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Case Report

Multidisciplinary Management of CPPD Disease, Quadriceps Muscle Lesion, and Post-Surgical Perifemoral Abscess: A Case Report

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Abstract:

We report the case of an 80-year-old man with right knee monoarthritis due to calcium pyrophosphate deposition (CPPD) disease, associated with a quadriceps muscle tear, intramuscular haematoma, and a perifemoral abscess following prior femoral fracture fixation surgery.

Ultrasound (US) and X-ray imaging were found crucial in identifying and managing the complex interplay between joint, muscular, and bone involvement. US also enabled image-guided interventions, optimizing therapeutic accuracy and safety.

To our knowledge, this is the first reported case combining CPPD disease arthropathy, quadriceps muscle lesion, and post-surgical perifemoral abscess, emphasizing the diagnostic and therapeutic value of musculoskeletal US in multidisciplinary clinical settings.

Key words: muscular lesion; hydrolized collagen peptides; soft tissue infections; musculoskeletal ultrasound; crystal arthropathy; thigh impairment

Case Presentation

M.D., an 80-year-old man presenting with a severe and disabling pain syndrome affecting the right lower limb mainly characterized by spontaneous knee and thigh pain and impairing standing and walking. Comorbidities: atrial fibrillation, diabetes mellitus type II and systemic arterial hypertension.

Main history findings chronologically reported.

In August 2022, he fractured the right femur in a car accident and underwent an osteosynthesis surgery with intramedullary nail. An excellent post-surgery recovery was recorded and in November 2022, M.D. was planning to drive the car again. In January 2023, the patient complained for pain of right groin hindering his walking and after few days, the subsequent sudden onset of the right knee pain completely impaired the weight-bearing on the lower limb. He had no history of prior trauma. Due to complexity of the clinical presentation, the patient underwent a multidisciplinary evaluation by a rheumatologist, a physiatrist, and orthopaedic surgeons. Below are the descriptions of the clinical and imaging findings and the therapeutic procedures carried out by each specialist.

Rheumatology

The patient was referred by the general practitioner to the rheumatological outpatient clinic as a case of recurrent hemarthrosis of the right knee in a patient receiving rivaroxaban for atrial fibrillation. The history, focused on the right knee, allowed to discard the traumatic hypothesis. Right knee was found highly inflamed: swollen, hot and tender. The short history of right painful knee raised the suspicion of septic arthritis. An ultrasound (US) examination performed as a bed side procedure revealed clear signs of meniscal calcifications indicative of calcium pyrophosphate crystal deposition (CPPD) disease [1-5] and very little fluid collection in the suprapatellar pouch (**Figure 1**).

