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KIENBÖCK DISEASE VERSUS BONE EDEMA: CASE REPORT OF A CHILD AND YOUTH TENNIS PLAYER

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ABSTRACT

Kienbock's disease is a rare disease, caused by avascular necrosis of the semilunar bone, and it can make a differential diagnosis with several diseases that course with wrist arthralgia. The main differential diagnosis is lunate bone edema. This study aims to report the case of a child and adolescent tennis player who had arthralgia during a competitive calendar, presenting changes in imaging tests compatible with Kienbock's disease, but showing regression after conservative treatment, in a period of 3 months, configuring only bone edema. lunate triggered by repetitive trauma related to sport effort. As a therapeutic form for Kienbock's disease, surgical approaches can be performed for more advanced stages of the disease, but in the early stages, conservative treatment is performed with physiotherapy and symptomatic drugs, being the modality of choice in cases of bone edema and tendinopathies. In the report presented, the conservative measures showed a good response, evidencing better completeness of the lunate bone edema, allowing the patient to return to the practice of activities.

KEYWORDS: Kienbock's disease; Bone Edema; arthralgia.

INTRODUCTION

Kienbock's disease is a disease caused by avascular necrosis of the lunate, which can be caused in any individual regardless of age, but is more frequent in adults even without any history of joint damage. It is rarely bilateral and early stage patients usually do not seek medical help.[1,2]

The lunate is a carpal bone easily distinguishable by its shape with a deep crescent-shaped concavity, hence its name. It has an intimate articular relationship with the scaphoid and radius bones, as well as with the pyramidal bone, being stable by the ligaments that fix it to these other bones, being extremely important for the joint balance of the wrist. Its vascularization occurs through branches of the palmar and dorsal arteries in most cases, and it can be vascularized by only one palmar artery, as demonstrated by some authors,[3] in addition, the pattern of intra-osseous vascularization is very varied, and in most cases it is vascularized. In most cases, there is a single path with no major ramifications. Clinically, due to its position and vascular characteristics, it is the carpal bone most subject to osteonecrosis and dislocations.[1]

Although the etiology of Kienbock's disease is not yet very well defined, it is known that it has a multifactorial aspect, being more prone in individuals with skeletal and vascular anatomical variations, as well as triggered by successive traumatic effects and repetitive mechanical load, causing osteonecrosis.[4,5]

The clinical presentation is due to joint pain with reduced movement, associated with carpal edema, which may

present loss of motor strength, with reactive synovitis present. The severity of symptoms varies according to the severity of the injury, and may evolve with constant and disabling pain even at rest. In the most severe cases, joint incongruity and osteoarthritis can occur due to carpal collapse. Among the diagnostic tools, radiography and magnetic resonance imaging are the most used auxiliary means for the staging of the disease, established by Lichtman in 1977, as shown in Table 1.[6,7]

Table 1: Classification, imaging characteristics and therapeutic option in Kienbock's disease.

Internship	Imaging characteristic	Therapeutic option
I	- Radiography: no changes or presenting linear fracture, without sclerosis or lunate collapse. - MRI: low intensity on T1, may have a sign of hypo or hyperintensity on T2 - Scintigraphy: may show reactive synovitis	Immobilization for three months
II	Radial edge of the lunate may present with sclerosis or collapse. On radiography, it may present a more hypotransparent image and may have one or more fracture lines. Lunate may be completely sclerosed, but with preserved height, without associated carpal anomalies, but with frequent chronic synovitis.	- No ulnar variance: Radius shortening osteotomy, ulnar lengthening, capitate shortening. - With ulnar variance: Direct revascularization+external fixation or temporary STT arthrodesis (only in stage II); wedge or cup radial osteotomy; capitate shortening with or without capitate-hemate fusion; combination of techniques to restore the distal radioulnar index and direct revascularization
III	IIIA: collapse of the lunate but with preserved height. Lateral radiographs show anteroposterior enlargement of the lunate with shortening in the coronal plane, without proximal migration of the capitate or hyperflexion of the scaphoid. Clinically presents progressive stiffness. IIIB: carpal collapse with fixed scaphoid rotation associated with ring sign and decreased carpal height. Clinically, it presents progressive stiffness associated with signs of wrist instability.	IIIA: - No ulnar variance: Radius shortening osteotomy, ulnar lengthening, capitate shortening. - With ulnar variance: Direct revascularization+external fixation or temporary STT arthrodesis (only in stage II); wedge or cup radial osteotomy; capitate shortening with or without capitate-hemate fusion; combination of techniques to restore the distal radioulnar index and direct revascularization. IIIB: STT or SC arthrodesis with or without excision of the lunatum, with autograft of the palmaris longus tendon; radius shortening osteotomy; proximal row carpectomy (PRC);
IV	Severe carpal collapse with intra-articular degenerative changes in the midcarpal or radiocarpal joint, or both. Clinically, it presents progressive stiffness associated with edema, pain, functional limitation, severe and exuberant symptoms.	PRC; wrist arthrodesis; wrist denervation;

