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Case Report

Septic arthritis of the wrist: A case of Parona space abscess in a rheumatoid arthritis patient with Charcot wrist ☆☆☆★★

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ABSTRACT

Closed-space hand infections are considered an emergency requiring prompt management to avoid debilitating consequences and potential morbidity. Septic arthritis of the wrist is particularly uncommon in comparison to the large joints that are usually affected. We report a case of a 64-year-old female with known rheumatoid arthritis and neuropathic wrist, with superimposed septic arthritis of the wrist, complicated by abscess formation. Ultrasound and Magnetic resonance imaging revealed spread of infection to the midpalmar region and the space of Parona. Although collections in this space are extremely rare, if left untreated, they may lead to permanent disability. Incision and drainage of the abscess along with synovectomy of the affected wrist joint was performed. *Streptococcus pneumoniae* was the causative organism, despite the fact that Non-gonococcal and *Staphylococcus aureus* bacteria are the main causative agents of septic arthritis in adults.

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Introduction

Initial superficial infections of the hand may be complicated by spread to the deep structures including deep fascia, tendon sheaths, adjacent compartments and further extension to regional joints and bones ultimately [1].

Closed space hand infections are considered surgical emergency, mandating quick management, as delays may result in catastrophic consequences of permanent disability and mortality in some cases [2,3].

Around 25-50 cases of serious hand infections are encountered annually according to a study published in 1993 [4]. Pyogenic tenosynovitis, infections of the Parona space, thenar and hypothenar as well as horseshoe abscesses form the majority of the deep seated hand infections [1].

Only 1.5%-5% of septic arthritis cases occur in the wrist rendering it, an uncommon presentation [3]. Our report is unique in that it combines a variety of uncommon and rare presentations in a case of a 64-year-old rheumatoid arthritis female with Charcot wrist, with superimposed septic arthritis, complicated by abscess in the Parona space.

Case report

A 64-year-old female with known rheumatoid arthritis (RA), hypertension, and asthma presented to the emergency with 3 days history of right wrist pain. The pain was of sudden onset, associated with swelling, redness, and itchiness. Generally, the patient suffered from constant dull pain with chronic bilateral hand deformity, as a result of the long-standing RA. The patient denied any history of penetrating trauma, except for insect bite. Upon physical examination, the wrist was tender and hot on palpation with a reduced range of motion (Fig. 1).

Upon admission, methotrexate was withheld and septic workup was conducted. White blood count was 16.91 (reference range 3.6-9.6), hemoglobin was 10.70 g/dL (range 12.0-14.5), platelets $423 \times 10^9/L$ (150.0-400.0). ESR (erythrocyte sedimentation rate) was high 35 mm/hour (reference range < 20). Peripheral blood gram stain showed positive cocci in pairs and chains, and thus peripheral blood culture revealed *Streptococcus pneumoniae* sensitive to Vancomycin.

Radiograph of the right wrist and hand, showed generalized osteopenia and bilateral marginal erosions involving the MCPs and carpal bones consistent with the diagnosis of rheumatoid arthritis. Moreover, destruction of the carpal and the distal radio-ulnar joint, with volar dislocation of the carpal bones in relation to the distal radio-ulnar articulation, in addition to debris, consistent with Charcot joint. Additionally, volar and dorsal wrist joint soft tissue swelling was noted, suggestive of cellulitis, and raised the possibility of an abscess formation (Fig. 2).

Ultrasound revealed features of septic arthritis, evidenced by extensor tendons abscess extending to the intercarpal joints, as well as small tenosynovitis of the flexor tendons, associated with subcutaneous soft tissue edema reflecting cellulitis (Fig. 3).



Fig. 1 – Right hand and wrist deformity and swelling.

