

Supracondylar Fractures of the Humerus in Children Caused by Traffic

Igor Lekšan¹, Vasilije Nikolić¹, Tomislav Mrčela², Ivan Lovrić³, Jozo Kristek³ and Robert Selthofer¹

¹ Department of Anatomy, School of Medicine, University »J.J. Strossmayer«, Osijek, Croatia

² Department of Fundamentals of Electrical Engineering, Electrical Measurements and Materials, Faculty of Electrical Engineering, University »J.J. Strossmayer«, Osijek, Croatia

³ Surgery Clinic, University Hospital »Osijek«, Osijek, Croatia

ABSTRACT

A sample of 38 patients aged under 14 treated at the Surgery Clinic of the University Hospital Osijek has been used in showing therapeutic guidelines supported by patients' functional status after the completed treatment. The patients suffered from supracondylar fractures caused by traffic accidents and classified into three types according to Gartland. Not a single patient with neurocirculatory disturbances has been registered. The most common treatment was a conservative one while more than half of the patients with fractures from type III underwent surgery. The duration of immobilization approximated three weeks whereas patients' recovery considering their functional status has justified the choice of the treatment. However, a lot can be done in the field of prevention, which would greatly decrease the frequency of such injuries.

Key words: supracondylar fracture, humerus, children, traffic

Introduction

The fractures of the distal part of the humerus are frequent injuries, particularly in children. Their frequency in children ranges from 10 to 15% while the incidence is highest in boys from 5 to 10 years of age. The fractures mostly result from traffic traumatism, especially when falling off a bicycle, skateboard or roller-skates. Children are usually exposed to this kind of traumatism. Consequently, the incidence of injuries is directly connected with the quality of traffic infrastructure as well with the education of small children regarding traffic. In respect to the construction and character of such vehicles the fractures of the distal part of the humerus are, in most cases, effects of indirect force, i.e. falling on an outstretched arm. More rarely they happen due to an impact of direct force on a flexed elbow. Neurocirculatory disturbances often make elbow injuries more serious, mostly by an injury to a. brachialis and n. medianus, and in some cases to n. radialis^{1,2}. Besides, early care and an adequate therapeutic approach reduce the risk of a limited volume of motion after removing immobilization. Moreover, an early diagnosis and adequate therapeutic approach affect future quality of life and work ca-

pability in a positive way. The therapeutic approach primarily depends on a clinical picture and a type of fracture.

The diagnostics of the distal part of the humerus is featured by several classifications. On a localization basis the fractures are divided into supracondylar, transcondylar and intercondylar ones and into the fractures of the condyle and of the elbow joint^{3,4}.

The AO classification of humerus fractures classifies humerus fractures depending on localization and a type of comminution⁵. That way the fractures of the distal part of the humerus are classified from 13A1 to 13C3. The most frequent fractures of the distal part of the humerus are supracondylar fractures making 70–80% of total distal humerus fractures. Their share in the total number of fractures ranges from 8 to 12%. The therapeutic guidelines are primarily linked with a type of fracture and possible neurocirculatory disturbances. When classifying supracondylar fractures, it is Gartland's classification (Figure 1) that matters the most, according to which there are three types of fractures¹.



Fig 1. Gartland's classification of the supracondylar fractures of the humerus: a) Gartland I, b) Gartland II, c) Gartland III.

A fracture of the type Gartland I is the type of a supracondylar fracture which does not include displacement of bone fragments, the type Gartland II is characterized by preserving the anterior or posterior periosteum while the third type incorporates displaced fractures. Furthermore, supracondylar fractures can be divided according to the direction of a displaced distal fragment. There is a more frequent extension type, and there is flexion type occurring in as little as 2–3% of cases.

The extension type of fracture usually follows a fall on the palm of an outstretched arm whereas the flexion type develops from an impact of direct force on a flexed elbow.

Apart from general symptoms of fracture such as pain, oedema, deformity and limited motion, the clinical picture also includes Hütter's triangle and the occurrence of Kirmisson's petechial bleeding in the elbow cavity^{1,3,4}. The choice of treatment is compatible with the type of fracture and possible complications. Among possible treatments there is a conservative treatment with humerus or Blount's immobilization, i.e. operative treatment, percutaneous transfixation, traction or extension.

Indications for a surgery usually involve neurovascular injuries, open fractures, the impossibility of satisfying reposition, threatening Volkmann's ischemic contracture or a large-scale haematoma and oedema in the elbow region⁶⁻⁸.

Complications are fairly common and can be divided into primary (blood vessel lesions, nerve lesions, soft-tissue injuries), secondary (fragment displacement, neurovascular problems) and final ones (ischemic contracture, myositis ossificans, adhesive arthritis, bone deformities and joint ankylosis)^{9,10}.

