

# A Rare Pediatric Monteggia Equivalent Fracture: Case Report, Literature Review and a New Proposed Pediatric Bado Classification



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**Citation** Silva R, Pinto LF, Fernandes J, Costa FP, Freitas JM, Coutinho J. A Rare Pediatric Monteggia Equivalent Fracture: Case Report, Literature Review and a New Proposed Pediatric Bado Classification. Case Reports in Clinical Practice. 2022; 7(1):16-20.

**Running Title** A Rare Pediatric Monteggia Equivalent Fracture



## Article info:

**Received:** 10 January 2022

**Revised:** 23 January 2022

**Accepted:** 27 February 2022

## Keywords:

Pediatrics; Trauma; Forearm

## ABSTRACT

Variations of Monteggia fractures are uncommon in the pediatric population and demand a high suspicion for early recognition and treatment. The involvement of the radial head in these types of injury isn't well documented, but literary reports are growing. We report a case of a poorly documented variant of a Monteggia Equivalent Fracture with a Salter-Harris II fracture of the radial head with medial displacement and propose a new approach to the Bado classification in the pediatric population based on a literature review.

## Introduction

# A

Monteggia fracture is defined as a proximal ulnar shaft fracture combined with a radial head dislocation and is named after Giovanni Battista Monteggia first described it in 1914 [1].

In 1967, a classification was created for these injuries by Bado based on the anatomical particularities of the fracture-dislocation [2].

Equivalent lesions constitute similar injuries with a few different characteristics, such as radial head fracture instead of the dislocated radial head, which are more common than initially suspected and commonly misdiagnosed [3]. Fractures to the radial growth plate

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are not included in the existent classifications [4], and neither are the ulnar fracture's medial displacement and medial apex.

We report a rare Monteggia Equivalent Fracture, with a Salter-Harris type II fracture of the radial head with a medial deviation of the radial shaft associated with a medial apex ulnar fracture.

### Case report

A 10-year-old boy presented to our emergency room after falling on his left elbow while playing in school. Clinical examination showed a closed proximal forearm injury without neurovascular deficits.

Radiographs showed a Bado equivalent fracture, with a Salter-Harris type II radial head fracture and medialized apex of the ulnar fracture, and medial deviation of radial neck and shaft (Figure 1). While the proximal radial shaft had a medial displacement from its normal alignment, the radial epiphysis remained centered on the capitulum in all views.

Under general anesthesia, the arm was manipulated with a particular focus on the ulnar alignment. Fixation was performed with a 2.5mm intramedullary elastic nail upon ulnar anatomic reduction. This fixation allowed for a reasonable reduction of the proximal radius fracture, which remained stable within the range of motion, thus deeming fixation unnecessary. Above the elbow, a splint was applied for three weeks (Figure 2). At 5 weeks follow-up, callus was evident on both fracture sites, and gentle ROM was initiated (Figure 3). By the 2.5 months

follow-up, the patient showed full flexion/extension motion and pronosupination without restrictions (Figure 4). Six months after the surgery, the fixation material was extracted without further complications.

### Discussion

Our case report presents two very particular and rare characteristics: A displaced Salter-Harris II fracture of the radial head and a medial oriented deviation of the fracture-dislocation. No similar fracture has been reported in the literature; however, isolated reports of Monteggia variants have been documented.

Kamali et al. described a fracture pattern with proximal third ulna shaft fracture associated with a radial neck fracture and radial head displacement [5].

ElKhouly et al. reported a rare Bado type I variant with a Salter-Harris type II of the radial head, with a good outcome following a treatment method similar to our own, by elastic nailing ulnar fracture [6].

Younus et al. described a Bado type IV variant with a Salter-Harris type II fracture of the radial head with an anteriorly displaced radius and ulnar anterior apex angulation in detail in a 2019 case report [7]. Our nomenclature differs from the ElKhouly's report since we classify the fracture as a Bado type IV variant because of the radial fracture, and ElKhouly calls it a Bado I because of the anterior ulnar apex and radial dislocation. Regardless of the given classification, both fracture patterns are similar. Differences, however, are found in the treatment



Figure 1. Emergency room radiograph



Figure 2. Postoperative radiograph




**Figure 3.** 5<sup>th</sup>-week follow-up radiograph


since Younus also fixates the radial fracture, thus diverging from the therapy chosen by ElKhouly and ourselves.

