Intra-synovial loose bodies ultrasound-guided removal

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Abstract

Intra-articular loose bodies can be a non-obvious cause of chronic joint pain. Patients often undergo many conventional treatments, such as nonsteroidal anti-inflammatory drugs (NSAID), physiotherapy, TECAR-therapy, laser-therapy or infiltration therapy, often achieving little or no benefits.

In our experience, in such cases, when an intra-articular or intra-bursal loose body is detected, it is likely to be the actual source of pain.

The aim of our study is to propose a new US-guided technique to remove intra-articular loose bodies, which is mini-invasive, cost-effective and can be used to eliminate the source of pain with little or no discomfort for the patient.

Introduction

Despite being an infrequent occurrence in daily outpatient experience, intra-articular loose bodies are among the differential diagnoses of painful joint diseases. Their presence must be suspected, if the patient has compatible symptoms and, above all, if conventional therapies are not effective enough.

Based on the available literature, it is possible to divide intra-articular loose bodies into three broad categories: those due to primary synovial chondromatosis, those due to secondary or unstable osteochondral detachments (traumatic, surgical or in *osteochondritis dissecans*) and those due to joint cartilage fragmentation or osteophytes following osteoarthritis phenomena in the context of a degenerative joint disease.[1-15] Secondary synovial chondromatosis can be distinguished from primitive chondromatosis by taking into account the different degree of concomitant joint degeneration, the history of traumatic events and the relative lower number and greater pleomorphism of the loose bodies in the latter compared to the primitive form.[5]

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In order to achieve the correct diagnosis and subsequently plan the best therapeutic procedure, it is essential to follow a correct diagnostic procedure, which includes: firstly, traditional radiography, followed by ultrasound and, in selected cases, CT, MRI or arthro-MRI.

The traditional radiography enables to highlight anomalous calcifications in periarticular tissues although, especially in the case of primary synovial chondromatosis,[15] these may not be visible due to a low mineral component.

Usually, the radiography detects one or more intra-articular calcifications projectively (70%-95% of cases), which may resemble avulsed fragments or may be similar in size and morphology to ring calcification patterns (typical of the chondroid matrix).

If a CT examination is necessary, extrinsic erosive phenomena of the bone can be demonstrated in 20-50% of cases.[5]

If the traditional radiographic investigation is not exhaustive, the ultrasound scan is able, in almost all cases, to clear up any diagnostic doubt, by accurately locating the position of the presumed calcified loose body typing mistake. Manual compression and/or joint mobilization maneuvers will subsequently serve to prove its mobility and its intrasynovial location.

If the loose body cannot be visualized by ultrasound and the suggestive clinic remains, magnetic resonance imaging or arthro-MRI can be used.

The most frequently complained clinical symptoms are: joint pain (85%-100% of cases), swelling (42%-58%) and reduction of joint mobility (38%-55%), sensation of joint "creaking", the sensation of having a bunch of small stones inside the articulation itself wich make noise during motion. (20%-33%), acute, subacute or recurrent joint blockage (5%-12%) and palpable masses (3%-20%).[5]

Symptoms are insidious, often progressive or continuous following an undetected traumatic event. The average duration of symptoms before a conclusive diagnosis is about 5 years.[5]

An adequate correlation between the presence of intra-articular loose bodies and the patient's clinic is essential as, in some cases, the latter is not the source of pain, but rather an incidental finding in the context of a more complex pathological scenario.

Materials and Methods

In our outpatient experience we have treated 15 patients belonging to all the three categories previously described according to the classification proposed by Milgram JW.

The average age of the patients was 45 years with a median age of 55 years; 11 of them were women and 4 were men.

15 loose bodies were removed: 1 located in the trapezium-metacarpal joint following the detachment of an osteophyte; 1 in the synovial sheath of the flexors of the third finger of the hand probably from primitive osteochondromatosis; 4 in the subacromial bursa; 3 in the bicipital recess; 3 in the femoro-tibial joint and 3 in the gastrocnemius-semimembranosus bursa.

The same radiologist, expert in musculoskeletal radiology, after collecting the clinical and iconographic information necessary to make a presumptive diagnosis, after evaluating the indication and feasibility of the minimally invasive percutaneous approach, in

agreement with the patient, performed the procedure, as described below, assisted by the nursing staff.