To sum up, even today supracondylar humerus fractures awake some doubts regarding a therapeutic approach. Therefore, the main goal of this study is to provide clear guidelines in order to reduce complications as much as possible and, consequently, to ensure better quality of life and work capability for a sensitive population such as children. On the other hand, it should be pointed out that appropriate traffic infrastructure can significantly contribute to a decrease in humerus fractures.



Fig 2. Radiographic diagnostics of the supracondylar fractures of the humerus: a) AP and LL projection, b) Jones's projection.

Material and Methods

The research was carried out on a sample of 38 patients treated at the Department of Surgery of the Clinical Hospital Osijek in the period 2004–2006. It comprised 24 boys and 14 girls aged between 4 and 14, having suffered from supracondylar fractures of the humerus. The fractures resulted from traffic traumatism, e.g. falling off a bicycle or roller-skates. The average age of the examinees was 6.92 years and the age-sex distribution was homogenous. No blood vessel or nerve injuries were registered.

The diagnostics and monitoring of the course of treatment involved anamnesis and physical examination accompanied by standard X-ray recording in AP and LL, i.e. Jones’s projection (Figure 2).

We used both conservative and surgical treatments whereas indications for a surgical treatment were based on existing references. Conservative treatments chiefly included immobilization by means of a humerus splint and cast as well as Blount’s immobilization. When having dealt with large-scale oedemas and haematomas or the impossibility of appropriate reposition, we used transfixation with Kirschner wires. The duration of immobilization, regardless of the type of fracture amounted to three weeks.

After the fractures had been taken care of and the treatments had been completed, we evaluated patients’ functional status by using a protractor to measure the volume of flexion and extension in an elbow joint.

Results

Figure 3 and 4 show the distribution of fractures considering the level and direction of the displacement of a distal bone fragment.

Figure 3 presents the dominancy of extension type fractures over flexion ones, which is evident in the ratio of shares – 86.84% comparing to 13.26% of. Figure 4 clearly indicates that the most frequent fractures are fractures belonging to the type Gartland I (47.40%) while displaced fractures of the types Gartland II I III occupy (31.60%) and (21.00%).

Figure 5 shows the shares of particular therapeutic methods.

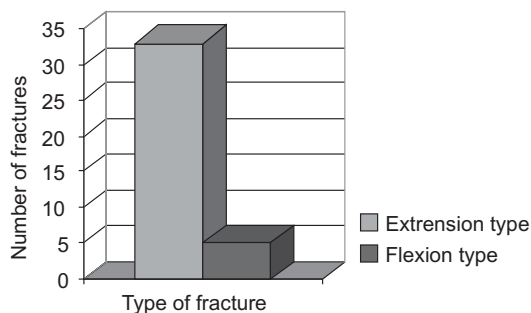


Fig 3. Distribution of fractures considering the direction of the displacement of a distal bone fragment.

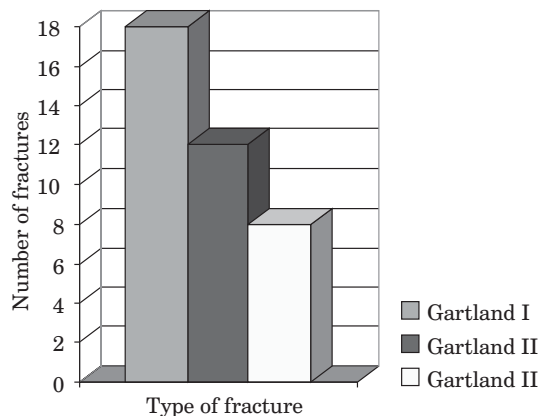


Fig 4. Distribution of fractures considering the level of the displacement of a distal bone fragment.

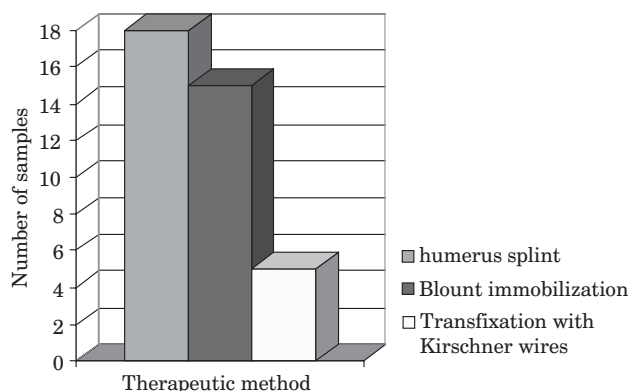


Fig 5. Shares of therapeutic methods.

Figure 5 reveals that the fractures of the distal part of the humerus are far more often treated conservatively (86.84%) than by means of a surgery (13.16%). The common method was immobilization with a humerus splint. Table 1 shows functional status after the completed treatment.

