

Management of neglected fracture neck femur in children

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Abstract: Objectives: To evaluate management of neglected fracture neck femur in children. **Design:** Prospective study with retrospective analysis. Setting and Timing: Department of orthopedic surgery in Al-Azhar university Hospitals from Sept. 2014 till Sept. 2016. Patient and Methods: All the patients collected from outpatient clinic of the hospital. The study is based on 5 patients including males and females having neglected fracture neck femur more than one month. A femoral neck fracture was considered neglected when no proper medical treatment was instituted for at least 1 month following the fracture. **Intervention:** Modified Pauwels intertrochanteric valgus osteotomy. Main Outcome Measurements: Fracture healing, neck-shaft angle, a vascular necrosis, and functional outcome. **Results:** Patients were followed for 9 months. All patients had union of their fracture within an average of 16.6 weeks (12–20 weeks) and of the osteotomy site within 8.2 weeks (7–9 weeks). Postoperatively, an average of 125.4 degree neck-shaft angle was achieved (range 125–160 degrees). The average preoperative neck-shaft angle was 105.2 degrees (range 92–120 degrees) and on the normal hip side it was 129 degrees (range 127–132 degrees). Significant improvement in the neck-shaft angle was seen compared with the preoperative angle (P, 0.001) and normal hip angle (P, 0.05). Using Ratliff's criteria, 4 patients (80%) were graded as a good result and 1 patient (20%) was graded as a fair result. **Conclusion:** Modified Pauwels' intertrochanteric valgus osteotomy creates a biomechanical environment conducive to healing of a neglected femoral neck nonunion in a child while simultaneously correcting an associated coxavara. The procedure also seems to have a biological role in helping restore viability to a noncollapsed femoral head with avascular necrosis.

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1. Introduction

Femoral neck fractures in children differ from those in adults because of the presence of an epiphyseal plate, the vulnerability of blood vessels to the femoral head resulting in the high incidence of a vascular necrosis (AVN) and angular deformity after fracture (**Chladek and Trc, 2002**). In contrast, nonunion is not as common in children as in adults. Although femoral neck fractures in children are rare (**Abramobic, et al., 2004**) they are serious injuries because their complications may lead to a lifelong disability, especially in those cases with AVN. The associated high rate of complications and the limited experience of individual surgeons in treating this entity also diminishes the possibilities for a successful result (**Mirdad, 2002**). In addition, the variability of presentation of these fractures has made standardization of treatment difficult because there is no agreement concerning the etiology and management of the complications that can accompany the sefractures (**Davison and Weinstein, 1992**). Last, many of these fractures seen in developing countries present late because of mismanagement by bonesetters and delayed referrals (**Huang and Chun-Hsiung,**

1986). The problem then becomes challenging because the femoral neck maybe partially or completely absorbed and radiologic signs of AVN may be present.

2. Materials and Methods

This study involved 5 patients with neglected fracture neck femur in children (neglection more than one month without treatment).

Average age was 10.2 years (9–14 years). The interval between injury and osteosynthesis ranged from 1 month to 6 months. All patients had Type II fractures, a transcervical fracture as Delbet's classification (**Colonna, 1929**). Plain anteroposterior radiographs of the pelvis were taken with both hips in 15-degree internal rotation to look for signs of a vascular necrosis, coxa vara, proximal migration of the distal fragment, degree of neck absorption, and inclination of fracture surfaces; a lateral view also was taken to study retroversion (**Azouz, et al., 1993**). Plain x-rays were the only modality used throughout the course of the patients' treatment.

It was difficult to collect cases because the rarity of this type of patients.

Our patients collected from our clinic of our

department of Al Azhar University Hospitals between the period of September 2014 till September 2016, were treated and followed for an average 9 month.

Inclusion criteria:

- 1- Age of patient less than 15 year.
- 2- No treatment for one month.

Exclusion criteria:

- 1- More than 15 y. old.
- 2- Pathological fractures.