The procedure was completed in all outpatients, after obtaining written informed consent. In all cases, a preliminary ultrasound evaluation was carried out in order to establish the exact location of the loose body(ies) and their relationships with the surrounding structures (vessels, nerves, tendons) and to plan the best percutaneous approach taking into account the distance from the cutaneous plane and the exhaustive visualization of the *target*.

The preliminary evaluation is a fundamental and essential step of the procedure, as it enables to select the materials to be used, the correct ultrasound probe and the best positioning of the Patient and the Operator.

After careful disinfection of the skin with iodine solution, in sterile conditions, a 22- 25- G needle was advanced until it reaches the loose body, then 2% of lidocaine chlorhydrate and 2% of ropivacaine were injected under ultrasound guidance.

Always under constant ultrasound visualization, the Operator performed a small incision through the skin, the subcutaneous tissue and the synovial membrane using a Kinda II type scalpel. The incision must be large enough to insert the surgical forceps and extract the loose body.

The tip of the scalpel must reach the loose body to create a complete link between the latter and the skin.

We did not experience any major complication during and/or after the procedure and in some cases we detected a modest bleeding.

The skin breach was treated with Steri-strips. NSAIDs, if needed, and antibiotic prophylaxis with Amoxicillin and clavulanic acid at therapeutic doses were prescribed for seven days.

Results

Among the treated cases we mention: firstly, a case of removal of an osteochondromatosic body located in the biceps recess, distally to the pulley of the homonymous tendon, in a 55-year-old woman. The patient came to our observation complaining pain in the right shoulder, which had been lasting for 2 years and worsened in the last 4 months, associated with overall functional limitation without episodes of joint blockage. No significant trauma was reported.

Symptoms were absolutely non-responsive to drugs or infiltration therapy (HA, PRP and steroids). The diagnostic procedure included radiography and ultrasound (Figure 1).

Secondly, a case of removal of an unstable osteochondral fragment near the lateral femoral condyle in the external parameniscal site in a patient with a positive history of trauma in the right knee.

In this case, the diagnostic procedure consisted of traditional

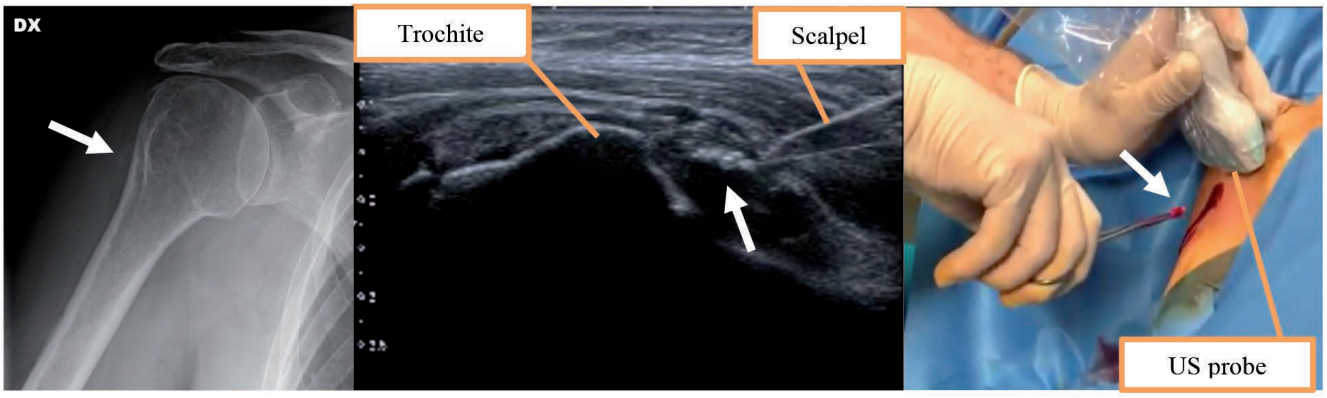

Figure 1. Radiographic, ecographic and macroscopic appearance of an intra-articular osteochondral loose body (white arrow) located inside the bicipital recess.

