseminated to understand its necessity for diagnosis and treatment of knee pain. Finally, the challenges involved and future perspectives of early diagnosis of knee pain severity with radiological techniques are provided.

1. Introduction

Knee pain is recognized as the most common musculoskeletal problem .The major causes of the knee pain are sudden injury, an overuse injury, or conditions such as arthritis that has been underlying for some time, which can induce swelling, stiffness and knee injury [1]. Other than these, knee pain has variety of causes.

1.1 Anatomy of knee

The main functions of a knee joint are to bend, straighten and bear the mass and weight of the human body, in conjunction with the hips and ankles. The knee is considered to be more than a simple joint that is hinged, and it is capable of rotation and twists. The knee thus encounters a variety of functions to be performed and thus relies on numerous structures which include bones, ligaments, cartilages and tendons [2]. A knee is essentially a synovial joint which means that it contains the fluids that are filled in the sacs of the joint.

The knee is designed for specific purposes that are given below.

- It supports the body condition to be and maintain in the upright position
- It helps to raise and lower the entire body
- Provides stability
- Allows turning and twisting of the legs
- Acts as an excellent shock absorber
- It helps in walking and enhances it
- Helps in the forward propulsion of the body.

The following parts helps in coordinating the functions of the knee

Bones: The knee joint comprises of four bones of which the top bone is called as femur and it is also called as femur, and tibia, which is in the lower portion of the leg, that provides the weight bearing area of the junction. A knee cap which is also called as patella is situated along the front area of the thigh bone. A bone called fibula, which is the remaining part of the calf, do not involve in the weight bearing function of the knee joint and its predominant function is to provide the stability with the help of ligament attachment [3].

Ligaments: The ligament attachments are fibrous and dense which connects the bone with each other. There are four important parts of the ligaments, and they all connect the femur to the tibia. The front and back rotational stability of the knee is provided by the anterior cruciate ligament (ACL) and posterior cruciate ligament [4]. And they are situated in the top and the back. There is also a medial collateral ligament, and lateral collateral ligament, which are located in the inner medial and the outer lateral sides of the knee that helps provide the medial and lateral stability to the knee.

ISSN:0975-3583,0976-2833 VOL12,ISSUE05,2021

Tendons: The tendons are the structures that are similar to the ligaments, which are fibrous band in structures. The tendons, instead of connecting to the other bones, they connect the muscles to the bones. There are two most important tendons in the knee which are the quadriceps muscle which lies in the front of the thigh and to the patella. The patella, tendons connects to the tibia, and it can be assumed that the tibia connects two bones. The extensor mechanism involves the quadriceps, and patellar tendons, and they are combined together by the quadriceps muscle and it helps in facilitating the leg movements and extensions [5].

Cartilages: The cartilages are otherwise also known as menisci and the collection of cartilages are called as meniscus, and they are found in the front portion of the tibia, and they lie between the tibia and at the lower portion of the femur, there are two knuckles present and this cartilage is present between the two portions [6]. The major purpose of this meniscus is to provide a smooth joint which acts as a cushion for the knees.

Bursae: There are some fluid filled sacs that prevents the knees from the shock, wear and tear, and bursae is one such part that provides a smooth functioning of the joints. There are three different parts of bursae which are important part of the knee which are prepatellar bursae, Pes anserine bursae, and infrapatellar bursae. The prepatellar bursae is located on the front side of the patella and it is the anterior region. In the middle region, the inner side of the region in the knee which is almost two inches below the knee and it is called pes anserine bursae. The infrapatellar bursae is located underneath the patella [7].

1.2 Physiology

The knee joint is an intricate mechanism that facilitates and acts as an hinge by supporting the legs and provision of the support of the legs.The main movement of the knee is flexion - extension. For that matter, knee act as a hinge joint, whereby the articular surfaces of the femur roll and glide over the tibial surface. During flexion and extension, tibia and patella act as one structure in relation to the femur.

The knee joint stability

2. Knee Severity

The ailments conditions that can arise from the knee joints and its surrounding, which can result in several complications that are detailed below.

2.1 Chondromalacia patella

The softening and the consequent break down of the cartilage tissue which is present in the underside of the knee cap is called as chondromalacia patella. There is an occurrence of pain, when the knee and the thigh bone rub and creates friction together. This could cause dull, aching pain and a grinding pain in the joints of the knee.

