Injury, Int. J. Care Injured 46S (2015) S44–S47

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Femoral neck fractures in children and the role of early hip decompression in final outcome

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ARTICLE INFO

Keywords:
Femoral neck fracture
Children
Hip decompression
Avascular necrosis

ABSTRACT

Background: Femoral neck fractures in children are very rare and account for about 1% of all paediatric fractures. The aim of this retrospective study was to analyse the clinical and radiographic outcome in paediatric femoral neck fracture and to review the role of early decompression of the hip in the final outcome.

Patients and methods: The study was performed at the Department of Paediatric Orthopaedics and Traumatology, University Children's Hospital in Belgrade, Serbia from January 1996 to January 2010. The study included 28 patients, 12 female and 16 male, aged 4–14 years. Patients who were aged over 14 years or who had pathological femoral neck fractures or metabolic disturbances were excluded from the study. The type of neck fracture was determined according to the Delbet and Colonna classification. The patients were treated using different surgical procedures: closed reduction and cast immobilisation, closed reduction and percutaneous fixation with Kirschner wires (K-wires), closed reduction and fixation with cannulated screws and open reduction with Wagner plate stabilisation. The final outcome was evaluated using the clinical outcome (based on the Howorth–Ferguson scale), radiographic outcome and occurrence of complications.

Results: The median age of patients included in the study was 10.75 years and the average follow up was 9 years. According to the Delbet classification, there was one patient with type I, eight patients with type II, 16 patients with type III and three patients with type IV femoral neck fracture. Based on the Colonna classification, there were 23 displaced and five non-displaced femoral neck fractures. Decompression of the hip was performed in 21 patients. Avascular necrosis (AVN) developed as the main complication in 11 patients. The final outcome was excellent in 14 patients, good in four patients and poor in 14 patients.

Conclusion: Our study unequivocally confirms the positive effect of urgent treatment on the incidence of AVN as well as on the outcome. We have established a 12-hour interval after injury as an optimal time limit for commencing treatment. Unambiguously positive effects of hip decompression on the incidence of AVN were also noted. We found similar efficiency for open and needle hip decompression.

Introduction

Femoral neck fractures in children are very rare and account for about 1% of all paediatric fractures. Most of these fractures are due to high-energy trauma, such as traffic accidents and falling from a great height [1–6].

Paediatric femoral neck fractures are also associated with trauma to other systems, particularly neurosurgical and urogenital injuries. There is a high rate of serious complications associated with these fractures, including avascular necrosis (AVN), coxa vara, delayed union and non-union, premature physeal closure and leg length discrepancy (LLD) [6]; therefore, administering the correct primary treatment to the fracture patient is essential. This study comprises the treatment of 28 paediatric patients with femoral neck fractures and assesses the role of early decompression of the hip in the final outcome of treatment.

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http://dx.doi.org/10.1016/j.injury.2015.10.059
0020–1383/

Patients and methods

We retrospectively reviewed the data from 28 paediatric patients aged from 4 to 14 years who were managed at the Department of Paediatric Orthopaedic Surgery, University Children's Hospital in Belgrade, Serbia from January 1996 to January 2010.

Inclusion criteria were age less than 14 years, intact growth plate, femoral neck fracture and absence of other disturbances (particularly metabolic and endocrinological disorders).

The fractures were categorised into four types according to the Delbet classification: transepiphyseal (type I), transcervical (type II), basicervical (type III) and intertrochanteric (type IV) fractures. These were then subdivided according to Colonna into two subtypes: displaced and non-displaced.

The patients were also divided according to the time from injury to primary treatment and according to decompression of the injured hip. All the relevant data were compared with the occurrence of complications. The Ratliff classification was used to review the rate of AVN as the major complication in treatment of femoral neck fractures. Ratliff type I AVN represented a total collapse of epiphysis, type II represented a segmental involvement of femoral head with minimal collapse of epiphysis and type III represented a metaphyseal involvement without epiphyseal changes.

Treatment options were varied: cast immobilisation only, closed reduction with cast immobilisation, closed reduction with stabilisation using K-wires, closed reduction and stabilisation using cannulated screws and open reduction with Wagner plate stabilisation.