Therapy will be evaluated according to the degree of injury and staging of the disease, as shown in Table 1, but the correction of carpal misalignment is the main objective of treatment in more severe cases, with a view to preventing wrist osteoarthrosis. The initial stages may have a conservative approach.[7]

Schmitt et al (2005)[8] reported Kienbock's disease as the most common cause of signal hyperintensity in the lunate on magnetic resonance imaging. A stress fracture in the lunate must be distinguished from osteonecrosis and must be considered in the differential diagnosis in athletes who complain of wrist pain.

According to Maquirrian and Ghisi (2006)[9], in elite tennis, two of the 139 players developed stress fractures of the lunate over a two-year period, possibly related to the type of grip they used. Of the two lunate fractures present in their study, the 16-year-old's injury was diagnosed in 3 weeks, with his full return to sport at 10 weeks, while the second case, of a 15-year-old tennis athlete, the diagnosis was at 4 weeks and complete improvement occurred at 9 weeks, both grade 3 injuries.

During rehabilitation, patients are encouraged to modify their original grip to distribute the load forces of the wrist during tennis strokes.[8,10]

The objective of this work is to report the case of a child-juvenile tennis athlete who developed a right wrist injury (dominant hand), at age 16, during an official tennis tournament, observing the evolution of the disease and the patient after diagnosis and follow-up. doctor with appropriate treatment. In addition to carrying out a bibliographic survey about the case and comparing it with similar cases described in the literature, as well as reporting the possible differential diagnoses relevant to the case, such as Kienbock's disease itself, bone edema, semilunar fracture, impact syndrome ulnocarpal, tenosynovitis and synovitis.

MATERIALS AND METHODS

This is an observational, single-arm study of a case report on a child-youth tennis athlete, treated at the Orthopedics outpatient clinic of the Hospital Escola de Valença/RJ. He presented with a complaint of arthralgia, who developed a lesion in his right wrist (dominant hand), at age 16, during an official tennis tournament, with the diagnostic hypotheses of KIENBÖCK disease and lunate bone edema. The case will be followed up for further investigation and determination of the final diagnosis. A brief literary review will be carried out to support the theoretical foundation of the article, and articles published between 2009 and December 2020, in the PubMed, Scielo and UpToDate databases will be selected. Data collection will be performed by observing a patient with arthralgia, with a diagnosis still to be clarified, during outpatient follow-up. The instrument used for this collection will be the medical records and evolutions. After obtaining the data collection, they will be analyzed according to their thematic content and ordered in systematic material, being classified, according to the information by categories, in the registration unit. The analysis will be processed in three phases: in the first phase, the organization of material and systematization of ideas will be carried out; in the second phase, a classification of the information in categories, in a unit of registers and the third phase refers to the treatment and interpretation of the data based on the literature. In compliance with the ethical precepts of Resolution 466/2012-CNS for research with human beings, the project was sent and approved by the Research Ethics Committee.