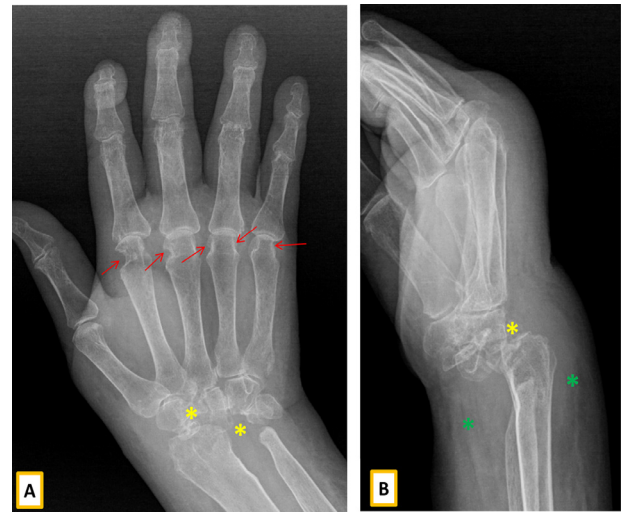


Fig. 2 – (A) Frontal and lateral (B) Radiographic views of the right wrist and hand, showing generalized osteopenia and marginal erosions involving the MCP joints (red arrows) consistent with the diagnosis of rheumatoid arthritis. Destruction of the carpal and the distal radio-ulnar joint, with volar dislocation of the radio-ulno-carpal joint with debris, reflecting Charcot joint (yellow asterisks), with volar and dorsal wrist joint soft tissue swelling (green asterisks).

MRI was performed to assess the degree of extent of the aforementioned infection, and again re-demonstrated features of rheumatoid arthritis, with MCP joints and carpal marginal erosions, effusion and synovitis. In addition to features of Charcot wrist joint, evidenced by destruction, and volar dislocation of the radiocarpal and ulnocarpal joints, as well as intercarpal joints destruction with carpal bony reabsorption, in addition to the presence of bony debris. Moreover, it re-revealed the extensor tendon abscess (measuring $6 \times 3.7 \times 3.3$ (ML x AP x CC) cm), extending into the intercarpal joints, which showed subchondral edema, osteitis and joint

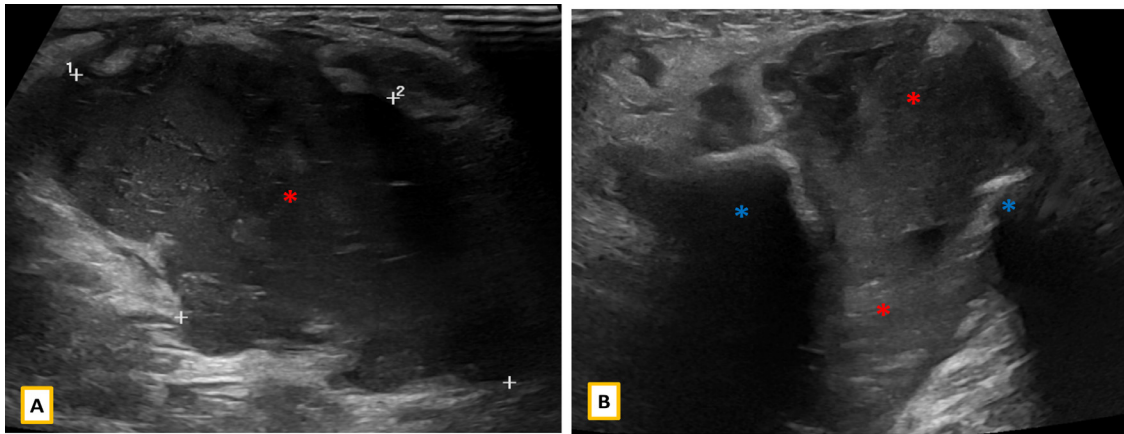


Fig. 3 – (A-B) Targeted ultrasound of the dorsal wrist joint, showing an extensor tendon collection (red asterisks), communicating with the intercarpal joints (blue asterisks).