2.2 Knee osteoarthritis

One of the most prevalent knee conditions is the osteoarthritis that usually results in the disability in the movements such as walking, particularly in the elderly population. Patients with the chronic knee osteoarthritis are at greater risk of death and it may arise due to medical complication histories such as diabetes, cancer, cardiovascular disease. This is not a localized complication but it may affect the whole region of knee such as whole joint, cartilages, meniscus, ligament and peri articular muscle which could result from multiple pathophysiological functions. This complication arises due to the interplay between systematic and local factors and a combination of risk factors, including advanced age, heredity, trauma, knee malalignment, higher biomechanical loading of joints due to obesity, increased bone density, and an imbalance in physiological processes, can cause this degenerative and severe condition [9].

2.3 Knee effusion

Many of the common causes such as arthritis, injury in the meniscus and the ligaments, can lead to knee effusion which occurs when excessive amount of synovial fluid is accumulated in the knee joint either inside or around them. The collection of fluids in the bursa also may lead to such condition, which is commonly called as prepatellar bursitis [10].

2.4 Meniscal tear

The shock absorber between the thighbone and the shinbone is known as meniscus and the tear in this region can be caused due to sudden twist in the knee or by bearing heavy weight. The torn meniscus is one of the common problems encountered by the population and it results in swelling, pain, stiffness and difficulty in the extension of legs [11].

2.5 Anterior/Posterior cruciate ligament (ACL/PCL)

The anterior cruciate ligament is more common when compared to the posterior cruciate ligament condition. These both structures connect the thigh bone to the shinbone and whenever an either of the ligament is torn, pain and swelling occurs that creates instability in the body. The frequent causes include, motor vehicle accidents and contact sports [12].

2.6 Patellar subluxation/Tendonitis

ISSN:0975-3583,0976-2833 VOL12,ISSUE05,2021

A partial dislocation of the knee cap is known as the patellar subluxation. It is otherwise known as patellar instability and knee instability. The knee cap usually attaches the near bottom of the thigh bone and it acts as a protective bone. A direct blow is what usually pushes the knee cap to either of its original side. It creates a sharp jab of pain [13].

2.7 Rheumatoid arthritis

When the body's immune system acts its own tissue including its own tissues, the condition is termed as rheumatoid arthritis. The immune system misidentifies the body's cells as foreign invaders, inflammatory chemicals are released, which damage the synovium in the case of RA. The tissue lining around a joint creates a fluid to aid in the smooth movement of the joint. The inflammatory synovium thickens, making the joint area unpleasant and uncomfortable, as well as red and swollen, and making moving the joint difficult.

It leads to painful swelling, and affects the lining joints. If the condition persists for a longer period of time, this inflammation can cause joint deformity and hence result in bone deformity. Treatments include physiotherapy and anti-rheumatoid oral drugs.

2.8 Baker's cyst

Due to the conditions such as torn cartilages, and arthritis, the baker's cyst occurs. This condition causes the knee to produce too much lubrication and the fluid filled sac causes a feeling of tightness in the knee and makes them bulge out [15]. The treatment options include, cortisone injection, draining the fluid with a needle or by proper physiotherapy.

2.9 Gout/Pseudogout

A sudden painful swelling caused by a type of arthritis is termed as gout or pseudogout. This is the crystal induced arthropathic. Gout is generally caused by the monosodium urate monohydrate crystals. The pseudogout is caused by calcium pyrophosphate crystals and it is precisely termed calcium pyrophosphate disease [16].

2.10 Septic Arthritis

The infection in the joint fluid otherwise known an synovial fluid and the corresponding tissues are called as septic arthritis. The blood stream carries the infection to the joints. In other cases, surgery, injury or an infection causes the septic arthritis. Less commonly, it occurs due to the punctured wound or a drug infection [17].

2.11 Knee bursitis

The inflammation in the small fluid filled sac called bursa leads to the condition called knew bursitis. This inflammation usually occurs eon the inner side of the knee just below the joint. It causes pain and swelling. The causes are attributed to the overuse of knee, increased, frequent and sustained pressure, bacterial infection in the bursa, strenuous activities or simply the complications from the arthritis and rheumatoid arthritis [18].