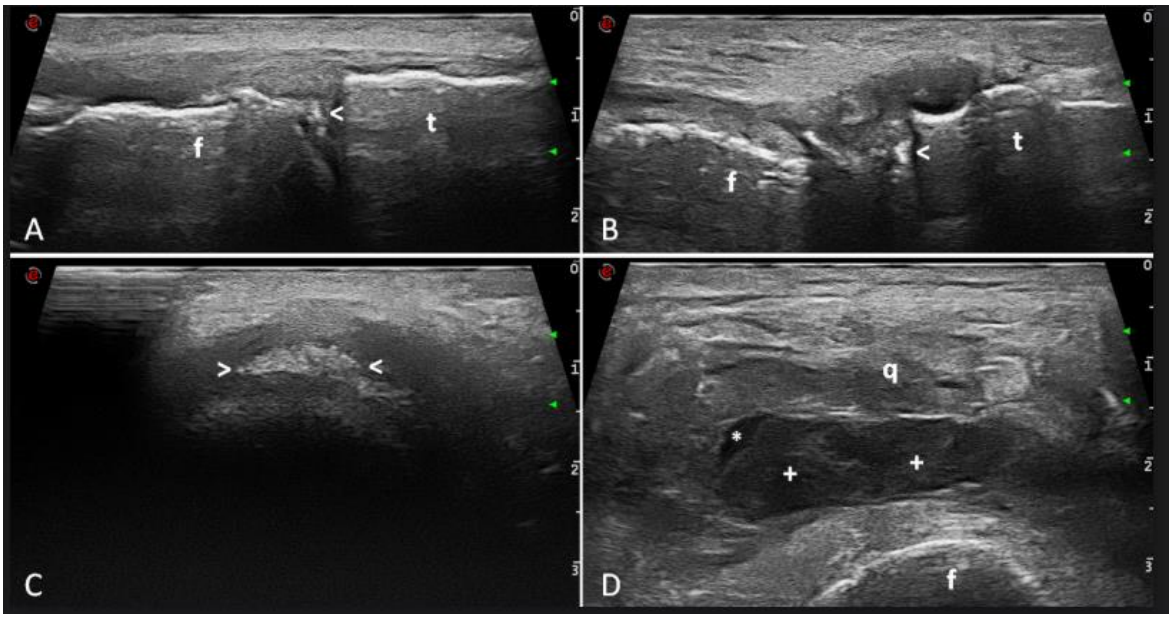

Figure 1: Ultrasound evidence of knee chondrocalcinosis. A-B. Longitudinal medial and lateral scans showing meniscal calcifications appearing as hyperechoic spots not generating acoustic shadowing (arrowheads). C. Axial scan confirming calcifications of the medial meniscus (arrowheads). D. Transverse suprapatellar view showing enlargement of the suprapatellar pouch due to hypoechoic synovial hypertrophy (crosses) and a small amount of anechoic fluid (asterisk). f=femur; q=quadriceps tendon; t=tibia.

Nevertheless, a neither haematic nor purulent synovial fluid was aspirated under ultrasound guidance from the right suprapatellar pouch using an 18-gauge needle and 40 mg of triamcinolone acetonide were injected. Synovial fluid analysis confirmed the diagnosis of CPPD disease and synovial fluid cultures remained negative. An x-ray of the right knee was asked, with the main aim to assess the degree of knee osteoarthritis, and colchicine treatment 1 mg a day was started [1]. At follow-up visit after one week, the patient did not report any intolerance reactions to colchicine (abdominal pain, diarrhea). Clinical and imaging findings led to the request for an intervention by the physiatrist and the orthopaedic surgeon. In fact, while the right knee completely recovered (patient was not complaining of knee pain and no signs of joint inflammation were detectable), two physical findings became evident: first the patient lying on the bed could not lift-up the lower limb and second a lump on the internal aspect and distal part of the thigh was noted which resulted painless and with a tense elastic consistency on palpation (**Figure 2**)

Figure 2: Right knee. Hypotrophy of the quadriceps muscle (**arrowheads**) and a lump on the internal distal aspect of the thigh (**arrow**).

Physiatry

Main findings on physical examination included: diffuse muscular hypotrophy, especially of the right thigh, with right lower limb slightly extra-rotated; active range of motion of the hips extremely limited, especially on the right side; passive right hip mobilization inducing intense antero-lateral thigh pain. The patient exhibited a clear case of secondary sarcopenia, characterized by reduced muscle strength as well as a decrease in both the quantity and quality of muscle mass recorded on

both clinical and US examinations. Moreover, in the lower medial third of the thigh, a cold, soft ad mobile mass was noted which showed a tense and elastic consistency on palpation. Thigh pain of the patient did not fit the radicular pattern and did not spread under the knee. No dysesthetic symptoms were reported. The right knee showed no signs of synovitis. Patient lying on the bed could not lift-up the right lower limb and could not stand-up and walk independently. US examination of the thigh revealed a wide quadriceps muscle lesion especially involving vastus medialis, (**Figure 3 A-B** and **Supplementary videos 1 and 2**).