CASE REPORT

Patient, male, 16 years old, tennis player since he was 7 years old, playing competitively since he was 9 years old. During competition, the athlete in question complained of a very strong "stinging" pain in the right wrist (dominant hand). The condition was pain in the region of the right wrist, of a compressive, throbbing and continuous nature, without irradiation, with limitation of movement and loss of motor strength. She reported worsening with extension movement, relief of symptoms at rest and when applying ice packs and functional bandages, but without complete improvement. The symptoms started after a streak of 12 games during the three weeks of competition. In the next round, in the tournament, with the condition still maintained, the athlete persisted with an ice pack, physical therapy and functional bandage, refusing to use any analgesic or medication. He was instructed to interrupt the match and withdraw from the tournament, but the same persisted. Despite the worsening of pain with the extension movement, the athlete reported that he did not feel the symptoms when using the backhand blow (performed with one hand). After completing the circuit, the athlete rested for a week, apparently showing improvement in his condition.

The following week, in a new stage of the circuit, the athlete withdrew in the second round due to the return of the team. With the maintenance of the symptoms, medical assistance was sought. On physical examination, there were no warning signs, and tendinitis was suspected. Initially, rest, physical therapy and the use of a palm splint were instructed, and radiography of the right wrist was requested (Image 1), which showed no changes.

Image 1: Right Wrist X-ray.

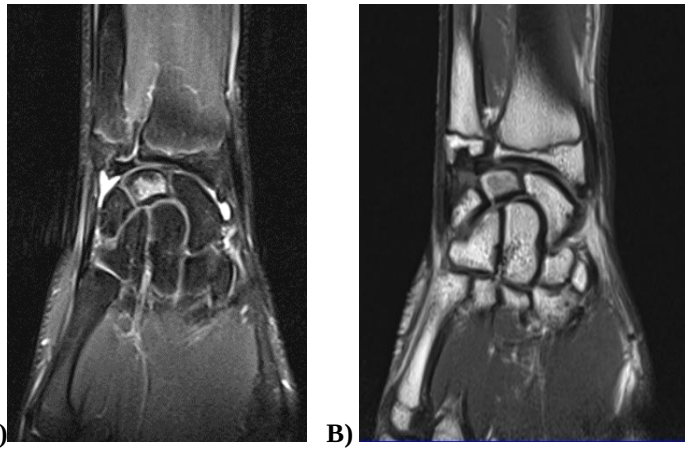


Image 2: Right Wrist Magnetic Resonance Coronal Section; a) T2 image; T1 image.

After a week, the condition progressed, and a MRI was requested (Images 2, 3 and 4) which showed a change in the signal with a pattern of bone marrow edema of the lunate, affecting almost the entire bone. Noticing minimal irregularity of the contours on the anterior face. There were no traces of fractures, nor alterations in the cartilage or ulnocarpal complex, which reduced the possibility of injury secondary to impact, considering the possibility of early-stage necrosis (Kienbock's disease). He presented liquid distension of the radiocarpal joint with formation of an arthrosynovial cyst on the dorsal surface next to the scaphoid measuring about 2 cm; Joint spaces and wrist compartment preserved; Triangular fibrocartilage with usual shape and signal strength; Scapholunate and lunopyramidal ligaments of normal appearance; Extensor tendons with normal thickness and intensity, without fluid in their sheaths; Preserved aspect flexor tendons; Median nerve with normal shape and signal intensity; Absence of extrinsic compressions inside the carpal tunnel, which has a usual appearance.

