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The Buttered Knuckles of the Martial Arts World – A Comprehensive Review on Boxer’s Knuckle

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Abstract

Introduction:

Boxer's knuckle is a common injury that occurs due to repetitive trauma to the hand, often seen in those who engage in boxing or other similar combat sports. It is a painful condition that can cause swelling, tenderness, and limited movement in the affected area. In some cases, boxer's knuckle can be severe enough to require medical attention and even surgery. This injury can have a significant impact on an athlete's training and overall performance, and it is important to take preventative measures to avoid its occurrence. Understanding the causes, symptoms, and treatment options for boxer's knuckle is essential for any athlete who regularly engages in combat sports or any activity that involves repeated hand trauma.

Objective of the study:

The objective of this review study is to analyze and summarize the literature related to boxer's knuckle, including its epidemiology, pathophysiology, clinical features, diagnosis, and management. The study aims to provide a comprehensive understanding of the condition, its causes, risk factors, and treatments, and to identify the gaps and limitations in the existing literature. Furthermore, this review intends to provide evidence-based recommendations and guidelines for the prevention, assessment, and treatment of boxer's knuckle in athletes and other individuals who are at risk of developing the condition. Ultimately, the study seeks to contribute to the development of a more precise and effective approach to managing this common hand injury.

Material and methods:

Review of PubMed articles using the following keywords: "mcp joint rupture boxing", "boxer's knuckle", "metacarpophalangeal joint boxing", "extensor hood injuries". Additionally, related articles proposed by the PubMed website were checked. Single citations that were not in the PubMed database but, in the opinion of the authors, contained valuable knowledge worthy of inclusion in the article were also reviewed.

Conclusions:

Boxer's knuckle is a condition that occurs as a result of repetitive punching, as it is in combat sports training. It is possible to tear the joint capsule, damage the fibers of the extensor tendon, joint cartilage, as well as the bones. Possible treatment includes both nonsurgical and interventional methods. Neglect can result in serious consequences. Current treatment methods allow athletes to actively train after the recovery period is over. This topic has not found much attention in the medical literature, which is a great field for the development of this branch of knowledge.

Keywords: mcp; metacarpophalangeal; joint; capsule; boxer's knuckle; punching

Introduction:

Boxer's knuckle is damage to the soft tissues of the dorsal part of the metacarpophalangeal MCP joint [1], in the literature often equated with a tear of the joint capsule [2][3]. The lesion thus named can involve only skin tissues [4], as well as damage to subsequent layers in depth - up to the articular surfaces of bones [5]. Thus, the deficit of consistency in calling lesions of different severity by the same name is noteworthy. Symptoms include soreness, tenderness and limited movement in the affected area, as well as thickening of the soft tissues after several weeks - several months [6]. Boxer's knuckle happens most often in people who train combat sports, including boxing, karate, taekwondo, MMA, due to repeated trauma to one part of the hand. Mostly the third metacarpophalangeal joint happens to be affected.[7]

Epidemiology:

Boxing is a popular sport around the world and injuries to the dorsum of the hand are quite common. Due to the characteristics of the sport in which this injury happens, the cases described usually involve young people (of competitive age), that is, between the ages of 16 and 45. Most of the injuries affected professional boxers.

[1][2][3][6][8][9][10] Furthermore, Loosemore et al. conducted a study from 2005-2012 on the Great Britain Olympic Boxing Squad, which revealed that injuries such as finger carpometacarpal instability and finger metacarpophalangeal joint extensor hood and capsule sprain, commonly referred to as "boxer's knuckle," were more prevalent than other types of injuries.[11]

Pathophysiology:

Injuries to the dorsal capsule typically affect the middle finger's MCP joint, followed by the index finger's MCP joint, which is because of the effective punch zone of the fist - the flat and wide surface over the proximal phalanges of the index and middle fingers. The middle finger's knuckle is more susceptible to injury because it extends a bit further than the other knuckles in a clenched fist. However, any joint can be injured if a boxer misses the effective punch zone of the fist.[12][13][14] The primary focus of avoiding hand injuries in boxing involves four key ideas: using wraps or tape on the hands and wrists, adjusting the design and padding of gloves, using correct techniques for striking, and maintaining good physical conditioning [7]

