ISSN: 1813-1638

The Medical Journal of Tikrit University

Available online at: www.mjotu.com

Pediatric hip fractures, Outcome of treatment options and complications in Al-Fallujah general hospital

Adil B. Hasan,[(1)]

AbdulWahhab A.,[(2)]

Mohammed Al-Alossy,[(2)]

(1) Department of Orthopedic Surgery
YarmookTeaching Hospital
Baghdad
Iraq

(2) Department of Orthopedic Surgery
Falloja Teaching Hospital
Al-Anbar
Iraq

***Keywords*:**

Pediatric,
hip fractures,
Vascular necrosis,
Coxa vara,
Spica cast

A R T I C L E I N F O

Article history:

Received 05 April 2019
Accepted 01 June 2019
Available online 01 Dec 2019

ABSTRACT

Background: Fractures of the hip in children are rare , although it have been associated with a very high rate of serious complications including avascular necrosis (up to 47%) and coxa vara (up to 32%). The Objective: Our objectives is to present a rare type of injuries presented to our hospital . and to discuss the type of treatment we did , and the outcome after 2 year fallow up , with discussion of other treatment options .

Material and methods : Over a period of 2 years from January – 2008 to December- 2009 we have treated displaced fractures by early anatomical reduction, internal fixation and immobilization in a spica cast to try to reduce these complications.

The Result : We have reviewed 6 patients who had a displaced non-pathological fracture of the hip when under 16 years of age. Their mean age at the time of the injury was eight years (4 to 11). They returned for examination and radiography at a mean follow-up of 2.1 year. Each patient had been treated by early (24 hours) closed or open reduction with internal fixation and all of them had immobilization in a spica cast.

DOI: http://dx.doi.org/10.25130/mjotu.25.02.09

**Corresponding author E mail :* drnihadkhalawe@gmil.com

Introduction

Hip fractures include fractures of the head, neck, and intertrochanteric region of the femur. They differ from pelvic and acetabular fractures because although they can occur in conjunction with a life-threatening injury, they more commonly produce late complications of osteonecrosis, coxa vara, nonunion and premature physeal closure. The importance of operating on a child's hip is not easily understood or accepted by the parents. Aggressive treatment of hip fractures in children is necessary, however, to prevent these late complications (1.(

Femoral head and neck fractures in children are rare injuries, accounting for fewer than 1% of all pediatric fractures. Proximal femoral fractures are most often categorized according to the Delbet's classification as Delbet type I injury is transepiphyseal separation—that is, acute traumatic separation of the proximal femoral epiphysis, similar to Salter-Harris type I epiphyseal injury. It is an uncommon injury, accounting for fewer than 10% of all pediatric proximal femoral fractures. This injury can occur in newborns after breech delivery and is often missed in these cases , Type I injury has also been reported in children 5-10 years of age. In these patients, it occurs after high-energy trauma and has a high incidence of associated injuries, especially femoral head dislocations .

This fracture type has the worst prognosis, and the reported rates of avascular necrosisrange from 20% to 100%. and second type as Delbet type II injury is a transcervical fracture and is the most common type, accounting for about 40-50% of proximal femoral fractures. These injuries are often displaced at the time of presentation. Avascular necrosis rates as high as 50% have been reported with these injuries. so third type Delbet type III injuryis a cervicotrochanteric fracture that occurs through the basicervical region; it accounts for 30-35% of proximal femoral fractures. Avascular necrosis has been reported in 15-20% of cases . the Delbet type IV injuryis a pertrochanteric or intertrochanteric fracture. This type accounts for 10-20% of proximal femoral fractures and is associated with the best prognosis; avascular necrosis is reported in fewer than 10% of cases. The involvement of the greater trochanter may lead to premature closure of the apophysis and coxa valga. The most serious complication of hip fractures in children is osteonecrosis, which occurred: type I, 100%; type II, 52%; type III, 27%; and type IV, 14%.

