

Treatment of supracondylar humerus fractures in children, according to Gartland classification

Emilis Čekanauskas, Ramunė Degliūtė, Romas Jonas Kalesinskas¹
Clinic of Children Surgery, ¹Clinic of Orthopedics and Traumatology,
Kaunas University of Medicine Hospital, Lithuania

Key words: supracondylar fractures, children, Gartland classification.

Summary. Supracondylar fractures are the most common fractures in the area of elbow in children. The purpose of this study was to review and analyze the treatment patterns of supracondylar humerus fractures in childhood. There were 93 children with supracondylar humerus fractures treated in the Department of Pediatric Orthopedics within the period from March 2000 till November 2002. Ninety fractures were extension-type injuries, 3 were flexion injuries, these were not included in our study. Supracondylar humerus fractures were classified according to Gartland classification. Type III fractures were found in 63 patients, type II fractures were seen in 23 patients and 4 patients had type I fractures. Indications for treatment were determined according to fracture type. Four children were treated with external immobilization alone. Twenty-three patients underwent closed reduction and percutaneous pinning by K-wires. Sixty-two patients were treated with closed reduction and external immobilization such as a plaster cast or according to Blount. Eleven of these 62 children (type III) underwent close or open reduction and internal fixation in follow-up. In 1 case of comminutive fracture a patient underwent immediate operation. There were no early or late complications. All operated patients healed without sequela and had excellent or good results. We had noticed that all manipulations should be performed immediately in order to avoid severe swelling and neurological or vascular complications. In type I fractures we performed the external immobilization only. Type II displaced fractures can be treated satisfactorily with closed reduction and external immobilization. Type III displaced fractures should be treated with closed reduction and percutaneous pinning with K-wires under the fluoroscope guidance. It is believed to be a safe, reliable and efficient method for treatment of this difficult fracture. Indications for open reduction and internal fixation includes open fractures, fractures complicated by vascular injury, unsatisfactory closed reduction due to unstable fracture.

Introduction

According to many authors, supracondylar humerus fractures account for 60 to 75% of all fractures about the elbow in children. The incidence reaches a peak about the age of 8 years (1, 2). Typically the fracture occurs due to a fall on an outstretched hand with hyperextension of the elbow joint. The distal fragment displaces posteriorly in more than 95% of fractures (2, 3). In most cases these fractures are difficult, displaced, with no cortical contact, often associated with neurological or vascular injury. All classifications of supracondylar humerus fractures are based on two factors: the degree of displacement and the type and location of the fracture line. It is useful in

determining whether manipulation is required. Supposedly, the location and type of fracture line will dictate the postmanipulative stability and give some prognosis for the development of late deformities (1, 2, 4). We used a Gartland classification for extension-type supracondylar fractures. It is based primarily on the degree of displacement divided into three types. Type I – undisplaced, type II – displaced with intact posterior cortex, and type III – displaced with no cortical contact (Fig.1). The latter ones occur almost twice as frequently as the type II. If all authors suggest type I fractures require only simple external immobilization, the literature is full of numerous methods of treatment of displaced fractures (1-4). Previously these frac-



Fig.1. Types of fractures according to Gartland classification

Type I – undisplaced; Type II – displaced with intact posterior cortex; Type III – displaced with no cortical contact:
(a) - posteromedial displacement, (b) - posterolateral displacement.

tures were treated by closed reduction with casting and traction. Scientific research and studies began to alter the methods of treatment. At the turn of this century, treatment began to change from simple passive methods to more aggressive and active methods. The most commonly used treatment of displaced supracondylar fractures of the humerus is percutaneous pinning after closed or open reduction at many institutions. Based on our experience, we will review the most common ones.

The purpose of this study is to review and analyze the treatment patterns of supracondylar humerus fractures in childhood.

Patients and methods

This study presents a review of treatment of supracondylar humerus fractures of 93 children, performed in the Department of Pediatric Orthopedics during the period March 2000 - November 2002. The average age was 5.5 years. There were 35 girls and 58 boys. Only 3 fractures were flexion-type injuries, which were not included in our study; the remaining

90 were extension injuries. All patients were classified into 3 groups according to fractures type. Elbow region was X-rayed and the type of the fracture was determined according to Gartland classification: type I – undisplaced supracondylar fracture; type II – displaced with intact posterior cortex; and type III – displaced with no cortical contact. The blood supply of the damaged upper extremity was evaluated in the emergency room before and after treatment. Indications for treatment were determined according to the type of fractures. The range of motion was evaluated after treatment at 3 weeks, 6 weeks, 3 months and 6 months.

