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Capitellar osteochondritis dissecans in an elite pre-adolescent gymnast: a case report and overview

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Objective: *Following sports injury, a timely and accurate diagnosis is important, so as to initiate appropriate care as soon as possible. This is perhaps even more paramount in pediatric athletic trauma, particularly during the pre-puberty through adolescent years of rapid skeletal growth. This paper presents the diagnosis and management of osteochondritis dissecans in its third most common location, the elbow, a presentation of which chiropractors should be aware, including the importance of timely diagnosis and appropriate treatment.*

Clinical features: *A 9-year-old elite gymnast presented at a chiropractic clinic with elbow pain and restricted range of motion after a fall during training. Following multidisciplinary involvement, the diagnosis was eventually made as osteochondritis dissecans.*

Intervention and outcomes: *The patient underwent successful arthroscopic surgery in order to remove the*

Ostéochondrite disséquante capsulaire chez une gymnaste pré-adolescente d'élite : rapport de cas et vue d'ensemble

Objectif : *À la suite d'une blessure liée au sport, il est important de poser un diagnostic précis rapide, afin d'entreprendre les soins appropriés le plus tôt possible. Ceci revêt peut-être encore une plus grande importance dans le cas d'un traumatisme sportif chez les jeunes, surtout pendant les années de croissance rapide du squelette, de la prépuberté à l'adolescence. Cet article présente le diagnostic et la gestion de l'ostéochondrite disséquante dans sa troisième localisation la plus fréquente, le coude, un cas que les chiropraticiens devraient connaître, y compris l'importance d'un diagnostic rapide et d'un traitement approprié.*

Caractéristiques cliniques : *Une gymnaste d'élite de 9 ans s'est présentée dans une clinique chiropratique avec une douleur au coude et une limitation de l'amplitude des mouvements après une chute pendant l'entraînement. Après une intervention multidisciplinaire, le diagnostic a finalement été posé comme étant une ostéochondrite disséquante.*

Intervention et résultats : *La patiente a subi avec succès une chirurgie arthroscopique afin de retirer le*

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osteochondral fragment, followed by a specific regimen of rehabilitation exercises, which helped to enhance and accelerate optimal healing for her return to athletic activity.

Summary: *This case reminds the practicing chiropractor of the valuable role he/she can play in a multidisciplinary management of pediatric sports trauma, particularly in diagnosis and post-surgical care. A literature review presents a synopsis of the reported clinical presentations, diagnostic assessment and therapeutic options for capitellar osteochondritis dissecans.*

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KEY WORDS: capitellum, osteochondritis dissecans, pre-adolescent sports injury, chiropractic

fragment ostéochondral, suivie d'un régime spécifique d'exercices de réadaptation, qui a contribué à améliorer et à accélérer la guérison optimale pour son retour à l'activité sportive.

Résumé : *Ce cas rappelle au chiropraticien en exercice le rôle précieux qu'il peut jouer dans une prise en charge multidisciplinaire des traumatismes sportifs chez les jeunes, notamment dans le diagnostic et les soins post-chirurgicaux. Un examen des documents scientifiques présente un synopsis des tableaux cliniques signalés, de l'évaluation diagnostique et des options thérapeutiques de l'ostéochondrite disséquante du capitulum.*

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MOTS CLÉS : capitulum, ostéochondrite disséquante, blessure sportive chez les préadolescents, chiropratique

Introduction

Most commonly, osteochondritis dissecans (OCD) occurs at the femoral condyle or the talar dome.[1] The humeral capitellum is the third most frequent location, and in young patients, may become a debilitating injury. OCD of the elbow typically begins with a local injury, followed by subsequent separation of the articular cartilage and subarticular bone of the capitellum.[2] Additionally, the radial head, olecranon and trochlea have been reported as rare sites of elbow OCD.[3,4]

OCD was first described in 1888 by König, who proposed three etiologies for loose intraarticular bodies: direct acute trauma causing osteochondral fracture; minimal trauma leading to osteonecrosis and fragmentation; and spontaneous occurrence with no antecedent trauma.[1,5,6] OCD is currently defined as an acquired lesion of subchondral bone, with possible involvement of the overlying cartilage, variable amounts of resorption, fragmentation and sclerosis, but not resulting from an osteochondral fracture.[6] The main population affected by elbow OCD is adolescent athletes engaging in repetitive overhead throwing, weightlifting and gymnastics.

