



# Arm-wrestling injuries – A systematic review of the medical literature

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## ABSTRACT

**Background:** Arm wrestling is a popular sport due to its simplistic nature and great appeal in popular culture. Unfortunately, it can lead to serious fractures. An understanding of these injuries and its mechanisms is vital to the undertaking of safe practice methods for this sporting modality. **Objectives:** This study aimed to review articles that demonstrate case reports about arm-wrestling related fractures. **Methods:** PubMed's database was searched with the keywords "Arm Wrestling," "Arm-wrestling," and "Armwrestling." Of the 34 articles found, 11 were fit to compose this review, being grouped into studies that dealt with adults and studies that dealt with adolescents. **Results:** Of the 63 adult subjects reported, 62 suffered fractures of the distal third of the humerus, occasionally accompanied by butterfly fractures and radial nerve palsy. Of the 22 adolescent subjects reported, 20 suffered fractures of the humerus medial epicondyle, never accompanied by butterfly fractures, and sometimes accompanied by ulnar nerve palsy. All injuries stemmed from unbalanced torsional forces suffered by the humerus from its own musculature. **Conclusions:** The injury profile presented by both populations is very homogeneous between the two different groups, which leads us to believe that correct technique can be a great ally in arm wrestling injury prevention. Athletes, as well as common practitioners, should be coached as to avoid these unfavorable positions and techniques

**Keywords:** Arm Wrestling; Fractures; Injuries

## INTRODUCTION

Arm wrestling is a very simple and popular sport due to its minimalist nature and great appeal in popular culture<sup>(1)</sup>. Unfortunately, it can be the catalyst of serious fractures which have been reported in the relevant medical literature<sup>(2)</sup>. Reports on injuries during arm wrestling are increasing, with fractures of the humerus shaft being the most common in nature<sup>(3)</sup>. During an arm wrestling match, two athletes face each other, either standing or sitting down, tie hands together and try to pin their opponents arm down to specified horizontal plane. These arm torsions, combined with other factors, are likely the key motives for fractures in arm wrestling<sup>(1)</sup>. An understanding of these injuries and its mechanisms is vital to the undertaking of safe practice methods for this sporting modality<sup>(4-6)</sup>.

## METHODOLOGY

Given the increasing number of arm-wrestling related injuries present in the specific medical literature<sup>(7)</sup>, this study aimed to review articles that demonstrate case reports about this specific topic according to the following criteria:

1. Be a medical case report with human subjects (thus excluding cadaveric, computational, or machine models)

2. Be specific to injuries sustained during the practice of arm wrestling
3. Be written in English and published in peer-reviewed journals

Article search occurred in the PubMed database with the keywords "Arm Wrestling," "Arm-wrestling," and "Armwrestling." Our primary search found 34 articles. Title and abstract inspection of these articles resulted in the exclusion of 21 titles. A full reading of the remaining 13 articles resulted in the further exclusion of three more articles, due to the use of cadaveric or computational models only. Thus, 11 articles were considered fit to compose this review.

## RESULTS

### Subjects

Of the 11 articles reviewed, seven presented case reports dealing strictly with adult subjects over the age of 18 years-old, totaling 63 subjects in total. Meanwhile, three articles presented case reports dealing strictly with adolescent subjects less than 18 years-old, totaling 22 subjects in total. Only one article did not discriminate subjects based on age.

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Due to the specific nature of bone and muscle development related to biological and maturational age, we will likewise present our data in such manner. Of all the 85 subjects reported in the 11 articles, only two were women, making gender an impractical review/analysis category.

### Models

Nine research papers presented multi-case studies, while two of them presented single-case studies.

### Types of Injuries

Seven studies present in this review focused on adult subjects, totaling 63 cases of arm-wrestling related injuries. Of those, 62 presented spiral fractures of the distal third of the humerus (SFDH), while only one of them presented a fracture of the radial neck (RNF), showing a very homogenous injury site profile. In 22 (35%) of the injuries, the SFDH were accompanied by butterfly fractures (BF), 14 (22.2%) of them were accompanied by radial nerve palsy (RNP). This information is summed up in Table 1.

The four studies that dealt with adolescent subjects under 18 years of age showed a very different injury data profile. In all, 22 injury cases were reported in them, 20 (91%) of them present humerus medial epicondyle fractures (MEF), and only two presenting SFDH. Only one reported case was accompanied by a BF, and three were accompanied by ulnar nerve palsy (UNP). This information is summed up in table 2.

