ОРИГИНАЛЬНАЯ СТАТЬЯ

MAGNETIC RESONANCE IMAGING IN THE DIAGNOSIS OF KNEE JOINT OSTEOARTHRITIS

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Purpose. To analyze the spectrum of morphological changes in all knee joint structures in middle-aged and elderly patients with knee osteoarthritis (OA) according to magnetic resonance imaging data.

Materials and Methods. The analysis of MR images of the knee joints of 81 patients (67 women, 14 men, average age 65 years) with an established diagnosis of OA, with complaints of mechanical pain, starting pain, swelling and hyperemia was performed. MRI was performed on a SIGNA Creator 1.5 T MRI scanner; General Electric Company. All joints were examined in coronary, sagittal and axial sections. The distance between the slices ranged from 2.5 to 3.5 mm. The following sequences were used – T1-WI, T2-WI, PD FS, STIR.

Results. MRI revealed a wide range of changes in soft tissue and bone intraarticular structures including osteophytes of the articular surfaces of the femur and tibia (93.8%), dystrophic changes in the menisci (92.6%), dystrophic changes in hyaline cartilage (88.8%), intraarticular effusion (79.01%), dystrophic changes in the tendon-ligamentous apparatus (77.7%), osteochondral lesions (76.54%), bone marrow edema (62.9%), subchondral cysts (53.08%). Taking into account the analysis of bibliographic sources, systematized data on the MR picture of the revealed pathological changes are presented.

Conclusions. Osteoarthritis of the knee joint is a disease that worsens the quality of life of the population mainly middle-aged and elderly, as well as young people. Magnetic resonance imaging due to the possibility of visualizing all structural changes in knee joint at various stages of the disease has advantages and makes it possible to reliably assess morphological changes, including in the process of monitoring dynamics and prescribe adequate, timely therapy for OA.

Keywords: magnetic resonance imaging (MRI), osteoarthritis, knee joint.

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МАГНИТНО-РЕЗОНАНСНАЯ ТОМОГРАФИЯ В ДИАГНОСТИКЕ ОСТЕОАРТРОЗА КОЛЕННОГО СУСТАВА

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Цель исследования. Анализ спектра морфологических изменений всех структур коленного сустава у больных остеоартрозом среднего и пожилого возраста по данным магнитно-резонансной томографии.

Материалы и методы. Выполнен анализ МР-изображений коленных суставов 81 пациента (67 женщин, 14 мужчин, средний возраст 65 лет) с установленным диагнозом ОА, с жа-

лобами на боли механического характера, стартовую боль, отечность и гиперемию. МРТ выполнялась на МР-томографе SIGNA Creator 1,5 Тл; General Electric Company. Все суставы исследовались в корональной, сагиттальной и аксиальной плоскостях. Расстояние между срезами составляло от 2,5 до 3,5 мм. Использовались следующие последовательности: Т1-ВИ, Т2-ВИ, PD FS, STIR.

Результаты. По данным МРТ выявлен широкий спектр изменений мягкотканных и костных внутрисуставных структур, включающий: остеофиты суставных поверхностей бедренной и большеберцовой костей (93,8%), дистрофические изменения менисков (92,6%), дистрофические изменения гиалинового хряща (88,8%), внутрисуставной выпот (79,01%), дистрофические изменения сухожильно-связочного аппарата (77,7%), остеохондральные повреждения (76,54%), отек костного мозга (62,9%), субхондральные кисты (53,08%). С учетом анализа библиографических источников, приводятся систематизированные данные о МР-картине выявленных патологических изменений.

Заключение. Остеоартроз коленного сустава – заболевание, которое ухудшает качество жизни населения в основном среднего и пожилого, а также молодого возраста. Магнитно-резонансная томография в связи с возможностью визуализации всех структурных изменений КС на различных стадиях ОА имеет преимущества по сравнению с рентгенографией и дает возможность достоверно оценить морфологические изменения, в том числе в процессе мониторирования заболевания, и назначить адекватную терапию ОА.

Ключевые слова: МРТ, остеоартроз, коленный сустав.

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Introduction.

The knee joint osteoarthritis (OA), also known as degenerative – dystrophic joint disease, is one of the leading causes of functional impairments and disability among middle-aged and elderly people, the ratio of the number of men to the number of women is 3:4 respectively.

According to the latest epidemiological data the prevalence of knee OA is estimated to increase from 1.5% to 15.9% [1].

Hereditary susceptibility, mechanical forces exerted on the joints, high loadings (professional and sports) at the knee, metabolic and endocrine disorders, joint dystrophic degradation, overweight and obesity are common risk factors of the development knee OA.

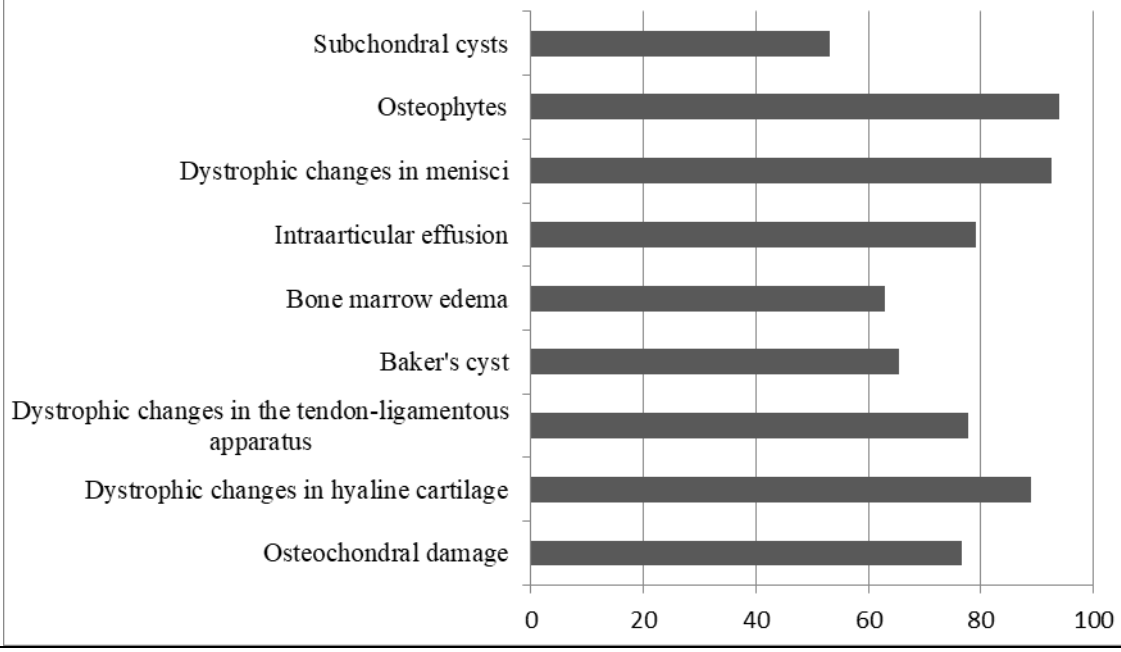
Being the main cause of articular hyaline cartilage dystrophy an abnormal metabolism leads to the decreased synthesis of chondroitin sulfate and, accordingly, to the proteoglycans degeneration; altered collagen and protein synthesis progresses to dehydration of cartilage, its thinning, fiber disintegration and results in its destruction. Small cartilaginous fragments irritate the synovium and cause synovitis. As the loss of the articular cartilage continues the shock absorbing ability is lost, loading on bone tissue increases, subchondral osteosclerosis is developed as a protective-adaptive response, cysts are formed in the underlying bone tissue. Ossification of the remaining cartilage fragments directly contributes to the formation of osteophytes developing at the peripheral margins of joints [2].

Typical symptoms of the knee joint osteoarthritis's (OA) clinical presentations are joint pain most often of a mechanical nature with its intensification in a standing alignment when the joint is loaded and pain that abates after rest, including at night.

While there are improvements in the treatment of osteoarthritis such as physiotherapy, new orthopedic designs, physiotherapeutic and drug treatment protocols, endoprosthesis, the challenge is higher quality recognition, improved visualization of joints in patients with OA.

Routine radiography remains the most standardized, common and cost-effective tool in the diagnosing and evaluation of the OA joint. In epidemiological and clinical studies the radiography is used to evaluate joint space narrowing being the consequence of the hyaline carti-

Table №1. Pathological changes seen in OA knee joints patients.



lage's thinning, flattening of the articular surfaces of the femur and tibia condyles, and osteophyte formation. However, with modern therapeutic approaches to the treatment of knee OA, it is important to have methods that can detect minimal structural changes and will reveal its pathogenetic aspects. Magnetic resonance imaging (MRI) can provide the most optimal visualization of the whole knee joint simultaneously, including the state of the bone marrow of the articular ends of the bones, hyaline cartilage and menisci, and the tendon-ligamentous apparatus, with the advantages of the absence of ionizing radiation exposure [3].

Purpose.