Case presentation

A 9-year-old elite gymnast presented to a chiropractic clinic with acute right elbow pain, two days after injuring it during her gymnastics floor exercises training session. She recalled that she was in the middle of a sustained handstand when her arm suddenly gave way with a loud "crack", resulting in her tumbling to the floor. Immediately, she was unable to resume training. She initially rated the pain intensity at 7/10. The pain became sharper and increased in intensity into the evening and through the night, and the patient elevated the intensity rating to an 8/10.

Upon presentation to the chiropractor two days later, the pain was now more of a dull ache with the intensity decreased to 5/10. The pain was localized to the medial and lateral aspects of the elbow joint, with the distal portion of the biceps at the elbow also painful. On initial presentation she was unable to flex her arm at the elbow. Relevant past history included a right elbow dislocation at age three, and fractures to her radius and ulna in 2016, some five years prior to her current presentation. From a training intensity standpoint, this patient started recreational gymnastics at the age of three, and began competitive gymnastics at the age of five. At age five she trained five hours per week (two days x 2.5 hours), and this increased year by year until she was 10 years old, when she trained 19.5 hours per week (three days x five hours and one day x 4.5 hours).

It should be noted that the COVID pandemic significantly affected her training schedule (when she was 9-10 years old), given the lockdown measures and the capacity limits that were established. As a result of the capacity limits and lockdown measures throughout the pandemic, she trained only 4.5 hours per day, three days a week. In previous years she had sustained a variety of assorted lower limb and pelvic injuries, all successfully treated with Active Release Technique (ART), joint mobilization and manipulation. ART is a 'hands on' movement-based soft tissue therapy technique.

Clinical findings

Maintaining her arm in full extension provided the greatest relief, with attempted active flexion causing the most pain; passive flexion caused less pain but was still very guarded and limited. There was no visible swelling of the elbow on inspection. She was able to cautiously pronate the hand, however was unable to supinate without pain. With the patient seated and her arm abducted at 90 degrees, she was unable to horizontally move her arm across her body without pain. She also described that, post-injury, she occasionally felt a "pinching" feeling in her right thumb. Palpation of the distal triceps, medial and lateral aspect of brachialis, brachioradialis, pronator teres and supinator, as well as the elbow extensor group, were all extremely tender on light palpation. A 128 Hz tuning fork over the lateral aspect of the right elbow (lateral humerus and radial styloid) elicited a jump sign from the patient, with tuning fork over the left elbow eliciting no patient reaction. Given the severe limitations in ROM, extreme tenderness on palpation and the positive tuning fork findings, a decision was made to order radiographs. While not definitive, an initial review of the radiographs led to a suspicion of a fracture, so a recommendation was made for the patient to present to the hospital; she was not treated at the chiropractic clinic.

Upon presentation at the hospital, a second set of images was obtained, which were read as normal (Figure 1). She was diagnosed with complex regional pain syndrome and was advised to see a rheumatologist. Approximately two days later, the patient's mother received a call from the hospital advising her of the presence of a focal osteochondral abnormality involving the capitellum, measuring 0.7 x 0.9 cm, along with recommendation for orthopedic consultation and MRI study.

Upon review of the x-rays by two radiologists, the consensus was that the diagnosis was most likely Panner's disease, given the patients age, with consideration given to osteochondritis dissecans as a potential differential that would be ruled in/ruled out with an MRI. Due to the COVID-19 pandemic, an MRI was not available until nearly one month following her initial visit. The