3. Knee Pain Management

The knee pain can be managed by visiting a doctor and taking treatments.The doctor may inspect the knee for any swelling, pain, warmth, tenderness and bruising. The treatment depends upon the cause factor of the knee pain.

Medications are prescribed for the cases in which gout and rheumatoid arthritis is involved. They help in the reduction of the inflammation [19].

Strengthening of the muscle is proven to improve the stability of the knee. Various types of strengthen the muscles and the knees. It is almost likely to be dependent upon the specific condition that causes the knee pain.

The therapy often involves in recommendation of exercises, and also establishing a good technique when playing sports or performing an activity.

4. Risk factor of knee pain and complications

The knee problems are amplified by numerous risk factors few of which are enlisted below.

4.1 Over weight

Even during the performances of ordinary duties and tasks, being overweight can contribute to additional stress in the knee joints and might complicate the day to day activities. In addition, the risk increases due to breakdown of the joint cartilages, the risk of developing arthritis is enhanced [20].

4.2 Low muscle strength and flexibility

The knee injuries can be increased by the lack of strength and flexibility. Improving the strength of the muscles can help improve the flexibility and the strength of the joints which makes the mobility easy [21].

4.3 Certain sports and occupation

There are some sports that impose greater stress on the knees when compared to the other kind of sports. For instance, hiking, basketball, running and jogging may cause a great stress of the limbs and knees of the body. Certain jobs mayrequire additional and repetitive stress on the limbs such as farming and construction work [22].

ISSN:0975-3583,0976-2833 VOL12,ISSUE05,2021

5. Standard Knee Tests

Every knee checkup includes a comprehensive inspection of all knee structures in the knee anatomy, common pain patterns and possible knee injuries, mechanical symptoms that includes locking, giving away and popping also, joint infusion such as timing, recurrence, amount and the mechanism of the injury.

5.1 Physical Examination

The physical examination shall include the careful examination of the knee, palpitation in the areas such as tenderness in a particular point, joint effusion assessment, testing the range of the motion, laxity or the inspection for the injuries in the ligaments, and also checking the meniscus. The radiograph inspection may help in assessing the isolated patellar tenderness, the fibula head and the ability to move the knee to 90 degree and bear the weight [23].

The effusion of supine with addition to the knee which is injured shall be conducted. To determine and check the effusion, the suprapatellar pouch should be milked. With the patient, patellofemoral tracking should be performed and should be checked for its smooth motion.

The physical examination is done by the comparison of the knee that is asymptomatic and inspecting the injured area for erythema, discoloration, swelling and bruising. Systematic bilateral is mandatory.

By drawing one line from the top superior iliac spine through the center of the patella, the quadricep angle can be determined and by drawing another second line from the middle of the patella through the tibial tuberpisty. If the angle of the quadriceps are greater than the 15 degrees, through the tibial tuberosity. If the angle exceeds 15 degrees, then it is considered as an patellar subluxation and if the angle is further increased, the a forceful contraction emerges and might result in the sublux lateral patella.

The quadriceps' vastus medialis obliquus, in particular, should be assessed to see if it is normal or shows signs of atrophy. A patellar apprehension test should be performed and if the signs of pains show up, patellar sub luxation is the reason for the condition. The superior and inferior patellar facets should both be palpated, and the patella should be subluxed medially and laterally.

5.2. Drawer Test

If the drawers test to be performed, the patient should be assigned a supine position maintaining the injured knee at 90 degrees. If the knee is injured there will be a difficulty in marinating the knee at such high degrees. The physician will fix the foot and rotate in slight manner and then will continue to examine by placing the thumb at tibial tubercle and also the fingers in the bottom calf. The assessment of the anterior displacement of the tibia will be done by pulling the anterior part and the hamstring muscles will be relaxed. To test the integrity and performance of the anterior cruciate ligament, there is a test involved called Lachman test. It is performed by making the patient to lie in the supine position and the knee that is injured is made to flex at 30 degree. The distal femur will be stabilized by the physician in one of his hands and with the other hand, the tibia anterior part many be flexed to sublux. If there is a lack of clear end point, then the Lachman test will turn out positive [24].

