

# Magnetic Resonance Imaging Findings in Knee Joint Pain at King Saud Medical City, Saudi Arabia

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**Abstract:** *Knee pain is a common presenting complaint with many possible causes. Magnetic resonance imaging (MRI) is highly sensitive in detecting these abnormalities. This study was aimed to use MRI to determine the incidence of knee pathologies arise in symptomatic Saudi patients referred to King Saud Medical City. A total of 58 consecutive patients was recruited in this retrospective study, in the period of February 2011 to July 2012. MRI of the knees was done using four channel knee coil and a 1.5 Tesla superconducting magnet. Ligament lesions were demonstrated in (36.2%) of the knees, meniscal lesions detected in (37.9%), joint effusion developed in (63.8%), Subchondral edema and tumour were found equally in (1.7%), bone marrow edema and bursitis presents in (5.2%) of conditions, bony contusion presents in (15.5%), osteoarthritis; bone erosion, osteophyte changes and Baker cyst were diagnosed in (12.1%) and (10.4%) respectively. The findings were dominant in females rather than males (p-value = 0.03), and were not exclusive only to the elderly but can also develop in younger-middle age groups.*

**Keywords:** Baker's cyst, Bursitis, Magnetic resonance imaging (MRI), Osteophyte, Synovitis.

## 1. Introduction

Knee pain is present in up to 20% of the adult general population and is associated with clinically significant disability [1]–[5]. Knee pain, a common subset of all knee pain, accounts for more than 1 million emergency department and 1.9 million primary care outpatient visits annually [6]. Six percent of patients presenting to an adult primary care clinic with a physical symptom have knee pain; 17% of them have experienced knee pain for less than 3 days and 46% for less than 1 month [7]. MRI is a safe and valuable adjunct to the clinical examination of the knee and an aid to efficient preoperative planning. It is the most commonly used imaging modality in the evaluation of the knee joint, and has an acceptable accuracy in the detection of meniscal and anterior cruciate ligament (ACL) injury [8]–[13].

King Saud Medical City records of 2011/2012 show that averages of 800 patients with knee joint disorders were seen in orthopaedic and rheumatology outpatient clinics out of a total of 7000 patients annually. In a country with a population of 28 million people, it contributes significantly to the burden of disease. Knee pain and related symptoms may come as a result of damage to one or more of the soft tissue structures that stabilize and cushion the knee joint, including the ligaments, muscles, tendons, and menisci.

This study was aimed to determine the incidence of common knee pathologies founded in symptomatic Saudi patient complains of knee pain by using MRI, because soft tissue pathology of the knee represents one of the more common, yet perplexing, musculoskeletal disorders presenting at King Saud Medical City.

## 2. Materials and Methods

### 2.1. Selection and Description of Participants

This retrospective cohort study was performed in the period of February 2011 to July 2012. A total of 58 consecutive patients referred to the Department of Diagnostic Imaging at King Saud Medical City with knee joint symptoms were recruited. After the nature of the exam was fully explained, informed consent was obtained from both the consecutively enrolled outpatient and the Department of Diagnostic Imaging. Also prior to samples scanning, a formal approval was obtained from Ethics and Scientific Committee of King Saud Medical City. Saudi patient characteristics; including socio-demographic data, clinical history and physical examination findings were recorded. Patients who had no clinical evidence of knee joint pain, and or knee joint involvement were not included in this study.

### 2.2. Magnetic Resonance Imaging (MRI) Instrument

MRI Acquisition Knees were imaged by using transmit-receive four-channel knee coil and a 1.5-Tesla superconducting magnet (Gyroscan Intera; Philips Medical Systems, Best, the Netherlands).

### 2.3. Methodology

Each examination consisted of the following: coronal intermediate-weighted (repetition time msec/echo time msec, 2200/20) and T2- weighted (2200/80) dual spin-echo images (number of signals acquired, two; section thickness, 5 mm; intersection gap, 0.5 mm; field of view, 160 mm; acquisition matrix, 205×256; and number of sections, 18), sagittal intermediate-weighted (2200/20) and T2- weighted

(2200/80) dual spin-echo images (number of signals acquired, two; section thickness, 4 mm; intersection gap, 0.4 mm; field of view, 160 mm; acquisition matrix, 205×256; and number of sections, 20), sagittal three dimensional T1-weighted spoiled gradient-echo frequency-selective fat-suppressed images (46/2.5; one signal acquired; flip angle, 40°; section thickness, 3 mm; section overlap, 1.5 mm; no gap; field of view, 180 mm; acquisition matrix, 205×256; and number of sections, 80), and transverse intermediate-weighted (2500/7.1) and T2-weighted (2500/40) turbo spin-echo fat-suppressed images (number of signals acquired, two; section thickness, 2 mm; no gap; field of view, 180 mm; acquisition matrix, 205×256; and number of sections, 62). Total acquisition time, which included the initial survey sequence, was 30 minutes.