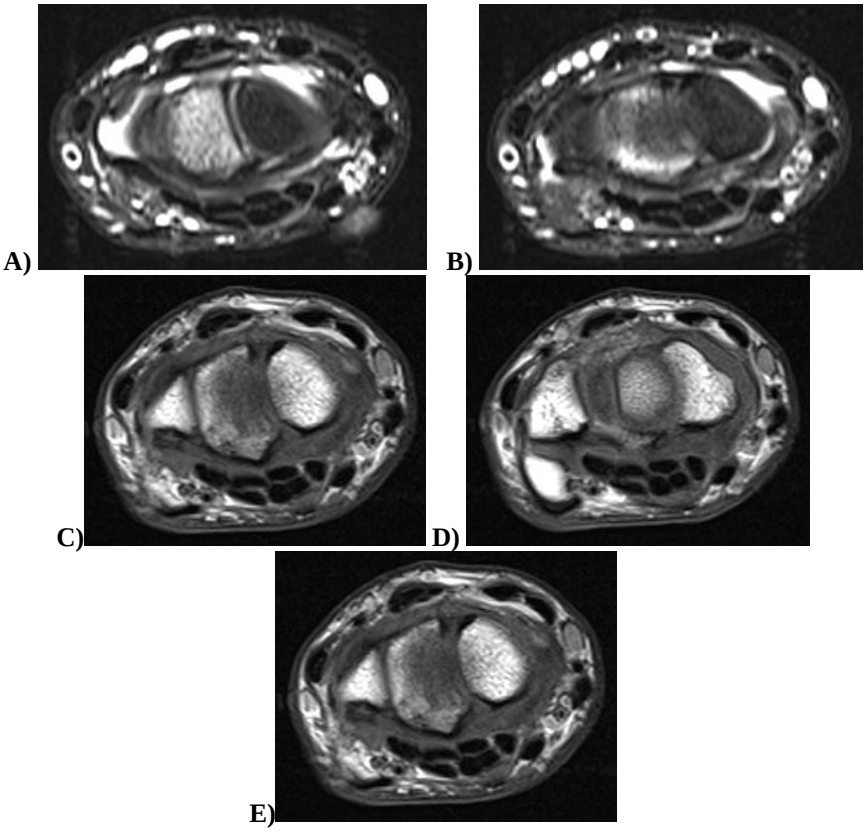


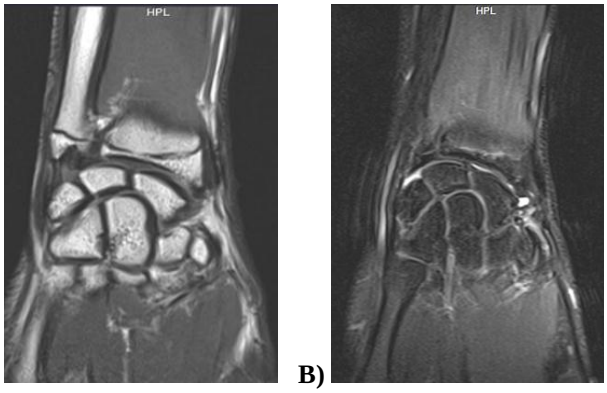
Image 3: Right Wrist Magnetic Resonance Transverse Section; A and B) T2 image; C, D and E) T1 image.

A) **B)**

Image 3: Right Wrist Magnetic Resonance Sagittal section; A) T2 image; B) T1 image.

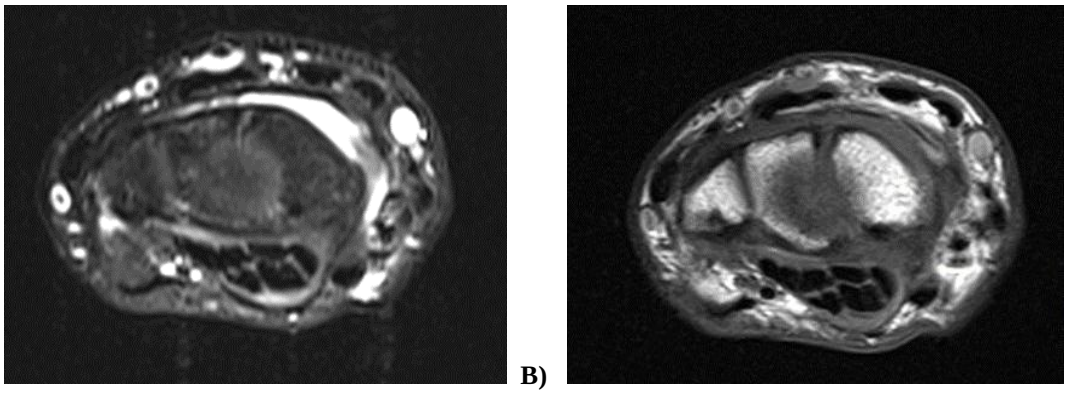
In view of the findings of the MRI of the right wrist, we opted for a conservative approach and a new control MRI in three months. As a form of initial therapy, he performed rest with immersion bath of the wrist in a bucket of water and ice for 20 min daily, performing light movements during immersion of the limb, and immobilization with a palm splint. This behavior was maintained for the first 2 months. During the third month of treatment, underwater US sections were started for 10 minutes each section, in the patterns (model: sonopulse III – sapphire Line; mode: pulsed at 20%; pulse: 100Hz; frequency: 1MHz; 1.0W/cm2 ; 3.5W), performed twice a week, with a total of 8 sessions. At the same time, the infra-red therapy was interspersed for a period of 15 minutes, three times a week, a total of 12 sections, keeping the palm splint to immobilize the affected wrist.

