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Case Report

"Osgood Schlatter of the Finger" – A Case Report of Apophysitis of the Proximal Inter-Phalangeal Joint of the Finger and Review of Injuries in Adolescent Climbers

Jeannette Wen Ching Ting[1,2], Tatiana Jacomel[1], Tommy R Lindau[3] and Kerstin Oestreich[1]*

[1]Department of Plastic Surgery, Birmingham Women's and Children's Foundation Trust Hospital, United Kingdom

[2]Department of Plastic and Reconstructive Surgery, Department of Surgery, Monash Health, Australia

[3]The Pulvertaft Hand Centre, University Hospital Derby Burton, Derby, UK

***Corresponding Author:** Kerstin Oestreich, Department of Plastic Surgery, Birmingham Women's and Children's Foundation Trust Hospital, United Kingdom.

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Abstract

Competitive climbing results in repetitive weight bearing on flexed proximal inter-phalangeal joints (PIPJ) resulting in chronic micro-trauma and risk of long-term severe injuries. Children are not immune to its effects.

We report a case of a 13-year-old boy who presented to our hospital with bilateral swollen PIPJ to both middle fingers and radiographic signs of severe apophysitis and physical fractures. This was attributed to his competitive climbing. The patient was advised to completely rest from climbing as the injuries were too severe to treat in any other way.

We have reviewed the literature regarding climbing injuries in adolescents and present general guidelines how to manage these increasing and potentially life-changing injuries.

Keywords: Apophysitis; Climbers; Adolescent Climbers; Physeal Fractures; Epiphysis

Abbreviations

PIPJ: Proximal Inter-Phalangeal Joint

Introduction

The International Federation of Sports Climbing estimates that currently over 25 million people of all ages, including children, climb regularly worldwide [1] with an estimated 1.27 million individuals regularly climbing in Britain alone [1]. Climbers are increasingly challenging themselves with the use of more difficult routes and more rigorous training resulting in more pathologies presenting earlier in the patient's climbing career [2,3]. It is estimated that regular climbers have a 75% - 90% probability of developing an upper limb injury or overuse syndrome from their sport [4]. Children are not immune to this with hand and finger injuries being the most common injury in young climbers, corresponding to 21% of all pathologies [4]. We report a case of a 13-year-old boy who presented at the Hand Clinic at Birmingham Children's Hospital, UK with bilateral severe apophysitis and physeal fractures of middle fingers attributed to his climbing.

Case Report - Materials and Methods

A 13-year-old boy presented to our Paediatric Hand Clinic with a 5-year history of bilateral pain and deformity of the proximal inter-phalangeal joint (PIPJ) of the middle finger. 2 years ago, he had suffered an unknown injury to his right middle finger whilst climbing, which was managed at another hospital with a period of

rest. No further advice was given at the time. Radiographs from that injury were not available.

The symptoms gradually worsened over the last 2 years, which was attributed to the increased training he underwent with the aim of joining the national climbing team. He trained 3 to 4 times a week for over 2 hours a day.

One year ago, the patient began to notice a swelling in the PIPJ of the contralateral middle finger after climbing without any history of trauma. The swelling and aching continued to worsen bilaterally and were associated with a gradual reduction of the range of motion bilaterally.

Upon presentation to our clinic, the middle fingers were in a fixed flexion contracture of the PIPJs (-18o on the right and -20o left side) (Figure 1). They were also swollen suggestive of active inflammatory reaction (Figure 1). The radiographs and computerised tomography (CT) images (Figures 2 and 3) show marked fragmentation of the epiphysis of the base of the medial phalanx of the middle finger. The dorsal cortices were osteolytic and the joint bases were severely narrowed.

Figure 1: Clinical findings of bilateral middle finger PIPJ deformities at presentation, boy (age 13).