The objective of this study is to analyze the spectrum of morphological changes in all knee joint structures in middle-aged and elderly patients with knee osteoarthritis OA according to magnetic resonance imaging data.

Materials and Research Methods.

MRI of the knee joints (SIGNA Creator 1.5 Tl MR tomograph; General Electric Company; T1-WI, T2-WI, PD FS, STIR) was performed in 81 patients (67 women, 14 men), middle-aged and elderly (average age 65 years), with an established diagnosis of OA; the median indicator was 66 (20;90) years. All examined patients reported joint pain of a mechanical nature (of standing alignment and gait), "starting pain" (transient morning stiffness that abates with movement), swelling and skin hyperemia of the knee when loading the joint. A total of 81 knee joints were examined. The MRI study of all knee joint structures comprised coronary, transverse and sagittal planes. The study also comprised the shape of the bones, the condition of the articular cartilage, menisci, tendon-ligament apparatus, synovium. The presence of intra-articular effusion and signal characteristics of the bone marrow were also evaluated.

Results and Discussion.

MR imaging of knee joints in these patients revealed soft tissue changes and changes in bone intra-articular structures (table 1).

The presented findings have demonstrated the prevalence, according to their frequency, of such alteration as osteophytes of articular surfaces of femur and tibia (93.8%), dystrophic meniscus changes (92.6%), dystrophic changes in hyaline cartilage (88.8%), osteochondral lesions (76.54%), all of them being the manifestations of OA. In accordance with descending degree also have been revealed: intra-articular effusion (79.01%), dystrophic changes in the tendon-ligamentous apparatus (77.7%), swelling of the bone marrow (62.9%), subchondral cysts (53.08%).

Osteophytes, which were seen in 93.8% of findings, had different localization and grade of severity.

Osteophyte formation includes the presence of articular cartilage's dystrophic changes (thinning, fragmentation, loss of cartilage), leading to an increased mechanical load on the subchondral bone and the appearance of mi-

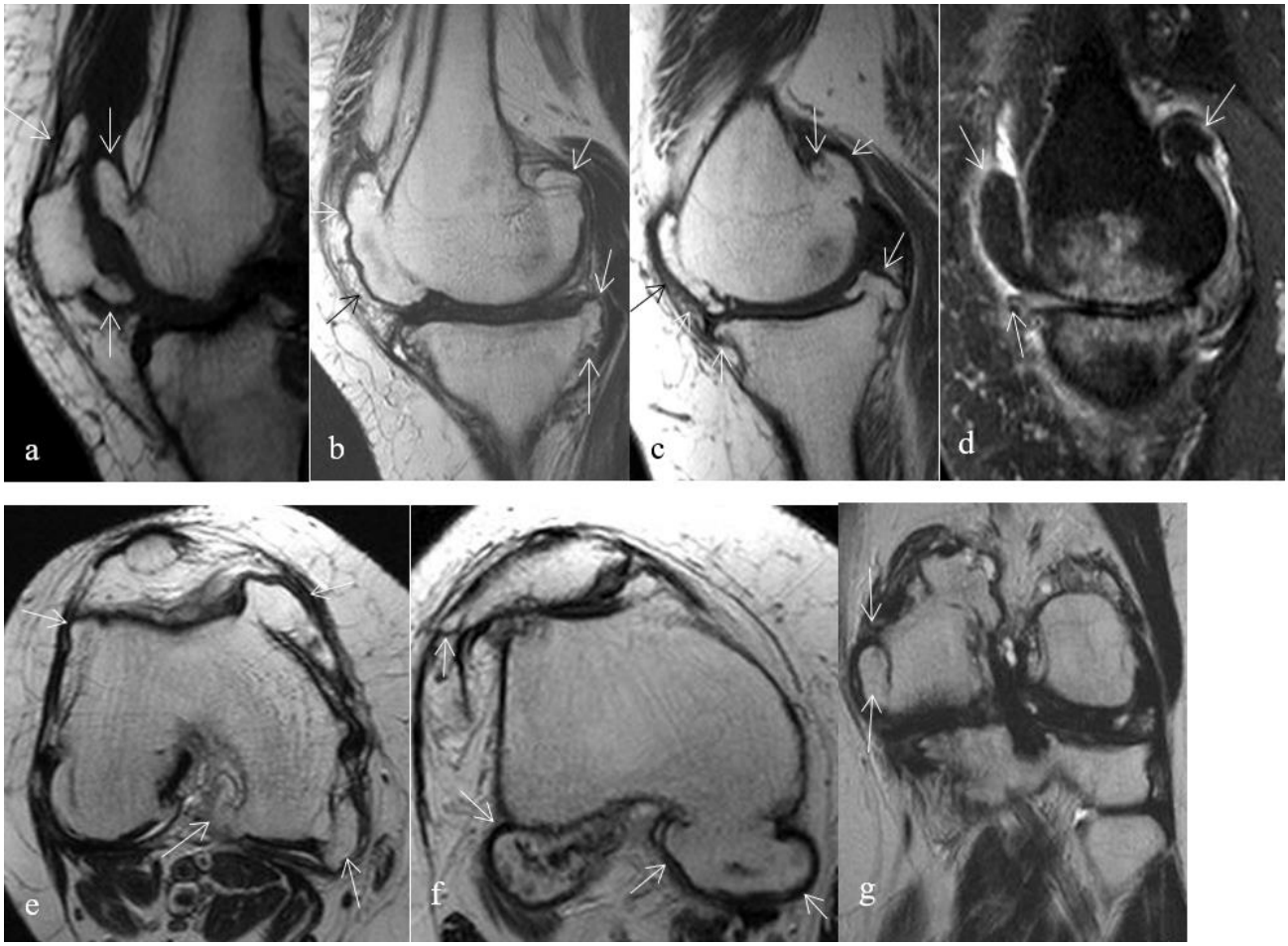


Fig. 1 (Рис. 1)

Fig. 1. MRI of the knee joint, osteophytes (arrows).

a, b, c – sagittal plane, T2-WI; d – FS, e, f – axial plane, g – coronal plane, T2-WI. Rough osteophytes of the lateral, predominantly anterior and posterior articular surfaces of the femoral condyle (a, b, c, d, d, e, f, g), patella (a, f), tibia (b, c); rounded osteophytes of the posterior surface of the femur (d, e, f).

Рис. 1. МРТ коленного сустава, остеофиты (стрелки).

а, б, в – сагиттальная плоскость, Т2-ВИ; г – FS, д, е – аксиальная плоскость, ж – коронарная плоскость, Т2-ВИ. Грубые остеофиты боковых, преимущественно передней и задней суставных поверхностей мыщелка бедренной кости (а, б, в, г, д, е, ж), надколенника (а, е), большеберцовой кости (б, в); округлые остеофиты задней поверхности бедренной кости (г, д, е).

crocirculatory disturbance areas within it, which results in compensatory osteosclerosis. The remaining fragments of cartilage then undergo ossification to form marginal bone growths [4].

The common feature in findings we encountered was marginal localization (78.94%) along all articular surfaces of femur and tibia condyles at the junction points between hyaline cartilage and the synovial membrane of the joint capsule. Also there were findings showing marginal osteophytes of rough and disfiguring nature (57,89%) which pushed aside the collateral ligaments, especially on the medial side, causing dystrophic ligament changes at that level. The osteophytes sizes were ranged from 0.61 to 2.34 cm in the sagittal plane. Large osteophytes of the femoral condyle extended to the level of the distal part of the metaphysis along the posterior surface of the joint, individual findings of this study showed rounded shapes of osteophyte (5.26%). Marginal osteophytes in superior and inferior poles of patella articular surface were noted (n=68,42%) (fig.1).

In some cases (n=3) osteophytes were formed in the central parts of the articular surfaces of femur and tibia condyles, large-sized osteophytes had a picture of “pseudo-erosions” and were associated with a more severe course of OA. There was an observation when a rough large-sized osteophyte was localized along the inner surface of the intercondylar recess of the

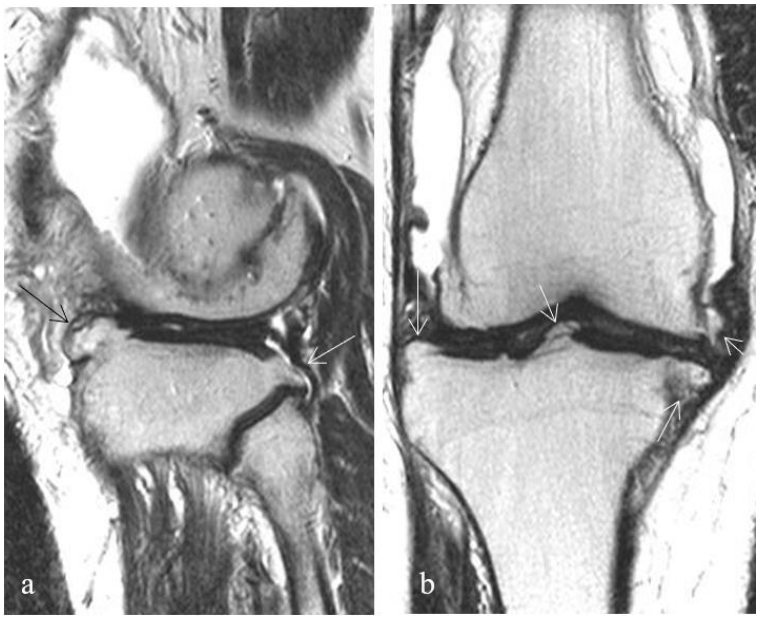


Fig. 2 (Рис. 2)

Fig. 2. MRI of the knee joint, T2-WI.

a – sagittal plane, b – coronal plane. Central osteophyte of the anterior articular surface of the tibia, marginal osteophytes of the femur and tibia (arrows).