The extensor hood of the MCP joint of the finger consists of a longitudinal middle tendon and a transverse peripheral tendon, called the sagittal band.[5] Damage to the extensor hood can lead to subluxation of the extensor tendon and its free movement over the joint surface. When an injury is limited to the sagittal band, it typically affects the band located on the radial side of the extensor tendon. This causes the tendon to move towards the ulnar side. However, if there is a tear in the ulnar sagittal band, the tendon may be pushed towards the radial side which is a less common occurrence. This could indicate that the patient has also sustained a more serious injury to the dorsal capsule.[12]The joint capsule of the MCP joint is positioned further inwards from the central tendon and sagittal bands, providing extra safeguarding to the joint surface. In certain instances, there were fractures in the cartilage and bone of the surface of the metacarpal head. These lesions can be found in the area where it aligns with the rupture of the sagittal band. It is important to note that all of these fractures occurred in individuals with boxer's knuckles that were chronically and severely damaged, and had not received any prior surgical treatment. If left untreated and experiencing multiple injuries, the extensor hood will weaken and expose the joint's surface, leading to possible joint damage and degenerative joint disease.[5][15] Injuries can range from minor cuts to the skin to more severe damage such as broken bones, injuries to the dorsal capsule and extensor mechanism, and injuries to the carpometacarpal joint.[8] Less advanced cases, untreated and neglected for months are characterized by overgrowth of scar tissue over the joint and painful hyperkeratotic, fissured callosities on knuckles ("knuckle pads") after having boxed regularly for a few months.[4]

According to Rayan and Murray, there are three different types of sagittal band injuries. The first type occurs without any instability in the extensor digitorum communis (EDC) tendon, the second type involves the subluxation of the EDC tendon, and the third type is characterized by a complete dislocation of the EDC tendon. 16]

Diagnosis:

Symptoms that indicate complete MP joint extensor hood disruption are noticeable swelling, limited joint movement, central tendon subluxation, an extensor lag, and a painful gap where there has been a sagittal band rupture. It is not common to require specialized imaging tests. Radiography can be used, including tangential views of the joint (known as Brewerton views), which occasionally show metacarpal head subchondral cysts. These cysts imply that there is likely an osteochondral fracture in the MP joint.[5] Radiographs may be useful in ruling out other possible associated conditions, such as fracture of the neck of the fifth metacarpal bone (Boxer's fracture)[17] and also can be useful in unusual cases that occur outside the training room[8]. Methods such as ultrasound and MRI are used to diagnose and determine the management of boxer's knuckles.[10][18].Ultrasonography can indicate swelling in soft tissues, which may suggest an irregularity in structure. It can also reveal ruptures in the sagittal band and movement of tendons from their proper location. Magnetic resonance imaging and angiography, as well as 3T magnetic resonance imaging, can display tears in the extensor hood and flaws in the capsule. Keep in mind that interpreting ultrasounds and MRIs can be complex because the extensor hood is thin. But, soft tissue edema can be a dependable sign of severe inner damage, and surgery may be required to investigate further.[11]

Treatment:

There are both surgical and non-operative treatment methods. Sources don't quite agree on the effectiveness of non-operative methods. Some report that non-operative therapy has no chance of success [19], others allow non-operative therapy in some cases, for example, in the non-training population [20]. In athletes, invasive methods are most often recommended in advance due to the stresses taken by the knuckles [5][21] In every situation, non-surgical therapy usually consists of keeping the affected area still for as long as 8 weeks. This can be done by either using neighboring straps [20] for minor injuries or placing a splint if there is a tendon subluxation.[20][22][23]. For operative methods there are direct repair methods [12] and extensor retinaculum grafting if there is no possibility of direct repair. [2]. Many sources describing surgical cases indicate the effectiveness of treatment and the possibility of returning athletes to their competitive careers [2][5][9], possible inability to return was due to the joints cartilage damage [9]. After surgery, immobilization for 3-4 weeks and further rehabilitation requiring cooperation from the patient is necessary. A return to punching is possible within 3 months, but it is preferred to be six months, but many athletes choose to return to sports sooner.[12]