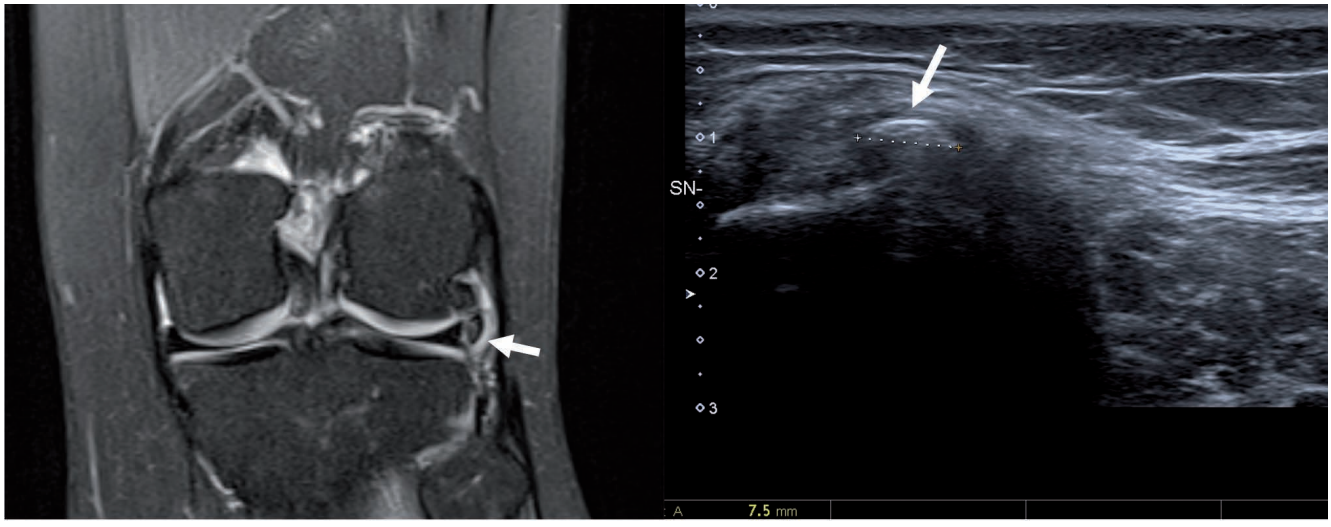

Figure 2. Magnetic resonance and corresponding ecographic aspect of an osteochondral fragment (white arrow) in the external parameniscal site.

radiography (negative findings), MRI and ultrasound in the last instance (Figure 2).

Finally, a case of avulsion of a cartilage fragment in a 55-year-old woman with a history of trauma and subsequent arthroscopic surgery with knee pain and symptomatic distension of the gastrocnemius-semi-membranous bursa, in the context of which the presence of a coarse loose body was demonstrated.

The patient underwent knee MRI before the operation, which, however, did not show gross loss of substance in the articular cartilage. In this case, ultrasound imaging was sufficient to make the diagnosis (Figure 3).

After the removal of the aforementioned loose body and the US-guided infiltration of the knee and of the gastrocnemius-semi-membranous bursa with HA, the remission of the symptoms was obtained (Figure 4).

In most cases, these patients were affected by degenerative osteoarthritis with secondary osteochondromatosis, which was subsequently demonstrated. Less frequently, the extracted loose bodies were of osteochondral origin in the framework of primary osteochondromatosis.

Unstable osteochondral lesions with fragments displaced in the joint recesses were a minority in our experience, with greater incidence in the knee joint.

All removed loose bodies were subsequently sent to the Pathological Anatomy Unit for histological analysis.