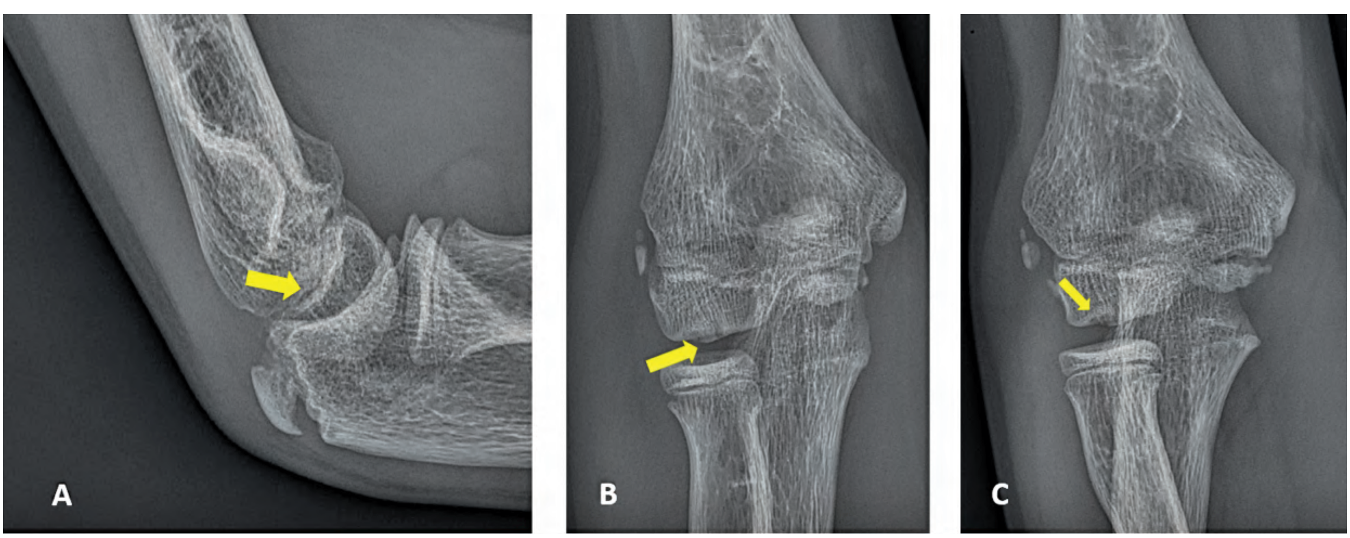

Figure 1.
A & B. Osteochondral fragment at distal capitellum; C. Osteochondral defect.

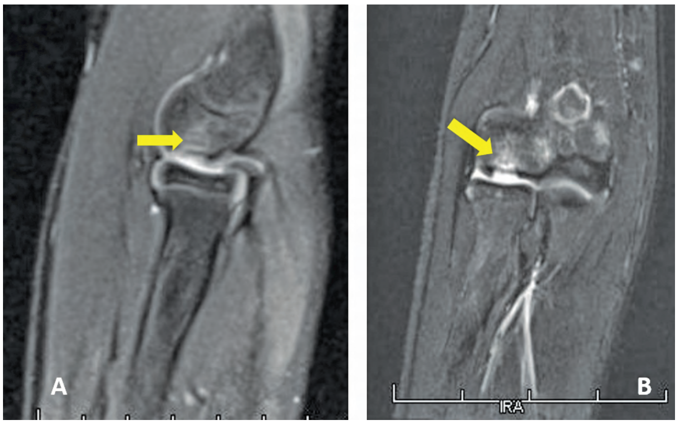

Figure 2.
MRI. A & B. Osteochondral defect is noted along with adjacent bone edema.

MRI confirmed the diagnosis of OCD (Figure 2), as there was an osteochondral defect on the articular surface of the capitellum measuring 0.7 x 0.7 x 0.2 cm. Subchondral bone marrow changes were also visible, along with a single tiny subchondral cyst. Within the anterior joint recess, there was a crescentic shaped osteochondral body measuring approximately 0.7 x 0.8 cm, the displaced osteochondral fragment from the capitellar defect.

Approximately one month after the MRI, a surgical consultation was arranged for this patient. The surgeon recommended immediate surgery and noted that there might be additional surgery forthcoming. Given the magnitude of the injury, the parents sought out a second sports medicine physician's opinion, as well as another orthopedic surgeon's opinion. All doctors unanimously agreed that surgery was the best course of action. Elective surgeries were not being performed at that time due to a COVID-19 pandemic lockdown. The surgeon did however assure the parents that once hospitals were able to resume surgeries, given the patient's age and the size of her lesion, coupled with the fact that the cartilage looked healthy and her growth plates were still open (the latter two points being positive from a recovery standpoint), she would be at the top of the surgical wait list. Approximately three months after her initial presentation, and now 10 years old, the patient finally underwent surgery. According to the surgeon, everything went very well with no complications. The surgery was a microfracture procedure of the capitellum with removal of the osteochondral