Prevention:

The use and correct technique of wrapping boxing bandages on the hands and wrists. that allows to stiffen the above, provide partial cushioning of blows, resulting in a reduction in the number of injuries. Using high-quality boxing gloves that have a large amount of padding material.[7] Using additional sponges and other materials to further absorb energy under the wraps. The technique of striking emphasizes the importance of directing force towards the middle finger metacarpal head through proper alignment of the elbow and wrist at impact. This helps to distribute the force to the fixed unit of the hand which consists of the middle and index metacarpals. However, striking at an angle or without proper coaching can lead to injuries.[7] Avoiding overtraining, letting go of exertion if there is pain, regular follow-up with a physiotherapist and doctor, proper diet and lifestyle, sufficient rest and care of injury-prone areas.

Results and conclusions:

Boxer's knuckle is a condition that occurs in most cases as a result of repetitive damage to the MCP joint area through regular punching exercises. It has been observed that this topic is underdeveloped in the available scientific literature. There are some gaps that require further research and analysis to improve diagnosis and treatment strategies. Studies on a larger group of patients with detailed analysis of the data are lacking. Patients are most often combat sports practitioners who delay seeking help until the condition becomes too severe to continue training and living in satisfactory comfort. Treatment for such individuals, most often comes down to surgery and further rehabilitation, which excludes the athlete from full training opportunities for at least 3 months. In all likelihood, it can be assumed that athletes delay diagnosis and treatment for fear of interruption in training, suggesting the need to provide proper education to those involved in sports in order to avoid situations that risk serious complications due to negligence. Treatment along with rehabilitation in most cases gives the possibility to return to continue the development of sports career. This knowledge is especially important in the context of improving the functionality and quality of life for those struggling with this disorder.

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References:

1. Arai K, Toh S, Nakahara K, Nishikawa S, Harata S. Treatment of soft tissue injuries to the dorsum of the metacarpophalangeal joint (Boxer's knuckle). *J Hand Surg Br.* 2002 Feb;27(1):90-5. doi: 10.1054/jhsb.2001.0656. PMID: 11895354.
- 2.Nagaoka M, Satoh T, Nagao S, Matsuzaki H. Extensor retinaculum graft for chronic boxer's knuckle. *J Hand Surg Am.* 2006 Jul-Aug;31(6):947-51. doi: 10.1016/j.jhsa.2006.02.027. PMID: 16843154.
- 3.Posner MA, Ambrose L. Boxer's knuckle--dorsal capsular rupture of the metacarpophalangeal joint of a finger. *J Hand Surg Am.* 1989 Mar;14(2 Pt 1):229-36. doi: 10.1016/0363-5023(89)90011-7. PMID: 2703667.