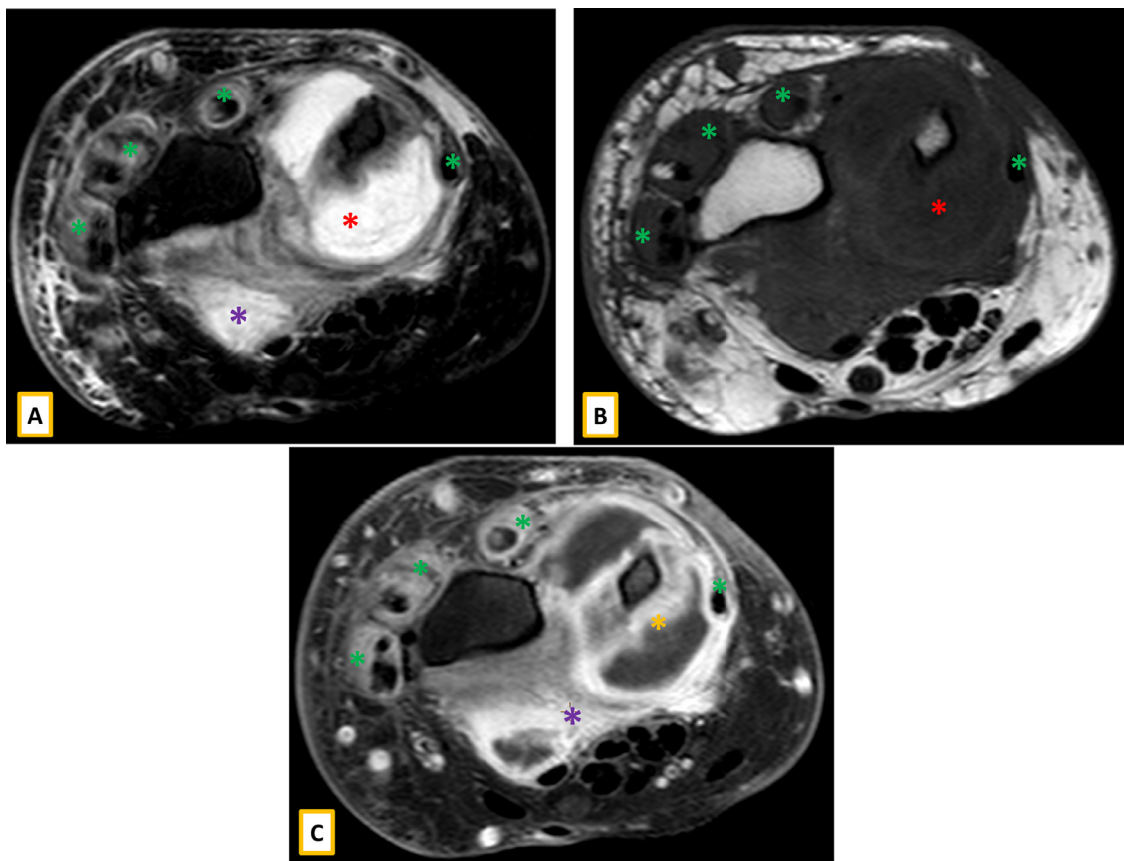


Fig. 4 – (A) Axial T2 fat sat, (B) Axial T1. (C) Axial T1 FS post-contrast, showing radioulnar joint effusion (red asterisk), and synovitis (yellow asterisks). Multi extensor tendon tenosynovitis (green asterisks), and fluid collection in the Parona space (purple asterisks).

widening, reflecting septic arthritis (Figs. 4-7). Flexor tenosynovitis, extending into the midpalmar space and Parona's space was identified (Figs. 4, 7, and 8).

Patient was started on Intravenous Cloxacillin (1 gram every 6 hours) plus Vancomycin (1 gram every 12 hours). Incision and drainage of the abscess in addition to partial synovectomy

of the right wrist was done under a supraclavicular block, after which wrist splint was applied. The patient's inflammatory parameters kept showing interval reduction, with a fast recovery. A 1-week follow-up showed complete recovery and patient was back to her baseline with no further management required.



Fig. 5 – Coronal T1 fat sat post-contrast, showing: radioulnar synovitis (yellow asterisks), MCP joints synovitis (green asterisks), MCP: Metcarpalphalangeal joints erosions (red arrows) with radiocarpal, ulnocarpal and intercarpal joints destruction (purple arrows).