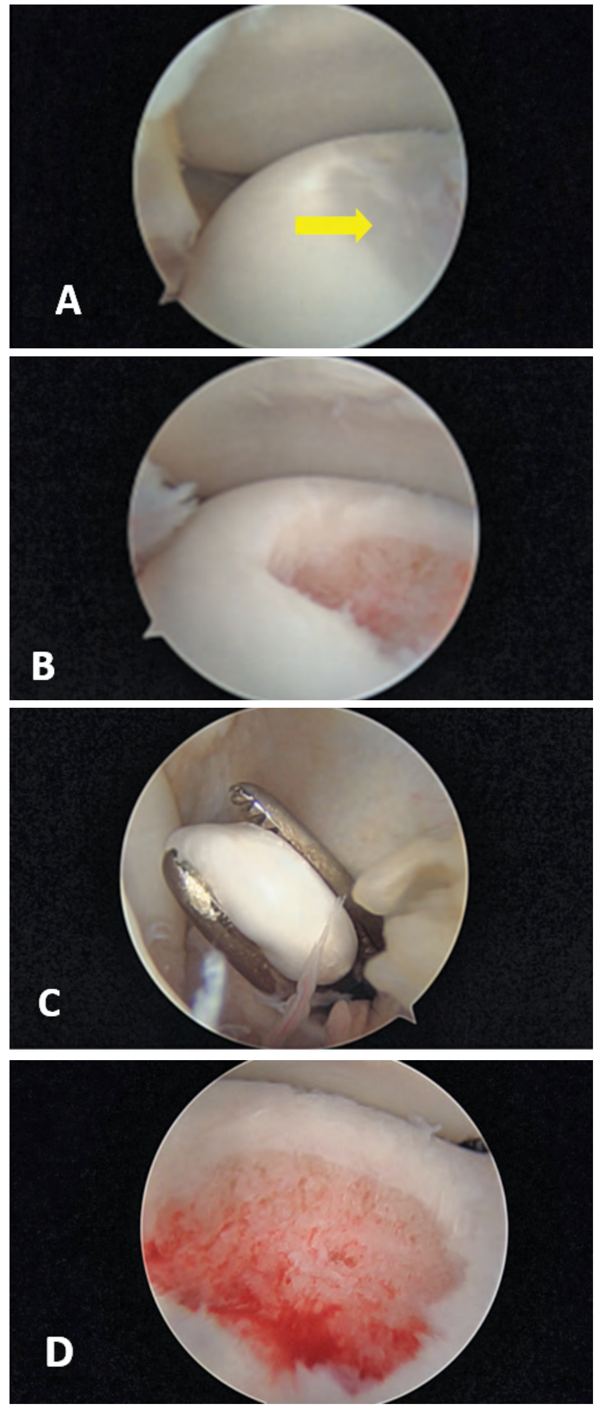

Figure 3.
Arthroscopic surgery. A. Region of chondral defect prior to debridement; B. Chondral defect following initial debridement; C. Free chondral body (joint mouse); D. Chondral defect following final debridement.

defect (fragment) and subsequent abrasion to smooth out the involved injured capitellum (Figure 3).

Post-surgical rehabilitation and return to sport

A comprehensive four-phase rehabilitation program was prescribed for the patient, that ran for a course of six months following surgery. Each phase had an anticipated timeline, with goals, bracing, range of motion parameters, exercises, inflammation control and criteria for progression to the next phase included. The rehabilitation program was devised by the orthopedic surgeon, then provided to, and supervised by, a physiotherapist. While there was no direct communication between the physiotherapist and the orthopedic surgeon, any information that was received by the patient and her parents at any of the six post-surgical consults was relayed to the physiotherapist.

Phase 1 was considered the "Early Protection Phase" and was to cover weeks 1 to 4 of the rehabilitation program. The goals in this phase were multiple and included:

- Protect the healing tissue from load and shear forces
- Decrease pain and effusion
- Maintain wrist and shoulder mobility
- Restoration of full passive elbow flexion
- Gradually restore elbow extension

The brace was to be locked at 75 degrees, and was to be unlocked for exercise. The use of a tensor was also advised to control swelling. Range of motion instructions dictated that immediate motion exercise happened on day one and that full passive elbow flexion be initiated immediately. The patient was instructed to begin passive flexion and extension of the elbow with 500 reps to be done three times daily. The brace was to be worn for comfort as necessary during these exercises, with an intention to progress to passive elbow extensions as tolerated.