Рис. 2. МРТ коленного сустава, Т2-ВИ.

а – сагиттальная плоскость, б – корональная плоскость. Центральный остеофит передней суставной поверхности большеберцовой кости, краевые остеофиты бедренной и большеберцовой костей (стрелки).

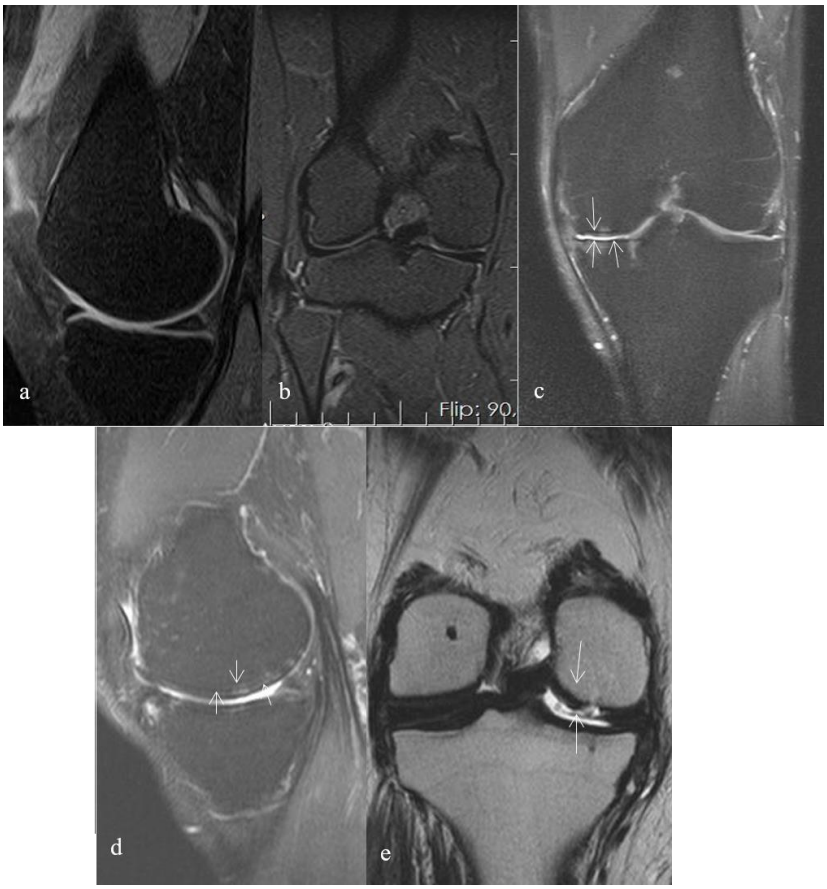


Fig. 3 (Рис. 3)

Fig. 3. MRI of the knee joint, T2-WI, sagittal and coronal (FS) planes (a, b, c, d), e – coronal plane.

a, b – normal MR picture of hyaline cartilage on sagittal and coronal MRI;

c, d – absence of hyaline cartilage of the articular surfaces of the medial condyles of the femur and tibia;

e – fragmentary absence of hyaline cartilage of the articular surface of the medial condyle of the femur (arrows).

Рис. 3. МРТ коленного сустава, Т2-ВИ, сагиттальные и корональная (FS) плоскость (а, б, в, г), д – корональная плоскость.

а, б – Нормальная МР-картина гиалинового хряща на сагиттальной и коронарной МРТ;

в, г – отсутствие гиалинового хряща суставных поверхностей медиальных мыщелков бедренной и большеберцовой костей;

д – фрагментарное отсутствие гиалинового хряща суставной поверхности медиального мыщелка бедренной кости (стрелки).

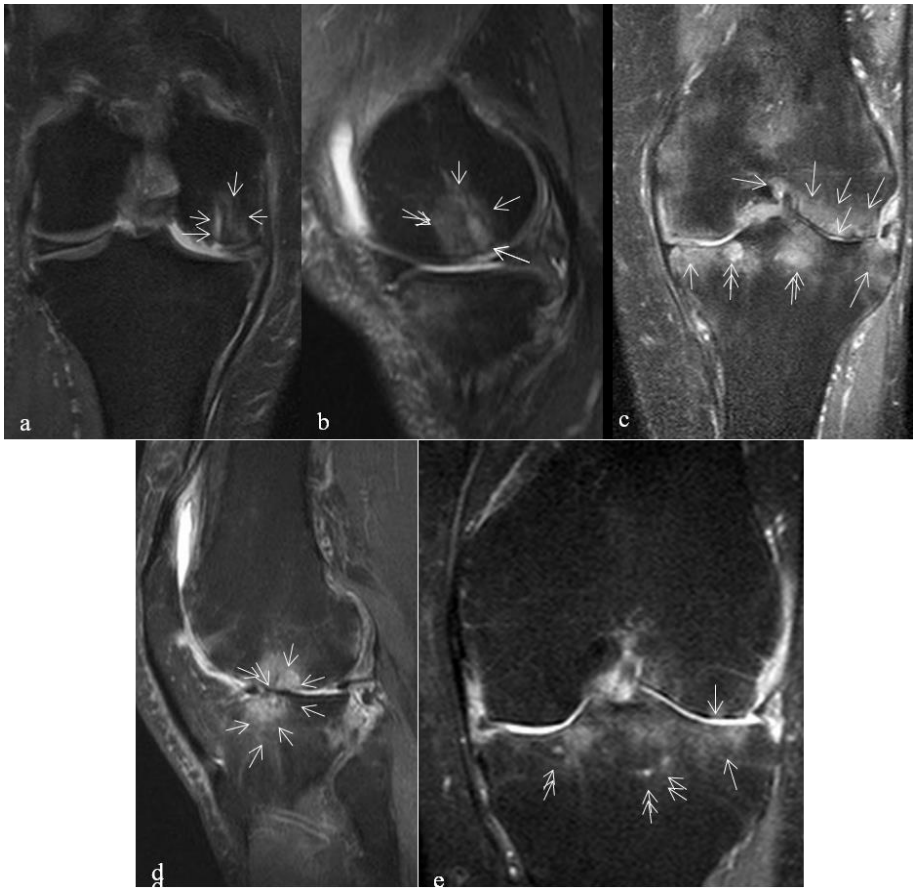


Fig. 4 (Рис. 4)

Fig. 4. MRI of the knee joint, FS. a, c, e – coronal plane, b, d – sagital plane. MR picture of osteochondral lesions of the patellofemoral joint (arrows).

a, b – Small subchondral cysts and perifocal edema of the bone marrow, localized at the level of fragmentary absence of hyaline cartilage of the medial femoral condyle;

c, d, e – more common due to the complete absence of hyaline cartilage.

Рис. 4. МРТ коленного сустава, FS. а, в, д – коронадьная плоскость, б, г – сагиттальная плоскость. МР-картина остеохондральных повреждений (стрелки).

а, б – Мелкие субхондральные кисты и перифокальный отек КМ, локализованные на уровне фрагментарного отсутствия гиалинового хряща медиального мыщелка бедренной кости;

в, г, д – более распространенные на фоне полного отсутствия гиалинового хряща.

lateral femoral condyle, directly adjacent to the anterior cruciate ligament (ACL). Central osteophytes are difficult to appreciate using radiography techniques due to the summation shadow effect; however central osteophytes are remarkably well shown on MRI tomography visualization (fig.2).

Dystrophic hyaline cartilage changes are strongly associated to the manifestation of osteoarthritis, which makes it extremely important to assess its condition. In anatomical sequence (T1WI – T1-weighted images), hyaline cartilage tends to have intermediate signal intensity, while its basal inner layers are not differentiated from subchondral bone.

with OA were detected with high prevalence its thinning (88.8%) or its complete loss (76.54%), and also surface defects (38.8%) in the form of focal changes in the high-intensity signal. It was shown that the articular surface of the tibia medial condyle and the patella articular surface were predominantly affected (fig.3).

Osteochondral defect is a common phenomenon associated with OA in MRI [6].