After three months of conservative therapy, a comparative MRI of the right wrist was performed, which found total resorption of bone edema, maintaining only signs of radio and ulnocarpal synovitis, as shown in the images below.



A) **B)**

Image 5: Right Wrist Magnetic Resonance Coronal Section; a) T1 image; T2 image.



A) **B)**

Image 6: Right Wrist Magnetic Resonance Transverse Section; a) T2 image; T1 image.

Image 7: Right Wrist Nuclear Magnetic Resonance Sagittal section T2 image.

With that, the doctor authorized the continuation of physiotherapy and release for activities with low impact on the wrist region. It started with strengthening activities with teraband. After two weeks of strengthening, specific exercises for tennis were started with the use of the racket in a liquid environment (pool), progressing to training on the tennis court gradually, respecting the insecurities and discomforts of the athlete, while maintaining the original grip of base. Associated with this, at the end of all sections, stretching was performed in all planes of wrist movements and ice packs.

The athlete resumed his activities six months after the start of the frame, entering new competitions and resuming his training routine. Got some positive results in championships in the first year after recovery, but currently only acting recreationally.

This patient is being followed up at the cardiology outpatient clinic, after being instructed on the need for the correct use of medications and on the risks involving his pathology.

DISCUSSION

When considering painful syndromes in athletes' wrists, several conditions can be mentioned: Fractures of the distal extremity of the radius, scaphoid, hamate, pisiform; Temporary or permanent traumatic epiphysiodesis; Synovitis (dorsal wrist impaction syndrome); Ligament injuries, scapomamununar ligament, triangular fibrocartilage complex; Pseudoarthrosis of the hamate hook; Tendinopathy or dislocation of the extensor carpi ulnaris tendon; Degeneration, due to impact, of the triangular fibrocartilage complex.[11,12,13,14,15]

Tenosynovitis and tendinitis are the most common pathologies of the osteoarticular system, characterized by inflammNatory pain, which worsens during movement. The hand and wrist regions are frequently affected. Its etiology is related to the effort and repetitive movements, which due to the overload of the region with the lack of adequate rest, there is an inflammatory condition of the tendons that can progress to more severe situations, which is compatible with the report that it is a young tennis player, subjected to excessive effort without adequate rest. Its diagnosis is mostly clinical, and can be aided by complementary exams such as ultrasound and magnetic resonance imaging. In the report, the diagnosis was confirmed by magnetic resonance imaging, which, in addition to bone edema, indicated a lesion compatible with tenosynovitis. Its treatment is based on rest, anti-inflammatories, common analgesics and even peritendinous infiltration.[6,9,13]

Speaking of tennis-related traumatic injuries, lunate osteonecrosis is an uncommon complication, but lunate stress fractures can occur. In elite tennis, two of the 139 athletes studied developed lunate stress fractures over a two-year period, possibly related to the type of grip they used and the routine stress caused by the impact of the sport, with grip type being a potential player. for the development of the lesion, but there was no evidence of prevalence for each type of grip.[16]

The ulnocarpal impingement syndrome is a degenerative pathology triggered by the compression, or impact, of the head of the ulna against the semilunar and/or pyramidal bone, with or without injury to the triangular fibrocartilaginous complex. The mechanics of the injury is justified by the relative shortening between the radius and the ulna during the wrist pronation movement, known as dynamic ulnocarpal impingement syndrome, being common in activities such as tennis and baseball, however it is an underdiagnosed condition. Such a condition should be suspected in the presence of pain in the ulnar edge of the carpus in situations of prehension in pronation of the forearm, which may present a positive fovea sign, being one of the differential diagnoses considered for the case presented. The range of motion may be preserved and pain absent during daily activities without the presence of load, characteristics that spoke against the diagnosis of our patient, since the athlete had movement limitation.[15]

The lunate fracture is extremely rare, and its visualization is difficult even with imaging tests, which makes its diagnosis difficult. It usually has a good prognosis, with full recovery and return of normal functions, but osteonecrosis is one of the possible complications for fractures, a hypothesis raised for the condition by the change in the wrist MRI. According to Cetti, this lesion occurs at an incidence of 1.1% (3 in 10 years) versus 14 patients with Kienbock's disease during the same period.[17]

The publication by Teisen and Hjarbaek (1988)[18] classified lunate fractures into five groups according to the affected bone portion.