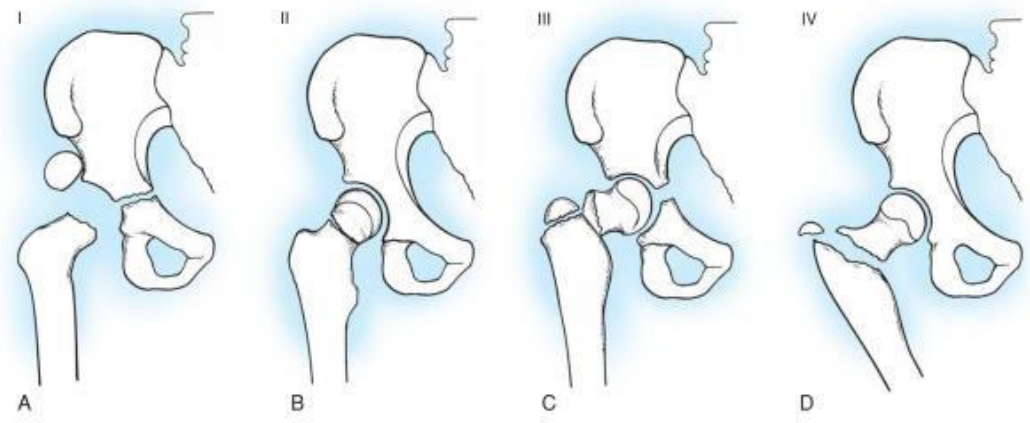


Figure (1) classification of fractures of the hip in children as modified by Colonna[7] from the classification of Delbet: type I, transepiphyseal; type II, transcervical; type III, basicervical; and type IV, intertrochanteric (pertrochanteric[(16)].

Vascularization of the femoral head in children differs from the blood supply to the adult hip. This makes the femoral head particularly vulnerable to trauma to the proximal femur. The blood supply to the femoral head has been studied extensively and described. Post mortem injection and micro angiographic studies have provided us with insights as to how the vascular anatomy changes with age. The vessels from the ligamentum teres contribute little to the vascularisation of the femoral head until the age of eight years. In adults, their contribution is around twenty percent and further decreases with age (10,1.(

At birth the branches of the medial and lateral femoral circumflex arteries traverse the femoral neck and predominantly supply the femoral head. With increasing size of the cartilaginous physis, these vessels diminish gradually and this blood supply is practically nonexisting from the age of four. The lateral epiphyseal vessels predominate and the femoral head is primarily irrigated by these vessels, which bypass the physeal barrier (11) .Two branches arise from the lateral circumflex artery, the postero-superior (PS) and the poster inferior (PI) branch. The medial circumflex artery anastomoses with the posterosuperior branch of the lateral circumflex artery (12,13 .(

At the intertrochanteric groove the medial circumflex artery ends into a retinacular system and enters the capsule. This vascular web ascends along the neck of the femur to irrigate the head of the femur. An anterior capsulotomy will therefore

not damage the blood supply of the femoral head when stopped at this level. Damage to the notch or lateral ascending arteries however, will leave the head avascular. From the age of three to four, the lateral postero-superior vessels appear to predominate and supply the entire antero-lateral portion of the capital femoral epiphysis. The postero-inferior and postero-superior vessels persist throughout life and supply the femoral head. The multiple small vessels of the young child join to form a limited number of larger vessels ; as a result, damage to a single vessel may lead to AVN in the older child. From the age of fourteen to seventeen the physis closes and the epiphyseal and metaphyseal vessels join to supply the femoral head and neck. In adults there is one system that irrigates the entire head of the femur. (13,15,1(

Patients and Methods

We reviewed prospectively every patient presented to our hospital (Fallujah hospital) with displaced , non pathological fracture of the hip under the age of 16 year . From January 2008 to 31 December 2009 , we collect 11 patients , 2 of them refused surgery by their parents and went to other hospital or to the bonesetter. We lost fallow-up in another 2 patient . and one patient came to the hospital after 24 hour from the injury , so they was excluded from the study .

All the remaining 6 patient was treated within the first 24 hour of injury , and all of them was treated in Fallujah hospital and was operated upon under fluoroscopy control . all of them were put in POP spica cast postoperatively. Follow-up by clinical examination and radiological evaluation was achieved for them .

Result:

We have four boys and two girls with a mean age of 6 , left hip was involved in 4 cases and right hip was involved in 2 cases , the mean fallow up is 2.1 years (1-3)years , Using Delbet's classification, there is one case Type I (16.5%), one type II (16.5%) and 4 type III (67 %).two of them sustained Fall from a height , and four of them sustained RTA .

Four patients had no complication (67%), one patient had AN (16.5%) and one patient had shortening (16.5%) .