Given the severity of the findings, the patient and his family were strongly advised to rest and abstain from climbing, which the patient was reluctant to give up. As part of the conservative management, they were also referred to the Hand therapy team for splinting and stretching exercises as well as review with the climbing coach, into possible changes in grip whilst climbing. He was also prescribed anti-inflammatory medications and was closely followed up. He has further been offered to attend a specialist paediatric sports clinic, to get further information, if any changes to his climbing pattern could be utilized, as he is keen to continue his wish to pursue a professional sports career.

Figure 2: Radiological findings.
A) Left side 10/2017 and b) Right side 01/2018. Note that there is deformity of the PIPJ of the right and left middle finger and the joint space is reduced with the epiphysis fragmented.

Figure 3: Computer Tomography (CT) of both middle fingers.
A) Left side B) Right side. Both sides present with advanced joint destruction: marked fragmentation of the epiphysis of the base of the middle phalanx; a dorsal fragment slightly displaced; a deficiency of the central aspect of the physis.

Results of Literature Review and Integrated Discussion

Hand injuries correspond to 50% - 70% of all the hand injuries of adult elite rock climbers with the majority occurring in the fingers [2,5]. The right and left hands are involved equally, but the proximal and distal inter-phalangeal joints of the index and middle fingers are the most commonly affected joints [5]. The most common injuries are A2 and A4 pulley injuries, fixed flexed contractions of PIPJ, tenosynovitis of the flexor tendons and epiphysiolysis of the PIPJ [2,5]. Two-thirds of these injuries present early in the climbing career, mostly within 2 years of climbing [5].

The first description of such injuries was reported by Leal., *et al*. in 1987 by reporting radiographic changes including subchondral sclerosis, cortical hypertrophy and micro-fractures associated with climbing [6]. Since then, climbing has become more popular and subsequently, there have been increasing reports of overuse injuries amongst elite rock climbers [5]. Adaptive changes that characterise a veteran adult climber's hand are doubling in tendon width size, hypertrophy of joint capsule, thickening of the collateral ligaments, thickening of finger phalanges and a generalized tendency to have 'thicker' fingers [3,5]. In young athletes, the findings are similar except for the lack of osteoarthritis [3].

The long-term effects of this high impact and repetitive stress on the finger joints of the young and adolescent has yet to be fully investigated [3]. We know from the literature that it is an increasingly common pathology, with 21% of the injuries young climbers suffer arising from their hands [2,7]. It is also known that most are due to repeated and prolonged movement (42%) with sprains being the most common injury (27%) [2]. Injury rates for both sexes peak during the pre-adolescent years [8] and children aged 5-14 years accounted for nearly 40% of all sports-related injuries [8]. Within this group, adolescents between 15 and 19 years old are at greater risk of injury than younger adolescents (11 and 14 years old) [7]. The hypermobility of the pubescent and pre-pubescent climber is an advantage for climbing. However, some authors believe that the hypermobility can also be seen as a risk factor to finger injury, as epiphysiolysis of PIPJ, tenosynovitis or increased joint fluid are generally associated with hypermobile joints [5].

General pathogenesis

Adolescence itself is associated with an increased incidence of physical fractures. This is attributed to periods of rapid growth leading to a thicker and more fragile epiphyseal plate, [4,8] lower stress resistance in the cartilage of the epiphysis and the epiphyseal plates being inherently two to five times weaker than the surrounding connective fibrous tissue [4,8]. In addition, bone mineralization is known to lag behind bone linear growth during the pubescent growth spurt, thereby rendering the bone temporarily more porous and more susceptible to injury [8]. Moreover, there is a greater risk of injury to the epiphysis when the growth plate cartilage is beginning to close. Despite the relative rarity of the condition, there are some case series of epiphyseal injuries and finger injuries in young climbers in the literature [2] (Table 1).

Authors	Year of Publication	Number of Rock Climbers Studied	Mean Age (Years)
Hochholzer., *et al.*	1997	5	13,6
Chell., *et al.*	1999	1	15
Hochholzer., *et al.*	2005	24	14,5
Desaldeleer., *et al.*	2016	1	17

Table 1: Number of cases reported in the literature in the last 20 years (1997-2016).

