Chondromatosis synovialis in the radiological image

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Abstract

Background: Synovial chondromatosis is a rare, benign disorder characterised by neoplastic proliferation of numerous chondral nodules in synovium of joints, bursae or tendon sheaths. Synovial chondromatosis may occur in two forms primary and secondary.

Discussion: The disease is usually diagnosed between the third and the sixth decade of life, more often in men than in women. In most cases it affects one joint though it may appear bilaterally. The most common location is the knee joint. Synovial chondromatosis follows three phases. X-ray pictures, computed tomography (CT) and magnetic resonance imaging (MRI) are used to diagnose synovial chondromatosis, while ultrasound imaging may be an alternative method. Synovial chondromatosis is a self-limiting disease thus the conservative treatment can prove to be sufficient for some patients nevertheless, surgical treatment is often necessary.

Conclusions: Diagnostic imaging plays an essential role in the diagnosis of synovial chondromatosis, however the final diagnosis is established on the basis of the histopathology examination.

Keywords: synovial chondromatosis, loose bodies, chondral bodies, osseous bodies, osteochondral bodies

Background

Synovial chondromatosis is a rare, benign disorder characterized by neoplastic proliferation of numerous cartilaginous nodules within the synovial membrane of joints, bursae, or tendon sheaths [1,2,3,4]. The cartilaginous foci may be pedunculated or completely detached, forming so-called loose bodies within the joint cavity. Histologically, these bodies may be cartilaginous, osteocartilaginous, or osseous in nature [1, 2]. Synovial chondromatosis occurs in two forms: primary synovial chondromatosis (also referred to as synovial osteochondromatosis, synovial chondrosis, Reichel's syndrome, or synovial chondrometaplasia) and secondary synovial chondromatosis [1].

Discussion

Synovial chondromatosis is typically diagnosed between the ages of 30 and 60 and occurs three to four times more frequently in men than in women. The disease is rarely observed in children [1,5]. Its prevalence in the general population is difficult to determine due to nonspecific symptoms but it is estimated to affect approximately 1 in 100,000 individuals [5]. In most cases, the condition involves a single joint, although bilateral involvement has been reported. The knee joint is the most commonly affected site (70%), followed by the hip joint (20%). Other joints that may be affected include the shoulder, elbow, ankle, wrist, and temporomandibular joint [1,2,6,7]. The etiology of primary

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***Fig. 1**. X-ray of the shoulder in the AP view. Loose osseous bodies*
Source: Own.

synovial chondromatosis remains unknown, whereas the secondary form may occur following trauma, joint inflammation, or in the course of degenerative joint diseases [1,2,5,8]. If left untreated, synovial chondromatosis can lead to irreversible joint damage, and in approximately 5% of cases may transform into chondrosarcoma [8,9,10,11,12].

Synovial chondromatosis may progress through three stages.

The first stage involves an active intra-synovial inflammatory process without the presence of loose bodies. This stage may be asymptomatic or present with localized joint pain and swelling. In the second stage, there is an active proliferation of the synovial membrane with the formation of loose bodies (located between the synovial membrane and hyaline cartilage, ranging from pedunculated bodies to free intra-articular bodies). These intra-articular loose bodies can vary in size—from a few millimeters up to several centimeters. At this stage, patients typically report pain and limited joint mobility. The third stage is characterized by the absence of ongoing synovial metaplasia, although intra-articular loose bodies and mild synovial inflammation are present. Patients at this stage may not exhibit any clinical symptoms [1,2,3,9,10].

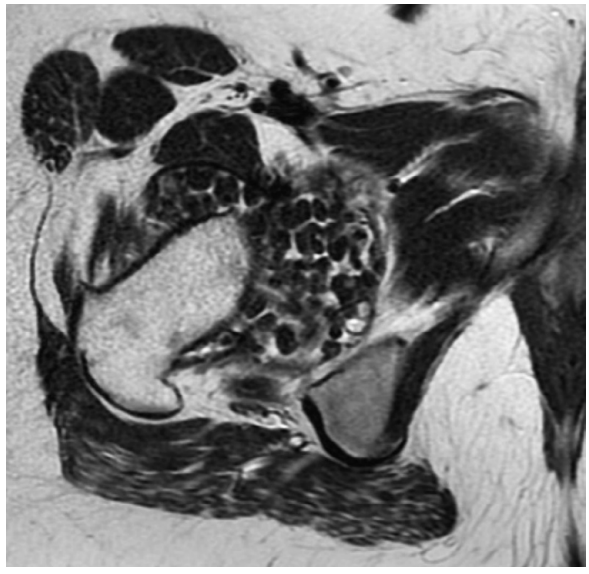

***Fig. 2** MRI of the hip joint. T2-weighted images in the axial plane. Numerous osteochondral loose bodies in the hip joint cavity*
Source: Own.