The minimum range of motion goals were broken down on a week-by-week basis and were as follows:

- Week 1 – 20 to 100 degrees of flexion
- Week 2 – 10 to 120 degrees of flexion
- Week 3 – 0 to 150 degrees of flexion
- Week 4 – Full flexion and extension

Suggested exercises included:

- Putty grip strengthening
- Wrist flexion and extension stretching
- Wrist curls and neutral wrist curls
- Shoulder pendulums
- Active Range of Motion (AROM) of the shoulder in flexion/extension/abduction/internal and external rotation (in brace)

Inflammation control for Phase 1 suggested the use of ice for 15-20 minutes six to eight times daily, with the criteria to proceed to Phase 2 being full passive elbow flexion and minimal pain and swelling.

Phase 2 was referred to as the "Intermediate Transition Phase" and took place post-operatively through weeks 4 to 6. The goals of this phase included full elbow ROM and to improving muscle strength and endurance. The brace was to remain locked at 75 degrees and to be unlocked for exercise. The range of motion goals included a gradual increase in the ROM, maintenance of full passive elbow flexion and progression to elbow extension of 180 degrees by week 6. Exercises suggested in the previous phase were to be continued in this phase with the criteria to advance to Phase 3 of the program being full ROM and minimal pain and swelling.

Phase 3 occurred between weeks 6 to 12 post-surgically, and was referred to as the "Remodelling Phase". The goals of this phase were to continue to improve muscle strength and endurance and to increase functional activities. The brace could now be unlocked; however, it was still to be worn until week 12. Exercises for this phase included:

- Multiangle isometric biceps
- Multiangle isometric triceps
- Concentric of biceps and triceps with load

The criteria to be able to progress to phase 4 included no pain, swelling or inflammation and full, pain-free range of motion. Strength was also to be within 80% of the contralateral extremity. Phase 4 was the last phase of the rehabilitation program and was referred to as the "Maturation Phase", which happened through weeks 12 to 26 post-operatively. The goal of this phase was a gradual return to full unrestricted activities and sport. Generally, two to three months post-operation, low impact sports such as swimming were permitted. High impact sports like tennis, baseball, basketball and gymnastics were allowed at six to eight months post-surgery.

Exercises suggested/not suggested for this phase were numerous and included:

- Biceps curls and triceps extensions
- PNF patterns
- Core stability
- Proprioceptive exercises
- Progress resistance as tolerated
- Emphasis on entire upper extremity strength and flexibility
- Progress in sport programs depends on patient variables
- Avoid axial load until 6 months

The patient successfully completed all four phases of the rehabilitation program. The physiotherapist confirmed that the ranges of motion in the elbow returned to pre-injury levels. Strength testing with a dynamometer at her final physiotherapy appointment confirmed that her right arm strength was, in fact, superior to her left arm strength, registering 60 pounds in the right arm and 55 pounds in the left. Her return to sport commenced in week 10 of the rehabilitation program, and consisted of leg and core conditioning only, with no axial loading of the arms. This continued for approximately seven weeks with nine hours per week of training. In week 18 of the program, the training increased to 12 hours per week, with some beam and floor work added into her training, along with continued training on her leg and core conditioning. At week 22, the patient was instructed by the surgeon to re-introduce some exercises with controlled axial loading, namely planks, push-ups and modified handstands, with the assistance of a wall for stability. The surgeon also advised at that same follow-up that the patient was to avoid bars, handsprings, and any repetitive skills that would place excessive weight/load on the arm. It is noteworthy to mention that at week 18 of her rehabilitation, in addition to her gymnastics, the patient took up diving one to three hours a week. The injury and the rehabilitation took a mental toll on her, and diving provided a much needed physical and mental outlet where she could avoid the limitations on her skills in the gym. It is also worth mentioning that exactly six months minus a day, at her final follow-up with the surgeon, the patient was given the go-ahead from the surgeon to resume full gymnastics training with no limitations.

Discussion

The etiology of OCD is considered to be multifactorial, including repetitive biomechanical stresses, inflammation, weak vasculature to the capitellum, and perhaps genetic factors.[6] Although the exact etiology is unknown, the speculation is that repetitive weight-bearing and excessive valgus compression force microtrauma acting on the immature capitellum promotes vascular insufficiency.[7,8]

Cadaveric anatomical and biomechanical evaluation has shown the central portion of the radial head to be considerably stiffer than the lateral capitellum, creating a biomechanical incongruity that may promote increased strain on the lateral portion of the capitellum during loading activities.[9]

