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MINIMAL INVASIVE SURGICAL TREATMENT OF RADIAL HEAD AND NECK FRACTURES IN CHILDREN WITH ESIO (ELASTIC STABLE INTRAMEDULLARY OSTEOSYNTHESIS) - OUR EARLY RESULTS

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Abstract

Radial head fractures are not very common injuries in children. Fractures through the articular surface of the radial head are rare in children. The more common site is through the physis (with a metaphyseal fragment, Salter-Harris type II) or the neck.
Treatment for radial neck fractures in children varies according to the displacement, angulation, and skeletal maturity.
The purpose of our study is to evaluated the benefits of percutaneous treatementof radial head and neck fractures.
This study was conducted in a ten year period (2005-2015) and includes 74 children aged 7-14 (mean age 10.4) years old with radial neck fractures type III and IV according to the Métaizeau classification. 32 patients underwent closed reduction and percutaneous fixation with titanium intramedullary nails. The average follow-up was 6 months, with X-rays and clinical evaluations conducted at four time points. The functional results were assessed with the Broberg and Morrey rating sistem for evaluation of the elbow.
X-ray results were excellent in 29 patients and good in 3 patients. Clinical results were excellent in all cases. There were no complications as infection, non-union, heterotopic ossifications or secondary loss of reduction of the radial head.
Good to excellent results without relevant complications were seen. Although the number of patients in the study was small, the results are encouraging and support the continued use of this percutaneous reduction and fixation technique. This technique of isolated radial neck fractures treatment in children represents a suitable and reliable method.

Keywords: radial neck and head fractures, children

МИНИМАЛНО ИНВАЗИВЕН ХИРУРШКИ ТРЕТМАН НА ФРАКТУРИТЕ НА ГЛАВА И ВРАТ НА РАДИУС КАЈ ДЕЦА СО ЕСИО (ЕЛАСТИЧНА СТАБИЛНА ИНТРАМЕДУЛАРНА ОСТЕОСИНТЕЗА) МЕТОДАТА-НАШИ ПОЧЕТНИ РЕЗУЛТАТИ

Апстракт

Скршеници на вратот и главата на радиус се застапени од 1% до 2% од сите фрактури кај деца, 10%-20% од сите фрактури на радиус и 5%-8.5% од фрактурите на лакотниот зглоб. За прв пат фрактурата на радијалната глава и врат е опишана во 1803 година од Portal.Фрактурите на проксималниот дел на радиус со епифизарни лезии на главата на радиус и метафизарните фрактури на вратот мора да се распознаат поради понатамошен адекватен третман. Кај овој тип на скршеници треба да се потенцира дијаметрално различен пристап во однос на скршеници кај деца и возрасни.

Ова е ретроспективна студија во која ќе бидат анализирани резултати од третманот на 74 пациенти со скршеница на глава и врат на радиус третирани на Клиника за Детска хирургија во период од 2005 – 2015 година. Пациентите се групирани според класификациониот систем на Judet. Користенисе две оперативни техники:42 пациенти се третирани со отворена крвава репозиција и транскондиларна фиксација, 32 пациенти се третирани со ЕСИО методата по METAIZEAU. Изборот на техника е рандомизиран. Во студијата се запазени инклузионите и екслузионите параметри. Индикацијата за оперативен третман е врз основа на класификациониот систем на Juded.
Добиените резултати од двете испитувани групи се во рамки на очекуваните добри резултати. Следејќи ги позитивните трендови во детската трауматологија кои ги преферираат минимално инвазивните методи и во нашата студија преовладуваат подобри резултати од оваа група.

Скршениците на главата и вратот на радиус во детска возраст се сериозни скршеници особено ако се со значителна дислокација и ангулација. Современи перкутани минимално инвазивни методи за третманот на скршениците на главата на радиус даваат подобри крајни функционални резултати.