In some cases, the diagnosis of synovial osteochondromatosis

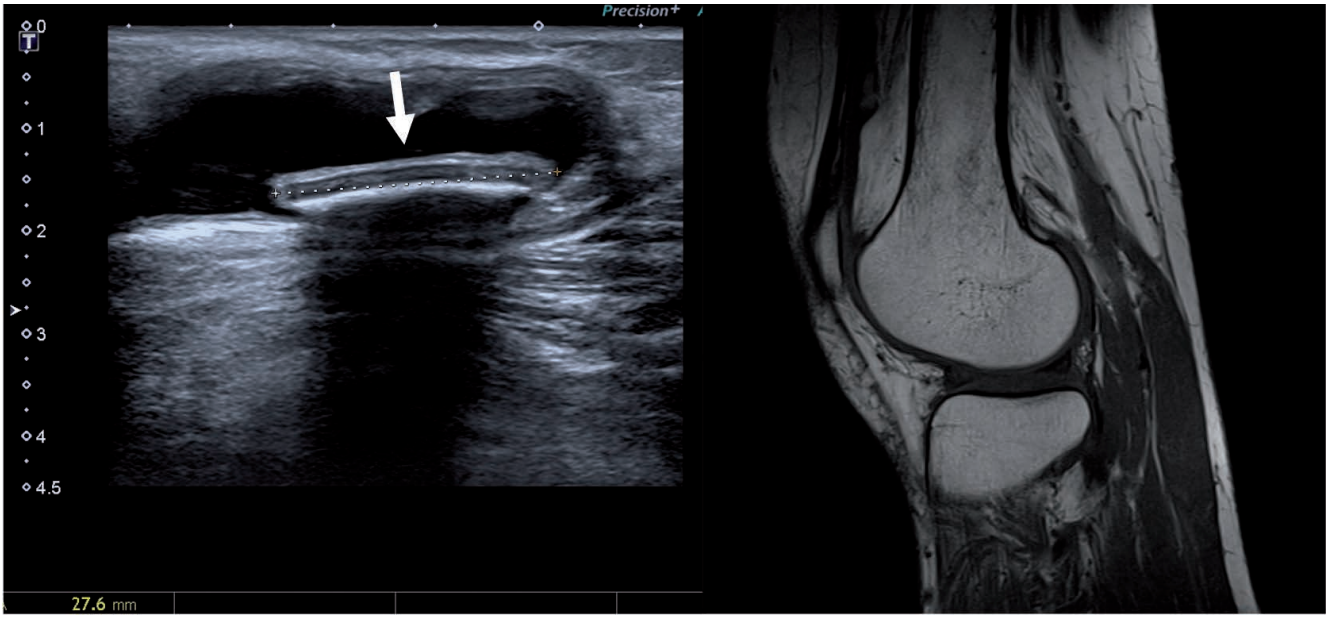

Figure 3. Dimensions and ultrasound appearance of the loose body inside the gastrocnemius- semimembranosus (GCSM) bursa (white arrow), while the preoperative MRI investigation showed no loss of cartilage substance.

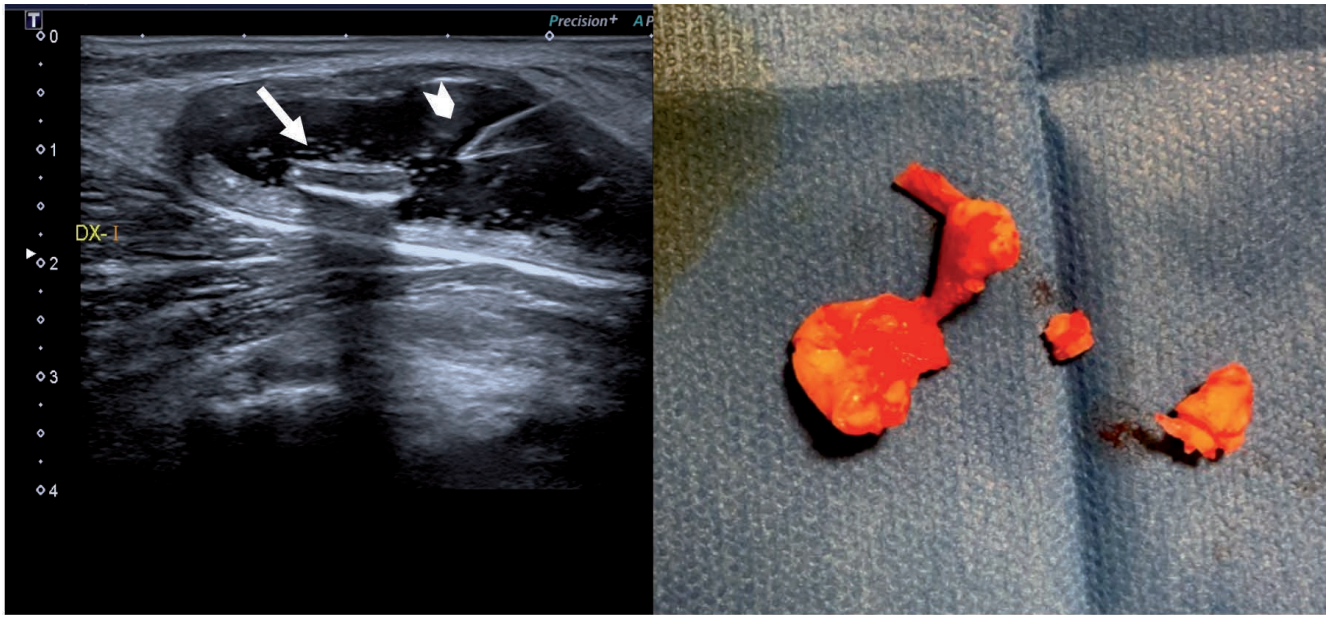

Figure 4. Percutaneous approach to the loose body to be removed (white arrow - arrowhead: scalpel) and its macroscopic appearance.