The vascular anatomy of the distal humerus, combined with an immature capitellum lacking significant metaphyseal collateral blood flow, potentially sets the stage for OCD development, where blood flow can be disrupted in a scenario of repetitive trauma.[3,10] Focal avascular necrosis of the capitellum ensues, with accompanying subchondral osseous changes. This results in loss of support for the suprajacent articular cartilage, with its eventual breakdown, and, once this structural foundation for the articular cartilage is compromised, formation of loose fragments.[7,8] Studies of twins suggest a possible genetic component.[11]

Hefti *et al.*[12] devised a classification system based on sequential changes observable on magnetic resonance imaging findings as follows:

1. A small signal change in the subchondral bone without clear margins
2. Osteochondral lesion with clear margins, no underlying fluid between the fragment and bone
3. Fluid partially visible between the fragment and underlying bone
4. Fluid completely surrounding fragment, fragment remains in situ
5. Fragment becomes a loose body

According to recent studies, capitellar OCD's incidence is higher than previously believed. Partly due to children competing in various athletics at younger ages, the incidence of elbow OCD, particularly at the capitellum, is quickly increasing.[13,14] Capitellar OCD patients are classically adolescents between 11 and 17 years old[15];

boys are affected more than girls[2]. Participants in repetitive overhead sporting activities, including baseball pitching, football throwing, overhead weightlifting, volleyball, javelin and gymnastics are prone to developing elbow OCD.[2,3,4,10,13,15-19] Juvenile OCD does have a better prognosis than in adults.[2]

Axial-loading sports, such as gymnastics and weightlifting, as well as overhead throwing, as in baseball pitching or football, generate repetitive compressive forces through the radiocapitellar joint.[3,10,16,18] Additionally, in baseball pitchers and football quarterbacks, the overhead throwing transmits repetitive shearing forces across the radiocapitellar joint during the late cocking and early acceleration pitching phases.[3,10,16,18] Kida *et al*.[4] found that baseball players who began competing at a younger age, and played for a longer period, were at greater risk for developing capitellar OCD.

Clinical presentation

Loss of elbow extension is an early sign. There is frequently an onset of insidious lateral elbow pain in the dominant arm, which is related to the sports activity. The pain and stiffness will get progressively worse.[4,10,17] Kida *et al*.[4] reported that patients who played through the pain presented with a higher grade of osteochondral lesion.

If there are one or more loose bodies, or joint mice, present, then catching, clicking or locking of the elbow may manifest as a later sign.[10] On examination, the loss of elbow extension may be mild, with lateral elbow tenderness, with or without crepitus on movement. The crepitus is especially noted on pronation and supination.[15] When active pronation and supination, with the elbow extended, reproduces pain at the radiocapitellar joint[3,10,20] this is a positive radiocapitellar compression test. Effusion of the elbow joint may be present as well.[13]

Elbow OCD patients are most commonly boys, ranging in age from 11 to 23 years. The dominant elbow capitellum is the usual site. Its prevalence in adolescent overhead athletes appears to be higher than previously thought.[15] Up to 20% of patients can have bilateral involvement.[13]

Diagnosis

A rapid and accurate diagnosis is key in order to affect proper treatment.[2] Initial x-ray examination of the elbow involves an anteroposterior (AP) in full extension, 45-degree flexion AP, and a lateral.[15] The 45-degree flexion view may better depict the lesion.[21] Although the first study may be negative, a subsequent set of films will show capitellar lucencies, flattening, sclerosis, fragmentation and intra-articular loose bodies. The anterolateral aspect of the capitellum is the most frequent site affected.[3,10] The diagnosis of OCD can be confirmed with the demonstration of these osseous defects.[19] However, due to the relatively lower sensitivity of plain radiography, additional imaging is often indicated when OCD is suspected.[21]

It has been reported that CT and MRI demonstrate greater accuracy.[21]MRI is very useful in assessing the size of the lesion, the status of the articular cartilage, and the extent of accompanying soft tissue edema.[22] Additionally, MRI can reveal lesions at an earlier stage, when x-rays still appear normal.[3,10,22] MRI is also valuable in assessing the stability and viability of the OCD fragment.[23] Early findings on MRI manifest as uniform low-signal-intensity changes on T1-weighted imaging in the superficial capitellum; T2-weighted images are normal. With progression, changes are demonstrated on T1 and T2 imaging.[15] When gadolinium contrast is seen to enhance the OCD lesion, this points to good vascularity of the fragment and better viability.[3] CT scans might be more sensitive and better depict loose bodies.[2]

The MRI findings in unstable OCD lesions were initially reported by De Smet *et al*., using the knee.[24] These criteria were then applied to OCD in the elbow, and they correlated well with findings at surgery.[25] On MRI, unstable lesions demonstrated a thin line of high-signal intensity between the OCD lesion and its underlying bone, as well as a discrete, round, focus of high-signal intensity, indicating a fluid-filled cystic osteochondral defect, on T2 imaging.[26] Evaluation of these criteria in 25 capitellar OCD patients by Jans *et al*.[27] found them to correlate 100% with lesions that were unstable at surgery.