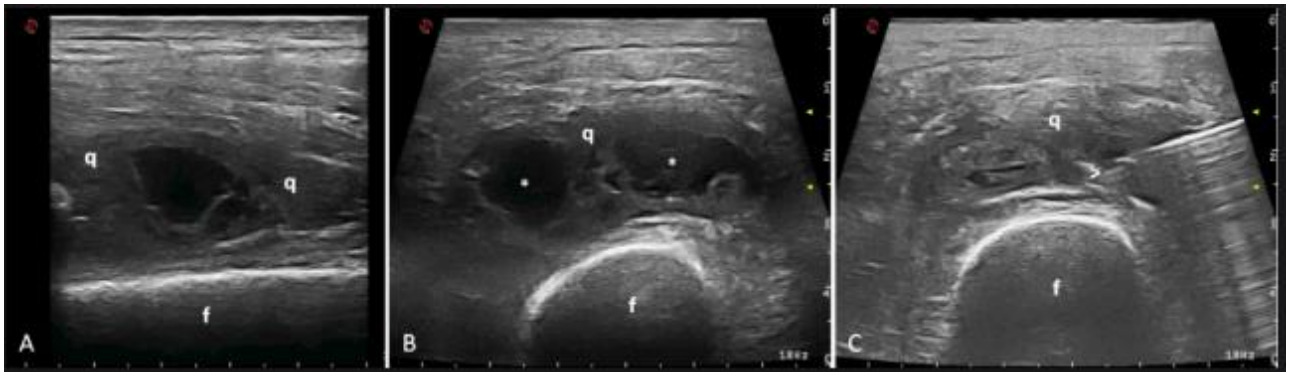

Figure 3: Ultrasound images acquired at baseline (T0) and showing quadriceps muscle rupture. A-B. Longitudinal and transverse scans of the quadriceps muscle showing anechoic fluid collection within the muscle interrupting the tissue texture (asterisks). C. Same view of image B. Needle placement within the muscle lesion during the aspiration of the collection ad injection of 5 mg/2 ml of a solution of hydrolyzed bovine collagen-derived low molecular weight peptides. The arrowhead indicates the tip of the needle. f=femur; q=quadriceps muscle.

(Main diameters of the lesion: 4.7 x 1.8 x 1.5 cm) and a periosteal cyst (**Figure 4** and **Supplementary videos 3 and 4**).