Kienbock's disease can also simulate lunate edema on magnetic resonance imaging, these two pathologies being the two main diagnostic hypotheses during the investigation of the athlete's condition, making it difficult to differentiate between the two pathologies. Unlike Kienbock's disease, where there is necrosis of bone tissue, bone edema regresses, showing regression of changes in control imaging exams. In the present case, the patient presented remission of the image alterations after a period of three months, thus ruling out Kienbock's disease.[19,20]

Ultrasound is a form of longitudinal sound energy, deep penetration, originated from electrical energy that, when passing through its transducer, is converted into mechanical energy that propagates by transferring vibrational energy from one molecule to another, causing cellular changes when applied to tissues. biological. Its waves oscillate rhythmically according to the propagation medium, which can be solid, liquid or gas. The frequency of ultrasound, by piezoelectric effect, when compressing and expanding the matter, created a pressure variation in individual cells through vibrations, generating a micromassage effect resulting in increased cellular metabolism, increased blood flow increase the oxygen supply and local temperature as a kind of physical catalyst that accelerates cellular exchanges without causing damage when applied in therapeutic dosage. In addition, it promotes changes in ionic and molecular concentrations by cell stimulation. Since air is not a good conductor, it is recommended that you keep the transducer in contact with the skin throughout the procedure to minimize losses. There are two modes of ultrasound application: continuous and pulsed, which differ in the propagation of the waves. Continuous mode has 50% thermal effect and 50% mechanical effect, frequency cycling is close to 100% and voltage is continuous. In pulsed mode, the voltage is applied in bursts and the frequency is less than 100%, which justifies its preferentially mechanical effect. Regarding the frequency, the higher frequencies (3 MHz) are absorbed more intensely, specific for superficial tissues, while the lower frequencies (1 MHz) penetrate more deeply, used for deeper tissues, being the frequency used in the treatment of the aforementioned patient, with the objective of penetration of sound waves in a bone window.[21]

Phototherapy is a non-invasive, low-cost technique with good results based on photobiomodulation. It is an athermal technique based on a beam of light with a single electromagnetic wavelength that interacting with chromophores interacting with this beam, acting through biochemical and biophysical stimuli that provide healing of various tissues, as well as anti-inflammatory action, increase in microcirculation., stimulation of angiogenesis and immunological and nerve regeneration processes, as well as pain relief from skeletal muscle disorders, being an adjuvant therapy in the condition due to pain complaints and the presence of inflammatory signs due to associated tenosynovitis.[22,23]

Photobiomodulation by infrared laser demonstrates effectiveness in reducing pain and proving its analgesic effect in the short and medium term, being superior to placebo and some drugs used to control pain, but when added to other therapies such as physical activity and manual therapy , did not show additional improvement, however, in the patient under study, improvement in symptoms was evidenced with this therapy.[24]

CONCLUSION

In wrist injuries associated with repeated trauma and excess carcass, despite its rarity, Kienbock's disease is one of the differential diagnoses to be considered in wrist involvement pathologies, with bone edema being its main differential diagnosis. It is clear that the presence of one pathology does not exclude the possible presence of others, since in the case reported there was an association of bone edema and tenosynovitis. Tennis, as it is a sport of joint impact that affects the wrist region, with repetitive movements, these pathologies should be suspected in cases of wrist arthralgia in its practitioners. The case in question used conservative therapy for the treatment of lunate bone edema and tenosynovitis, through the use of ultrasonography therapy and infrared ray, as well as immersion in ice associated with submerged wrist motor physiotherapy, presenting a satisfactory response to the adopted protocol. More studies are needed that can show the prevalence of wrist injuries for each type of grip adopted by tennis players, for a better assessment of cases of wrist arthralgia in this population.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

Consent

All authors declare that ‘written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

Ethical Approval
Not applicable

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