Table 1. Details of the 6 patients with displaced fracture of the hip

case	Age (y)	gender	type of racture Delbets	mechanism	Treatment*	Follow-up (years)	complications
1	11	Male	type III	Fall From A high	CR screw fixation	2	leg shortining 2.5 cm
2	4	Female	type III	RTA	CR K-wire fixation	1	none
3	5	Male	type II	RTA	CR K-wire fixation	3	none
4	6	Male	type III	Fall From A height	CR K-wire fixation	2	none
5	5	Female	type I with dislocation	RTA	OR with K-wire fixation	3	AN
6	5	Male	type III	RTA	CR K-wire fixation	2	none

* CR, closed reduction; OR, open reduction.

X ray At Time of Injury, showed displacement of the head outside the acetabulum

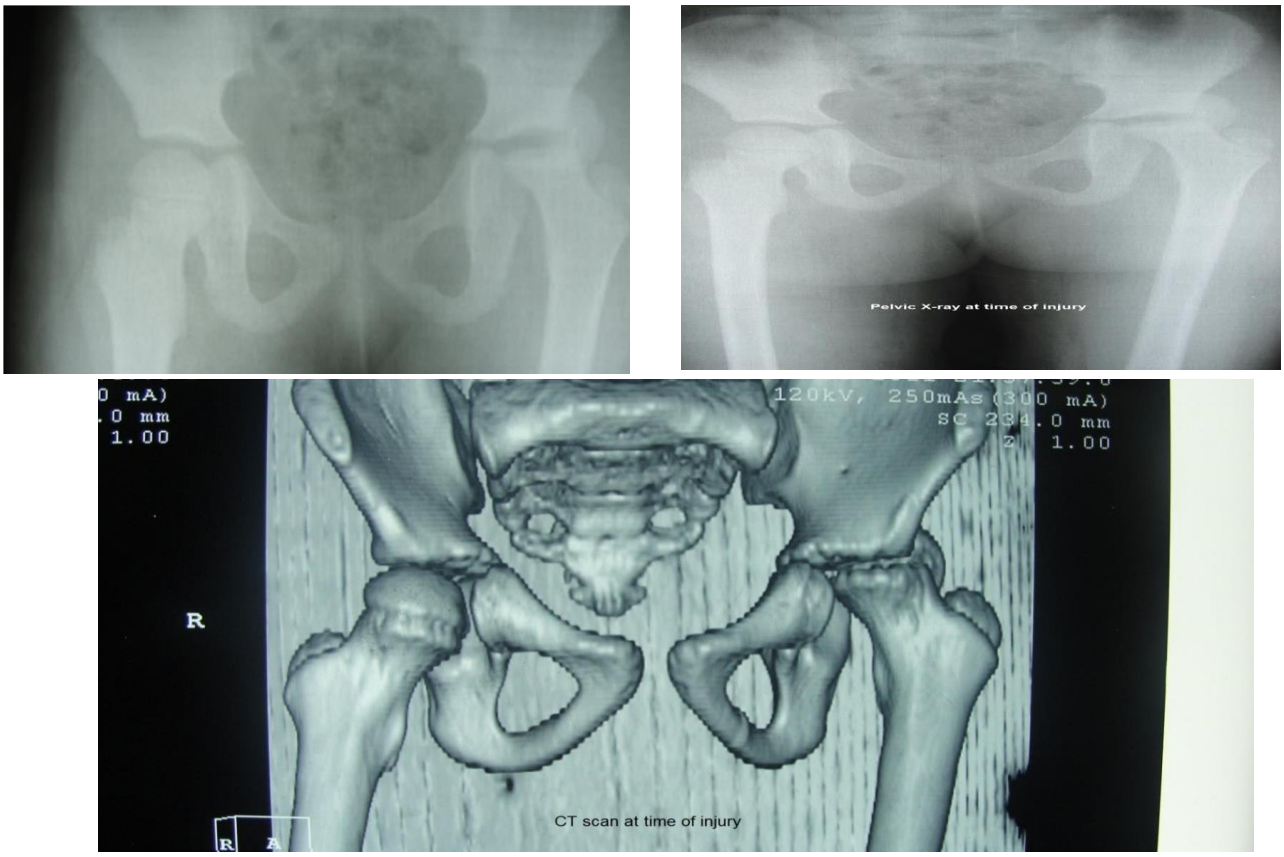


Figure (2):3 D Ct Scan showed obvious separation of the femoral epiphysis to the posterior side