The patient should assume a supine position with the knee flexed at 90 degrees for the posterior drawer test. The physician should stand next to the examination table and the posterior should be inspected for the displacement of the tibia. Then the foot should be tried to rotate in the neutral rotation and the thumb should be positioned to check the posterior calf. Then the knee should be pushed posteriorly and assessed for any displacement in the position of the tibia.

5.3. Valgus Stress Test

When the patient's legs are slightly abducted, then the valgus stress test can be performed. The physician is bound to test by placing one hand on the alteral position of the knee joint and the other hand can be kept at the medical aspect of the distal tibia. Then the valgus stress is applied to the knee held at zero degrees, for both the legs. This position is called as full extension and when the knee is held at 30 degree of flexion, and also with the zero degrees. The posterior part of the ligament circulate and the articulation of the femoral condyles with the tibial plateau and it must stabilize the knee and with the knee rotated to the 30 degree flexion the valgus stress can be analyzed for the laxity or integrity of the medical collateral ligament.

In order to execute the Varus stress test, the one hand of the physician should be kept at the lateral portion of the distal fibula and the other hand should be maintained at the patient's knee. Then this same test is performed on the knee and it is flexed to the 30 degree. A firm end point of the knee indicates that collateral ligament is intact and the soft or the absent end indicated that the complete rupture, which is regarded as the third-degree tear in the ligament [25].

When the physician examines the lateral joint line and places the fingers are at the medial joint line, the knee must be made to flex and bend maximally. In order to test the lateral meniscus and the flexion, the tibia should be roatted internally and the maximal flex should be maintained about 90 degrees. Then the sompresssion is added to the lateral meniscus and this can be done by the application of valgus test along the knee when it is being extended. The

ISSN:0975-3583,0976-2833 VOL12,ISSUE05,2021

tibia could also be rotated internally and externally and the knee is tried to extend to the maximum of 90 degrees and the compression in the medial meniscus will be received by performing the varus test and the knee joint should be extended. A positive test shall produce a break or sound such as thud and click which noticeably causes pain that is in the reproducible range of motions.

Since knee soft injuries are major in all of the patients, the plain film radiography tests are generally not recommended.

5.4. Radiological Technique

In adjunct with the clinic examination, the role of imaging is pretty much important for the estimation of the knee defects. Symptoms could be broad such as crepitus, and the mechanisms such as locking and mechanical stiffness are often reported to be an accurate diagnosis of the clinical examination when in isolation. The primary indication of the fractural management is the plain radiography. This can reveal specific bone deformity, bone density, joint congruity and the calcification. This modality can be used to assess the other disruptions such as neoplastic, infection in the vascular regions, and neurogenic disorders. Also, the examination of the knee could end up in many draw backs. Despite the information about the joints, they cannot be visualized. The knee arthrography of the meniscus and compared with the corresponding of the plain radiographs. The reported cases are as normal and show an early showed normal as corresponding to the early degenerative change in the arthrography studies that demonstrated visible tears in the areas of the medial and lateral menisci.

5.4.1 Knee X-Ray

Any pain, swelling and the abnormality in the knee can be examined by x-ray which is a crucial and first and foremost step in the detection of the abnormality. These x-rays give much more information in depth about the alignment of the knee and the damage or destruction in them.

Soft-tissue changes: The X-rays are the best when it comes to image the bones but the x-rays can detail much more information besides the structure and the integrity of the bones. The x-rays are also capable of showing signs of swelling related to the soft tissue and the excess fluid inside the knee can be studied.

Bone quality: Although the x-rays cannot be adequate for the detailing and evaluation of the bone density, they are able to detect the any change or abnormalities in the structure such as thinning and certain bone disorders.

Alignment: The x-rays can show the knee joint and abnormalities in the bone alignment when they are imaged in the standing position. Any change in the alignment is referred to as the mal-alignment and hence it can put excessive force on the parts that are in the knee bone joint and is capable of accelerating arthritic changes.

Joint spaces: The spaces between the bones are completely filled with the cartilages and they can be seen with the x-ray images. The most important signal of the knee arthritis is the narrowing down of this joint space.

Early arthritis signs: In addition to the bone spurs that occurs in the knees, other additional signs can be seen with the help of x-rays. These signs can be a tool in the investigation of the knee pain in the beginning stages of the arthritis.