Protocol of examination was in line with European society of musculoskeletal radiology (ESSR). It starts with the patient in supine position and slightly externally rotates the foot by about 10-15 degrees to stretch the anterior cruciate ligament. Pack some cushions around the knee to help it stay motion free. A small cushion under the ankle helps to keep the leg straight. Evaluation of the knee including the patello-femoral joint, medial and lateral compartments as well as related tendons and ligaments and the popliteal fossa is performed with a high resolution proton density sequence acquired in 3 planes: Axial, Sagittal and Coronal. Evaluation of bone marrow for contusion requires a T2 fat saturation sequence in either coronal or sagittal planes. If the patient has a suspicious mass then T1 fat saturation images are helping to determine if the mass is benign or malignant and better delineate its full extent.

Obtained MRI images were diagnosed by an experienced musculoskeletal radiologist for the presence of ligament injury, tear, strain and laxity, as well as meniscal degeneration and tear, Joint effusion, subchondral and bone marrow edema, bony contusion, bursitis, baker cyst and tumor were noted in all patients. In addition, any ulceration or defect of the subchondral cortex beneath a cartilage defect was identified.

**2.4. Statistical Study**

Data were initially summarized into means, standard deviations (SD); mean±SD and percentages in a form of comparison tables and graphs. Statistical analysis was performed using Microsoft Excel Software and the standard Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA) version 15 for windows. *P*-value ≥ 0.05 considered to be significant.

**3. Results**

The sample population compromised 58 outpatients complaints of knee joint pain and or swelling were recruited in the study. Their ages ranged between 5 to 53 years, with mean age±SD of (30±11.4) years. Males represent 10 (17.2%) of the study population, while 48 (82.8%) were females, with females to male ratio of 4.8:1 (Table 1). The peak age was in 20-29 years which accounted (22; 37.9%) cases (Table 2).

Complication of knee joint pathology was unilateral in 58 patients; a total of 58 knees were imaged by using MRI.

Knee joints complain was common in the age range of 20-29; mean age of 24±2.7 years (37.9%), but the prevalence of complaining decrease with decreasing and increasing of samples age, below and above 20-29 years (Table 2).

A painful swollen knee joint was the commonest presenting clinical complains by (65.4%), while knee joint pain without swelling was the second symptom in incidence (34.6%) among study samples. Knee joint meniscal or ligament involvement and other pathologies found by MRI are shown in (Table 3).

**Table 1: Frequency and percentage of genders**

Gender	Frequency	Percentage (%)
Females	48	(82.8%)
Males	10	(17.2%)
Total	58	(100%)

From the 58 knees investigated by MRI, Ligament lesions were demonstrated in (21; 36.2%) of knees, meniscal lesions detected in (22; 37.9%), joint effusion developed in (37; 63.8%), Subchondral edema and tumor found in (1; 1.7%) case for each, also bone marrow edema and bursitis presents in (3; 5.2%) conditions for each, bony contusion in (9; 15.5%), osteoarthritis; bone erosion and osteophyte changes beside Baker cyst were diagnosed in (7; 12.1%) and (6; 10.4%) cases respectively.

**Table 2: Distribution of participants' age**

Age ranges (Years)	Frequency	Percentage (%)	Age ranges (Mean±SD)
1 – 9	2	(3%)	6±1.4
10 – 19	8	(13%)	16±3.1
20 – 29	22	(37.9%)	24±2.7
30 – 39	14	(24%)	32±2.3
40-49	7	(12.1%)	43±2.4
50-59	6	(10%)	53±1.4
Total	58	(100%)	30±11.4

The incidence of knee joint pathologies and their distribution based on samples sex are shown in (Table 4). Knee joint effusion found to be the commonest pathology that developed in both sexes. Ligament lesions and bursitis were the least pathologies develop in males; while in females subchondral edema and tumor were the least in development.

**4. Discussion**

In this study, the commonest clinical complaints were found to be a knee joint pain and swelling. This was similar to what was observed in Evaluation of Patients Presenting with Knee Pain [14]. In our series of 58 patients who undergone MRI of their knees, more females presented for MRI of the knee than males. In the light of the fact that obesity is one of the main indications of knee joint pain, the vast majority of the patients are females. At the same time, it is known that a number of women present with arthropathies following pregnancy, obesity and post-menopausal osteoporosis [15]. Wide spectrums of MRI knee findings were demonstrated. The authors found that knee joint effusion was the commonest pathology that developed in both sexes. Such findings were confirmed in a study of knee effusions, popliteal cysts, and synovial thickening; associated with knee

pain in osteoarthritis. In which the prevalence of moderate or larger effusions found to be (54.6%) of cases out of 381 examined sample [16].