Results and discussions

The fractures were classified as Gartland type III in 63 patients. Type II fractures were seen in 23 patients and type I were seen in 4 patients. Six fractures were comminutive, one fracture was open, and one fracture was associated with radius and ulna dislocation. Out of 90 children, 8 had preoperative neurapraxias grouped as follows: 4 had radial nerve

involvement, 1 had median nerve injuries and 3 had ulnar nerve injury. Five children had preoperative vascular injuries. In 4 cases of type I fracture only external fixation was performed. Twenty-three children with type II fractures were treated with closed reduction and external immobilization such as a plaster cast or according to Blount with the elbow flexed up to 120 degrees. Twenty-three of 63 children with type III fractures underwent closed reduction and percutaneous pinning with 2 or 3 K-wires under the fluoroscopic guidance, whereas the remaining 39 children were treated with a closed reduction and external immobilization only. But 11 of those due to unstable secondary displacement underwent a repeated closed reduction or open reduction and internal fixation with Kirschner wires in follow-up. In one case of open fracture an open reduction and internal fixation were performed immediately. No postoperative and later complications were seen. All preoperative blood supply disturbances were temporary and disappeared after reduction. The circulatory was fixed with pulse oxymeter in operating room. All preoperative neurapraxias resolved spontaneously within 6 months. The range of motions was good or excellent in 6 months after treatment.

According to many authors supracondylar humerus fractures are common and account to 60 – 75% of the elbow fractures in children. Most of the authors suggest type I fractures to be treated with external immobilization such as a plaster cast or according to Blount only, with the elbow flexed in 90 degrees (2, 3). The decision of hospitalization of a child for a brief observation period usually depends on the degree of soft tissue swelling and the reliability of the parents.

As to type II and III fractures they can be treated differently (1-4). There are the following patterns of displaced supracondylar humerus fractures treatment in children:

1. Closed reduction and external immobilization such as a plaster cast or according to Blount (Fig. 2).
2. Closed reduction and percutaneous pinning with 2 or 3 K-wires and casting.
3. Overhead skeletal traction.
4. Open reduction and internal fixation.

According to the findings of the numerous authors, type II fractures can be treated with closed reduction and casting alone, especially if the fracture is not rotated. Check radiographs must be taken in two planes immediately after reduction. Follow-up radiographs are made at weekly intervals until there is sufficient healing, usually 3 weeks (2, 3). As many authors suggest type III fractures are intrinsically unstable and if they are treated with the closed reduction without internal fixation they have the highest incidence of residual deformity, usually of cubitus varus. Thus, primary closed reduction and percutaneous pinning with 2 or 3 K-wires is the preferred treatment for type III injuries. In most of the cases the children with type II and III fractures are treated in our department with closed reduction and casting primarily (2, 5, 6) (Fig.3). Our research has shown that even type III fractures could be treated successfully with the closed reduction only doing without an internal fixation and nevertheless the fragments remain stable until complete recovery. We have had no later complications, such as a cubitus varus. Under unstable fracture with secondary dis-