Trauma and fracture: The injury of the bone can be mapped with the x-rays including the fractures. Most of the fractures can be seen on the x-rays. The most common kind of fractures includes, tibial plateau fractures and patella fractures

5.4.2 Magnetic Resonance Imaging

The magnetic resonance imaging of the knee utilizes a strong magnetic field radio waves and a computerized system that produces detailed images of the knee in the knee joint and this is the preferred modality. This is typically used to treat any pain, swelling, bleeding that can be located in and around the knee and in addition to the treatment procedures it can also be used for diagnostic approaches. It does not, in particular use any elements that are related to the ionizing radiation and it helps in assessment and determination of the treatment or the surgery required. This is a non-invasive test that provides proper medical diagnosis. Sometimes, this is used in addition to the x-ray technique and they can help us to detect the following health conditions in the knee. A detailed physical examination is done to evaluate the diagnosis such as

-sport related knee injuires
-Dead bone
-damage from arthritis
-knee cap pain and injury
-Complications that arises from the knee surgeries and implants
-damaged cartilages and so many other complications.

ISSN:0975-3583,0976-2833 VOL12,ISSUE05,2021

The MRI knee procedure and sequencing shall ensure detailed and accurate identification of both tissue and physical structures due to the variety pathologies, complicated anatomy, and a variety of injury processes. For a precise diagnosis, awareness of knee anatomy and the usual or injured MRI image of these important components are essential.

In most cases an arthrography is performed prior to the MRI scan in the knee. Contrast material is injected to the knee before the imaging. The MRI scan is a painless and non-invasive procedure. It is proven to be working in diagnosing the broad range of conditions that includes damage in tendons, ligaments, cartilages etc.

Any degeneration or tears in these structures interferes with the uniformity in the collagen of the knee structures and it shows in the signals acquired by the MRI scans. The proton density sequences helps in the primary evaluation of the menisci that their sensitivity is high in the fibrocartilage signal.

The most useful sequence is the detecting the accuracy of the marrow and the soft tissue edema. The magnets employed in the technique has high substantial more signal to noise ratio than the other types of magnets such as 1.5T magnets and thus allowing for the higher resolution protocols by imaging the structures in the knee.

Anatomic, functional, and metabolic MRI are the three types of MRI now employed for tumour imaging. The level of tumour involvement and invasion of nearby structures such as the neurologic bundle can usually be determined by standard anatomic imaging. Chemical shift images, diffusion-weighted imaging, MR perfusion, and MR spectroscopy are examples of advanced techniques that can be used if necessary.

Standard anatomic patterns consisting of T1-weighted, STIR or T2-weighted fat-suppressed, and T1-weighted postcontrast images in the musculoskeletal system serve as the traditional means of tumour evaluation. Because the hyperintense signal from yellow marrow contrasting with the T1 hypointensity characteristic of most bone malignancies, T1-weighted imaging is particularly effective for bone lesions.T1-weighted imaging has a lower contrast between any of the soft-tissue masses and muscle, hence T2-weighted images, either STIR or T2-weighted fat-suppressed, are more useful for distinguishing a soft-tissue mass. Although this relies on the tumor's pre - operative imaging features, most sites of tumour recurrence will show mass-like T2 hyper-intensity

The usefulness and applicability of knee MRI for the evaluation of perioperative change, tumours, nerves, cartilage abnormalities, and synovitis/infection continue to get better as MRI technology advances. The advancement of metal artefact reduction and ultrashort TE sequences continues to push MRI of the knee to new heights.

5.4.3 Arthroscopy

The knee arthroscopy is a procedure that is surgical and helps the doctors to view the knee joint without having to make any large incision in between the skin and the other soft tissues. This is used to diagnosis a variety of knee problems.

This knee arthroscopy is done by inserting a small camera which is known as arthroscope in the region of the knee joint. The camera will then display a video monitor and the surgeon will use the camera to monitor the surgical instruments.