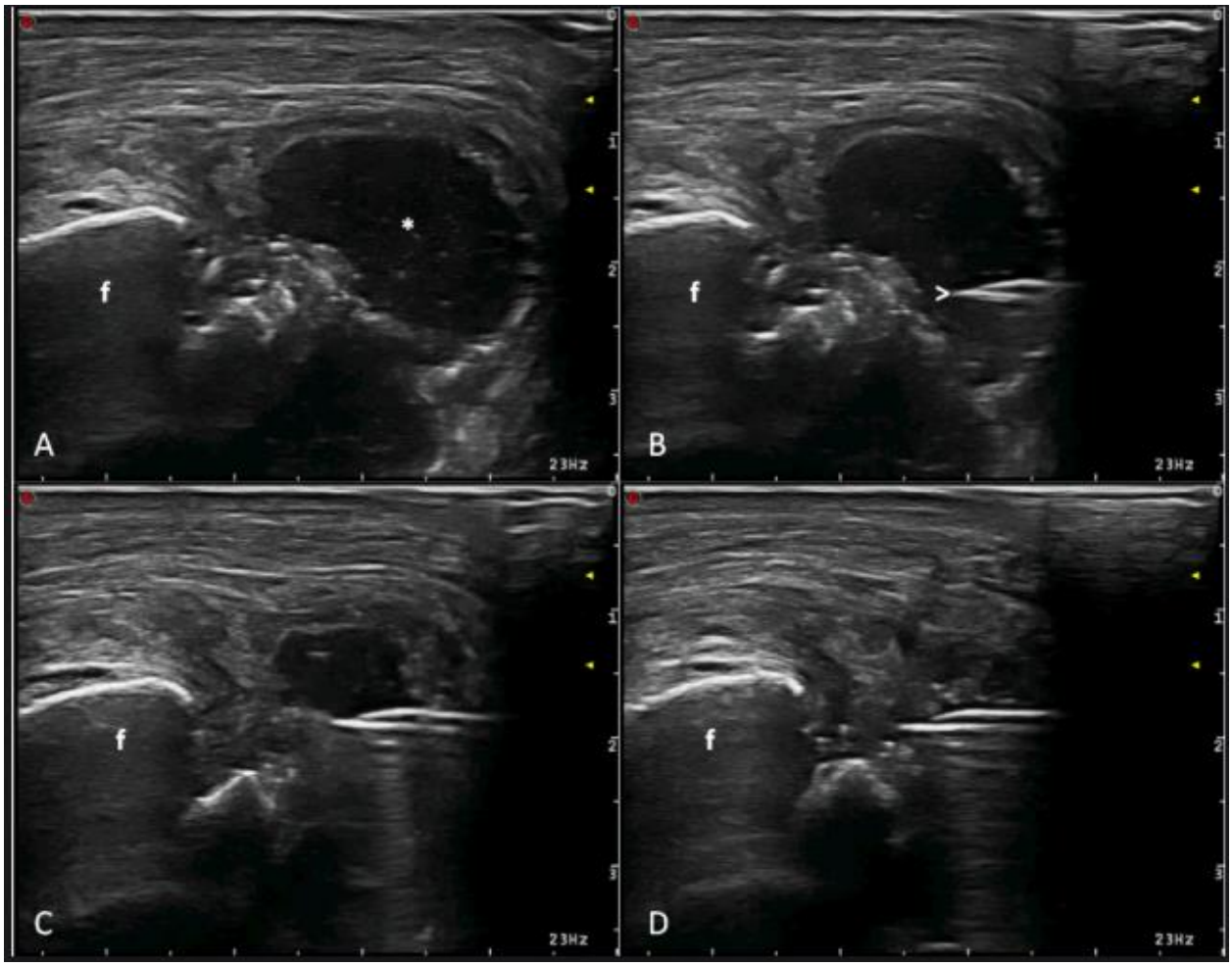

Figure 4: Ultrasound images showing the periosteal abscess (A) and different steps of its ultrasound guided aspiration (B-D). A. Transverse medial scan of the internal distal aspect of the femur showing a hypoechoic round fluid collection (asterisk). B. Tip of the needle placement within the abscess (arrowhead). C. Ultrasound guidance allows for the visualization of the tip of the needle that during the aspiration is maintained in the right position. D. Complete aspiration of the abscess. f=femur.

(Main diameters of the lesion: 3 x 2 x 1.5 cm). The muscle injury was characterized by two large, round-shaped, communicating areas with irregular margins and hypo-anechoic content consistent with a fluid collection. Moreover, X-ray of the knee confirmed CPPD disease and showed bony cortex resorption adjacent to the proximal screw (**Figure 5**).

Figure 5: Conventional radiography anteroposterior view of the knee showing meniscal chondrocalcinosis (arrows) and bony cortex resorption adjacent to the proximal screw **(arrowheads)**.

US-guided aspirations of both the fluid collections identified by US were performed. From the quadriceps muscle lesion, the procedure allowed the collection of 8 ml of slightly haematic fluid (**Figure 6**).

Figure 6: 8 ml of slightly haematic fluid collected from quadriceps muscle lesion (**arrow**).

while from the periosteal cyst 6 ml of frankly purulent material was aspired, characteristic for abscess and tissue necrosis **(Figure 4 B-C-D)**.

Patient was immediately started with empiric antibiotic therapy, and after five days, following the identification of *Serratia marcescens* on cultural examination of periosteal cyst, the antibiotic treatment was modified according to the antibiogram: meropenem 1 gr tid and ciprofloxacin 500 mg bid intravenously administered. At home antibiotic therapy continued with cefditorelpivoxil 400 mg sid + trimethoprim-sulfamethoxazole 160/800 mg bid orally. In order to increase muscle mass and strength, patient also took essential amino acid at home [6,7]. The cultures of the haematic fluid aspired from the quadriceps muscle lesion remained negative. Moreover, the patient underwent a personalized rehabilitation treatment under the supervision and assistance of a dedicated physiotherapist. He continued the rehabilitation program independently at home, performing lower limb mobilization exercises, isometric muscle strengthening, and ambulation with partial weight-bearing using a forearm walker.

Intramuscular haematoma US-guided injection with low molecular weight hydrolized bovine collagen solution.

At baseline (T0), after obtaining the patient's informed consent and according to the indications provided by the research and development and drug safety department of HLC Srl, we proceeded with the US-guided aspiration of the quadriceps muscle haematoma and US-guided injection of 5 mg/2 ml of a solution of hydrolyzed bovine collagen-derived low molecular weight peptides (LWPs), (PEPTYS 52©, Horizon Lab Company Srl, San Marino Republic), was performed (**Figure 3C and Supplementary video 5**). After the procedure, patient underwent a compressive medication and performed a rehabilitation program consisting of hip and knee joint mobilization, isometric quadriceps strengthening and assisted gait rehabilitation program.

Two weeks after the baseline (T1), patient showed an increase in quadriceps strength and pain during hip flexion reduced; however, he could not stand up nor walking. At T1, US examination showed (**Figure 7 A-B**) a significant reduction of the muscular lesion and a second injection with LWPs was performed under US guidance.

At week seven from T0, one month after the second injection with LWPs (T2), muscular strength and active range of movement of the right hip increased, pain during hip flexion nearly disappeared and patient was able to stand-up on his own and move independently from bed to wheelchair. At T2, US examination showed further progress in the healing process in terms of volume reduction and echogenicity increase of the muscle lesion due to scar formation (**Figure 7 C-D**).