Discussion

Parona space was first described by an Italian surgeon called Fracensco Parona in 1876 [1,5]. It is located between the fascia of pronator quadratus and the flexor digitorum profundus tendon sheath, proximal to the flexor retinaculum at the volar aspect of the distal forearm, being connected to the midpalmar space through the carpal tunnel [5]. The ulnar and radial bursae are tendon synovial sheaths, and begin in the distal forearm in relationship with Parona space, passing through carpal tunnel, and extending in to the palm, creating a closed space, that can easily facilitate the spread of infection, leading to potentially limb-threatening complications [3,5] (Figs. 9, 10). Although collections of the space of Parona are exceptionally rare, the possibility of limb amputation, in cases of developed forearm compartment syndrome that dictates prompt and aggressive management [6].

Septic arthritis can mimic a rheumatoid arthritis episodic flare-up, with fear of potential misdiagnosis [7]. To our knowl-

edge, there are no studies in literature up to date discussing the exact incidence rate of septic arthritis in patients with pre-existing inflammatory arthritis. However, an estimation of 28–38 per 100000 per year has been reported, with a prevalence of 0.3% to 3% [7,8]. An additional study estimated the annual incidence rate to be 0.2% in pre-existing cases of rheumatoid arthritis [7,9]. Other studies concluded that 46% of septic arthritis occurs in cases of pre-existing joint disease, of those, 14% were rheumatoid arthritis patients [10], with a predilection for the wrist and the hand [10]. Generally, the large joints are affected in septic arthritis including the knee, shoulder and elbow [11].

The main causative organisms of this infection in adults are non-gonococcal gram-negative bacteria as well as non-group A beta-hemolytic *Streptococci* and *Staphylococcus aureus* [11].

Streptococcus pneumoniae is considered a relatively rare causative agent for septic arthritis. In 1888, the first case of *S. pneumoniae* septic arthritis was reported. A total of 285 cases have been documented in 82 years between 1888 and 1970, denoting its' rarity [11]. A more recent literature review of studies published from 1950 to 2017 found 121 cases of *S. pneumoniae* causing septic arthritis [12].

Patients with rheumatoid arthritis may be susceptible to septic arthritis due to their impaired immunity and reduced phagocytic activity [7], additionally the chronic synovitis in RA, creates an ideal habitat for the survival and proliferation of bacteria [8].

Rheumatoid arthritis is a systemic disease, targeting the synovium [13]. Generalized (as in our case) or periarticular osteopenia can occur, due to inflammation, and subsequent increased blood flow and vascularity. Hand joints in particular, are involved in the early phase of the disease, with affinity for the proximal interphalangeal and metacarpophalangeal joints of the 2nd and 3rd fingers, manifested by synovitis, effusion and marginal erosions. These erosions can also be found in the carpal bones, including the hamate, and triquetrum [13,15]. Inflammation of the flexor and extensor tendons can occur, evidenced by tenosynovitis [14]. Ankylosis can occur in the later stages of the disease, further deteriorating patients' quality of life by reducing their hand function, worsening the disability [13,14].



Fig. 6 – (A) Coronal T2 fat sat, (B) Coronal T1, (C) Coronal T1 fat sat, post-contrast, showing: radiocarpal, ulnocarpal and intercarpal joints destruction and bony re-absorption, reflecting Charcot joint (red asterisks), with synovitis (yellow asterisks).