**Table 1 – Case-Report Studies with Adult Subjects (>18 yrs old)**

Study	n	Major Fracture	Minor Fracture	Nerve Palsy
Bumbasirevic et al <sup>(2)</sup>	6	6 SFDH	1 BF	-
Rutkowska et al <sup>(8)</sup>	10	10 SFDH	5 BF	2 RNP
Kruczyński et al <sup>(1)</sup>	9	9 SFDH	4 BF	3 RNP
Ogawa & Ui <sup>(9)</sup>	30	30 SFDH	7 BF	7 RNP
Low & Lim <sup>(10)</sup>	2	2 SFDH	-	2 RNP
Falis et al <sup>(3)</sup>	1	1 RNF	-	-
Whittaker <sup>(11)</sup>	5	5 SFDH	5 BF	-
Total	63	62 SFDH (98.5%), 1 RNF	22 BF (35%)	14 RNP (22.2%)

**Note:** SFDH = Spiral Fracture of the Distal Third of the Humerus, RNF = Radial Neck Fracture, BF = Butterfly Fracture, RNP = Radial Nerve Palsy

**Table 2 - Case-Report Studies with Adolescent Subjects (<18 yrs old)**

Study	n	Major Fracture	Minor Fracture	Nerve Palsy
Low & Lim, 1991 <sup>(10)</sup>	3	1 SDHF, 2 MEF	-	2 UNP
Chang et al, 2000 <sup>(12)</sup>	1	1 SDHF	1 BF	-
Nyska et al, 1992 <sup>(13)</sup>	8	8 MEF	-	-
Ogawa & Ui, 1996 <sup>(14)</sup>	10	10 MEF	-	1 UNP
Total	22	20 MEF (91%), 2 SDHF	1 BF (4.5%)	3 UNP (13.6%)

**Note:** MEF = Humerus Medial Epicondyle Fracture, SDHF = Spiral Fracture of the Distal Third of the Humerus, BF = Butterfly Fracture, UNP = Ulnar Nerve Palsy

### DISCUSSION

Humerus fractures resulting from violent muscular force is a well-documented injury in various sports where upper limb strength performance is determinant to success<sup>(15,16)</sup>. In arm wrestling, it is no different, its athletes being especially at risk to this kind of injury. In adults, fractures are usually spiral in nature and located at the distal third of the humerus, being potentially accompanied by butterfly fractures and radial nerve palsy. In adolescents, the characteristics of the injuries are different, being primarily avulsion fractures of the medial humerus epicondyle. In this case, butterfly fractures are never present, and UNP may be a possibility. According to Whitaker<sup>(11)</sup>, in adults the forces acting on the humerus while the forearm muscles are contracted during a match are bending (from arm abductors), axial compression (from arm flexors and shoulder adductors), and torsional (internal rotators of the arm). They exert tension on the humerus when the internal rotator muscles of the shoulder go from their maximum concentric contraction to passive eccentric contraction, resulting in an intense rotational force leading to the fracture<sup>(9,18)</sup>, usually when trying to escape from a losing position while keeping the glenohumeral joint fixed. Also, Nyska et al<sup>(13)</sup>, in relation to the morphological characteristics of the humerus, state that these forces may lead to a fracture of specifically the distal third of the bone due to it being the portion of the bone with the smallest circumference, therefore having the lowest moment of inertia, and also having the thinnest diaphyseal-metaphyseal junction.

Ogawa e Ui<sup>(14)</sup> state that the primary reason for the difference between usual injury sites in adults and adolescents is that the latter’s humerus growth plates are not yet closed, configuring themselves as weak points where arm flexor musculature tension may be greater than the strength of the growth plate itself, thus acting in its fracture on violent muscle contractions<sup>(17,14,19,20)</sup>. Due to the presence of this weak spot, an avulsion fracture in the medial humeral epicondyle happens before the tensional forces can even reach the shaft of the humerus.

### FINAL CONSIDERATIONS

Arm wrestling is a popular activity, which should not be perceived as safe when practiced by amateurs, as many reports have proven such<sup>(21)</sup>. However, the homogenous nature of the reported injuries, together with the fact that fractures are rare in competitive, professional and supervised competitions<sup>(10)</sup>, leads us to believe that correct technique can be a great ally in arm wrestling injury prevention.

All articles reviewed in this study stated that injuries always occur when unbalanced tensional forces directly affect the humerus. In practice, this means a position when both the arm and forearm are rotated, either internally or externally, in juxtaposition to each other, on a fixed glenohumeral joint. Therefore, athletes, as well as common practitioners, should be coached as to avoid these unfavorable positions and techniques<sup>(22,23)</sup>.



## Ethical Procedures

This research was not conducted with living subjects; therefore, it is exempt from approval by an ethics committee

## AUTHOR CONTRIBUTIONS

RFC and RPA framed questions for the review. ANR and RFC identified relevant work. RFC and ANR assessed the quality of studies. RPA and RFC summarized the evidence. RFC, RPA, and ANR interpreted the findings. RFC and RPA drafted the final manuscript.

## CONFLICT OF INTEREST

Nothing to declare.

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