Клучни зборови: фрактури на глава и врат на радиус, детска возраст

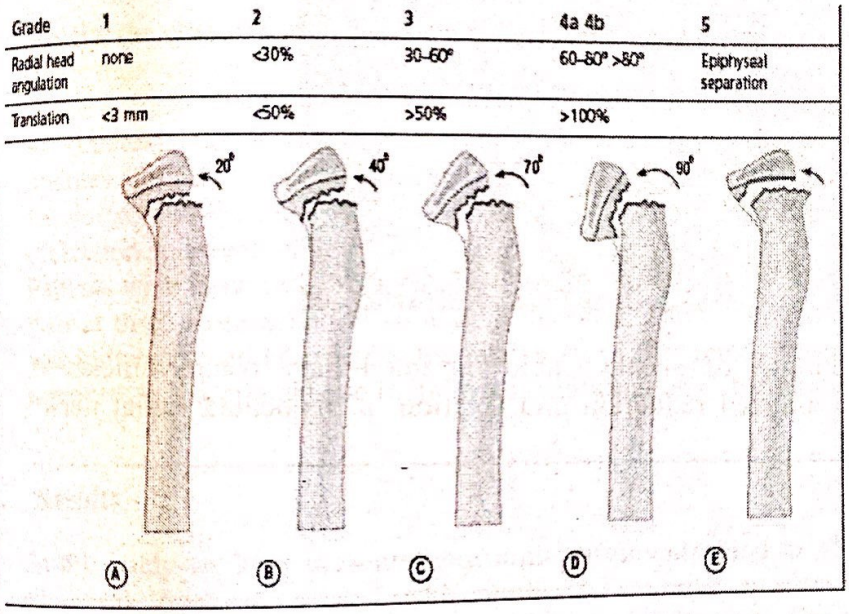
Introduction

Radial head and neck fractures are represented by 1% to 2% of all fractures in children, 10% -20% of all fractures on the radius and 5% -8.5% of the fractures of the elbow joint. They usually occur at the age of 8 to 10 years. For the first time, the fracture of the radial head and neck was described in 1803 by Portal. The ossification of the epiphyses of the head of the radius begins at the age of 4 years. The final closing of the epiphyseal plates in girls is at the age of 14 years, and in boys at the age of 17 years.
The mechanism of injury is most commonly in the case of a fall onto an outstretched arm with an elbow in extension, while the forearm is supine. The resultant valgus force then presses the capitullum against the head of the radius. The neck fracture of the radius may occur in association with the posterior dislocation of the elbow. Most of these fractures include proximal radial physis, usually producing a Salter-Harris type II injury.
The fractures of the proximal part of the radius with epiphyseal lesions on the head of the radius and metaphyseal neck fractures must be distinguished for further adequate treatment. In this type of fractures, a diametrically different approach should be emphasized in relation to fractures in children and adults.
In this paper we present our early experiences in this area, when we began to use retrograde intramedullary nailing of the radius (the Métaizeau technique) instead of open reduction and transcondylar fixation.

Aim of the stud
The aim of our study was to evaluate the benefits of using minimal invasive surgical treatment - closed reduction with percutaneous intramedullary pinning in the treatment of radial head and neck fractures type 3 and 4 according to the Judet classification.
Materials and methods
This is a retrospective study with a survey of 74 patients with radial head and neck fractures treated at the University Clinic for Pediatric Surgery Skopje in the period from 2005 to 2015. Patients were grouped according to the Judet classification system (Figure 1).

Fractures type 1 and type 2 were treated non-surgically with good long-term results and we excluded those patients from the study.

All 74 patients included in our study had type 3 and type 4 fractures and were treated with surgical treatment. Two operating techniques were used: 42 patients were treated with open bloody reduction and transcondylar fixation and 32 patients were treated with retrograde intramedullary nailing of the radius (the Métaizeau technique). The technique used was randomly chosen. The indication for treatment was based on the classification of Judet. Displaced radial neck fractures with an angulation of more than 30° were treated surgically. This minimal-invasive technique with a limited risk of the surgical approach leaves the proximal radio-ulnar joint intact, allows a reliable reduction of the radial head, and has given good to excellent results in children and adolescents.



Type 1 – fractures without dislocation
Type 2 – angulation less than 40 degrees
Type 3 – angulation from 40 to 70 degrees
Type 4 –angulation more than 70 degrees
Type 5 – epiphyseal separation

Figure 1 Judet classification

Surgical technique

The surgical treatment of intramedullary pinning was performed using the technique described by Métaizeau. In all cases, the patient was placed supine with the injured arm prepared, covered and placed on a radiolucent table under general anesthesia. Before skin incision, fluoroscopy was performed to confirm joint stability. The entry point for the TEN (titanium elastic nail), the metaphyseal zone of the styloid process of the distal radius was marked under image intensifier (see Figure 2). Then, a small 0.5 cm skin incision was made about 2 cm above the epiphyseal plate. The soft tissue was dissected under direct control, taking care not to damage the cutaneous branch of the radial nerve, muscles or tendons. The lateral radial cortex was exposed and perforated using a drill; it is preferable to use a Pfriem-type trocar.

Flexible needle (TEN- titanium elastic nail) with a diameter of 2 to 2.5 mm (depending on age) with a slightly bent end is introduced into the intramedullary canal and gently pushed cranially until it reaches the lower part of the dislocated radial head epiphysis. Then, with the elbow set under moderate varus stress, the fracture is reduced by a maneuver after Peterson. In order to reduce the remaining radial-lateral displacement, the needle is rotated 180 degrees so that the tip is positioned toward the ulna, and the fragment is moved medially, then the anatomical reduction of the radial head in the joint is facilitated (Figure 2).