Additional studies assessed the ability of MRI and other imaging modalities to predict intraoperative stability, and found that preoperative MRI findings directly related to a lesion's intraoperative stability.[28] Hence, MRI is still considered the best imaging tool to evaluate OCD stability. Ultrasound of the elbow has also shown promise as a predictor of unstable OCD lesions.[29]

Differential diagnosis

Panner's disease, a self-limiting capitellar osteochondrosis, is the main differential consideration, as it is also linked to overuse of the elbow. In contrast to OCD, Panner's involves the physeal plate. The blood supply to the capitellum is compromised, leading to necrosis, bone softening and collapse, causing the capitellar knob to flatten. This is followed by regeneration and recalcification.[15]

Panner's disease typically affects a younger age group, usually boys under 10 years of age.[3,20,30] They present with activity-related pain and tenderness along the lateral aspect of the elbow and capitellum. Fissuring, lucencies, contour changes and fragmentation of the capitellum can be seen on x-ray examination. Panner's disease exhibits an irregular epiphysis, while OCD demonstrates a well-defined subchondral lesion. Later films of Panner's patients demonstrate reossification, coinciding with symptom relief.[10,20]

Although recovery can be slow, even taking a year or two, most children with Panner's disease require little treatment, and heal completely. It is a benign self-limiting disorder, which usually resolves with rest;[2,15] surgery is contraindicated. As the child grows, the bone matures, the capitellum regains its original shape, and the symptoms typically totally resolve, with no long-term residual problems.[15]

Treatment

The chosen therapies are dependent on several criteria, including symptom severity, and the size, location and stability of the lesion. Deciding whether an OCD lesion is stable or unstable is important in determining the initial approach to treatment. A variety of classification systems have been employed to evaluate the stability of an OCD lesion, utilizing the clinical examination, imaging and findings at surgery.[15] Many authors have actively encouraged the use of the MRI characteristics noted above in contributing to the determination of lesion stability.[3,10,18,20,22,27,28,31]

In general, stable lesions are typified by an immature capitellum with an open growth plate, and flattening or radiolucency of the subchondral bone, in a patient with (almost) normal elbow motion.[15,32,33] Generally, stable lesions can be reversible, healing completely with no surgery.[32]

A high potential for spontaneous healing of OCD in patients with open capitellar growth plates has been reported.[33] OCD lesions which are stable can usually be treated non-surgically: rest, activity modification (cessation of repetitive stress on the elbow), physiotherapy and chiropractic.[2,15] Additional therapy can include anti-inflammatory medications, and brief periods of immobilization when symptoms are particularly severe.[15]

There are those who promote using a hinged elbow brace for 1 to 6 weeks during the first part of the resting period, in order to permit some intermittent range of motion exercises and prevent stiffness, while others recommend simple rest without immobilization.[10,20] Following a period of rest, physical therapy is initiated, avoiding strengthening until the patient is asymptomatic.[10]

Resolution of symptoms is often achieved in the majority of stable OCD patients in 6 to 8 weeks, with prescribing muscle strengthening exercises and a gradual return to activity once the patient is asymptomatic.[32-34] The majority of patients who do respond to conservative care can begin light overhead throwing in three to four months, with return to competitive play by six months.[3,10,14,20] It should be noted that only a minority of OCD lesions are classified as stable.[32,33]

A study by Matsuura *et al*.[34] reported that patients presenting with stable OCD lesions who were compliant with conservative therapy had a greater than 84% rate of healing; however, the healing rate dropped to less than 23% in those who were non-compliant. Patients treated conservatively who showed no improvement at six months did undergo subsequent surgery.[34]