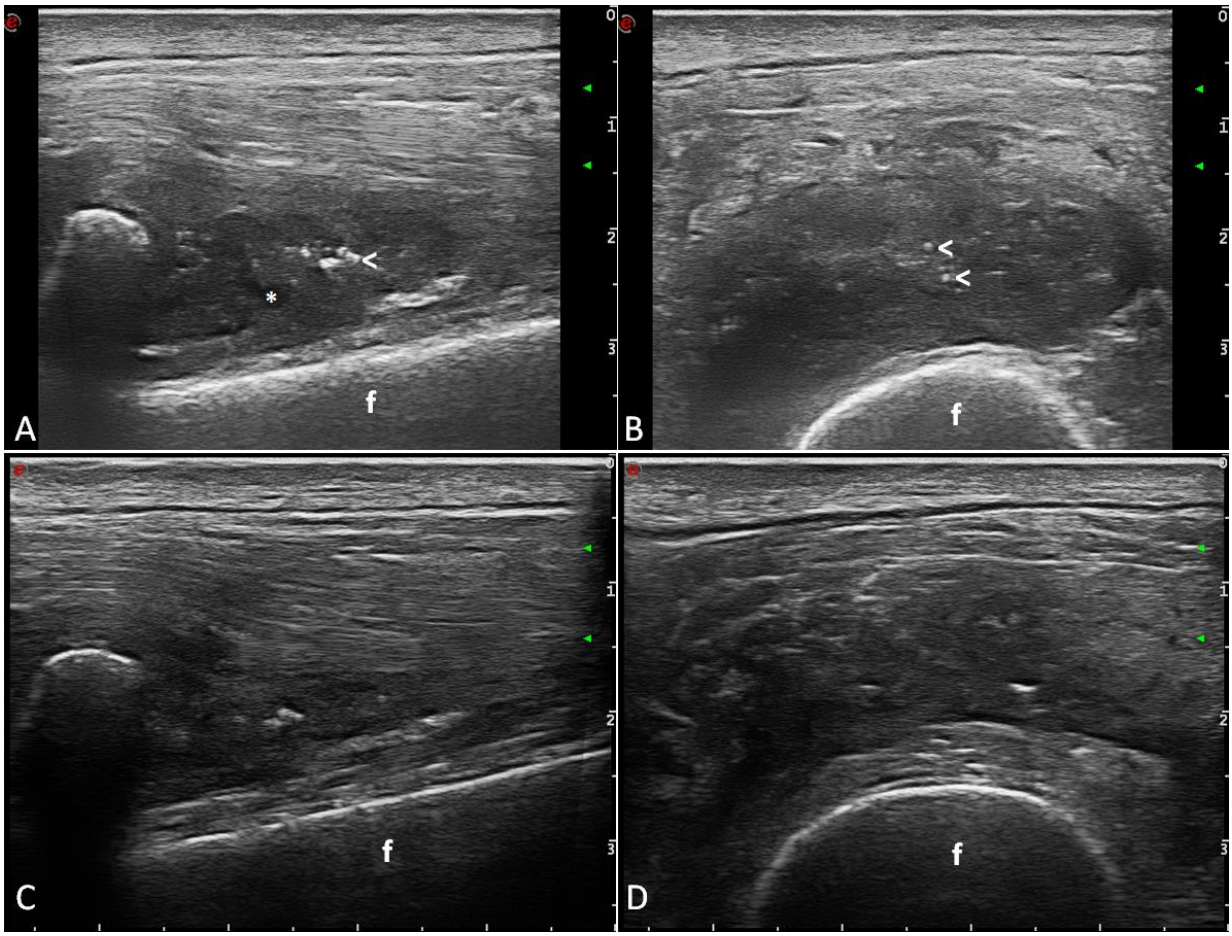

Figure 7: Representative ultrasound images of quadriceps muscle lesion at follow-up visit T1 (**A-B**) and T2 (**C-D**), respectively two and six weeks after the first injection of 5 mg/2 ml of a solution of hydrolyzed bovine collagen-derived low molecular weight peptides. **A-B**. At T1, the muscle lesion appeared more echogenic, some hyperechoic spots (**arrowheads**) were detected, and anechoic fluid collection was nearly disappeared (**asterisk**). **C-D.** At T2, further progress of the healing process could be detected by ultrasound: the volume of the muscle lesion reduced and no fluid collection was detected within the quadriceps muscle.

Orthopedics

On May 2023, patient underwent surgical intervention consisting in the removal of a gamma nail and the placement of an antibiotic-loaded spacer (**Figure 8A**). Following the surgical intervention, the swab tested positive for *Serratia marcescens*, indicating the presence of this specific pathogen in the infection site.