Osteochondral defects in OA patients were observed in 76,54% of cases and are identified as a multitude of small individual subchondral cysts of femoral condyle, less frequently of tibia with perifocal edema of bone

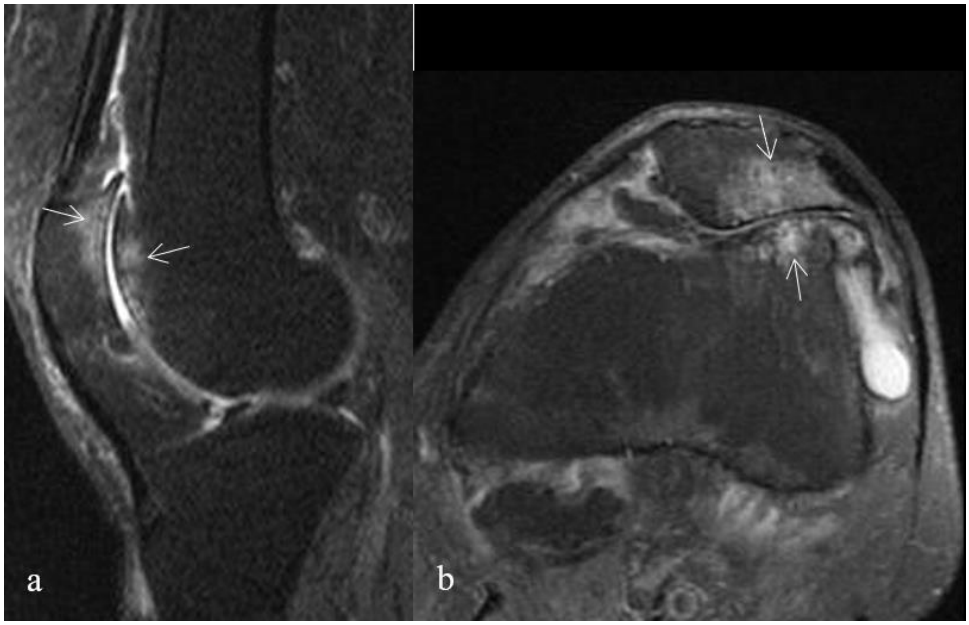


Fig. 5 (Рис. 5)

Fig. 5. MRI of the knee joint, FS. a – sagittal plane, b – axial plane.

MR signs of osteochondral injuries of the patellofemoral joint. Subchondral cysts and perifocal edema of the bone marrow along the anterior surface of the femur and the articular surface of the patella at the level of complete absence of hyaline cartilage and marginal osteophytes.

Рис. 5. МРТ коленного сустава, FS. а – сагиттальная плоскость, б – аксиальная плоскость.

МР-картина остеохондральных повреждений пателло-феморального сустава (стрелки). Субхондральные кисты и перифокальный отек КМ по передней поверхности бедренной кости и суставной поверхности надколенника на уровне полного отсутствия гиалинового хряща и краевых остеофитов.

Sequences with suppression of the signal from fat (STIR, FS), rapid gradient echo (T2*-GRE) make articular cartilage hyperintensive, increasing the contrast of the surrounding structures, and allowing to accurately assess the condition of articular hyaline cartilage. In addition, the magnetization transfer technique provides high contrast between cartilage and adjacent structures [5].

When assessing the condition of the hyaline cartilage of tibia and femur articular surfaces and the patellofemoral joint in patients

marrow and thinning/absence (localized, extensive) of articular hyaline cartilage at this level. These structural changes were often combined with meniscus tears (fig. 4, 5).

Small subchondral cysts with perifocal edema generally were associated with osteochondral damage.

Bone marrow edema is associated with a reaction to an inadequate traumatic force applied on the joint. It was observed in 62,9 % cases of presented material among AO patients, localized in central parts of the epiphyses of the

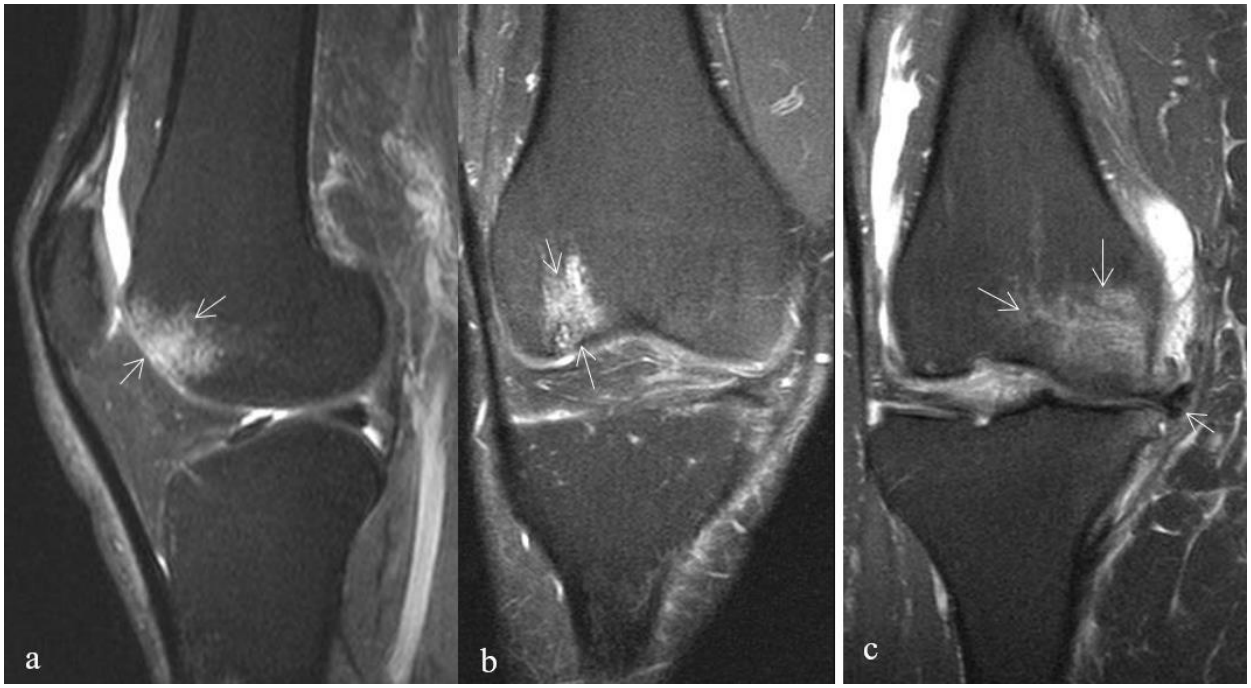


Fig. 6 (Рис. 6)

Fig. 6. MRI of the knee joint, FS. a – sagittal plane, b, c – coronal plane. MR-signs of bone marrow edema (arrows).

a, b – of bone marrow edema, small subchondral cyst, local thinning of hyaline cartilage.

c – more extensive edema of the bone marrow of the medial condyle of the femur, marginal osteophytes of the femur and tibia, absence of hyaline cartilage in the central part of the medial meniscus, extrusion of peripheral fragments of the meniscus.

Рис. 6. МРТ коленного сустава, FS. а – сагиттальная плоскость, б, в – коронарная плоскость.

МР-картина отека костного мозга (стрелки). а, б – Отек костного мозга, мелкая субхондральная киста, локальное истончение гиалинового хряща.

в – Более обширный отек костного мозга медиального мыщелка бедренной кости, краевые остеофиты бедренной и большеберцовой костей, отсутствие гиалинового хряща в центральной части медиального мениска, экструзия периферических фрагментов мениска.

femur and tibia. Bone marrow edema is identified as a typical low signal T1WI, isointense T2WI signal and high signal in the FS. Besides bone marrow edema in 66,7% of cases edema of Hoffa fat pad inner layers was present. Generally perifocal edema was observed surrounded by small subchondral cysts in combination with osteochondral changes associated with OA (fig.6).

Subchondral cysts were visible in 53,08 % of cases. They constituted a high signal fluid-filled space with clear contours in T2WI and in FS. Those of various sizes – ranging from small (up to 0,2-0,4 cm) to large (up to 0,8-1,0 cm). One type of a large cyst is a so-called geode – large subchondral round or oval-shaped space, communicating with the joint cavity (fig. 7).

Geode is a term attributed to geology, which means spherical formation within sedimentary and volcanic rocks. There are two theories concerning pathogenesis of subchondral cysts: synovial fluid is forced through the hyaline cartilage into the subchondral bone due to elevated intra-articular pressure, resulting in a cystic collection of joint fluid; cystic necrosis development post subchondral fracture [7].

Geodes are characterized as T1WI low signal and high signal T2WI and FS in 16,3%; in 6,9% T1WI signal was high, which indicated it as being proteinaceous. Peripheral contrast enhancement of cysts arises due to epithelium-lining of a cyst, internal contrast enhancement of the contents due to the diffusion of the contrast agent into the liquid contents is possible. Geodes are not specific to OA, they can form in patients with RA, crystalline arthropathy, in the presence of osteonecrosis [8] (fig.8).