This technique can detect a variety of injuries in the knee and treat them. Such as

- Damage in the anterior or posterior cruciate ligaments
- Meniscus damage and tears in them
- Dislocated patella
- Damaged cartilage and loose joints
- Helps in removing the baker’s cysts
- Knee bone fractures
- Swell in the synovium

The procedure in the common arthroscopy includes:

- Helps in removing the loose fragments in the bone or cartiale
- Treatment in the knee sepsis
- Removal or repair in the meniscus tear
- Reconstruction of a tear in the anterior cruciate ligament
- Treatment of the knee cap
- Inflamed synovial tissue removal

The treatment is done by making small incisions that are called as portals in the knee and a sterile solution is added to fill the knee and the any cloudy fluid. This helps in seeing the structure of the knee in brief. The arthroscopy uses the image that is projected on the screen. The instruments used for shaving, cutting and grasping are specialized for the particular applications and the special devices are used for stitching the bones. Most of the knee arthroscopy takes more than an hour. The duration of the surgery also depends on the problems associated with the knee and the required treatment. Sterile strips or soft bandages are used to cover up the stitches. The complications associated

ISSN:0975-3583,0976-2833 VOL12,ISSUE05,2021

with the knee arthrosurgery are low. However, if there are any complications that arises due to the surgery, it may include, knee stiffness, infection, blood clot and accumulation of the blood in the knee.

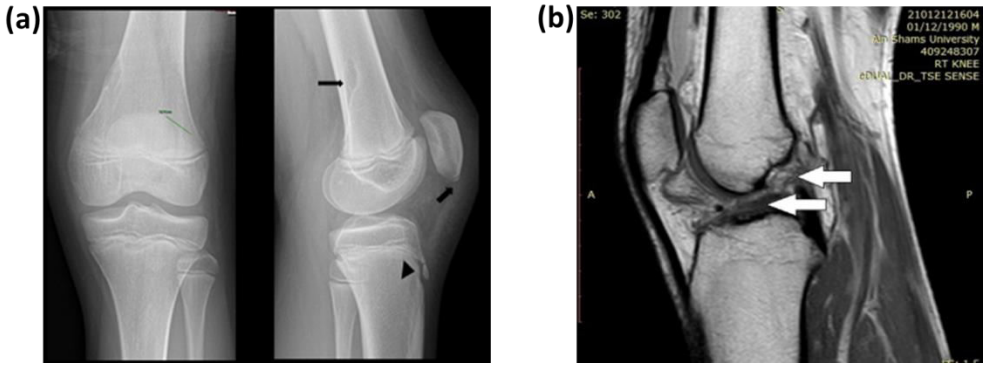

Figure 1: (a) Conventional X-ray of a subject with knee pain due to a fall 10 days before the examination and (b) MR image depicting the ACL tear.

6. Conclusion

With the recent surge in knee replacement around the globe, radiological techniques have been a complement diagnostic technique. Specifically, MRI has gained interest for early diagnosis, staging the severity and provides deeper understandings for proper treatment. The discussion in the report revealed the credibility of MRI technique for the treatment of knee pain to improve the quality of life.

References

[1] Peterson W et al., Anterior knee pain after total knee arthroplasty: a narrative review *International Orthopaedics* 2014; 38: 319-328.

[2] Abulhasan J F, Grey M J. Anatomy and Physiology of Knee Stability *Journal of Functional Morphology and Kinesiology* 2017; 2: 34.

[3] Almaawi A M et al., Kinematic Alignment on Knee Anatomy in Total Knee Arthroplasty *The Journal of Arthroplasty* 2017; 32: 2133-2140.

[4] Patel R M, Brophy R H. Anterolateral Ligament of the Knee: Anatomy, Function, Imaging, and Treatment *the American Journal of Sports medicine* 2018; 46: 217-223.

[5] Reina N, Abbo O, Brouchet A G, Chiron P, Moscovici J, Laffosse J M Anatomy of the bands of the hamstring tendon: How can we improve harvest quality? *The Knee* 2013; 20: 90-95.

[6] Robert B, Joseph S. Physical Examination of the Knee: Meniscus, Cartilage, and Patellofemoral Conditions *Journal of the American Academy of Orthopaedic Surgeons* 2017; 25: 365-374.

[7] Ruangchaijatuporn T, Udager K G, Jacobson J A, Yablon C M, Morag Y. Ultrasound evaluation of bursae: anatomy and pathological appearances *Skeletal radiology* 2016; 46: 445-462.

[8] Tuna B K, Oysu A S, Pekar B, Bukte Y, Hayirlioglu A. The association of patellofemoral joint morphology with chondromalacia patella: a quantitative MRI analysis *Clinical Imaging* 2014; 38: 495-498.