4. Kanerva L. Knuckle pads from boxing. *Eur J Dermatol.* 1998 Jul-Aug;8(5):359-61. PMID: 9683870.
5. Melone CP Jr, Polatsch DB, Beldner S. Disabling hand injuries in boxing: boxer's knuckle and traumatic carpal boss. *Clin Sports Med.* 2009 Oct;28(4):609-21, vii. doi: 10.1016/j.csm.2009.06.004. PMID: 19819405.
6. GLADDEN JR. Boxer's knuckle; a preliminary report. *Am J Surg.* 1957 Mar;93(3):388-97. doi: 10.1016/0002-9610(57)90828-0. PMID: 13403057.
7. Drury BT, Lehman TP, Rayan G. Hand and Wrist Injuries in Boxing and the Martial Arts. *Hand Clin.* 2017 Feb;33(1):97-106. doi: 10.1016/j.hcl.2016.08.004. PMID: 27886844.
8. Javed M, Hemington-Gorse S, Shokrollahi K. A new recreational mechanism for the boxer's knuckle: cause for concern? *Ann R Coll Surg Engl.* 2011 Jul;93(5):e55-6. doi: 10.1308/147870811X583250. PMID: 21943451; PMCID: PMC5827219.
9. Matharu GS, Gatt IT, Delaney R, Loosemore M, Hayton MJ. Extensor hood injuries in elite boxers: injury characteristics, surgical technique and outcomes. *J Hand Surg Eur Vol.* 2022 Dec;47(11):1162-1167. doi: 10.1177/17531934221123139. Epub 2022 Sep 15. PMID: 36112963; PMCID: PMC9727113.
10. Watté N, Walschot L, Vanhoenacker F. Boxer's Knuckle. *J Belg Soc Radiol.* 2021 Nov 22;105(1):79. doi: 10.5334/jbsr.2620. PMID: 34901740; PMCID: PMC8622069.
11. Loosemore M, Lightfoot J, Gatt I, Hayton M, Beardsley C. Hand and Wrist Injuries in Elite Boxing: A Longitudinal Prospective Study (2005-2012) of the Great Britain Olympic Boxing Squad. *Hand (N Y).* 2017 Mar;12(2):181-187. doi: 10.1177/1558944716642756. Epub 2016 Jul 8. PMID: 28344531; PMCID: PMC5349401.
12. Stracher M, Posner MA. Boxer's Knuckle. *Tech Hand Up Extrem Surg.* 2002 Dec;6(4):196-9. doi: 10.1097/00130911-200212000-00007. PMID: 16520601.
13. Leon Lam W, Bruyere A, Leclerc:1105-1106. doi: 10.1177/1753193420934072. Epub 2020 Jun 26. PMID: 32588711.
14. Bents RT, Metz JP, Topper SM. Traumatic extensor tendon dislocation in a boxer: a case study. *Med Sci Sports Exerc.* 2003 Oct;35(10):1645-7. doi: 10.1249/01.MSS.0000089340.89660.EB. PMID: 14523299.
15. Tomori Y, Ohashi R, Naito Z, Nanno M, Takai S. Florid reactive periostitis in the fifth phalange of a professional boxer: A case report. *Medicine (Baltimore).* 2016 Dec;95(51):e5697. doi: 10.1097/MD.0000000000005697. PMID: 28002343; PMCID: PMC5181827.
16. Ghazi M. Rayan, David Murray, Classification and treatment of closed sagittal band injuries, *The Journal of Hand Surgery*, Volume 19, Issue 4, 1994, Pages 590-594, ISSN 0363-5023, [https://doi.org/10.1016/0363-5023\(94\)90261-5](https://doi.org/10.1016/0363-5023(94)90261-5).
17. Hussain MH, Ghaffar A, Choudry Q, Iqbal Z, Khan MN. Management of Fifth Metacarpal Neck Fracture (Boxer's Fracture): A Literature Review. *Cureus.* 2020 Jul 28;12(7):e9442. doi: 10.7759/cureus.9442. PMID: 32864266; PMCID: PMC7451089.
18. Kichouh M, De Maeseneer M, Jager T, Marcelis S, Van Hedent E, Van Roy P, De Mey J. Ultrasound findings in injuries of dorsal extensor hood: correlation with MR and follow-up findings. *Eur J Radiol.* 2011 Feb;77(2):249-53. doi: 10.1016/j.ejrad.2010.05.015. Epub 2010 Jun 20. PMID: 20566255.
19. Ferlemann K, Zilch H. Geschlossene Streckhaubenverletzungen am Grundgelenk der Langfinger [Closed injuries of the extensor hood of the metacarpophalangeal joint]. *Unfallchirurgie.* 1997 Dec;23(6):262-6. German. doi: 10.1007/BF02628923. PMID: 9483789.
20. Lin JD, Strauch RJ. Closed soft tissue extensor mechanism injuries (mallet, boutonniere, and sagittal band). *J Hand Surg Am.* 2014 May;39(5):1005-11. doi: 10.1016/j.jhsa.2013.11.018. PMID: 24766832.
21. Loosemore MJ, Ansdell ML, Charalambous CP, Harrison JW, Hayton MJ. Traumatic extensor hood rupture. *Hand (N Y).* 2009 Jun;4(2):177-9. doi: 10.1007/s11552-008-9154-7. Epub 2008 Dec 19. PMID: 19096895; PMCID: PMC2686793.
22. Scalcione LR, Pathria MN, Chung CB. The athlete's hand: ligament and tendon injury. *Semin Musculoskelet Radiol.* 2012 Sep;16(4):338-49. doi: 10.1055/s-0032-1327007. Epub 2012 Oct 9. PMID: 23047281.
23. Newport ML, Shukla A. Electrophysiologic basis of dynamic extensor splinting. *J Hand Surg Am.* 1992 Mar;17(2):272-7. doi: 10.1016/0363-5023(92)90404-d. PMID: 1564273. C. An unusual presentation of Boxer's