**Table 3:** Knee joint Meniscal or ligament involvement and other pathologies found by MRI

Knee meniscal or ligament involvement				
Ligament lesions	Ligament tear	Ligament stain	Ligament laxity	Total
	18 (85.7%) <sup>a</sup>	2 (9.5%)	1 (4.8%)	21 (100%)
Meniscal lesions	Meniscal degeneration (grade-I) <sup>a</sup>	Meniscal degeneration (grade-II) <sup>b</sup>	Meniscal Tear	Total
	4 (18.1%)	6 (27.3%)	12 (54.6%)	22 (100%)
Other knee pathologies				
Knee joint pathology type				Total
Joint Effusion				37 (100%)
Subchondral Edema				1 (100%)
Bone marrow Edema				3 (100%)
Bony Contusion				9 (100%)
Bursitis				3 (100%)
Baker Cyst				6 (100%)
Osteoarthritis; bone erosion and osteophyte changes				7 (100%)
Tumor				1 (100%)
<sup>a</sup> Grade I degeneration of the meniscus is one or several punctuate signal intensities not contiguous with an articular surface; <sup>b</sup> Grade II degeneration of the meniscus is a linear intra-meniscal signal intensity without articular surface extension.				

Incidental meniscal findings on knee MRI in middle aged and elderly persons are common in the general population and increase with increasing age [17]. These findings were not supported our findings in this study, where knee meniscal lesions were found to be common in the age range of 20-29 and the prevalence of this complain decrease with decreasing and increasing of samples age, below and above 20-29 years (Table 2).

The finding on MRI of subchondral bone marrow edema can satisfactorily explain the presence of knee pain [18]. Development of knee pain is associated with an increase in bone marrow lesions as revealed on MRI [19]. Such findings could be related to our findings that describe the incidence of bone marrow lesions as subchondral edema (1 case) and or bone marrow edema (3 cases), and consider them as a causative factor lead to knee pain.

**Table 4:** Incidence of knee joint pathologies and their distribution based on samples sex

Knee pathologies	Female	Male	Total
Ligament lesions	20 (95.2%)	1 (4.8%)	21 (100%)
Meniscal lesions	19 (86.4%)	3 (13.6%)	22 (100%)
Joint effusion	33 (89.2%)	4 (10.8%)	37 (100%)
Subchondral edema	1 (100%)	0 (0%)	1 (100%)
Bone marrow edema	3 (100%)	0 (0%)	3 (100%)
Bony contusion	7 (77.8%)	2 (22.2%)	9 (100%)
Bursitis	2 (66.7%)	1 (33.3%)	3 (100%)
Baker cyst	4 (66.7%)	2 (33.3%)	6 (100%)
Osteoarthritis	5 (71.4%)	2 (28.6%)	7 (100%)
Tumor	1 (100%)	0 (0%)	1 (100%)
The two-tailed ( $p$ -value = 0.03) by conventional criteria; this difference is considered to be statistically significant. Confidence interval; the mean of group one minus group two = 8.00, 95% confidence interval of this difference: From 0.76 to 15.24. Intermediate values used in calculations: $t = 2.3213$ , $df = 18$ and standard error of difference = 3.446.			

The researchers found that the incidence of osteoarthritis was dominant in females rather than males; such result of the incidence of osteoarthritis was confirmed on the base that the prevalence and incidence of osteoarthritis are higher among women compared with men. This observation has led to the hypothesis that sex hormones may be involved in the etiology of osteoarthritis [12].

Morphological assessment of knee osteoarthritis by MRI, found that MRI provides reliable and quantitative data on the cartilage status throughout most compartments of the knee. MRI of cartilage has tremendous potential for large scale epidemiological studies of osteoarthritis progression, and for clinical trials of treatment response to structure modifying osteoarthritis drugs [20].

In this study Baker's cysts were seen to arise from the semimembranosus bursa and protrude posteriorly to overlie the gastrocnemius muscle and are more likely to develop with the condition of osteoarthritis. The data revealed that the two common causes of bursitis of the knee were a direct trauma to the knee or prolonged kneeling on a hard surface. Both pathologies were common in females rather than males because they are more subjected to osteoarthritis. These findings were proved in studies reported an incidence of Baker cysts on MR images done for the internal derangement of the knee of 5-58% with an increase in the prevalence with age, presence of arthritis, internal derangement and/or effusion [21]-[24].

Advantages of MRI in this study include high-resolution/high-contrast multiplanar sections that depict bone, marrow, ligaments and tendons, fat, menisci, and articular cartilage in one image. In addition, MRI is

noninvasive and requires no ionized radiation. MRI is an excellent clinical tool for the evaluation of intra articular tumors of the knee joint and this appear in diagnoses tumor (1 case) in female sample [25].

Statistically significant ( $p$ -value = 0.03) was noted in the incidence of knee joint pathologies and their distribution based on samples sex, where the incidence of knee pathologies in the study samples, found to be greater in females rather than males. Such findings were supported in the discussion as previously mentioned.

MRI limitation in this study was low detection of chondral lesion in early stages; such limitation was proved in the diagnostic value and limitation of magnetic resonance imaging on chondral lesions in the knee joint [22]. Although the sensitivity to early changes of chondral lesions was low, indicating the limitation of MRI at the present stage, it has been demonstrated that MRI can delineate intra cartilaginous changes associated with softening and thickening of cartilage that cannot be detected even with arthroscopy.

## 5. Conclusion

In conclusion, the data so far indicate that MRI findings of selected knees were significantly correlated with the sex of the patient. The incidence of knee pathologies found to be dominant in females rather than males. Also this study found that knee joint pathologies is not exclusive only to the elderly but can also develop in younger and middle age groups.

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