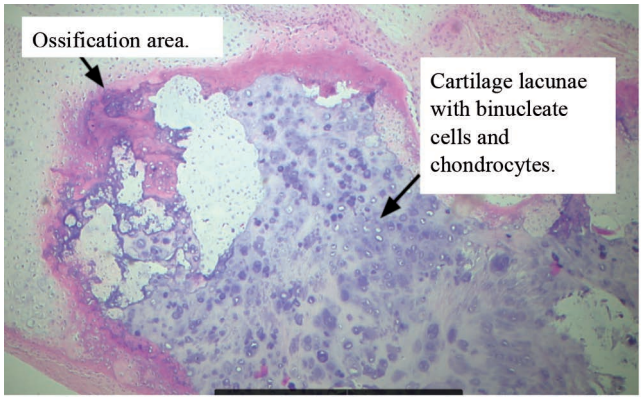

Figure 5. Histological examination of one of the extracted loose bodies.

was confirmed, while for some others it was not possible to achieve a definitive histological diagnosis (Figure 5).

All patients visited in our outpatient clinic with a diagnosis of intra-articular loose bodies were offered a minimally invasive US-guided treatment, which was extremely advantageous, if compared to the traditional arthroscopic approach.

Discussion

The therapeutic strategies described in the literature include, in the first instance, the conservative treatment, if there is no evidence of joint blockage and the functional demands of the patient do not imply the need for surgery.

In case of a failure of the conservative treatment in a symptomatic patient, the possibility of recovery and reasonable functional demands, the hypothesis of surgical treatment should always be considered.[6-10]

Arthroscopy is considered the best option, in most cases, where there is an indication for the extraction of intra-articular loose bodies: it is less invasive than the *open* treatment, while allowing easy visualization of fragments.[4,12,13]

Raval *et al.* reported a case of arthroscopic extraction of more than 100 loose shoulder bodies distributed along the synovia and adjacent to the proximal humerus.[12]

Andrade *et al.* described a case of a 20-year-old man with a history of chronic shoulder pain who subsequently underwent arthroscopic removal of 42 loose bodies distributed in the glenohumeral joint, with MRI and radiographic imaging compatible with synovial chondromatosis.[6] In both cases a synovectomy was then performed.

The advantages of arthroscopic surgical treatment are: i) the direct visualization of the articular plane; ii) the possibility of repairing associated lesions during the extraction of the loose bodies; and iii) the possibility of performing a synovectomy.

The disadvantages are mainly the cost of the procedure, its invasiveness (although very limited compared to the open technique), the need to perform the procedure in an outpatient setting, possible infectious complications and the possibility of therapeutic failure in case the movable bodies are located within joint recesses that are not reachable by arthroscopic optics.

Our approach is innovative and unique, described in the literature, extremely minimally invasive and burdened by negligible post-procedural morbidity.

Compared to the *traditional* arthroscopic treatment, it can be performed on an outpatient basis with a clear reduction in social and biological costs in terms of patient recovery, periprocedural complications, and exposure to the risk of infection, as well as, undoubtedly, saving economic resources.

Our approach's main issues, besides the need for a significant operator's experience, are related to the feasibility of the procedure, because the operator needs a satisfactory loose body visualization and safe percutaneous access without crossing noble structures. Moreover, it is impossible to repair any associated injuries.

In conclusion, the removal of intra-articular loose bodies with minimally invasive percutaneous US-guided technique could be considered, in expert hands, a valid alternative to arthroscopic treatment. The procedure should be proposed to selected patients where a good trade-off between usefulness of the intervention and its feasibility, in the absence of associated lesions documented clinically and iconographically, allows to take full advantage of its therapeutic benefits minimizing the risk for the patient and the consequences of a more invasive approach.

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