Operative Technique

The aim of surgery was to achieve Pauwels' angle from 25 to 30 degrees to bring the fracture site under compression with rigid fixation of both the original fracture and the osteotomy site to achieve sound union of the fractures. Surgery was done with the patient in supine position, under general anesthesia, using traction table and image intensifier. The skin incision was directly lateral and straight over the greater trochanter and proximal femur. The vastus lateralis was cut in L-shaped manner and elevated subperiosteally. The fracture site was not exposed in any patient. In all cases operative traction achieved closed reduction of the femoral neck to accepted alignment. Non forceful manipulations were done and the trials of reduction were maximum two trials. Just after reduction of the fracture the Pauwels' angle was pre - determined for every case and the angle of osteotomy was determined by subtraction of 30 from the already present Pauwels' angle. The proximal limb of the osteotomy was transverse and lies just above the lesser trochanter while the distal limb was oblique meeting the proximal limb at the medial cortex of the femur making a triangle. The angle of entry of the guide wire was estimated by subtraction of the osteotomy angle from the angle of the DHS, for example after fracture reduction we had Pauwels' angle of 60 degrees so the osteotomy angle should be 30 degrees and we used DHS with an angle of 150 degrees so the angle of the entry point of the guide wire should be $150^\circ - 30^\circ = 120^\circ$, so the guide wire will make an obtuse angle of 120 degree with the lateral femoral cortex and the entry site will be slightly higher than the level of the lesser trochanter. In all cases temporary k - wire was inserted superior to the guide wire before the use of the triple reamer and the lag screw to prevent rotation of the femoral head and removed after their insertion. The plate was connected to the lag screw but kept away from the osteotomy site. The use of this angle made the entry point nearer to the lesser trochanter which was not the case if DHS of lower angles were used, the entry point will be much higher away from the lesser trochanter which would be a very difficult technical problem to deal with, also the use of 150 angle DHS allows the lag screw to be perpendicular to the fracture site allowing maximum compression of the fracture. A laterally

based wedge at the level of the lesser trochanter was taken. At the level of osteotomy, a proximal transverse cut and a distal angled cut were made and a predetermined sized wedge was removed. After osteotomy was complete, the lower limb was swung into abduction to align the femur to the plate and reduction clamps were applied. The barrel plate was fixed to the femoral shaft. Hip spica was applied for 5 cases that were less than 10 years old for 6 weeks, dressing was exchanged on the 3rd postoperative day and all patients were discharged, sutures were removed in the outpatient clinic on the 14th day, post operative plain radiographs were done after discharge and on monthly intervals till union.

3. Results

Patients were followed for 9 months. All patients had union of their fracture within an average of 16.6 weeks (12–20 weeks) and of the osteotomy site within 8.2 weeks (7–9 weeks). Postoperatively, an average of 125.4-degree neck-shaft angle was achieved (range 125–160 degrees). The average preoperative neck-shaft angle was 105.2 degrees (range 92–120 degrees) and on the normal hip side it was 129 degrees (range 127–132 degrees). Significant improvement in the neck-shaft angle was seen compared with the preoperative angle (P, 0.001) and normal hip angle (P, 0.05). Radiologic healing was determined by the presence of bridging trabeculae across the osteotomy and the nonunion site on plain radiographs in both anteroposterior and lateral views. Clinical union was defined as pain free full weight bearing without assistance. Results were analyzed clinically using Ratliff's criteria.

Using Ratliff's criteria, 4 patients (80%) were graded as a good result and 1 patient (20%) was graded as a fair result. Excellent remodeling of the femoral neck was seen in all the patients when compared with the normal opposite hip in anteroposterior and frog-leg views. Implant failure was not observed in any of the patients until the last follow-up. Postoperative coxavara, proximal overgrowth of the greater trochanter, and signs of chondrolysis or postoperative infections were not observed in any of the patients in the present series.