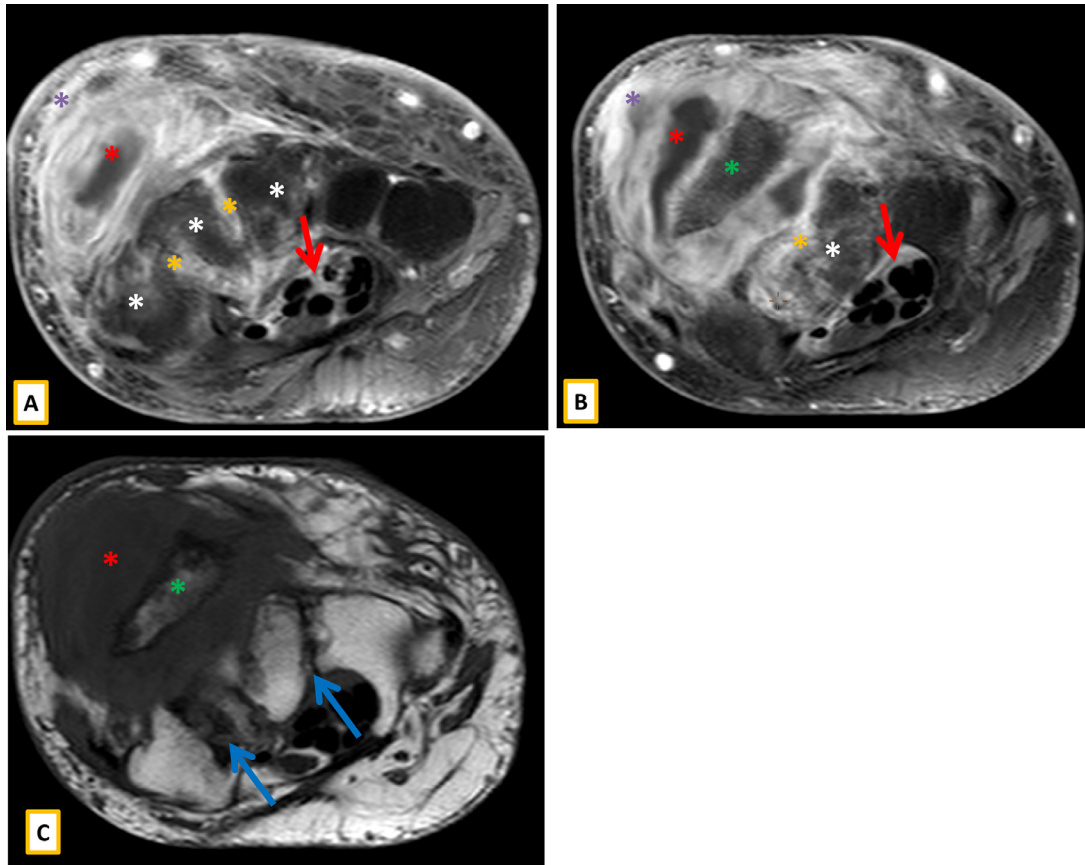


Fig. 7 – (A-B) Axial T1 fat sat post-contrast, (C) Axial T1, showing: extensor tendon abscess (red asterisks), cellulitis (purple asterisks), bony debris and carpal destruction and dislocation reflecting Charcot joint (green asterisks), carpal erosions (blue arrows), carpal subchondral edema and osteitis (white asterisks) and intercarpal enhancing effusion and synovitis (yellow asterisks) and thus joint space widening (yellow asterisks), reflecting septic arthritis. Note the flexor tenosynovitis and spread of the Parona's space collection to the midpalmar space (red arrows).