In a recent article, Alrashidi discloses an unusual Monteggia-like fracture pattern with a laterally displaced and comminuted radial head fracture, which the author deems challenging to fit in Bado's classification [8]. Our understanding and opinion are that the described fracture is a Bado type III variant based on the lateral displacement. Still, this difficulty underlines the poor applicability of the Bado classification, especially in the


**Figure 4.** 2.5 months follow-up radiograph


pediatric population, as readily observed in the divergence mentioned above between ElKhouly and Younus.

Regarding the medial deviation of the fracture pattern, limited literature is available. Segaren et al. discloses a case of an olecranon fracture with concomitant medial radial head dislocation and emphasizes the need for revision of the Bado classification by proposing the addition of a Bado type V category to represent the medial or anteromedial deviated injuries, much similar to the

**Table 1.** New proposed pediatric Bado classification

| Types | Bado Type      | Ulna Fracture Angulation  | Radial Head Dislocation  | Radial Head Fracture  |
|-------|----------------|---|--------------------------|---|
| I     | A (True)       | Anterior  | Anterior                 | -   |
|       | B (Equivalent) | Anterior  | -                        | Yes, with an anterior deviation of the radius                 |
| II    | A (True)       | Posterior   | Posterior                | -   |
|       | B (Equivalent) | Posterior   | -                        | Yes, with a posterior deviation of the radius                 |
| III   | A (True)       | Lateral or anterolateral  | Lateral or anterolateral | -   |
|       | B (Equivalent) | Lateral or antero-lateral   | -                        | Yes, with a lateral or antero-lateral deviation of the radius |
|       | IV             | Dislocation of the radial head with fracture of the proximal third of the radius and ulna at the same level |                          |   |
|       | A (True)       | Any   | Any                      | -   |
|       | B (Equivalent) | Any   | -                        | Yes   |
| V     | A (True)       | Medial or anteromedial  | Medial or anteromedial   | -   |
|       | B (Equivalent) | Medial or antero-medial   | -                        | Yes, with a medial or antero-medial deviation of the radius   |



one presented in our study [9]. Takase et al. also report an irreducible anterolateral radial head dislocation with a concomitant undisplaced olecranon fracture, but no more reports of Monteggia medial fracture-dislocations were found [10].

Bado type IV is defined by a proximal diaphyseal ulnar fracture with dislocation of the radial head in concomitance with a proximal diaphyseal radial fracture, thus, not including the radial head or physeal fractures. Cepelik et al. defines Monteggia equivalent lesions as a fracture of the ulna at any level conjoined with a proximal radius fracture (metaphyseal or physeal injury) and found Monteggia Equivalent Fractures with a displacement of the proximal radius in all possible directions [11]. Sferopoulos underlines this hypothesis of the variant fractures and reports 2 cases of a Monteggia type IV equivalent fracture in pediatric ages, with fractures of the middle thirds of the radius and ulna associated with displaced fractures of the radial head [12]. This case report comes into conflict with the one from Younus regarding the nomenclature of the fractures [7]. When comparing the 2 reported fracture patterns, the cases reported by Sferopoulos seem to fit more accurately in the Bado IV variant type [12]. In contrast, Younus' issue appears to fall in the Bado type I variant, as seen in the previously mentioned ElKhouly report [6].

Based on our case report and the found literature, we advocate that the classification for the pediatric Monteggia fractures is limited and propose a new model that considers the Monteggia equivalent lesion and the medial/anteromedial dislocation presented in our patient (Table 1). Our classification considers the classic Bado classification and adds the type V group proposed by Segaren et al. [6]. Additionally, we subdivide each group into 2 subgroups, subgroup an (actual Monteggia fracture) and subgroup b (Equivalent Monteggia fracture with proximal radial fracture), thus encompassing all described fracture types, providing an easy, reproducible, and embracing classification for the Monteggia fractures.

## Conclusion

The applicability of the Bado classification for the pediatric population has been questioned, with difficulty fitting the variable fracture patterns in the 4 groups. Based on reported cases, a need for integration of the radial head fractures and the medial/anteromedial deviation pattern in a modified Bado classification is in order, which we present in our report. Further investigations of applicability and usefulness are needed to validate this classification and rare cases.

## Ethical Considerations

### Compliance with ethical guidelines

All procedures performed were following the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments. The patient gave full signed consent for the publication of this case.

### Funding

This research did not receive any grant from funding agencies in the public, commercial, or non-profit sectors.

### Conflict of interest

The authors declared no conflict of interest.

### Acknowledgments

A special thanks to the Department of Pediatric Orthopedics of Hospital de São João, Porto.

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