At the knee joint a meniscus plays a major role in congruence of t he joint, providing

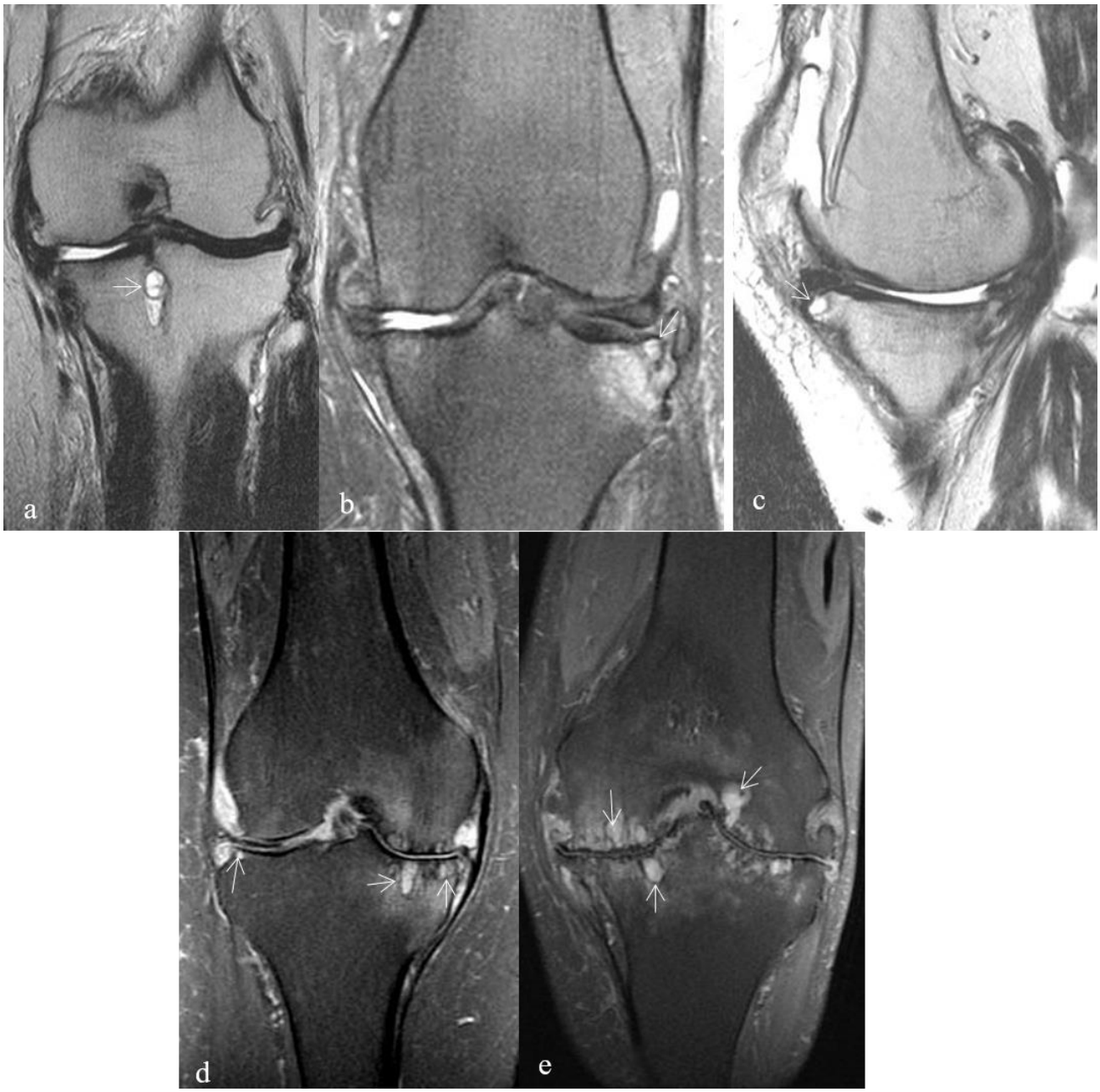


Fig. 7 (Рис. 7)

Fig. 7. MRI of the knee joint. MR signs of reorganization cysts (arrows). a, b – T2-WI, coronal plane; c – T2-WI, sagittal plane; d, e – FS, coronal plane.

a – reorganizing subcortical cyst of the central parts of the tibial epiphysis,

b, c – a cyst in a marginal osteophyte with perifocal edema of the bone marrow;

d, e – reorganizing subchondral cysts with moderate perifocal edema of the bone marrow, absence of hyaline cartilage and menisci, marginal osteophytes.

Рис. 7. МРТ коленного сустава, а, б – Т2-ВИ, корональная плоскость; в – Т2-ВИ, сагиттальная плоскость; г, д – FS, корональная плоскость. МР-картина перестроечных кист (стрелки).

а – Перестроечная субкортикальная киста центральных отделов эпифиза большеберцовой кости; б, в – киста в маргинальном остеофите с перифокальным отеком костного мозга; г, д – перестроечные субхондральные кисты с умеренным перифокальным отеком костного мозга, отсутствие гиалинового хряща и менисков, краевые остеофиты.

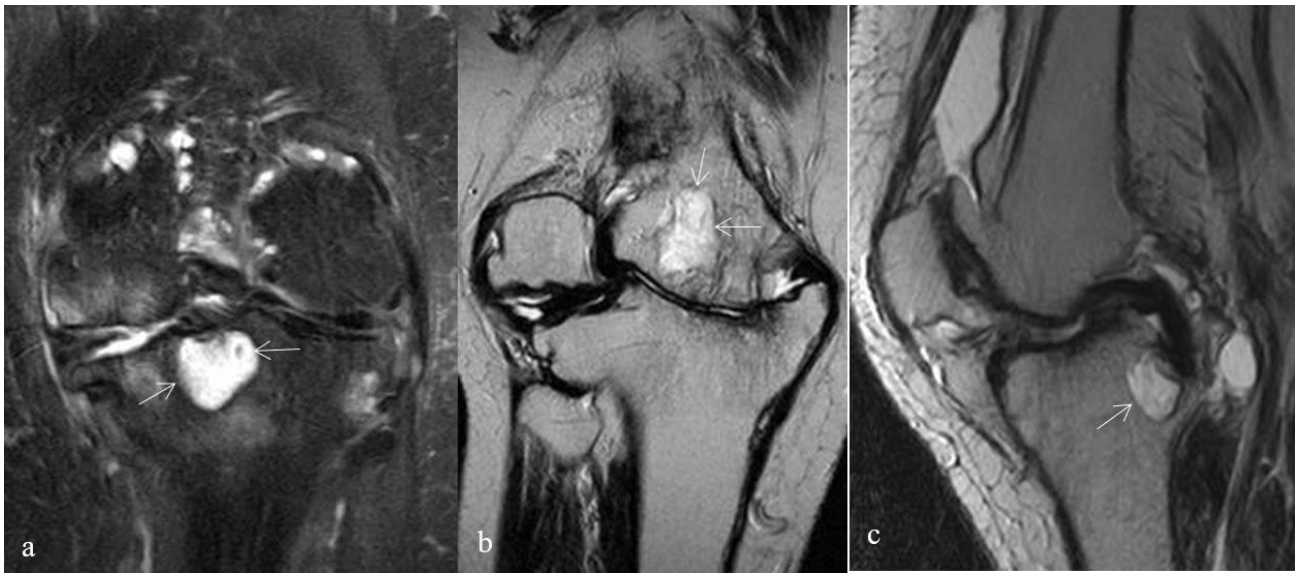


Fig. 8 (Рис. 8)

Fig. 8. MRI of the knee joint. a – FS, coronal plane; b, c – T2-weighted image, sagittal plane. MR of the Geode (arrows).

a – Geode of the central parts of the epiphysis of the tibia, flattening of the articular surfaces of the condyles of the femur and tibia;

b, c – femoral and tibial geodes, deformation and flattening of the articular surfaces of the condyles of the femur and tibia;

b, c – small paraligmental ganglia and a small popliteal cyst.

Рис. 8. МРТ коленного сустава, а – FS, корональная плоскость; б, в – Т2-ВИ, сагиттальная плоскость. МР-картина геод (стрелки).

а – Геода центральных отделов эпифиза большеберцовой кости, уплощение суставных поверхностей мыщелков бедренной и большеберцовой костей; б, в – геоды бедренной и большеберцовой костей, деформация и уплощение суставных поверхностей мыщелков бедренной и большеберцовой костей; б, в – мелкие паралигаментарные ганглии и маленькая подколенная киста.