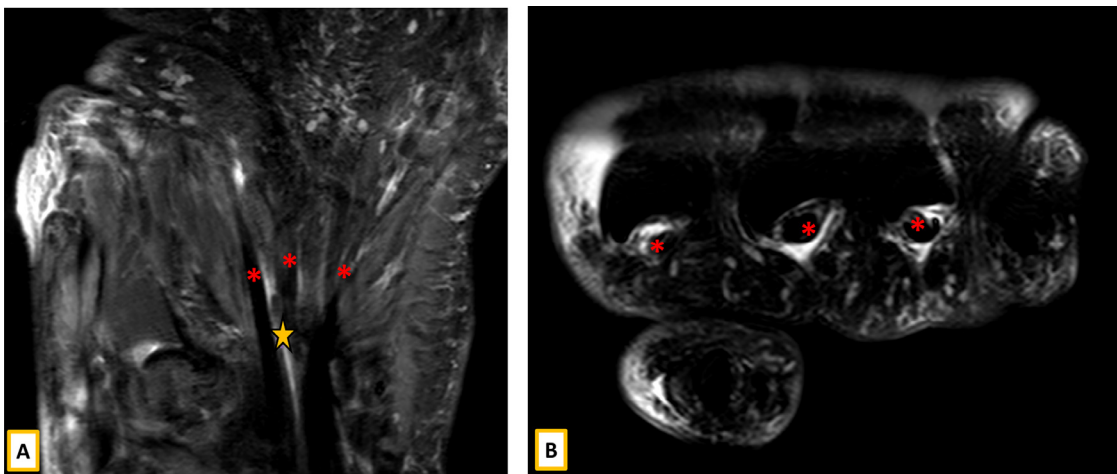


Fig. 8 – (A) Coronal STIR, (B) Axial T2 fat sat, showing the aforementioned collection extending through the flexor tendons sheaths (red asterisks) and the radial bursa (yellow star).

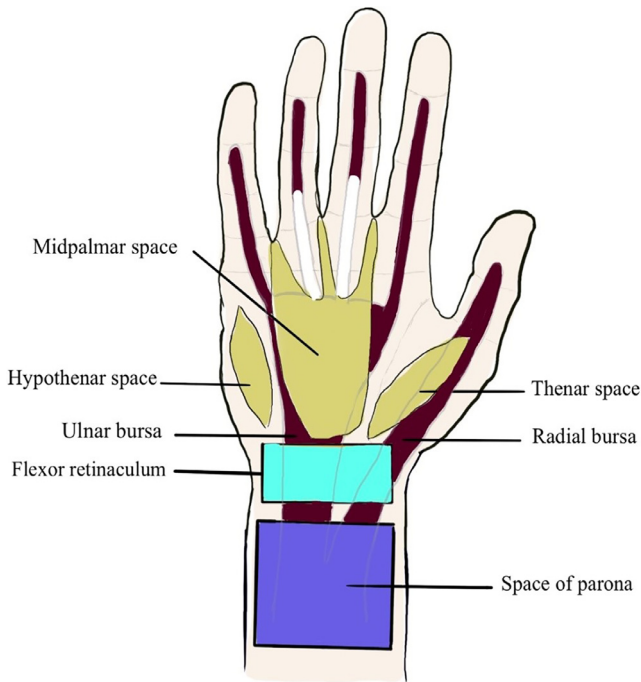


Fig. 9 – Anatomical illustration of the spaces within the hand. The radial and ulnar bursae in relation to the space of Parona and the carpal tunnel.

Plain radiography is considered the first line of imaging for rheumatoid arthritis [13]. MRI has proven its' superiority in accurately identifying synovial hypertrophy, synovitis, joint effusions, and bone erosions in comparison to plain radiogra-

phy, especially in early stages where subtle changes are undetectable by the latter [13,16].

Radiological features of rheumatoid arthritis can be indistinguishable from those of septic arthritis and neuropathic arthropathy. Nevertheless, all three entities were present in our case.

Septic arthritis, can exhibit soft tissue swelling, joint effusion, erosion, periarticular osteopenia, synovitis, and bone destruction [15], all of which were present in our case. Clinical features and inflammatory markers, including erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) and the white blood cell count (WBC), can further aid in reaching the diagnosis, as they were raised in our case in addition to the positive blood culture for *S. pneumonia*.

Similarly, Charcot or neuropathic arthropathy can result in joints destruction, deformity and dislocation, as well as bony re-absorption and debris [17], as seen in our case. The radiological resemblance in these joint diseases may be challenging, mandating a systematic approach with various radiological modalities to reach the diagnosis.

Surgically, the deep anatomical spaces communications within the hand are of utmost importance in order to locate the pathways of the infection spread and have the ideal incision and drainage approach [2].

The Parona space and midpalmar space connect through the carpal tunnel [5], in 85% of the general population [18] (Figs. 9, 10). The midpalmar space is located deep to the 3rd, 4th and 5th flexor tendons anatomically. It contains the ulnar bursa which is in continuity normally with the digital synovial sheath of the 5th digit.