- knuckle in the little finger: a case report. *J Hand Surg Eur* Vol. 2020 Dec;45(10):1105-1106. doi: 10.1177/1753193420934072. Epub 2020 Jun 26. PMID: 32588711.
14. Bents RT, Metz JP, Topper SM. Traumatic extensor tendon dislocation in a boxer: a case study. *Med Sci Sports Exerc.* 2003 Oct;35(10):1645-7. doi: 10.1249/01.MSS.0000089340.89660.EB. PMID: 14523299.
15. Tomori Y, Ohashi R, Naito Z, Nanno M, Takai S. Florid reactive periostitis in the fifth phalange of a professional boxer: A case report. *Medicine (Baltimore).* 2016 Dec;95(51):e5697. doi: 10.1097/MD.0000000000005697. PMID: 28002343; PMCID: PMC5181827.
16. Ghazi M. Rayan, David Murray, Classification and treatment of closed sagittal band injuries, *The Journal of Hand Surgery*, Volume 19, Issue 4, 1994, Pages 590-594, ISSN 0363-5023, [https://doi.org/10.1016/0363-5023\(94\)90261-5](https://doi.org/10.1016/0363-5023(94)90261-5).
17. Hussain MH, Ghaffar A, Choudry Q, Iqbal Z, Khan MN. Management of Fifth Metacarpal Neck Fracture (Boxer's Fracture): A Literature Review. *Cureus.* 2020 Jul 28;12(7):e9442. doi: 10.7759/cureus.9442. PMID: 32864266; PMCID: PMC7451089.
18. Kichouh M, De Maeseneer M, Jager T, Marcelis S, Van Hedent E, Van Roy P, De Mey J. Ultrasound findings in injuries of dorsal extensor hood: correlation with MR and follow-up findings. *Eur J Radiol.* 2011 Feb;77(2):249-53. doi: 10.1016/j.ejrad.2010.05.015. Epub 2010 Jun 20. PMID: 20566255.
19. Ferlemann K, Zilch H. Geschlossene Streckhaubenverletzungen am Grundgelenk der Langfinger [Closed injuries of the extensor hood of the metacarpophalangeal joint]. *Unfallchirurgie.* 1997 Dec;23(6):262-6. German. doi: 10.1007/BF02628923. PMID: 9483789.
20. Lin JD, Strauch RJ. Closed soft tissue extensor mechanism injuries (mallet, boutonniere, and sagittal band). *J Hand Surg Am.* 2014 May;39(5):1005-11. doi: 10.1016/j.jhssa.2013.11.018. PMID: 24766832.
21. Loosemore MJ, Ansdell ML, Charalambous CP, Harrison JW, Hayton MJ. Traumatic extensor hood rupture. *Hand (N Y).* 2009 Jun;4(2):177-9. doi: 10.1007/s11552-008-9154-7. Epub 2008 Dec 19. PMID: 19096895; PMCID: PMC2686793.
22. Scalcione LR, Pathria MN, Chung CB. The athlete's hand: ligament and tendon injury. *Semin Musculoskelet Radiol.* 2012 Sep;16(4):338-49. doi: 10.1055/s-0032-1327007. Epub 2012 Oct 9. PMID: 23047281.
23. Newport ML, Shukla A. Electrophysiologic basis of dynamic extensor splinting. *J Hand Surg Am.* 1992 Mar;17(2):272-7. doi: 10.1016/0363-5023(92)90404-d. PMID: 1564273.