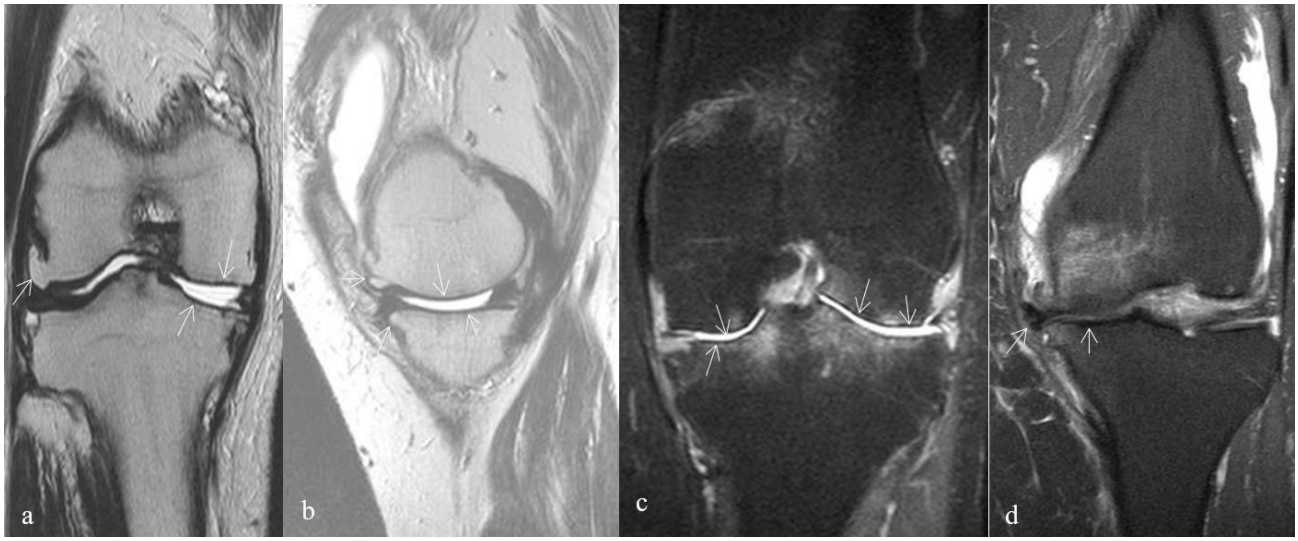


Fig. 9 (Рис. 9)

Fig. 9. MRI of the knee joints. a, b – T2-WI, coronal and sagittal plane, respectively; c, d – FS, coronal plane. MR signs of dystrophic changes in the menisci.

a, b – absence of the medial meniscus, marginal osteophytes;

c – absence of both menisci and osteochondral lesions;

d – absence of the central part of the medial meniscus, marginal osteophytes and extrusion of peripheral fragments of the meniscus with displacement of the medial collateral ligament, absence of hyaline cartilage of the medial condyles of the femur and tibia, swelling of the femoral bone marrow; thickening of the medial collateral bundles.

Рис. 9. МРТ коленного сустава, а, б – Т2-ВИ, корональная и сагиттальная плоскость соответственно; в, г – FS, корональная плоскость. МР-картина дистрофических изменений менисков (стрелки).

а, б – Отсутствие медиального мениска, краевые остеофиты; в – отсутствие обоих менисков и остеохондральные повреждения; г – отсутствие центральной части медиального мениска, краевые остеофиты и экструзия периферических фрагментов мениска с оттеснением медиальной коллатеральной связки, отсутствие гиалинового хряща медиальных мыщелков бедренной и большеберцовой костей, отек костного мозга бедренной кости; утолщение медиальной коллатеральной связки.

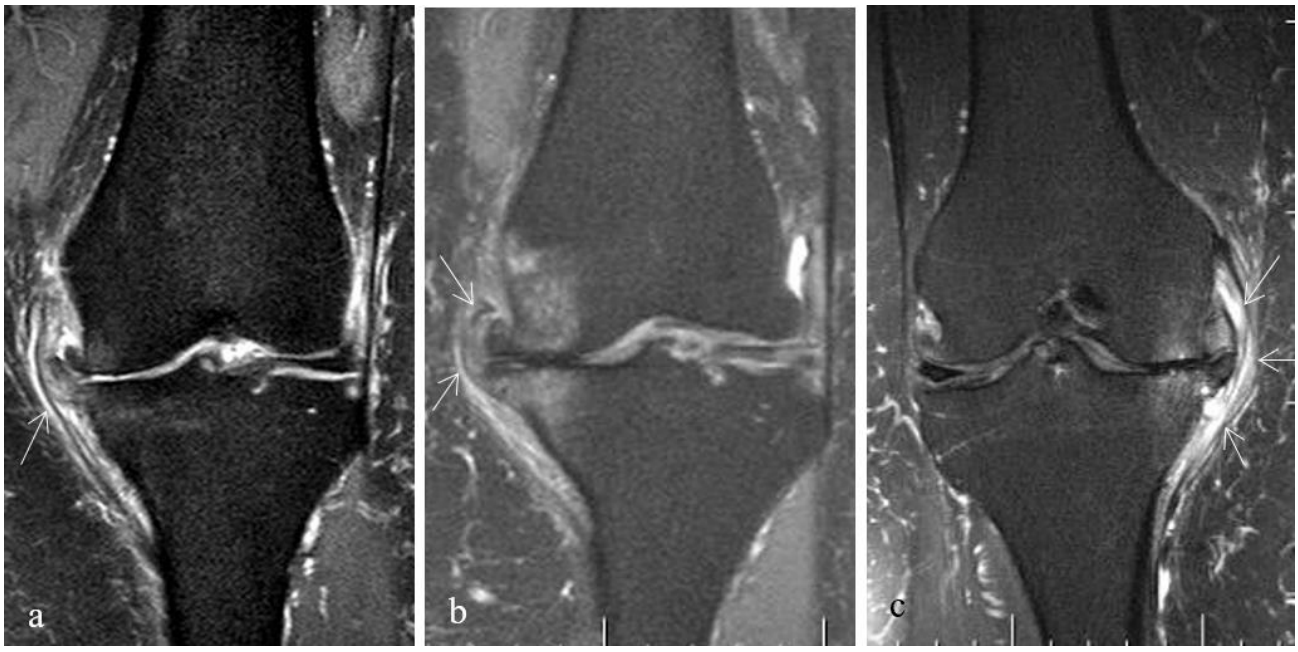


Fig. 10 (Рис. 10)

Fig. 10. MRI of the knee joint, a, b, c – FS, coronal plane. MR is a picture of dystrophic changes in the medial collateral ligament (arrows).

a, b – dystrophic changes of the medial collateral ligament of the 2nd degree;

c – dystrophic changes of the medial collateral ligament of the 2nd degree in combination with bursitis of the medial collateral ligament bag.

Рис. 10. МРТ коленного сустава, а, б, в – FS, корональная плоскость. МР-картина дистрофических изменений медиальной коллатеральной связки (стрелки).

а, б –Дистрофические изменения медиальной коллатеральной связки 2 степени; в –дистрофические изменения МКС 2 степени в сочетании с бурситом сумки МКС.

structural integrity during axial load and protecting the adjacent joint cartilage. Spontaneous or associated with unrelated trauma meniscus tearing is present in almost 50% of OA cases reported in the literature, with the most common location of spontaneous tearing being the posterior horn of the medial meniscus [9].

Our research shows dystrophic changes of various severity in menisci in 92,6% of cases. In the prevalent majority partial destruction of the central part of the lateral meniscus without displacement (65,3%) and with extrusion (34,6%) was observed.

Meniscal extrusion refers to the peripheral meniscal margin extending up to 0,3 cm beyond the external aspect of the tibiofemoral compartment of the knee. Meniscal extrusion can imitate a condition which is similar to total meniscectomy, being the cause of osteoarthritis of the knee-joint. Moreover, meniscal extrusion also contributes greatly to the narrowing of the joint space in patients with OA, especially at the early stages, which can be reliably verified with MRI and makes radiography less reliable due to the limitations of the method [10].

Complete destruction of the medial meniscus was observed in 50,6% of cases. Dystrophic meniscus changes are shown in the form of linear tearing that spreads to one or two articular surfaces. It was identified in 20,9% of cases, although the majority (14,6%) includes partial lesions of the central part of the meniscus with linear tearing of the posterior horn of the medial meniscus. Furthermore, loss of meniscus was conjoint with partial or total loss of hyaline cartilage, which led to the convergence of the articular surfaces of the condyles of the femur and tibia (fig. 9).

Ligament changes in patients with OA are dystrophic by nature, with the main cause of the knee-joint injury being a reaction to an inadequate load distribution in the joint.

Ligaments dystrophic changes, which includes interstitial tear, were observed in 77,7%, with lack of ligament visualization in 25,9 %. Dystrophic injuries of medial collateral ligament (49,2%), associated with marginal osteophytes occurred in the majority of cases, including lesions of the 1st degree (32,8%) and 2nd degree (16,4%). Lesions of the 1st degree renders as a local intraligamentary and periligamentary elevated signal with maintaining fiber continuity, while 2nd degree characterizes as thinning of ligament and separating into individual fibers, associated with periligamentary tissue elevated signal [11].