In climbers, the constant and repetitive weight bearing on flexed PIPJ results in chronic micro-trauma to the PIPJ. This is a relatively unique injury to climbers where their body weight hangs on flexed fingers during climbing with the maximum pressure placed on the base of middle phalanx. In adults, the same micro-trauma results in ligament, tendon or pulley injuries. In adolescents however, with less resistance in the epiphyseal plate compared to surrounding soft tissue joint support, chronic damage is done to the plate. Also, as the physics of the phalanx begins to close there is less cartilaginous protection to the joints after adolescence [9]. These present as displaced epiphyseal fractures, usually of the Salter Harris Type III. The actual mechanism of injury is thought to be chronic compression by the extensor mechanism to the joint via the central slip that is attached to the epiphysis of the middle phalanx [2,10]. This repetitive strain on epiphyses leads to micro-trauma to epiphyses and surrounding bone stock. It is our view, that the chronic irritation of the insertion of central slip in the middle phalanx further leads to insertion tendinopathy, possibly micro-trauma with partial avulsion of the central slip insertion and healing back in fragmentation of the insertion area and erosion at dorsal aspect of the middle phalanx. This is similar to the picture seen in the apophysitis in Osgood Schlatter in the knee, where the tibia insertion of the

infrapatellar tendon is fragmented and sometimes fractured. We have therefore suggested that this very particular PIPJ apophysitis is looked upon as "the Osgood Schlatter of the finger".

General clinical presentation and radiological findings

Clinically, athletes with this type of pathology usually present with chronic pain over the PIPJ, swelling and reduction in the range of motion [10].

Within a decade of climbing radiological changes are also evident with a cortical hypertrophy especially dorsally which is evident on a lateral x-rays. There are often also signs of cortical stress reactions that are more pronounced on the volar part of distal phalanx, associated with increased tensile load to the flexor digitorum profundo's (FDP) tendons as the fingers grip onto surfaces. In addition, the medullary canal of those athletes' phalanges are also narrowed [11].

After 15 years of climbing, 28% of the climbers also show osteoarthritic findings on x-rays [3]. Other than the osteoarthritic changes, the other radiographic changes have also been seen in young climbers [4] and are directly correlated to climbing years, training hours and climbing level [3].

General management guidelines

Current recommended treatment for these chronic overuse injuries is complete rest from climbing, especially in patients who present with early, reversible pathologies, as with our case [9]. Stretching exercises are also thought to be vital to prevent the fingers adopting a fixed flexion position when at rest [9]. Training programs are gradually introduced with reduced weight bearing, increase of rest periods and joint intensive stretching. Analgesia and splinting have also been advocated. In addition, young patients should avoid intensive and prolonged training until their fingers have stopped growing to prevent the injury from occurring in the first place [2,10].

Surgery may be useful in very selective patients, namely those who have a delayed presentation and for those with displaced fractured epiphysis. These patients may benefit from open reduction and fixation but there are no long term results available [10].

Conclusions

There is an increased incidence in adolescent climbers' injuries due to increased popularity of the sport. Our case of "Osgood Schlatter of the finger" illustrates severe bilateral advanced PIPJ destruction due to climbing with repetitive overuse, which will have long-term irreversible consequences to the child later in life. Once the epiphysis is destroyed there are no good treatment options in the growing skeleton, other than conservative measures and advice to stop climbing to reduce the repetitive trauma, or, if available, a modification of the climbing technique.

The literature review supports limitation to training in young climbers to prevent the injury in the first place and strongly advocate early conservative treatment when these patients present. Late, advanced joint destruction will be present long after the patient's climbing career is over with potentially life-changing consequences. It is important to fully inform the significance of this to the patient and their family, which in turn is a challenge as most of these children simply love their sport.

Conflict of Interest disclosure

No conflict of interest.

Presentations

This paper has not been presented.

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