4. Discussion

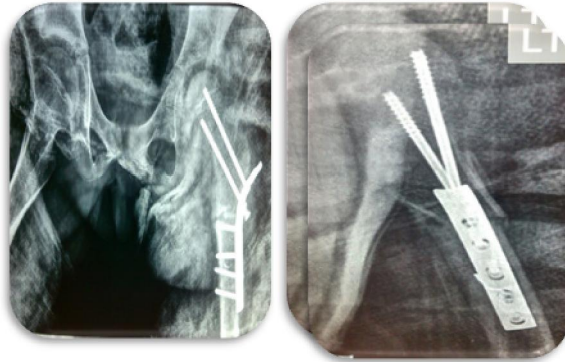
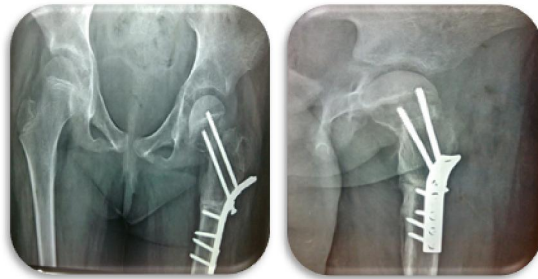
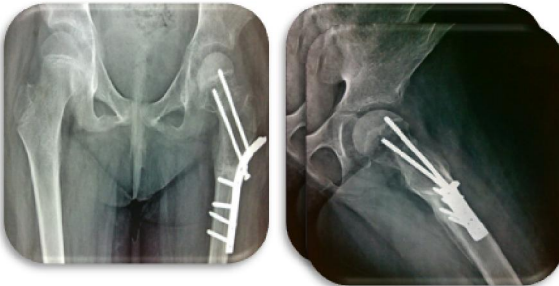
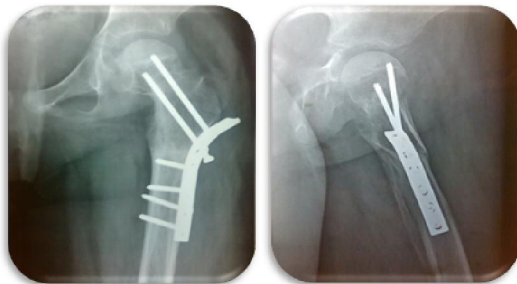
Neglected femoral neck fractures are more commonly reported from developing countries where the patients are initially seen by bonesetters (Nagi, et al., 1992). Most authors found the incidence of nonunion in non neglected children's femoral neck fractures to be around 6% to 10% (Flynn, et al., 2002) and a lower incidence seems to follow internal fixation. Because of the rarity of femoral neck fracture in children and the low incidence of nonunion,

management protocols for neglected fractures are not well defined. Excellent results of valgus intertrochanteric osteotomy have been reported in relatively young patients with a femoral neck nonunion and in those patients younger than 70 years of age (**Marti, et al., 1989**). A high incidence of good results (90%) in our series and 100% union in patients with neglected femoral neck fractures is attributed to Pauwels' sound biomechanical principles because the valgus intertrochanteric osteotomy makes the nonunion more horizontal, thus allowing the axial compressive forces to aid in union. In the present series union of the fracture and of the osteotomy site was obtained in all patients. There was also a significant improvement in the neck-shaft angle compared to the preoperative angle and normal hip angle. Coxavara and signs of chondrolysis were not observed in any of the patients. Radiologic signs of avascular necrosis disappeared completely in 3 patients presenting with avascular necrosis. Postoperative coxavara was not seen in any of our patients in the present series. It is a rather frequent complication in fractures of the femoral neck in children, can occur with or without avascular necrosis, and often occurs with nonunion (**Togrul, et al., 2005**). In the present series, a significant improvement in the neck-shaft angle has been observed compared to preoperative angle and the normal hip. Encouraging results of fibular osteosynthesis have been reported for delayed union in Type II and Type III femoral neck fractures in children; however, coxavara was a consistent finding postoperatively (23.5%). Excellent remodeling and united fractures in the presence of neck resorption were observed in all of our patients. Proximal migration of the trochanter and coxavara was not seen in any patient in spite of the premature closure of the femoral capital epiphysis. We believe Pauwels' osteotomy has the added advantage of correcting coxavara accompanying the nonunion and seems to prevent varus through the buttressing effect of the distal fragment, thus improving stability in both the sagittal and the coronal planes. In present series, a semitubular plate was contoured into a 120-degree double-angle blade plate for osteosynthesis because of the nonavailability of a standard implant for children. Additionally, a hip spica was applied as protection because of the poor strength of the implant. It is expected that the use of a standard implant will provide stable osteosynthesis and eliminate supplementation with a plaster of paris hip spica. The incidence of avascular necrosis in series of these patients ranges from 0% to 92%, with the most commonly reported number being approximately 45% (**Davison and Weinstein, 1992**). We have opined that intertrochanteric osteotomy has a biological role in healing of the fracture and revascularization of the

avascular femoral head. The present study likewise strengthens our view that radiologic signs of AVN may be followed by revascularization of the head of the femur. We did not observe any significant difference in age and sex of these 3 patients compared with other patients in our series for risk of AVN, except that their injuries were neglected for longer durations (average: 5.8 months, range: 5–6 months). Age at the time of injury is also a factor in the prognosis of the AVN and final outcome as it relates to the capacity of the femoral head to revascularize and remodel (**Forlin, et al., 1992**). The limitations of the present study include the absence of a control group and the small number of patients. The strengths of the study include a sufficiently lengthy follow-up period and results that substantiate our views expressed regarding the problem of neglected femoral neck nonunions in children. Treatment of pediatric femoral neck fractures with accurate anatomical rigid fixation on urgent basis is the golden standard for optimum results and the best way to avoid a high rate of complications associated with these fractures. For neglected cases of pediatric femoral neck fractures valgus intertrochanteric osteotomy and rigid internal fixation is the technique of choice in treating this problem.