Medial collateral ligament bursitis was more common (40%) and MRI illustrates it as T2WI and FS high signal between outer and deep layers of the ligament; generally it is combined with dystrophic medial collateral ligament changes of second grade severity.

No full medial collateral ligament tearing was observed. Changes in patellar tendinosis (38,3 %) and quadriceps tendon were observed in 38,3% and 29,62 % cases respectively. Cruciate ligaments remained intact in most OA cases, however in 23,8% ACL was completely absent, associated with either complete or widespread lack of hyaline cartilage and extensive meniscus damage (fig.10, 11).

Bursitis are an essential part of an OA MRI image, as inflammatory changes of synovial membrane of bursae in specific localization can be explained by redistribution of chronic inadequate load or compression of the corresponding tendon or muscle due to their compression by the osteophyte [12].

Along with intra-articular joint effusion, isolated cases of OA (3,2%) were accompanied by pes anserine bursitis («goose foot») in the analyzed material. Pes anserine bursitis is a focal liquid accumulation between the pes anserine tendons (tendons of the sartorius, gracilis and semitendinosus muscles) which are conjoined proximally on the medial side of the tibia (fig.12).

Prepatellar bursitis was the most common type of bursitis identified (45%). Liquid localization could be detected along the anterior surface of the joint, between the subcutaneous tissue and the quadriceps tendon, while swelling of the surrounding subcutaneous tissue was present (fig.13).

Intra-articular joint effusion was observed in 79,01% of presented material and was generally localized in suprapatellar bursa with the spread to lateral inversions. The amount of liquid was estimated by the maximum thickness of the liquid layer in the axial plane and was more often regarded as moderate (from 3.6 to 5 mm).

Intra-articular joint effusion identified in our observation was not specific; there was no clear correlation between the amount of liquid and the severity of intra-articular changes in the knee joint in the patients with OA.

In the literature this condition is widespread among the population in general, including people without pain syndrome and common visual signs of OA [13].

Moreover, in the article focusing on clarification of the cause of pain syndrome in knee-joints of patients with OA there was no correlation between the severity of dystrophic changes in intra-articular structures and the thickness of the effusion layer according to the results of the ultrasound scan [14].

Baker's cysts and intra-articular ganglia are also quite common and less specific relative

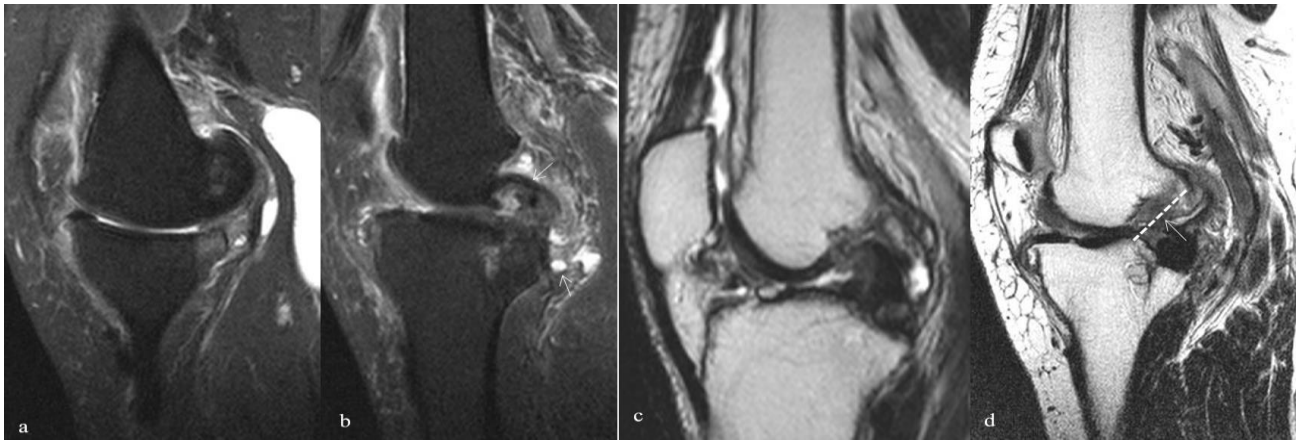


Fig. 11 (Рис. 11)

Fig. 11. MRI of the knee joint. a, b – FS, sagittal plane; c – T2-WI; d – T2-WI, oblique-sagittal slice. MR signs of dystrophic ligament changes (arrows).

a – Absence of anterior cruciate ligament, absence of hyaline cartilage,

c, d – absence of the anterior cruciate ligament;

b, c – enhanced angulation of the posterior cruciate ligament, intra-articular ganglia along the posterior surface of the joint.

Рис. 11. МРТ коленного сустава, а, б – FS, сагиттальная плоскость; в – Т2-ВИ; г – Т2-ВИ, косо-сагиттальный срез. МР-картина отсутствия передней крестообразной связки (стрелки).

а – отсутствие передней крестообразной связки, отсутствие гиалинового хряща; в, г – отсутствие передней крестообразной связки; б, в – усиленная ангуляция задней крестообразной связки, внутрисуставные ганглии по задней поверхности сустава.

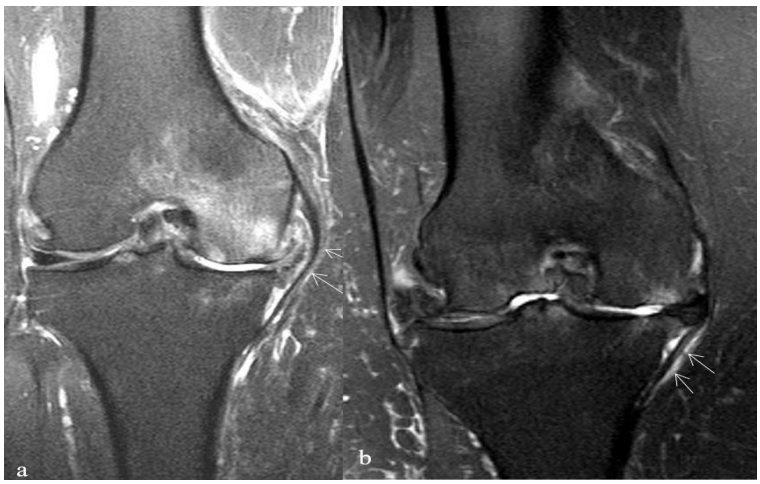


Fig. 12 (Рис. 12)

Fig. 12. MRI of the knee joint, FS, coronal plane. MR signs of "crow's foot" bursitis. A linear-shaped fluid accumulation adjacent externally to the contour of the medial collateral ligament (arrows).

a – Extrusion of peripheral fragments of the medial meniscus with displacement of the medial collateral ligament, its dystrophic changes and bursitis of the medial collateral ligament bag, absence of hyaline cartilage of the medial condyles of the femur and tibia, osteochondral changes.

Рис. 12. МРТ коленного сустава, FS, корональная плоскость. МР-картина бурсита «гусиной лапки». Скопление жидкости линейной формы, примыкающее снаружи к контуру медиальной коллатеральной связки (стрелки).

а – Экструзия периферических фрагментов медиального мениска с оттеснением медиальной коллатеральной связки, ее дистрофическими изменениями и бурситом сумки МКС, отсутствие гиалинового хряща медиальных мыщелков бедренной и большеберцовой костей, остеохондральные изменения.

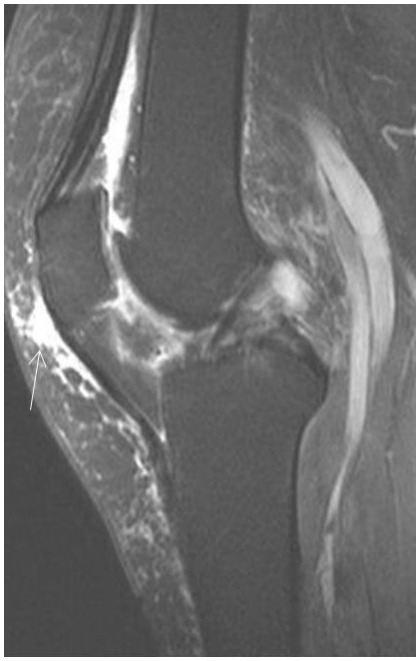


Fig. 13 (Рис. 13)

Fig. 13. MRI of the knee joint, FS, sagittal plane. Prepatellar accumulation of fluid (arrow).

Osteophyte of the anterior surface of the condyle of the femur, a small amount of retro- and suprapatellar effusion.

Рис. 13. МРТ коленного сустава, FS, сагиттальная плоскость. Препателлярное скопление жидкости (стрелка).

Остеофит передней поверхности мыщелка бедренной кости, небольшое количество выпота ретро- и супрапателлярно.