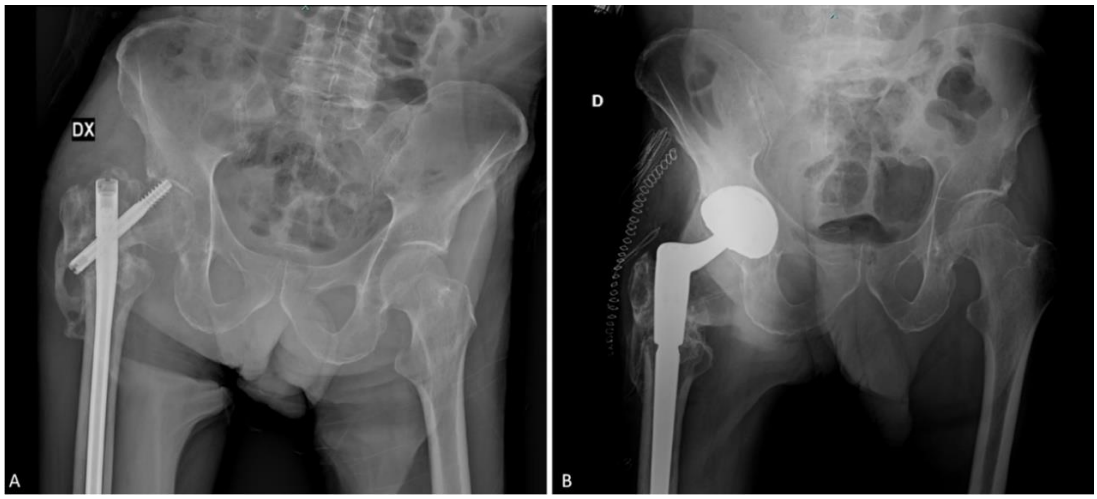

Figure 8: X-ray imaging showing femoral gamma nail (**A**) and total hip arthroplasty (**B**).

Description of the surgical intervention: the patient was positioned in left lateral decubitus. A sterile field was prepared with iodine-impregnated adhesive drape. A posterior-lateral incision was made following the Gibson-Moore approach. Fasciotomy was performed, followed by dissection of the extra-rotators. Upon reaching the articular plane, the presence of purulent material was observed, which was removed and sent for culture examination. A pseudarthrosis was identified. The metal implant was removed, along with the gamma nail, using appropriate instruments. The fracture site was regularized, and the acetabulum was prepared using progressively larger reamers up to size 54. The femur was prepared. After adequate debridement, an antibiotic spacer with gentamicin and vancomycin was cemented at the metaphyseal level. Reduction and final stability were tested. A suction drainage system was placed subfascially, followed by layered closure and sterile dressing.

After 6 months, the spacer was removed, and a hip arthroplasty (hip prosthesis) was placed (**Figure 8B and 9**). Postoperative swab tests were negative. The patient is ambulating with the assistance of a walker.

Figure 9: X-ray imaging showing total hip arthroplasty.

Surgical intervention summary: the procedure was performed with the patient in left lateral decubitus, following a standard posterior-lateral (Gibson-Moore) approach through the previous scar. After removal of the antibiotic spacer and sampling of periprosthetic tissue for cultures, a total hip revision arthroplasty was performed with implantation of a cementless acetabular cup and femoral stem. Stability was confirmed intraoperatively, and the wound was closed in layers with drainage and sterile dressing.

Of note, lavage was performed thoroughly using saline solution. Antibiotic-loaded cement was applied, and proper debridement of the infected tissues was completed. Stability was confirmed after the first test. The postoperative course was uneventful, the patient underwent adequate perioperative care and rehabilitation treatment according to the established protocol [8].

Discussion

Comprehensive clinical examination and merging clinical with imaging findings were the keys for the accurate diagnosis of this severe and disabling pain syndrome affecting the right lower limb.

In fact, obvious clinical signs of acute knee monoarthritis together with US findings confirming CPPD disease could lead to a hasty conclusion of the diagnostic process neglecting other important clinical signs which could not be explained with knee synovitis [2,3]. As a matter of fact, pain induced by passive right hip mobilization and painless lump on the internal distal aspect of the thigh were due to other pathologic conditions and imaging findings helped in making the correct diagnosis.

In this case, US examination accelerated the diagnostic process by simultaneously identifying three distinct pathological conditions in the right lower limb: knee chondrocalcinosis, quadriceps muscle lesion, and peri-femoral abscess. Additionally, US guidance was crucial for therapeutic interventions, allowing accurate aspiration of fluids and injection of LWPs precisely into the injured muscle area. Conventional radiography later supported US findings, confirming CPPD disease and highlighting radiolucency in the femoral cortex suggestive of infection around the screw.

Moreover, the treatment of a large muscle injury, particularly in a elderly patient with multiple comorbidities and limited recovery capacity, represents a challenge for the physicians.

In recent years, the literature has highlighted the important role of LWPs in soft tissues regeneration such as tendons and cartilage. LWPs can be administered orally or directly injected into the target area [9,10,11]. This innovative therapy has demonstrated a potential role in enhancing muscle performance and in the prevention of soft tissue injuries [10].