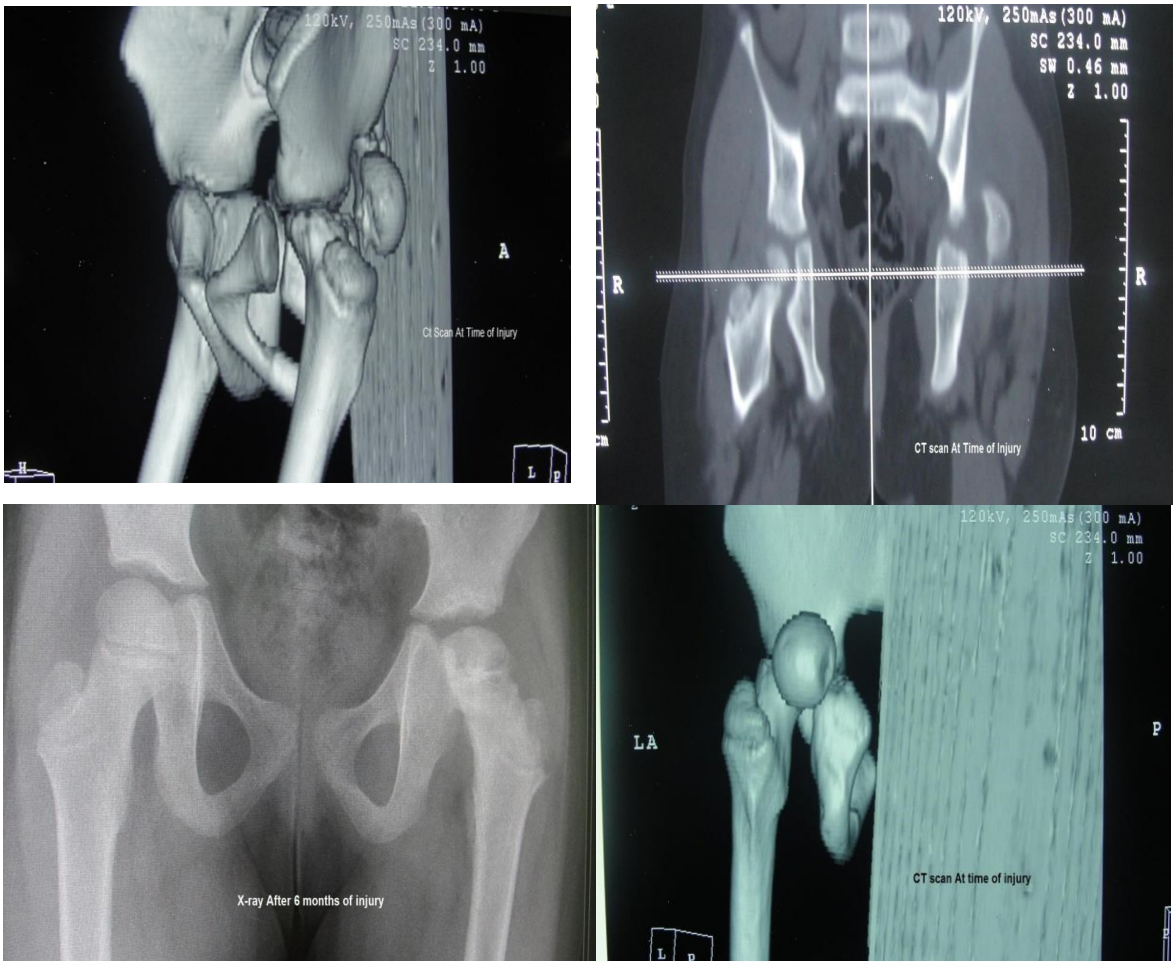
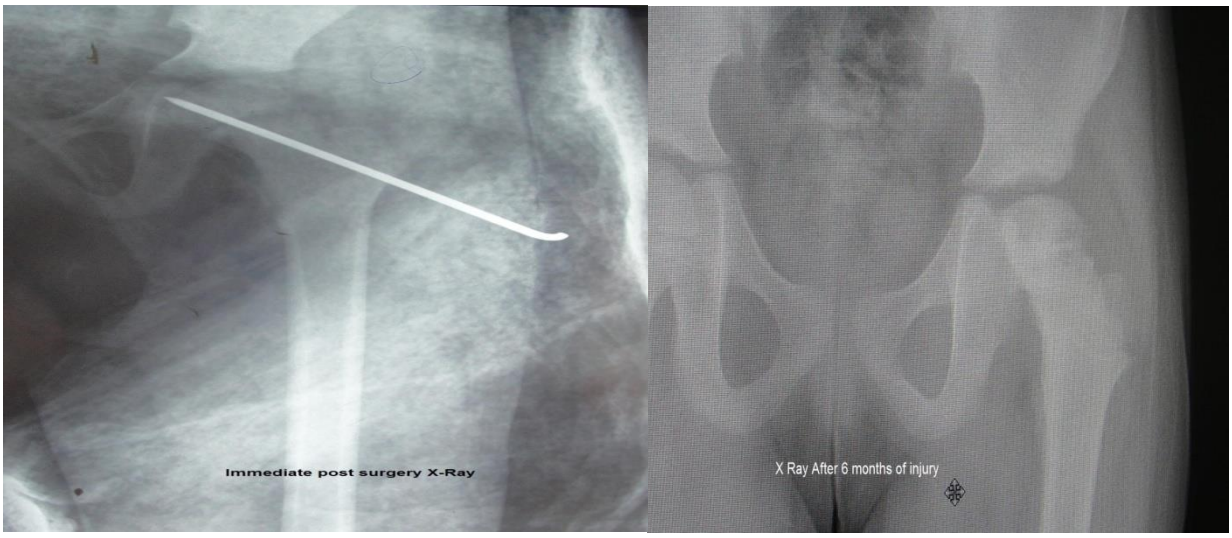


