

## Original article

# FRACTURE OF THE RADIAL NECK FOLLOWING ELBOW SUBLUXATION IN CHILDREN. JEFFERY TYPE II LESION. A NEW CONCEPT OF FIXATION

## FRACTURA DEL CUELLO RADIAL DESPUÉS DE LA SUBLUXACIÓN DEL CODO EN NIÑOS. LESION JEFFERY TIPO II. UN NUEVO CONCEPTO DE FIJACIÓN

Laura Corominas-Frances<sup>1\*</sup>; Juan Fernandez-Lavilla<sup>2</sup>; Ignacio Sanpera-Trigueros<sup>1</sup>

<sup>1</sup> Department of IM Trauma y Cga Ortopedica Infantil, Hospital Universitario Son Espases, Palma de Mallorca, Spain.

<sup>2</sup> Complejo Hospitalario San Pedro, Caceres. Spain

**\* Corresponding Author:**

Department of IM Trauma y Cga Ortopedica Infantil, Hospital Universitario Son Espases. Ctra. De Valldemossa 79. Balearic Islands, Palma de Mallorca, 07010. Spain.

Phone: +34 871205000.

E-mail: lauracorominas1979@gmail.com

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### Abstract

**Introduction:** Since Jeffery, in 1950, described the type II fracture to the present day, the literature has only twenty-eight cases of children with this type of injury.

**Material and Methods:** We would like to present a new concept of fixation of this fracture which, as far as we know, has never been described in the literature.

**Results:** Open reduction should be performed with minimal injury to osteochondral, ligamentous and muscular structures to reduce complications associated with this injury. We believe that the best technique, once you decide to perform an open approach is to fix the fracture with mini-screws. Achieve a stable fixation and avoids the distraction of the fracture.

**Discussion:** Although there is no consensus regarding the need for internal fixation or the type of fixation system to be used in the Jeffery type II fracture, we recommend an open approach and fix the fracture with screws, in order to stabilize the fracture.

### Resumen

**Introducción:** Desde que en 1950, Jeffery describiese la fractura tipo II, en la literatura solo se han encontrado 28 casos

**Material y Métodos:** Presentamos un nuevo concepto de fijación de esta fractura, que nunca antes ha sido descrito

**Resultados:** La reducción abierta, debe realizarse minimizando el riesgo de lesión osteocondral, ligamentosa y muscular para reducir el índice de lesión asociada. La mejor técnica, una vez que se decide realizar un abordaje abierto es fijar la fractura con tornillos de mini-fragmentos. Adquiriendo una fijación estable que evita la distracción de la fractura

**Discusión:** A pesar que no existe consenso sobre el tipo de fijación recomendada para las fractura Jeffery tipo II, nosotros recomendamos, realizar abordaje abierto y fijación con tornillos para estabilizar la fractura.

**Keywords:** Orthopedic procedures, Child, Fractures, Bone, Radius.

## Introduction

Radial neck fractures are rare lesions. They account for 5-10% of all elbow fractures in children [1] and 1% of all the fractures in the pediatric age [2].

In 1950, Jeffery [3, 4] showed two different types of displacement of the capital epiphysis of the radius. In the most common type displacement, were fractures of the neck of the radius produced by a valgus overload that caused a lateral inclination of the head of the radius from 0° to 90°.

In the most uncommon type II fracture, the capital epiphysis of the radius was found rotated backwards 90°. Jeffery [3, 4] described the Type II fracture as an injury produced during the reduction phase of a dislocation or subluxation of the elbow as a result of the impact of the capitellum against the anterior lip of the radial head that causes the backward tilt of the latter. This mechanism can be compared with that of a bottle-opener [5]

The elbow strikes the ground and the resulting upward force on the flexed elbow separates the capital epiphysis of the radius by impacting against the inferior aspect of the capitellum which causes spontaneous reduction of the dislocation, leaving the separated radial head beneath the capitellum [1, 5]

The treatment of radial neck fractures in children varies according to fracture's displacement, angulation, and skeletal maturity [6]. Nondisplaced fractures can be treated with closed reduction and casting [5, 7] Displaced radial neck fractures with > 30° angulation should be treated surgically; there are several options, percutaneous pin reduction, elastic stable intramedullary nailing, and open reduction with or without internal fixation [6,8,9]. Open reduction is a method of treatment often used in comminuted fractures or in fractures with a completely, anteriorly or posteriorly, displaced head on the radial metaphysis and when closed reduction has failed [6].

The aim of this article is to analyze the outcomes of completely displaced and angulated fractures. Also, since there is no consensus on which technique should be used, we believe that surgeons must be aware of the importance of a correct reduction, and if an open approach is performed, internal fixation should be the technique of choice.

## Material and methods

We present a case of a 12 year-old boy who was admitted to our emergency department in September 2016. He was injured after falling on his right hand with his elbow flexed. He referred a spontaneous reduction of his elbow. Physical examination showed moderate swelling of the elbow and any passive or active motion of the joint was impossible due to pain. Radiographs showed a displaced radial head lying at 90° to the shaft (Fig.1A, 1B) a.

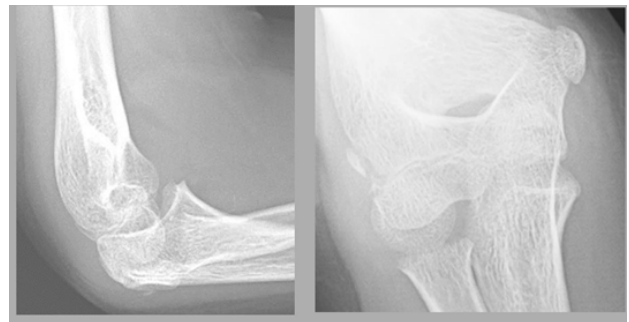


Fig 1A, 1B: Radiographs showed a displaced radial head lying at 90° to the shaft

Reduction by closed external manipulation by the Patterson and Israeli technique was unsuccessful. Open reduction was performed via a lateral radial head approach; it showed that the head was completely turned over without vascular supply.