[9] Ringdahl E, Pandit S. Treatment of Knee Osteoarthritis *American Family physician* 2011; 83: 1287-1292.

[10] Rutherford D J, Kozey C L H, Stanish W D. Knee effusion affects knee mechanics and muscle activity during gait in individuals with knee osteoarthritis *Osteoarthritis and Cartilage* 2012; 20: 974-981.

[11] Maffulli N, Tarantino D, Aicale R. Meniscal Tears. Evidence-Based Orthopedics, Second Edition Edited by Bhandari M 2021; doi: 10.1002/9781119413936.ch134.

[12] Fanelli G C, Beck J D, Edson C J. Current Concepts Review: The Posterior Cruciate Ligament *Journal of knee Surgery* 2010; 23: 61-72.

[13] Geppert M J History and Physical Examination in Peroneal Tendon Injury Edited by Sobel M The Peroneal Tendons. Springer, Cham 2020; doi: 10.1007/978-3-030-46646-6_4

[14] Lee K J, Choi C H. Total Knee Arthroplasty in Rheumatoid Arthritis *Knee Surgery and Related Research* 2012; 24: 1-6.

[15] Perdikakis E, Skidas V. MRI characteristics of cysts and “cyst-like” lesions in and around the knee: what the radiologist needs to know *Insights into Imaging* 2013; 4: 257-272.

[16] Hsiung K K, Chih H Y, Sheng L H, Her L C, Shu H G. Tophaceous Gout of the Knee Revisiting MRI Patterns in 30 Patients *Journal of Clinical Rheumatology* 2010; 16: 209-214.

ISSN:0975-3583,0976-2833 VOL12,ISSUE05,2021

[17] Dave O H, Patel K A, Andersen C R, Carmichael K D Surgical Procedures Needed to Eradicate Infection in Knee Septic Arthritis *Orthopedics* 2015; 39.
[18] Draghi F, Corti R, Urciuoli L, Alessandrino F, Rotondo A. Knee bursitis: a sonographic evaluation *Journal of Ultrsound* 2015; 18: 251-257.
[19] David D, Jay L, Steven M. Current and Innovative Pain Management Techniques in Total Knee Arthroplasty *Journal of Bone and Joint Surgery* 2011; 93: 1938-1943.
[20] Goulston L M et al., Does obesity predict knee pain over fourteen years in women, independently of radiographic changes? *Arthritis Care and Research* 2011; 63: 1398-1406.
[21] Henriksen M, Rosager S, Aaboe J, Nielsen T G, Bliddal H. Experimental Knee Pain Reduces Muscle Strength *Journal of Pain* 2011; 12: 460-467.
[22] Van der Worp H, Zwerver J, Kuijer P P F M, Dresen M H W F, Scheek I V D A. The impact of physically demanding work of basketball and volleyball players on the risk for patellar tendinopathy and on work limitations *Journal of Back and Musculoskeletal Rehabilitation* 2011; 24: 49-55.
[23] Wagemakers H P et al., Diagnostic Accuracy of History Taking and Physical Examination for Assessing Anterior Cruciate Ligament Lesions of the Knee in Primary Care *Archives of Physical Medicine and Rehabilitation* 2010; 91: 1452-1459.
[24] Makhmalbaf H, Moradi A, Ganji S, Kashani F O. Accuracy of Lachman and Anterior Drawer Tests for Anterior Cruciate Ligament Injuries *The Achieves of Bone and Joint Surgery* 2013; 1: 94-97.
[25] Aronson P A, Gieck J H, Hertel J, Rijke A M, Ingersoll C D. Tibiofemoral Joint Positioning for the Valgus Stress Test *Journal of Athletic Training* 2010; 45: 357-363.
[26] De Smet E. Imaging of Anterior Knee Pain *Journal of the Belgian Society of Radiology* 2017;101:12.
[27]Hetta W, Niazi G. MRI in assessment of sports related knee injuries*The Egyptian Journal of Radiology and Nuclear Medicine* 2014; 45: 1153-1161.
[28] Jarvinen T L, Guyatt G H. Arthroscopic surgery for knee pain *British Medical Journal* 354. Doi: 10.1136/bmj.i3934.