Figure (3):Post reduction film with fixation by single K Wire . with good reduction .



A **B**

Figure (4): A- immediate post surgery X-Ray and B- after 6 months of injury.

Figure (5)After 6 months of injury

Discussion:

Fractures of the hip are uncommon in children, but require careful attention because of the incidence of complications such as avascular necrosis, coxa vara, nonunion, and premature physeal closure. (18,8,9) We have analysed the long-term results in 6 children who were treated for a displaced fracture of the femoral neck by urgent reduction and internal fixation. Since children are often active and unreliable after operation, and the risks from immobilization are minimal we used a spica cast in all 6 patients for six weeks even although the internal fixation was satisfactory.

Avascular necrosis is the most devastating complication following internal fixation of fractures of the hip in children because of the tenuous blood supply to the femoral head(17) .There is no effective treatment once avascular necrosis is established. (18) Canale and Bourland(9) reported that the incidence is specially high in Delbet type-I (100%) and type-II (50%) and lower in type-III (27%) and type-IV (14%) fracture. The degree of displacement of the fracture is thought to be a reliable predictor of avascular necrosis, so Canale and Bourland(9) found that 96% of fractures in their series which developed avascular necrosis were displaced.

The incidence of avascular necrosis in our study was 16% (one Delbet type-I). Since avascular necrosis of the hip after an injury in children usually presents within one year,1 our minimum follow-up of two years should have detected all potential cases.

Coxa vara and non-union did not occur in our study. In the three largest

series of hip fractures in children in the literature, the rate of coxa vara has been reported as 14%, (8)21% (9) and 32%, (6) that of nonunion as 6.5% (9) 27%(6) and 33%(8)and of premature physeal closure as 20%(6,8) and 62%.(9)

Delbet type I injury is transepiphyseal separation—that is, acute traumatic separation of the proximal femoral epiphysis, similar to Salter-Harris type I epiphyseal injury. It is an uncommon injury, accounting for fewer than 10% of all pediatric proximal femoral fractures. This injury can occur in newborns after breech delivery and is often missed in these cases.Type I injury has also been reported in children 5-10 years of age. In these patients, it occurs after high-energy trauma and has a high incidence of associated injuries, especially femoral head dislocations. This fracture type has the worst prognosis, and the reported rates of avascular necrosis range from 20% to 100% (6)

The results of the transepiphyseal separations are the worst of any fractures. in Campbell's operative orthopedics series, All five patients with transepiphyseal separations had dislocation of the femoral head from the acetabulum, and all these children developed osteonecrosis. Closed reduction and fixation with pins through a short lateral incision should be performed in an older child if possible. Open reduction was necessary, however, in all but one of our patients. These transepiphyseal separations with dislocation often occur in young children in whom fixation with threaded screws or pins can cause premature physeal closure. The physis should be crossed only by smooth pins when internal fixation is necessary (4).