However, the efficacy of collagen peptides administered for muscle injury has not yet been described in the literature.

Our therapeutic approach was based on the evidence that the role of the extracellular matrix (ECM) in muscle repair mechanisms is widely recognized [12] and the stimulation of ECM synthesis is probably caused by specific Hyp-Pro-Gly-containing peptides with a molecular size <10 kDa [12,13,14].

This case highlighted the healing of the muscle injury both anatomically, through US examination, and functionally, through clinical assessment. Moreover, thanks to the rehabilitation program, the patient managed to increase segmental muscle strength and endurance, to recover quadriceps strength and to restore the functionality of the right lower limb. The rehabilitation treatment also focused on addressing generalized fatigue and counteracting sarcopenia.

In patients presenting with multiple coexisting musculoskeletal conditions—such as peri-implant infection, muscle injury, and chondrocalcinosis—a multidisciplinary and holistic approach is essential. These complex clinical scenarios require not only the integration of expertise from rheumatologists, physiatrists, and orthopaedic surgeons, but also continuous clinical monitoring to promptly identify complications and adjust the therapeutic strategy accordingly. A comprehensive, patient-centered management plan is fundamental to address the interplay of comorbidities and to ensure optimal functional recovery.

We would like to emphasize that the clinical outcome achieved in our case should be considered within the context of a multidisciplinary approach involving a rheumatologist, physiatrist, and orthopedic specialist.

Conclusion

Our work mainly aimed to highlight, on one hand, the significant diagnostic and therapeutic value of value of ultrasound across various medical specialties, and on the other, the importance of teamwork. It is widely recognized that a multidisciplinary approach allows for better management of clinical cases that are challenging to address in routine clinical practice.

We present a case in which the contribution of three different musculoskeletal specialists was essential to resolving the clinical issues encountered.

Although a consensus on the routine use of musculoskeletal ultrasound among specialists in locomotor system disorders—such as physiatrists, orthopaedic surgeons, sports medicine physicians, and rheumatologists—is yet to be fully established, we believe that every effort should be made to promote the widespread adoption of this diagnostic and therapeutic tool. Its broad clinical utility, non-invasiveness, and relatively low cost make it an invaluable resource in daily practice.

Limitations

This case report supports the integration of musculoskeletal ultrasound and injectable collagen peptides as effective tools in the treatment of soft tissue lesions. The clinical experience described confirms their therapeutic value in enhancing diagnostic precision and promoting tissue recovery. Given their non-invasiveness, safety profile, and growing evidence in the literature, these approaches should be more widely adopted in routine practice. Nevertheless, further studies are needed to establish standardized protocols and optimize their use across different clinical settings.

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Supplementary Material

Supplementary videos legends.

Supplementary Video 1.

Ultrasound imaging of the thigh. Video acquired first placing the probe on the longitudinal anterior scan of the suprapatellar pouch of the knee and then moving the probe proximally towards the hip. The video shows the suprapatellar pouch enlargement, the quadriceps muscle marked hypotrophy and finally the vastus lateralis muscle lesion.

Supplementary Video 2.

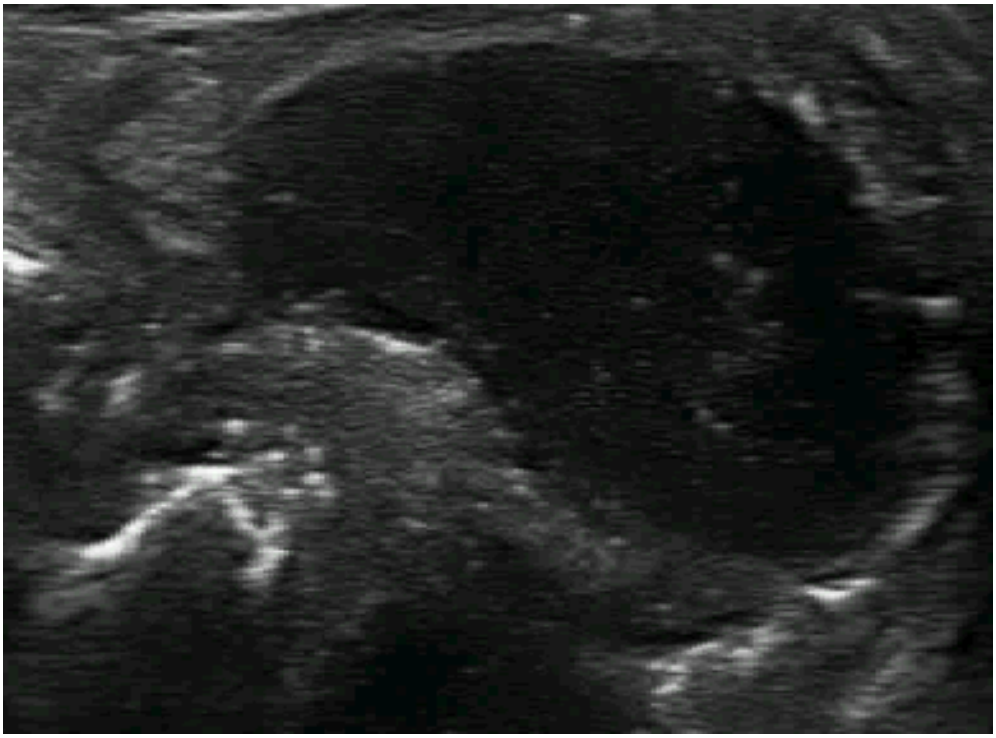
The dynamic compression with the ultrasound probe on the thigh showed the displacement of the anechoic area and the movement of the torn muscle flaps. Such ultrasound imaging evidence during real-time examination provides visual confirmation of fluid collection within the quadriceps muscle lesion.