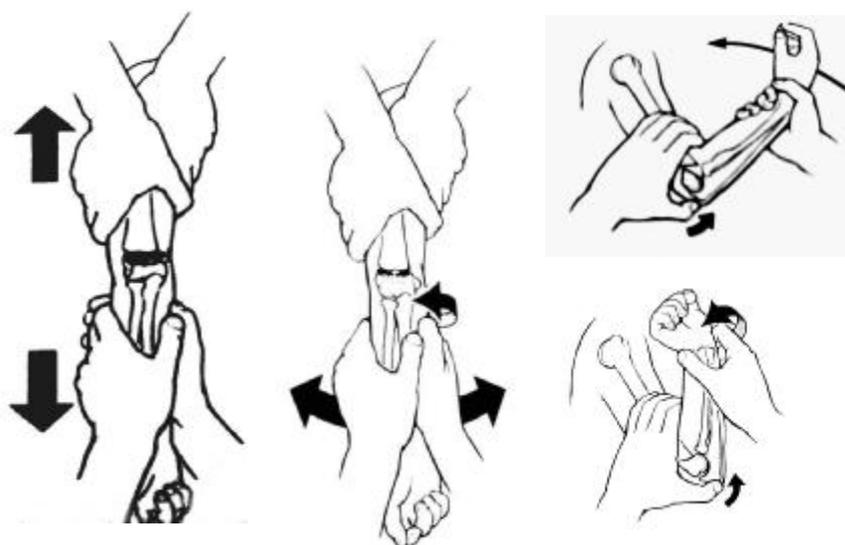


Fig.2. Manipulative closed reduction of supracondylar humerus fractures
(Wilkins K. E., King R. E. Fractures in children)

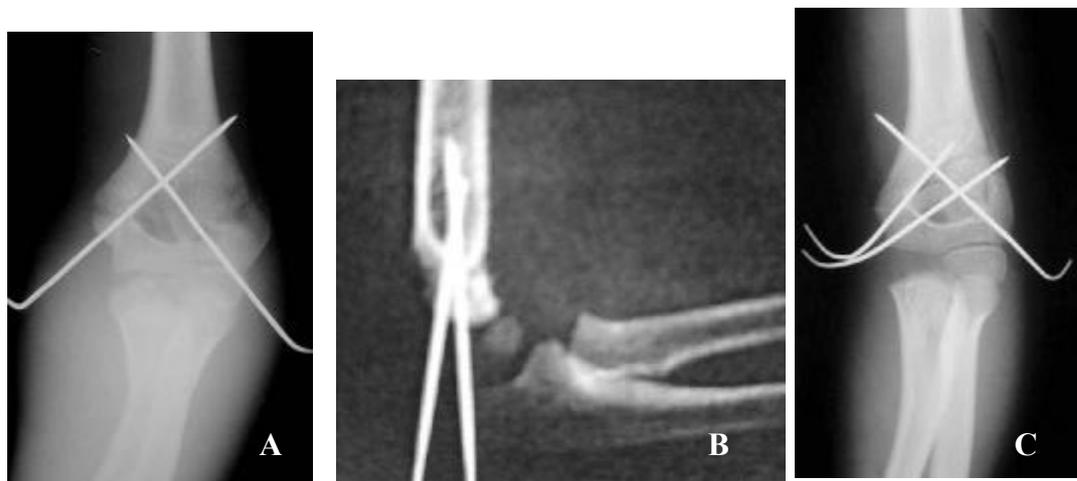


Fig.3. Pinning of supracondylar humerus fracture with 2 crossed pins in anteroposterior (A) and lateral (B) position, (C) - internal fixation with 3 K-wires

placement, we repeat closed reduction and perform internal fixation with 2 or 3 K-wires under the fluoroscopic guidance. Anteroposterior and lateral radiographs of the distal humerus are essential for assessing of the quality of the reduction and satisfactory alignment after pinning. Immobilization is maintained for approximately 3 weeks, after which the pins are removed and active range of motion exercises is started. In case of comminuted or open fractures, the best choice is to perform an open reduction and internal fixation without any delay. If the elbow is so severely swollen, that closed reduction cannot be maintained, overhead skeletal traction may be used for several days, followed by closed or open reduction (1-4). It is necessary to mention that all manipulations should be performed immediately to avoid

severely swollen and neurological or vascular complications.

Conclusions

1. Type II and III fractures can be treated satisfactorily with closed reduction and external immobilization such as a plaster cast or according to Blount.

2. In case of type III fracture a close reduction and internal fixation with K-wires under the fluoroscopic control is often performed. We believe it is a safe, reliable and successful treatment method of the above difficult fractures.

3. Indications for open reduction and internal fixation include open fractures, fractures complicated by vascular injury, unsatisfactory closed reduction due to unstable fractures.

Viršgumburinių žastikaulio lūžių gydymas vaikams remiantis Gartlando klasifikacija

Emilis Čekanauskas, Ramunė Degliūtė, Romas Jonas Kalesinskas¹

Kauno medicinos universiteto klinikų Vaikų chirurgijos klinika, ¹Ortopedijos traumatologijos klinika

Raktažodžiai: viršgumburinis lūžis, vaikai, Gartlando klasifikacija.