All relevant data were obtained from clinical examination, presented using the Howorth–Ferguson (H–F) grade (Table 1), and from radiographic examination.

The final outcome was set as excellent, good or poor. An excellent outcome included H–F index of 80–90, no limping or leg length inequality (LLI), no pain or other problems during physical activities, no radiographic signs of AVN and no differences compared with contralateral epiphysis. A good outcome included no pain, LLI up to 20 mm, H–F index from 60 to 80, discrete signs of AVN type II or III on radiography and slight deformation of non-dislocated epiphysis (up to 15 degrees compared with the contralateral side). A poor outcome included limping, LLI over 20 mm, painful physical activities, H–F index less than 60, radiographic signs of deformation and dislocation of epiphysis with obvious signs of AVN.

All the relevant data were analysed using descriptive statistical analysis, Kruskal–Wallis unifactorial rang test, Wilcoxon Rang-Sum Test (Mann–Whitney test), Fisher's Exact Test and Pearson Chi-Square test. Statistical significance was set at $p < 0.05$.

Table 1
Howorth–Ferguson grade (maximum 90).

Motion	Range of motion	Factor	Total
Flexion	140	0.4	56
Abduction	35	0.4	14
Adduction	30	0.2	6
Internal rotation	30	0.2	6
External rotation	60	0.1	6
Extension	20	0.1	2

Results

Our study included 28 paediatric patients (16 boys, 12 girls) aged from 4 to 14 years (median 10.75 years). Follow-up ranged from 4 to 18 years (median 9 years). The mechanism of femoral neck injury was predominantly traffic accidents (18 patients) and falling from a great height (six patients). Injuries of other systems were presented in 15 patients and in four patients there were concomitant extremity fractures.

According to the Delbet classification, there was one patient with type I femoral neck fracture, eight patients with type II, 16 patients with type III and three patients with type IV. Based on the Colonna classification, there were 23 displaced and five non-displaced femoral neck fractures.

Various treatment options were used in the study: closed reduction and cast immobilisation according to Whitman in five patients, closed reduction and percutaneous fixation using three K-wires in seven patients, closed reduction and cannulated screw fixation in 11 patients and open reduction with plate stabilisation in five patients.

Treatment began within the 12-hour period after injury in 16 patients; in the remaining 12 patients, treatment was initiated over 12 h after injury. There was a statistically significant difference in final outcome depending on the timing of initiation of treatment (Table 2).

Assessment of the influence of decompression on the final outcome of treatment showed that there was better final outcome in patients who underwent hip decompression compared with those who did not, see Table 3. There was also better outcome in patients who underwent open drainage of the hip.

Table 2
Review of the final outcome depending on the initial period of treatment.

	Final outcome *N* patients (%)			Total *N* (%)	Mann–Whitney Wilcoxon Rang-Sum Test
Time to initial treatment *N* patients (%)	Poor	Good	Excellent		$U = 41.000$ $Z = 2.807$
Less than 12 h *N* (%)	3 (18.8%)	1 (6.3%)	12 (75%)	16 (100%)	$P = 0.005$
Over 12 h *N* (%)	7 (58.3%)	3 (25%)	2 (16.7%)	12 (100%)	
Total *N* (%)	10 (35.7%)	4 (14.3%)	14 (50%)	28 (100%)	

Table 3
The influence of decompression on the final outcome of treatment.

	Final outcome *N* patients (%)			Total *N* (%)	Chi-square test Df = 2 Kruskal–Wallis test
Decompression *N* patients (%)	Poor	Good	Excellent		
No decompression *N* (%)	5 (71.4%)	2 (28.6%)	0 (0%)	7 (100%)	$H = 8.215$ $P = 0.016$
Punction *N* (%)	2 (25%)	1 (12.5%)	5 (62.5%)	8 (100%)	
Open *N* (%)	3 (23.1%)	1 (7.7%)	9 (69.2%)	13 (100%)	
Total *N* (%)	10 (35.7%)	4 (14.3%)	14 (50%)	28 (100%)	