Immediate post operative

**1 month post operative****2 months post operative****3 months post operative****4 months post operative**

Summary and Conclusions

Femur neck fracture is a rare injury in children. The child adult ratio in femur neck fractures has been reported to be 1/20. There are several factors differentiating the pediatric femur neck fractures from the adult fractures, and the two most important ones should be mentioned. First, the main etiologic factor is the high energy trauma, as proximal femoral bone excluding physis is very strong in children and requires a significant force to break it, whereas minor trauma is the main etiological factor in adults. This is the main reason why pediatric femur neck fractures are rare injuries. The findings of this issue supported this knowledge, as nearly 85% of the fractures were due to a major trauma. Secondly, the blood supply of the femoral head is different. The adult hip has intraosseous blood vessels that supply the femoral head. However, the blood vessels cannot cross the open physis and, therefore, the blood supply to the femoral head is critical and can be easily disrupted by a hip fracture in children. So, AVN is the most common and damaging complication in pediatric femur neck fractures.

The high complication rates and rarity of these fractures suggest that ideally only surgical teams with a high degree of experience of pediatric trauma should manage them.

The treatment recommendations are anatomical reduction and fixation with cannulated screws for types 1, 2 and 3 fracture patterns. For management of type 4 intertrochanteric fractures the use of a sliding screw and side plate.

The common complications which occur are avascular necrosis of the head and neck of femur, physis premature closure, coxa vara, and occasionally nonunion.

Modified Pauwels' intertrochanteric valgus osteotomy in children with neglected femoral neck fracture because it has the advantage of creating a biomechanical environment conducive to healing of the nonunion while simultaneously correcting the accompanying coxa vara. The osteotomy also seems to have a biological role in restoring viability of the head of the femur with avascular necrosis.

In our study, have been working on 5 cases only because the scarcity of this type of fracture especially if neglected. These patients were treated as non united fracture neck of femur, because the first presentation of these cases at our outpatient clinic was non united fracture neck of femur. From this point our philosophy in treatment have been biomechanical changing of hip joint, through itertrochantric valgus osteotomy.

References

1. Abramobic D, Brdar R, Vidosauljevic M. Orthopedic relation and percutaneous fixation of femoral neck fracture in children. *Srp Arh Celok Lek.* 2004; 132:72–76.
2. Azouz EM, Karamitsos C, Reed MH, et al. Types and complications of femoral neck fractures in children. *Pediatr Radiol.* 1993;23:415–420.
3. Chladek P, Trc T. Fracture of the femoral neck in children: complications and their treatment. *Acta Chir Orthop Traumatol Cech.* 2002; 69:31–34.
4. Colonna PC. Fractures of the neck of the femur in children. *Am J Surg.* 1929; 6:793–797.
5. Davison BL, Weinstein SL. Hip fractures in children: a long-term follow- up study. *J Pediatr Orthop.* 1992;12:355–358.
6. Flynn JM, Wong KL, Yeh GL, et al. Displaced fractures of the hip in children. Management by early operation and immobilization in a hip spica cast. *J Bone Joint Surg (Br).* 2002;84:108–112.
7. Forlin E, Guille JT, Kumar SJ, et al. Complications associated with the fracture of neck of femur in children. *J Pediatr Orthop.* 1992; 12: 503–509.
8. Huang, Chun-Hsiung. Treatment of neglected femoral neck fractures in young adults. *Clin Orthop.* 1986;206:117–126.
9. Marti RK, Schuller HM, Raaymakers ELFB. Intertrochanteric osteotomy for nonunion of the femoral neck. *J Bone Joint Surg (Br).* 1989; 71: 782–787.
10. Mirdad T. Fracture of the neck femur in children: an experience at the Aseer Central Hospital, Abha, Saudi Arabia. *Injury.* 2002; 33:823–827.
11. Nagi ON, Dhillon MS, Gill SS. Fibular osteosynthesis for delayed type II and type III femoral neck fractures in children. *J Orthop Trauma.* 1992;6: 306–313.
12. Togrul E, Bayram H, Gulsen M, et al. Fractures of the femoral neck in children: long term follow up in 62 hip fractures. *Injury.* 2005; 36: 123–130.

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