Premature closure of the proximal femoralphysis has been reported in 5 to 65% of all paediatric hip fractures. The prevalence increases when the physis is bridged by osteosynthesic material. It also increases in the presence of AVN (7) .In Ulukan İnan et all series "Pediatric femur neck fractures: a retrospective analysis of 39 hips", According to Delbet's classification system, there were no type I (transepiphyseal) fractures in all 39 hip fractures (3). Nayeemuddin *et al*. in a study of 14 child, 2 out of 14 was delbet type I treated surgically with 67 % Avascular necrosis rate for all 14 child , 33% premature closure for all 14 child(5)

Forlin *et al.* reported that osteonecrosis developed in 14 of 16 children (87.5%) with displaced femoral neck fractures(18) , Davison and Weinstein reported osteonecrosis in nine (47%) of 19 children with hip fractures, seven of whom required operative treatment (2).

Open or close reduction and internal fixation is mandatory in management of such type of fractures .

We use anterior approach in our surgery (case 5) in spite of good result used in posterior approach , our explanation was , that the gluteal region was bruised and we were afraid of infection , This type of injury is very rare and it need carful and immediate managements.

Conclusion :

- Paediatric hip fracture is not a large burden in the orthopaedic traumatology as it is rare , and comprise about 1% of all pediatric fractures , although it face every orthopedic surgeon and is a challenging cases.
- Every case should be assessed and classified according to Delbets classification and treated accordingly.
- The potential adverse events following these fractures are of great implication to the growing child.
- Undisplaced fractures should be treated without surgery , although, Delbet's type 2 and 3 fractures are known to have greater risk for redisplacement.
- All displaced fractured should be reduced , stabilized by open or close method , and by fixation it give some predictable result .
- AN is the most dangerous and frequent complication .
- Stability is more important than sparing the growth plate.
- Non union is another less frequent complication .
- Follow-up until the child has reached skeletal maturity is necessary to determine if mal-union or leg length discrepancy is present.

References :

1. Richard BIMMEL, Alex BAKKER, Ben BOSMA, Joseph MICHIELSEN , Acta Orthopædica Belgica, 2010,76 - 1.
2. Davidson BL. Hip fractures in children : a long-term followup study. J Pediatr Orthop 1992 ; 12 : 355-358.
3. Ulukan İnan. Pediatric femur neck fractures: a retrospective analysis of 39 hips. J Child Orthop. 2009 August; 3(4): 259–264.
4. Campbell's Operative Orthopaedics , 11th ed.Vol.III. 2007.
5. Nayeemuddin, Mohammedb; Higgins, Gordon A.a; Bache, Edwardb; O'Hara,
6. Johnb; Glitheroe, Phillipb. Complication rate after operative treatment of paediatric femoral neck fractures. Journal of Pediatric Orthopaedics B:November 2009 - Volume 18 - Issue 6 - pp 314-319.

7. Lam SF. Fractures of the neck of the femur in children. J Bone Joint Surg [Am] 1971; 53A:11651179
8. Hasan Bombaci, Tuncay Centel, Ata Babay, I. Metin Turkmen.Evaluation of
9. complications of femoral neck fractures in children operated on at leas 24 hours after initial trauma. Acta Orthopaedica et Traumatologica Turcica. ISSN: 1017-995x.
10. Ratliff AHC. Fractures of the neck of the femur in children. J Bone Joint Surg [Br] 1962;44-B:528.
11. Canale ST, Bourland WL. Fracture of the neck and intertrochanteric region of the femur in children. J Bone Joint Surg [Am] 1977;59-A:431-43.
12. Leung PC, Lam SF. Long-term follow-up of children with femoral neck fractures. J Bone Joint Surg [Br] 1986;68-B:537-40.
13. Ovesen O, Arreskov J, Bellstrom T. Hip fractures in children: a longterm follow-up of 17 cases. Orthopaedics 1989;12:361-7.
14. Colonna PC. Fractures of the neck of the femur in children. Am J Surg 1929;6:793-7.
15. Boitzy A. Fractures of the proximal femur. In: Weber BG, Brunner C, Freular F, eds. Treatment of fractures in children and adolescents. Berlin: Springer-Verlag, 1980:254-67.
16. Cheng JCY, Tang N.Decompression and stable internal fixation of femoral neck fractures in children can affect the outcome. J Pediatr Orthop 1999;19:338-43.
17. Swiontkowski MF, Winquist RA. Displaced hip fractures in children and adolescents. J Trauma 1986;26:384-8.
18. Larson CB. Rating scale for hip disabilities. Clin Orthop 1964; 31:85-92.
19. Morrissy R. Hip fractures in children. Clin Orthop 1980; 152:202-10.
20. Forlin E, Guille JT, Kumar SJ, Rhee KJ.Non-operativetreatment of pediatric hip fractures. J Pediatr Orthop 1992 ;12 ; 503-509