Supplementary Video 3.

The dynamic compression with the ultrasound probe on the lump on the internal distal aspect of the thigh showed the displacement of the hypoechoic material, providing evidence of a fluid collection in communication with the internal part of the bone.

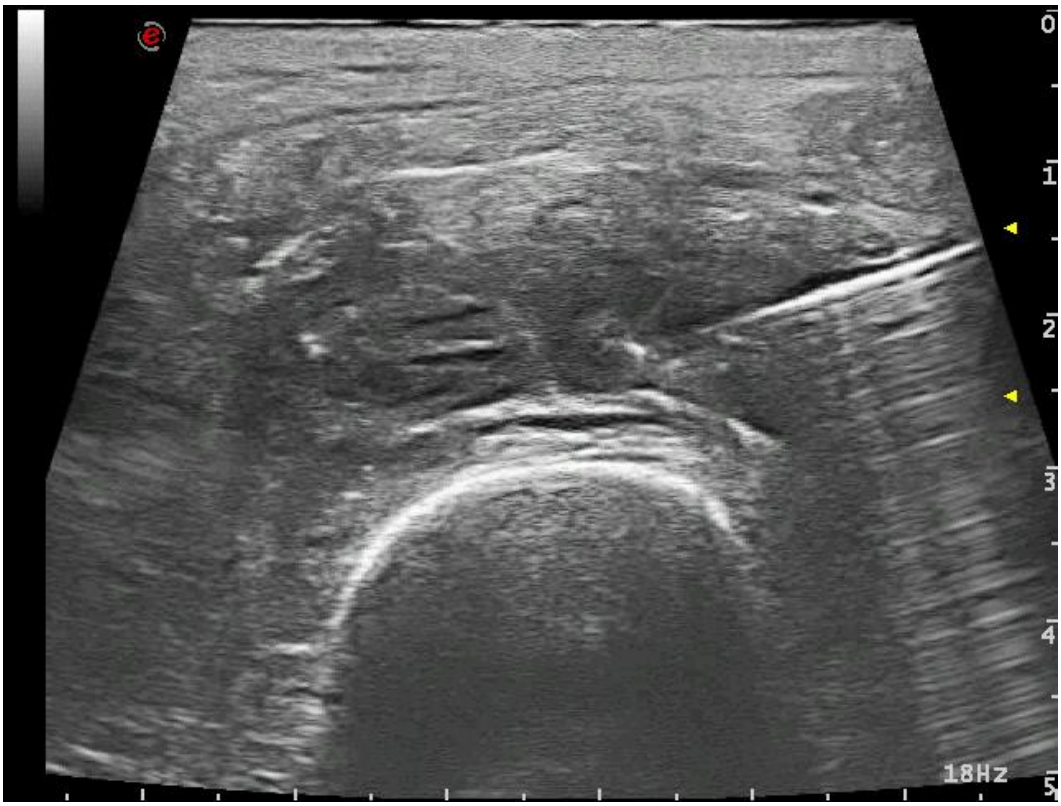
Supplementary Video 4.

Video showing the ultrasound guided aspiration of the periosteal abscess.



Supplementary Video 5.

Video showing the ultrasound guided injection of 5 mg/2 ml of a solution of hydrolyzed bovine collagen-derived low molecular weight peptides within the muscle lesion.



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