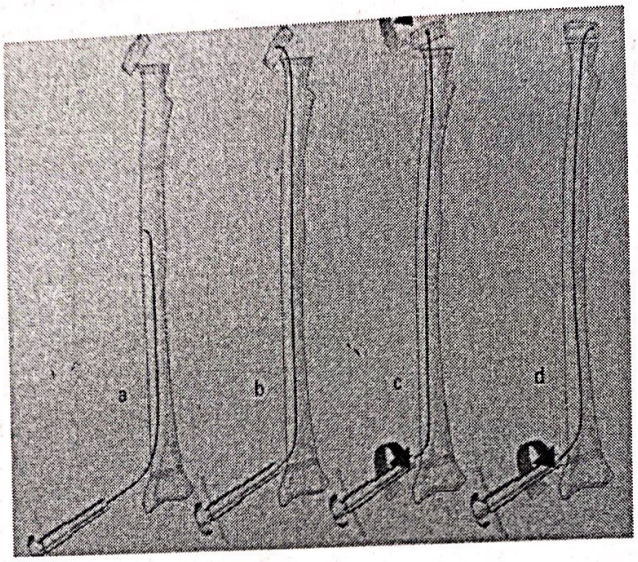
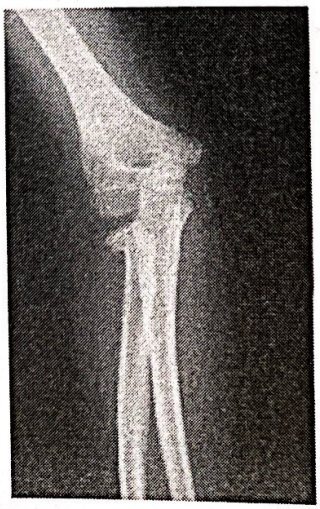
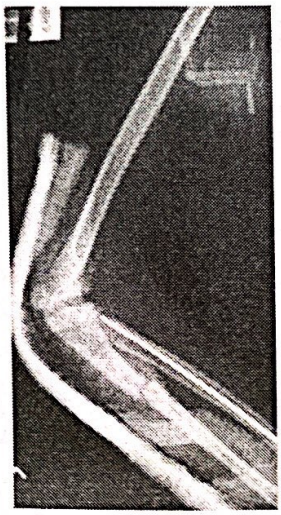
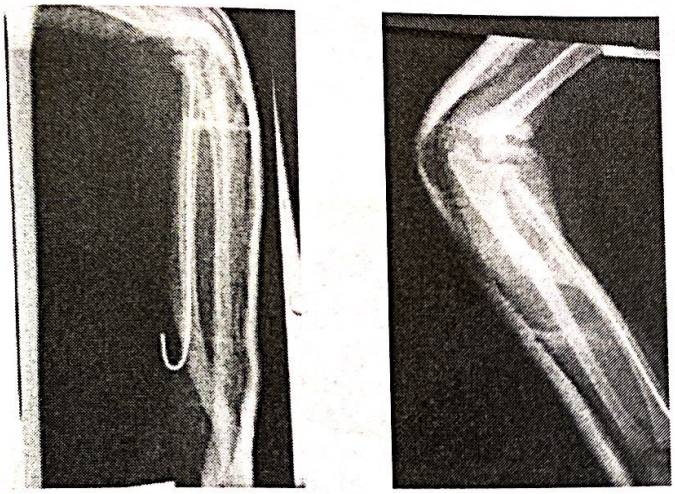


Figure 2 Surgical technique of elastic stable intramedullary osteosynthesis - pinning with assisted reduction and fixation in dislocated radial neck fractures

Clinical Data







Finally, the elbow is immobilized in a cast, primarily for pain control. The median duration of the intervention was found to be about 35 minutes (25 to 45 minutes), with the exception of one patient where there was an additional fracture of the ulna (the intervention lasted for 90 minutes). The median radiation time of the patients was 3 minutes and 30 seconds (2 minutes and 40 seconds to 4 minutes and 10 seconds). During each intervention, the patient, the doctor and the medical staff in the hall were wearing clothes according to prescription protection and were exposed to a dose of less than 0.01 Gy / s.
Patients were monitored both clinically and radiologically for 4 weeks after the intervention, then at three months and at six-month intervals. The mobilization of the elbow in patients was initiated several days after the intervention (after removing the cast) and the needle was removed during clinical and radiological confirmation of the fracture healing.