The best functional status was reported by patients with non-displaced fractures while the opposite was found in patients with displaced fractures of the type Gartland III.

Table 2 compares the functional status of patients with displaced fractures of the type Gartland III after the

TABLE 1
FUNCTIONAL STATUS OF THE JOINT ELBOW AFTER THE COMPLETED TREATMENT

Type of fracture	N	Mean (°)	Span (°)	SD (°)
Gartland I	18	128.83	110–140	8.65
Gartland II	12	117.92	90–135	13.56
Gartland III	8	106.88	70–125	17.51
Total	38	120.76	70–140	14.94

TABLE 2
FUNCTIONAL STATUS AFTER CONSERVATIVELY AND
SURGICALLY TREATED PATIENTS WITH FRACTURES
BELONGING TO THE TYPE GARTLAND III

Therapeutic procedure	N	Mean (°)	Span (°)	SD (°)	P
Operated	3	115	110–125	13.23	0.35
Treated conservatively	5	102	70–120	19.24	
Total	8	106,88	70–125	17.51	

completed surgical treatment with the ones treated conservatively.

Better functional status was achieved using a surgical treatment, although the difference is not statistically relevant.

Discussion

The goal of this research is to show the frequency of upper limb injuries in children caused by traffic traumatism. We have been trying to define and correct therapeutic guidelines thereof in order to obtain patients' better functional status and, consequently, their better quality of life and work capability. The sample was homogenous in respect to the sex-age distribution, which minimizes the probability of making a statistical mistake.

The methodology of the procedure was based on anamnesis and physical and radiological examination that were all consistently applied on all the examinees. After the completed treatment their functional status was established by means of objective methods.

Taking account of the results one may say that the non-displaced fractures of the extension type as an effect of indirect force when falling on the palm of an outstretched arm, are the most common fractures. Regarding the share of such fractures in total fracture number conservative treatment was favoured since it

had been supported by clear post-therapeutic functional status in most patients. Fractures belonging to the type Gartland III with a total displacement of bone fragments were the least common, so they were analyzed according to the kind of applied treatment, i.e. conservative and surgical treatments were compared. Fairly better, even though not statistically relevant, functional status was achieved in surgically treated patients.

The results stated hereinabove indicate that supracondylar fractures of the types Gartland I and Gartland II should be conservatively treated. Fractures being categorized in the type Gartland I should be treated by using a humerus splint with a support noose preventing bone fragments from secondary displacement due to the load of immobilization and limbs. Blount's immobilization is an appropriate method for treating fractures of the type Gartland II, in which the terminal tendon of m. triceps brachii keeps fragments in an anatomically retained position. Finally, fractures of the type Gartland III represent indications for a surgical treatment. The selected method is mostly transfixation with crossed Kirschner wires which block rotational deformity and enable the best therapeutic effect despite the possibility of a iatrogenic lesion of n. ulnaris. That possibility is negligible in case of an adequate surgical technique and should not overshadow potential therapeutic benefit. Regardless of the type of fracture, the duration of immobilization equals three weeks.

In a nutshell, children are exposed to a high risk of being injured in traffic, which is reflected by serious supracondylar fractures of the humerus. On the other hand, timely treatment and an adequate therapeutic method can significantly reduce the risk of secondary and final complications and bring to satisfying quality of life and work capability. However, much is to be done in the field of prevention since it is the most efficient way of decreasing the frequency of such injuries. Additionally, improving traffic infrastructure and providing the respective population with appropriate traffic education are the things that should be taken account of.

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I. Lekšan

Department of Anatomy, School of Medicine, »University J. J. Strossmayer«, J. Huttlera 4, 31000 Osijek, Croatia
e-mail: igor_leksan@net.hr

SUPRAKONDILARNI LOMOVI NADLAKTIČNE KOSTI U DJEČJOJ DOBI KAO POSLJEDICE PROMETNOG TRAUMATIZMA

S A Ž E T A K

Na uzorku 38 bolesnika starosti do 14 godina liječenih na Klinici za kirurgiju KB Osijek, prikazali smo terapijske smjernice koje smo potkrijepili funkcijskim statusom po završenom liječenju. Radilo se o suprakondilarnim lomovima koji su bili posljedica prometnoga traumatizma, i koje smo klasificirali u tri skupine po Gartlandu. U promatranom uzorku nije bilo bolesnika s neuro-cirkulatornim ispadima. Najčešće je primjenjivano konzervativno liječenje dok je u više od polovice lomova tipa III primijenjeno operativno liječenje. Vrijeme imobilizacije bilo je tri tjedna, a zadovoljavajući funkcijski status po završenom liječenju ukazao je na ispravnost izabranih terapijskih postupaka. Ipak, najviše se može napraviti na planu prevencije čime bi se znatno smanjila učestalost takvih ozljeda.