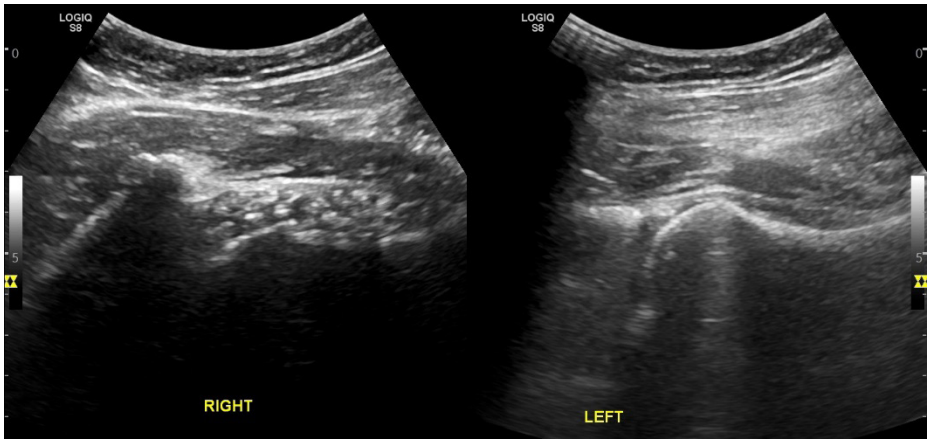

Fig. 3 *Ultrasound examination of the hip joint. Intra-articular loose bodies in the right hip joint*
Source: Own (courtesy of Dr. Joanna Staryszak).

Although synovial chondromatosis is a disease which is already well-known and widely recoginised, its preoperative diagnosis still poses significant challenges due to nonspecific symptoms and its rarity, often leading to delays in treatment [13]. Imaging diagnostics play a key role in the diagnostic process. Signs of synovial chondromatosis can be sought using X-ray (radiography), computed tomography (CT), and magnetic resonance imaging (MRI). On X-ray, calcifications may be visible—typically round, with smooth edges and similar in size in primary synovial chondromatosis, while in the secondary form they tend to be irregularly shaped (Fig. 1, 2, 3). Diagnosis should not be ruled out based solely on X-ray imaging, as in 20–30% of cases calcifications appear only in the later stages of the disease. Clinically, symptoms may appear months or even years before calcifications become visible. Non-calcified nodules may be present within the joint or bursa, often leading to joint effusion [1,8,11]. Computed tomography (CT) is a significantly more sensitive method for detecting synovial chondromatosis and provides the best visualization of the intra-articular location of loose bodies. An additional advantage of CT is its ability to detect both calcified and non-calcified intra-articular bodies. CT also allows for the assessment of joint surfaces and the structures adjacent to the joint. Magnetic resonance imaging (MRI) is recommended for all patients with synovial chondromatosis.

The signal intensity of intra-articular loose bodies depends on the degree of their calcification. In T1-weighted images they typically show low signal intensity but higher than that of muscle tissue. In T2-weighted images they usually exhibit high signal intensity which is characteristic of the high water content in cartilage, with signal voids corresponding to calcifications. MRI also reveals changes in soft tissues adjacent to the joint, bone marrow involvement, and possible infiltration of nerves and blood vessels. Additionally, MRI provides the most accurate visualization of the presence of free fluid within the joint cavity [1,8,10,14] (Fig. 4, 5). Ultrasonography is an alternative diagnostic method to CT and MRI for patients who, for various reasons, cannot undergo those examinations. On ultrasound imaging it is possible to identify nodules associated with the synovial membrane or intra-articular loose bodies [8] (Fig. 6). The definitive diagnosis of synovial chondromatosis is established based on histopathological examination [2,3,14]. Histological evaluation of intra-articular loose bodies also enables differentiation between the primary and secondary forms of synovial chondromatosis. In the primary form chondrocytes are densely and irregularly arranged and exhibit varying degrees of atypia. In the secondary form chondrocytes are also numerous but appear homogeneous and regularly arranged. A characteristic feature of the secondary form is the presence of fragments of normal articular cartilage. Primary synovial chondromatosis tends to be more aggressive and is associated with a higher recurrence rate [6,12].

In the differential diagnosis of synovial chondromatosis, one should consider, among others: synovial chondrosarcoma, pigmented villonodular synovitis (PVNS), osteochondritis dissecans, crystal-induced arthritis with hydroxyapatite deposition, lipoma arborescens, synovial hemangioma, chronic inflammatory conditions including tuberculous arthritis, and rheumatoid arthritis [4,6,10,13,14].