Infections in these tendon sheaths and thus fingers, as well as the ulnar bursa may spread to this space and in-turn into the Parona space [2] (Fig. 9).

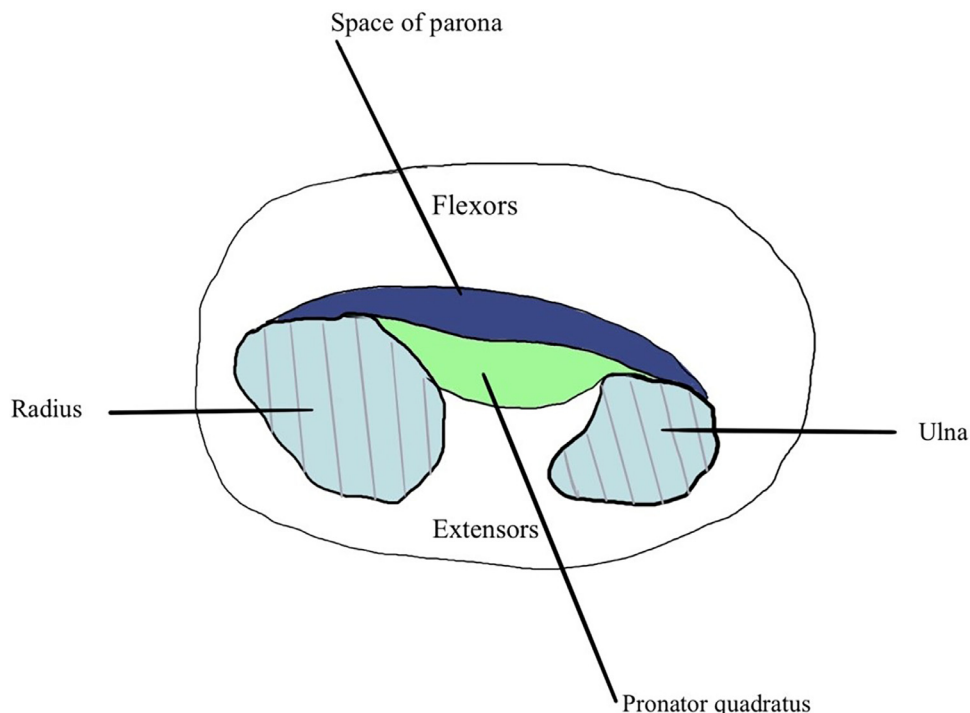


Fig. 10 – Illustrated axial view of the hand featuring the Parona space and its adjacent anatomical structures.

Most of the flexor tendons are surrounded by the palmar ulnar bursa, forming the largest bursa in the hand. It is located at the pronator quadratus muscle level and extends up to 3 centimeters proximal to 2nd, 3rd and 4th tendon sheaths. Possible connections with the palmar radial bursa have been identified in some anatomical variants [19] (Fig. 9).

The space between the adductor pollicis and thenar muscle compartment is known as the thenar space. The radial bursa infections can spread to the thenar and Parona spaces. The superficial fascial web spaces are joined with deep palmar spaces through the lumbricals channel, facilitating the spread of infection between the two spaces [2] (Fig. 9).

Infections of the midpalmar space present with tenderness and rigidity of the involved digits, with edema involving the palmar and dorsal aspects of the hand [2] as observed in our case.

Early identification, starting the appropriate antimicrobial therapy in combination with urgent surgical debridement are crucial in the management of such cases to ensure a favorable prognosis [11,18].

Conclusion

We present a unique case of wrist septic arthritis complicated by abscess collection in the space of Parona in a 64-year-old female with rheumatoid arthritis and Charcot wrist joint. Imaging findings can be misleading due to the overlapping radiological features of these entities. In such cases, clinical information, laboratory inflammatory markers and, in some instances, joint aspiration are essential for diagnosing and managing the patient accordingly and promptly, in order to avoid complications such as infections involving the fingers, spread through the space of Parona to the proximal forearm, and compartment syndrome.

Patient consent

No consent was obtained nor required for the writing of this manuscript, as it is waived by our institution's IRB policy.

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