Results

In this study we have presented our initial results obtained in 32 patients with radial head and neck fractures, treated with minimally invasive surgical method – elastic stable intramedullary osteosynthesis (ESIO) method of Métaizeau. The age of the patients was 7-14 years (mean age 10.4 years), of whom 15 male and 17 female children. According to the analyzed parameters regarding the mechanism of injury, 7 patients were injured by falling from height, and most often it was a sports injury and/or injury sustained by playing (25 patients). According to the type of fracture, 16 children had type III and 16 type IV according to the Judet classification.

The results are based on postoperative evaluation of the elbow function. Normal pronation/supination was defined as 85/0/90 degrees and normal flexion/extension at 160/0/0 in boys and 160/0/5 in girls. The control group consisted of children with uninjured elbow.
The evaluation of the results was 6 months after the intervention, and in our study we used the Broberg and Morrey scoring system to evaluate the elbow function by analyzing several parameters – range of motion, motor strength, stability and pain.

The postoperative follow-up in all 32 patients was good. The radiological signs of consolidation were observed after four weeks and the treatment of fractures was completed three months after the injury by removing the needle after 8-18 weeks. All patients received complete clinical and radiological recovery with a normal range of motion of the elbow and forearm with the head placed in the anatomical position in the elbow.

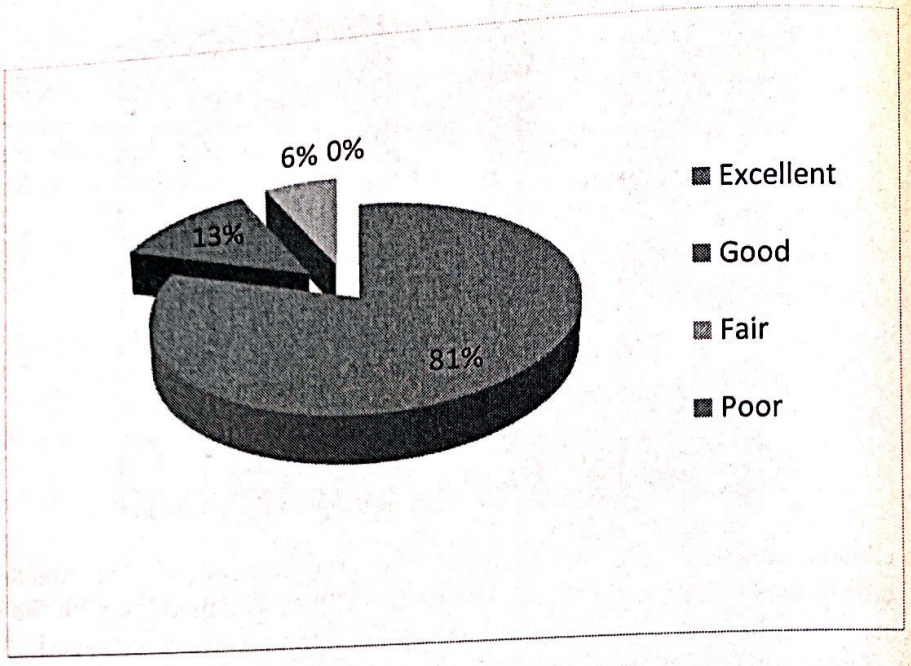


Figure 3 Display of our results according to Broberg and Morrey scoring system

Discussion

The Métaizeau technique is shown to give good results in severe dislocated radial head and neck fractures in children. The advantage is in allowing an acceptable indirect reduction without disturbing the blood flow. As the distal end of the needle is left under the skin, the possibility of infection as a result of pinning is minimal. Rotational movements are permitted after short periods of cast removal. The removal of the implant is easy without major complications.
In our series, 7 patients had associated fractures (21.8%) compared to the reported incidence of 30% -50%. All patients from the group were treated by placing one needle without loss of reduction.

Our study has limitations due to a small number of patients. We recommend a closed reduction with intramedullary pinning because it is a simple, indirect, minimally invasive method, easy to perform, with excellent results and minimal complications. The intramedullary pin allows fixation of the radial head and prevents the secondary displacement. The open reduction is reserved for those fractures that are non-reducible with percutaneous methods.
The minimally invasive approach with the ESIO technique has numerous advantages over open surgical techniques in the resolution of radial head and neck fractures such as: extra-epiphyseal approach, preservation of fracture hematoma, intact elbow joint (possibility for faster rehabilitation), shorter immobilization time, prevention of injuries to soft tissue structures and neurovascular elements.

Closed reduction with intramedullary pinning offers a satisfactory stabilization of the head of the radius by healing the fracture. This technique is fast, safe, easy to perform and minimally invasive. Additional surgical damage is avoided, and the procedure prevents

repositioning and repeated manipulation of the head. In situ mobilization of the joint shortens the period of rehabilitation.

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