Synovial chondromatosis may be a self-limiting disease, and in some patients conservative treatment can be effective. Management may include nonsteroidal anti-inflammatory drugs (NSAIDs),modification of physical activity and cryotherapy.

However, the definitive treatment of synovial chondromatosis is surgical intervention involving the removal of loose bodies from the joint cavity and partial or complete synovectomy [1,10,15]. Surgical treatment is indicated in cases of persistent joint swelling and restricted range of motion.

Currently, minimally invasive arthroscopic techniques are used in surgical management due to their greater safety and shorter rehabilitation time. However, arthroscopy is only feasible when the diameter of intra-articular loose bodies does not exceed 3 mm and they are confined to a single compartment of the joint. In some cases, traditional open surgical procedures are necessary [1,2,7,10,15]. Recurrence occurs in 3% to 23% of

cases, mainly due to incomplete removal of the inflamed synovial membrane and residual intra-articular loose bodies [1,9,10,13].

Conclusions

Imaging diagnostics play a very important role in the recognition of synovial chondromatosis**,** however, the definitive diagnosis is established based on histopathological examination**.**

Computed tomography (CT) and magnetic resonance imaging (MRI) are the most effective in visualizing intra-articular loose bodies and also allow for the assessment of both intra-articular structures and those adjacent to the joint.

References

1. Habusta SF, Mabrouk A, Tuck JA. *Synovial chondromatosis*. Stat Pearls. Treasure Island; 2023 Jan.
2. Chaliyadan S, Gujar A, Valikkad S, Kataria R. *Synovial chondromatosis in a rural healthcare setting*. Cureus. 2023;15(2):e34498.
3. Pace Lasmar N, Barreiros Vieira R, de Oliveira Rosa J, Campos Pace Lasmar R, Campos Scarpa A. *Synovial chondromatosis*. Rev Bras Ortop. 2010;45(5):490-2.
4. Greenspan A. *Diagnostyka obrazowa w ortopedii dla lekarza praktyka*. Warszawa: MediPage; 2011.
5. Beger AW, Millard JA, Bresnehan A, Dudzik B, Kunigelis S. *Primary synovial chondromatosis: an elemental investigation of a rare skeletal pathology*. Folia Morphol (Warsz). 2022;81(3):685-93.
6. Sozzi D, Bocchialini G, Novelli G, Valente MG, Moltrasio F, Bozzetti A. *A rare case of synovial chondromatosis of the inferior TMJ compartment: diagnosis and treatment aspect*. Ann Stomatol (Roma). 2015;6(3-4):91-5.
7. Song Z, Yuan S, Liu J, Bakker AD, Klein-Nulend J, Pathak JL, Zhang Q. *Temporomandibular joint synovial chondromatosis: an analysis of 7 cases and literature review*. Sci Prog. 2022;105(3):00368504221115232.
8. Bonisegna E, Fassio A, Testoni M, Gatti D, Viapiana O, Mansueto G, Rossini M. *Radiological features of knee joint synovial chondromatosis*. Reumatismo. 2019;71(2):81-4.
9. George J, Paul N, Kaganur R, Gopurathingal A, Jirel A. *Synovial chondromatosis ankle – a case report*. J Orthop Case Rep. 2023;13(4):21-4.
10. Mo J, Pan J, Liu Y, Feng W, Li B, Luo K, Mo W, Lin H, Liao S. *Bilateral synovial chondromatosis of the elbow in an adolescent: a case report and literature review*. BMC Musculoskelet Disord. 2020;21(1):377.
11. van der Valk MR, Veltman ES, Assink J, Veen MR. *Synovial chondromatosis of the hip: a case report and literature review*. J Orthop. 2019;16(3):249-53.
12. Utashima D, Matsumura N, Suzuki T, Iwamoto T, Ogawa K. *Clinical results of surgical resection and histopathological evaluation of synovial chondromatosis in the shoulder: a retrospective study and literature review*. Clin Orthop Surg. 2020;12(1):68-75.
13. Benvenuti H, Liao CH, Pinsky B, Christy M. *Primary distal interphalangeal joint tenosynovial chondromatosis of the small finger: a case report with literature review*. Hand (N Y). 2022;17(6): NP1-NP5.
14. Shafie M, Babaei Aghdam Z, Shirzad Moghaddam Z, Ayati Firoozabadi M, Emami Razavi SZ, Hosseini M, Azadvari M. *Bilateral primary synovial chondromatosis in the knee joint*. Clin Case Rep. 2022;10(12):e6618.
15. Apathy A, Bely M. *Calcium hydroxyapatite and calcium pyrophosphate dihydrate crystals in primary synovial chondromatosis*. EC Orthop. 2022;13(9):9-27.