Patients with closed growth plates or those with unstable OCD lesions, even if undisplaced, who are treated non-surgically demonstrate extremely low healing levels.[8,33,35,36] Unstable lesions (closed physis, fragmentation and range of motion reduced by more than 20°), achieve much better outcomes via the surgical route.[32,37] Unstable lesions, and stable lesions not responding to conservative care, typically require surgical intervention.[2]

Possible surgery choices include arthroscopy to remove loose bodies, abrasion chondroplasty, microfracture, retrograde drilling, in situ fixation, osteochondral autograft transplantation system (OATS), and costal osteochondral transplantation (COT).[21,31,38-45] Surgical management most commonly consists of arthroscopic debridement, bone marrow stimulation (by microfracturing the subchondral bone) and removal of loose fragments. This is the standard initial surgical choice for capitellar OCD patients.[2,46] Due to its minimally invasive nature, encouraging results are typically reported, there is a low risk of morbidity, and it facilitates early postoperative recuperation. A majority of studies report substantial clinical improvement, even up to nine years post-surgery.[34,47-49] The open surgery options are reserved for more advanced cases, or those patients with failed previous surgery.[2]

Post-surgery and prognosis

Anywhere from 80-90% of patients return to playing sports, varying from one to five months after surgery.[50-51] Complications are typically minor, such as transient nerve palsies, and only occur in 7 to 14% of cases.[48,52] Major complications, including deep infection and permanent nerve damage, are rare, with an incidence of 0.5 to 5%.[53,54] The aims of postoperative rehabilitation are to reduce pain and swelling and restore optimum ranges of motion. Recovery following an arthroscopic procedure is faster than following open surgery.[13]

Passive exercises usually begin within a few days post-surgery. At approximately eight weeks after arthroscopic surgery, resistive exercises are introduced; 12 weeks following open surgery. Throwing-type exercise program can start when the patient experiences no pain with normal range of motion.[13]

While it may appear logical to expect that OCD patients are prone to early degenerative arthritic changes in the elbow, the relationship has not yet been clarified.[2] Data are available on OCD of the knee and ankle, reporting that large lesions of the knee appear to predispose to osteoarthritis, however, the evidence is limited.[55] However, no such relationship has been demonstrated for the ankle[56], with only 4% of ankle OCD patients developing any degenerative changes even up to twenty years following their surgery[57].

Sparse data are available regarding the risk of long-term osteoarthritic changes for elbow OCD. Research by Bauer *et al*.[58] studied elbow osteoarthritis among 31 OCD patients, with an average follow-up time of 23 years. Only one-third had degenerative changes on x-ray, with 42% complaining of pain and/or reduced ranges of motion at their follow-up.[58]

It has been reported that younger patients are more likely to maintain an asymptomatic elbow, with no x-ray evidence of osteoarthritis over the long term.[2] Furthermore, larger lesions appear to be more prone to arthritic changes over time.[2] Takahara *et al*.[59] noted poorer long-term results in patients with large cartilage lesions, as compared to those with smaller lesions. Additionally, there is no evidence that surgical debridement protects against degeneration.[59]

With more young athletes becoming competitive earlier, it appears that there is a move toward developing screening programs for adolescent overhead throwers, perhaps involving more cost-effective imaging algorithms, in order to diagnose OCD sooner, thus facilitating the use of more conservative therapies.[15]

Limitations

There are a myriad of factors contributing to the outcome of any individual case, including, but not limited to: management of patients in a primarily uncontrolled environment, patients possibly introducing a variety of confounding factors outside of the doctor's office, which may affect progression or outcome, as well as the possible natural progression options of osteochondritis dissecans in its various locations. For example, some cases can appear to undergo remission, with self-reattachment of the osteochondral fragment, rather than progression to a mobile "joint mouse".

Based on these limitations, drawing generalized conclusions regarding the care and outcome of patients with osteochondritis dissecans of the capitellum is inappropriate. The overview presented along with our case offers a summary of several presenting factors, diagnostic approaches and management strategies for these patients. Finally, the authors data collection relied heavily on dialogue with the patient's mother, and access to some health care records which were not composed by the authors.

Summary

This case report demonstrates the importance of a timely diagnosis for the effective management of osteochondral trauma, particularly in pediatric athletes. Our patient experienced a somewhat multidisciplinary journey, wherein the chiropractor was solely the portal of entry. Although the primary therapy for OCD is often surgery, chiropractic can also play a role in a comprehensive post-surgical rehabilitation protocol necessary to afford pediatric athletes the ability to achieve a safe and successful return to competitive sport.

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