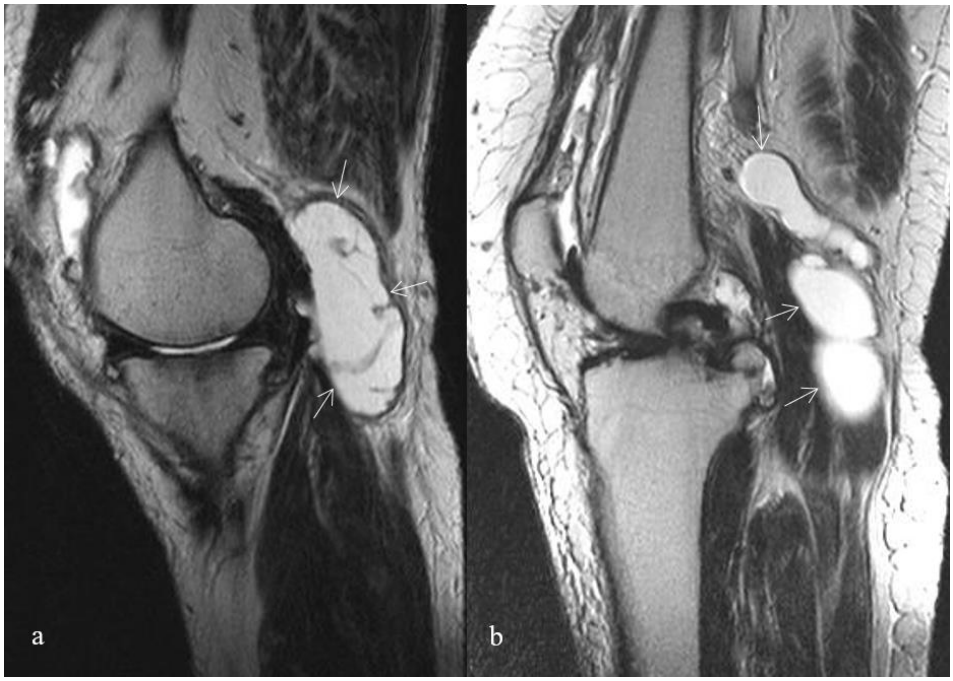


Fig. 14 (Рис. 14)

Fig. 14. MRI of the knee joint, T2-WI, sagittal plane.

Baker's large-lobular popliteal cysts (arrows).

Рис. 14. МРТ коленного сустава, Т2-ВИ, сагиттальная плоскость.

Крупно-лобулярные подколенные кисты Бейкера (стрелки).

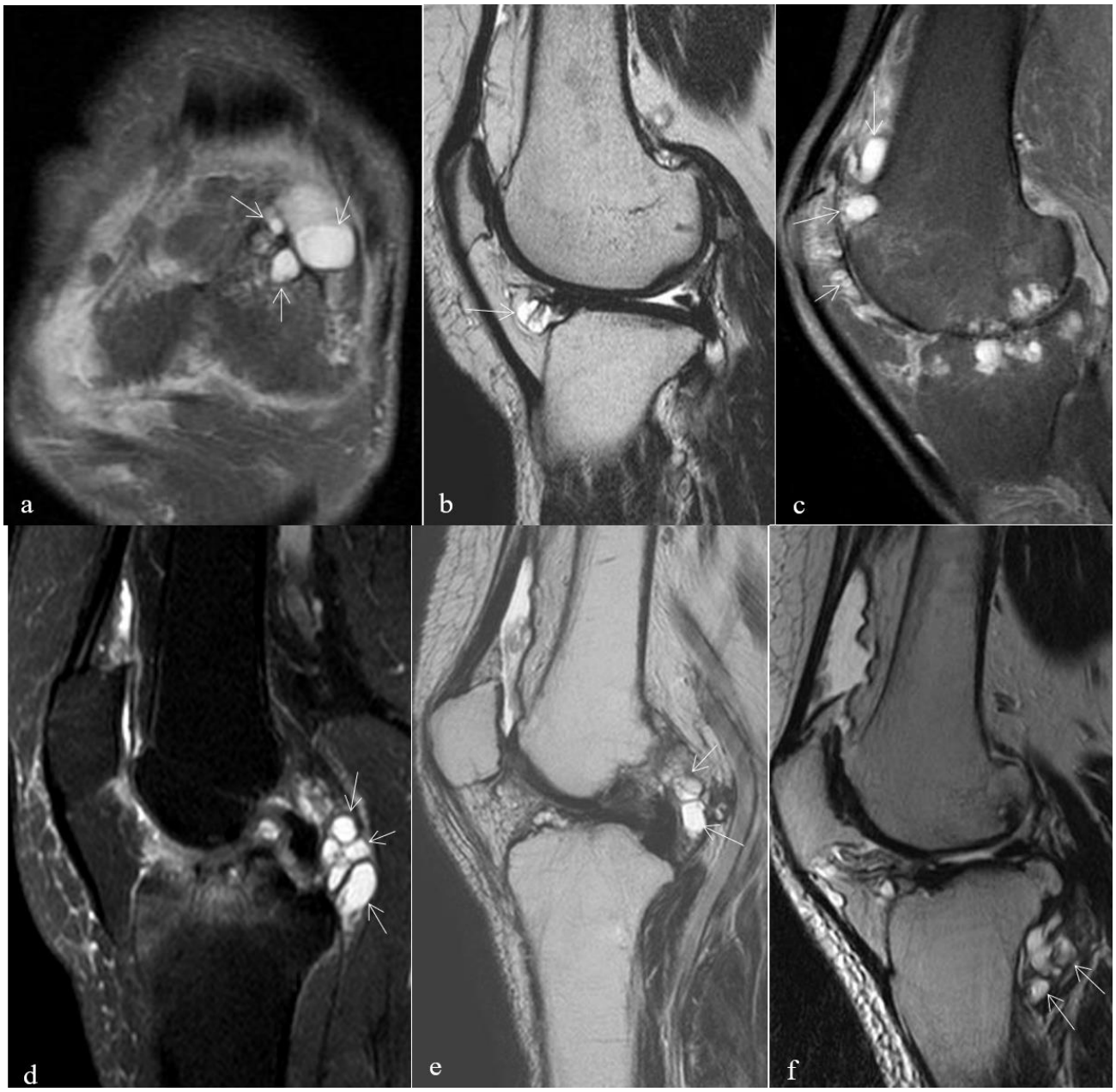


Fig. 15 (Рис. 15)

Fig. 15. MRI of the knee joint, a – FS, coronal plane; b, d, f – T2-WI, sagittal plane; c, d – FS, sagittal plane. MR signs of intraarticular ganglia (arrows).

a, c – paraosseous ganglia along the anterior surface of the joint; b – parameniscal ganglia along the anterior surface of the joint; d – paraligamentary ganglia along the posterior surface of the PCL; e – paraarticular ganglia along the posterior surface of the proximal tibiofibular joint. Intra-articular effusion, osteophytes, osteochondral lesions.

Рис. 15. МРТ коленного сустава, а – FS, корональная плоскость; б, д, е – Т2-ВИ, сагиттальная плоскость; в, г – FS, сагиттальная плоскость. МР-картина внутрисуставных ганглиев (стрелки).

а, в – параоссальные ганглии по передней поверхности сустава; б – парамениссковые ганглии по передней поверхности сустава; г – паралигаментарные ганглии по задней поверхности ЗКС; е – параартикулярные ганглии по задней поверхности проксимального межберцового сустава. Внутрисуставной выпот, остеофиты, остеохондральные поражения.

to OA symptoms. Worthy of note is their association with trauma, inflammatory rheumatoid diseases of the joints, as well as dystrophic processes related to increasing age of the patient [15].

Baker's cyst is a hernia-like protrusion of the posteromedial capsule of the knee joint in the form of a multifocal, clear contoured liquid accumulation between the medial head of the gastrocnemius and semimembranosus muscle. It was observed in 65,43% of cases, unrelated to the severity of dystrophic changes.

Intra-articular ganglion cysts were presented as round or oval formations with a high signal on T2WI and FS (with sizes from 0.3-0.5 cm), not connected with the synovial cavity of the joint. They were detected in our observations in 51.2% of cases and were generally localized along the rear surface of the joint, adjacent to the posterior cruciate ligament (fig.14, 15).

Conclusion.

Knee osteoarthritis is a public health problem, which mainly concerns the aged population and impairs the quality of life of a targeted patient significantly. It is the most prevalent in adults and elderly, while their numbers rise by increasing average age of general population. Elderly are not the only ones affected, as younger individuals practicing sports are also susceptible. Visualization techniques are widely used for diagnosis of the severity of knee OA and progression of the therapy. Radiographic assessment is less effective at early stages of the disease, due to the underlying physical principles and the summation shadow effect, it cannot be used to make an accurate morphological assessment of all structures specific to the disease. The ability to visualize intra-articular joint effusion, dystrophic changes in hyaline cartilage, menisci, knee joint ligaments, changes in subchondral layers of bones makes an argument about MRI advantages in assessment of these groups of patients for early diagnosis and monitoring the dynamics for evaluating progression of the disease (OA).

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