Santrauka. Vaikams alkūnės srityje dažniausiai pasitaikantys yra viršgumburiniai žastikaulio lūžiai. Tyrimo tikslas. Apžvelgti ir išanalizuoti viršgumburinių žastikaulio lūžių gydymo metodus. Kauno medicinos universiteto klinikų Vaikų chirurgijos skyriuje nuo 2000 m. kovo iki 2002 m. lapkričio mėn. gydyti 93 vaikai, kuriems diagnozuotas viršgumburinis žastikaulio lūžis. 90 vaikų buvo nustatytas ekstenzinio tipo lūžis, trims – fleksinio tipo lūžis. Pastarieji į šį tyrimą neįtraukti. Lūžio tipas nustatytas remiantis Gartlando klasifikacija. III tipo lūžis buvo 63 vaikams, II tipo – 23, I tipo – 4 vaikams. Gydymo metodas buvo parenkamas pagal lūžio tipą. Keturi vaikai gydyti konservatyviai, t. y. naudota tik sužeistos rankos imobilizacija gipso longete. 23 vaikams atlikta

uždara fragmentų repozicija, jie fiksuoti Kiršnerio vielomis. 62 vaikai gydyti atliekant uždarą repoziciją ir imobilizuojant ranką gipso longete arba pagal Blountą. Tačiau 11 iš jų vėliau uždarą repoziciją teko pakartoti ir fiksuoti fragmentus vielomis arba operuoti atviru būdu. Vienam vaikui, kuriam buvo nustatytas skeveldrinis lūžis, nedelsiant buvo atliekama atvira fragmentų repozicija ir osteosintezė. Pooperacinių ir vėlesnių komplikacijų nebuvo. Mes manome, kad, nustačius viršgumburinį lūžį, visos chirurginės procedūros turi būti atliekamos nedelsiant. Esant I tipo lūžiui, pakanka ranką imobilizuoti ilga gipso longete. II tipo lūžius galima sėkmingai gydyti atliekant tik uždarą repoziciją ir išorinę imobilizaciją. Esant III tipo lūžiui, reikėtų atlikti uždarą repoziciją, o fragmentus fiksuoti Kiršnerio vielomis kontroliuojant rentgenoskopu. Mūsų nuomone, tai yra saugus, patikimas ir sėkmingas šių sudėtingų lūžių gydymo metodas. Indikacijos atvirai fragmentų repozicijai ir jų vidiniam fiksavimui yra atviri lūžiai, taip pat lūžiai, komplikavęsi kraujagyslių pažeidimu, arba nestabili fragmentų padėtis ir todėl uždara repozicija nesėkminga.

Adresas susirašinėjimui: R. Degliūtė, KMUK Vaikų chirurgijos klinika, Eivenių 2, 3007 Kaunas
El. paštas: rdegliute@hotmail.com

References

1. Canale ST. Fractures and dislocations. In: Canale ST, Beaty JH. Operative pediatric orthopaedics. 2nd ed. St. Louis: Mosby – Year Book; 1995. p. 913-1112.
2. Wilkins KE. Supracondylar fractures. In: Rockwood ChA, Wilkins KE, King RE. Fractures in children. 3rd ed. Philadelphia: J B Lippincott Company; 1991. p. 526-617.
3. Devito DP. Supracondylar fracture. In: Morrissey RT, Weinstein SL, editors. Lovell and Winter's pediatric orthopaedics. 4th ed. Philadelphia: Lippincott-Raven publishers; 1996. p. 1242-7.
4. Canale ST. Distal humeral fractures. In: Crenshaw AH, editor. Campbell's operative orthopaedic. 8th ed. St. Louis: Mosby – Year Book; 1992. p. 1087-116.
5. Lee SS, Mahar AT, Miesen D, Newton PO. Displaced pediatric supracondylar humerus fractures: Biomechanical analysis of percutaneous pinning techniques. J Pediatr Orthop 2002;22(4):440-3.
6. Shim JS, Lee YS. Treatment of completely displaced supracondylar fracture of the humerus in children by cross-fixation with three Kirschner wires. J Pediatr Orthop 2002; 22(1):12-6.

Received 22 November 2002, accepted 4 April 2003