The head was stabilized by using the Métaizeau technique pinning. Under general anesthesia, stability of the elbow was checked, and immobilized by cast in 90° elbow flexion and about 45° of pronation for 4 to 5 weeks.

At 4 months follow-up, the patient presented loss of motion and on radiographic examination;(Fig 2A,2B) the fracture was a bit slow to heal which was considered as a delayed union. At that moment, the oxford elbow score [10] was 28.



Fig 2A, 2B. Four months post-op. Delayed consolidation can be observed, in both AP and lateral views

A new open reduction was performed, intramedullary pinning removed, and the area was cleaned of fibrous adhesions and fixed with 1.5mm screws (Fig.3A,3B). The stability of the fracture and the mobility of the elbow were checked in the operating room. Range of motion (ROM) in flexion was 140° with a loss of 10° of extension and complete pronation and supination. The immobilization was removed 15 days after the surgery, and physical therapy was started. One and a half months after surgery, he started to swim and, after five months, he progressively restarted his sporting activity, canoeing.



Fig 3A, 3B. In the X ray of the 2nd surgery, after the area was cleaned of fibrous adhesions and the head was fixed with 1.5mm screws

At 1 year follow up, one of the mini screws was removed; the other was completely integrated into the periosteum. In the X-Ray, a correct consolidation of the fracture was noted. (Fig.4A,4B). No fusion or posttraumatic proximal radioulnar synostosis was noted.

The patient is currently 14 years old, does his usual sports activity without pain, and complete ROM. The carrying angle is 8° versus 10° on the contralateral side. Normal Baumann angle in the pediatric population ranges from 9° and 26° (Fig 5). He is a canoeist and competes without problems. Currently, the Oxford elbow score is 44.



Fig4A, 4B: In the AP and Lateral views of X ray, a correct consolidation of the fracture can be observed.



Fig 5. Clinical photo. Similar carrying angle on both sides and complete flexo-extension can be seen.

## Discussion

Initially, Jeffery described the mechanism of injury [2] in 1950 which he further detailed in 1972. He put forward that this injury occurs during the reduction phase of a posterior dislocation or subluxation of the elbow. Twenty-eight more cases [5,11,12,13,14,15] of Jeffery type 2 have been reported in children, if we add our case. The sex ratio is 1.4 males to one female. [5] The youngest patient in the review was 6 year old [16]. But the diagnosis of Jeffery type 2 lesions before 5 years when the radial head is not yet ossified is still a challenge, and it would require further tests if there is a fat pad sign without obvious fracture on plain radiographs [17].

It is important to differentiate a typical Jeffery type 2 fracture from a radial neck fracture with posterior displacement. In our opinion, to be able to refer to a Jeffery type 2 there should be a capitellum interposition between the head and the radial metaphysis. This lesion should be differentiated from those where there is a posterior displacement between 10° and 90° without bone interposition. Capitellum interposition renders closed manipulation ineffective, although Chotel et al [18] have described a new maneuver to allow closed reduction of this Jeffery type 2 fracture. However, the series is too short and the potential risks of a repetition of this maneuver are high, and hardly reproducible, therefore if a posterior metaphyseal periosteal is present between the two radial fragments, it would be necessary to take out this interposition to allow the reduction of

the fracture.

The main obstacle to the reduction of this fracture is capitellum interposition between the radial epiphysis and the metaphysis [5]. This is due to a rotating movement of the head around a fixed point represented here by the posterior periosteal hinge [5, 18]. The interposition of the capitellum, characteristic of Jeffery type II lesions makes closed handling ineffective.

We still recommend open surgery, due to the potential risk of damage the articular radial head. Open reduction is a method of treatment often used in comminuted fractures or in fractures with a completely displaced head anteriorly or posteriorly on the radial metaphysis.

More severe fractures warrant a more aggressive approach. The literature suggest that when the head of the radius remains displaced >30% and angulated >45° after attempts of closed or percutaneous reduction, an open reduction is indicated [9,19,20]. Open reduction was performed to provide an anatomic alignment with minimal trauma of soft tissue around the fracture [19].

It is important to always keep this fracture in mind, in posterior elbow dislocations in children. Before reduction of the dislocation, correct radiographs are required, looking for a radial neck fracture. However in 80% of Jeffery type 2 injuries no evident dislocation was reported.

We emphasize that even if the head is free of all vascular supply, a displaced proximal radial epiphysis with capitellum interposition should always be repositioned by open surgery and fixed with screws.

## Conclusion

In our opinion, the Jeffery type II fracture should be treated with open surgery. Open reduction should be performed with minimal injury to osteochondral, ligamentous and muscular structures to reduce complications associated with this injury. We believe that the best technique, once you decide to perform an open approach is to fix the fracture with mini-screws. Due to some important phenomenon, the

main objective is, once we have exposed the area, is to achieve a stable fixation. The second objective is that the Métaizeau technique, in spite of being widely extended, produces distraction of the fracture and therefore the lack of consolidation. It can even damage the articular cartilage when the fracture collapses. We believe that osteosynthesis with screws is the most precise technique especially when there is a 90° posterior tilt of the radial head. The ideal area for screw placement is, with the forearm supinate, on the outer edge, so that they do not block pronosupination, and is away from the cartilage surface. The only cases in which we would consider the Métaizeau technique after an open reduction, are those in which a broad periosteal pedicle was seen in young patients.

## Conflict of interests

This work has not received funding of any kind. The authors declare that they have no conflicts of interest in carrying out the work.

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