Treatment of proximal third femoral shaft fractures in children by intramedullary Kirschner wires

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ABSTRACT

Objective: to evaluate intramedullary K-wire fixations a surgical technique in the management of closed fractures of the proximal femoral shaft in children. Design and Subjects: Retrospective study of 14 patients (10 boys and 4 girls) with closed fractures of the proximal femoral shaft treated by closed reduction and elastic stable intramedullary K-wire fixation inodistal metaphysis, one wire from each side. Early mobilization with weight bearing was allowed. The wires were removed 3-6 months (mean 5 months) post surgery. Setting: King Khalid University, Riyadh, Saudi Arabia. Results: After a mean follow-up of eighteen months, all fractures have healed without relevant limb length discrepancy or residual angulation. Conclusion: Fractures of the proximal femoral shaft in children between 5 to 14 years can be successfully treated by closed reduction and intramedullary fixation using two thick K-wires.


Keywords: Proximal femoral fractures, children, intramedullary K-wire fixation.

Although the treatment of choice for closed fractures of the femoral shaft in children remains conservative, situations do occur in which surgical intervention is indicated. Examples include multiple injuries, cerebral injury, vascular injury, and severely displaced fractures with persistent displacement after application of traction. Failure to maintain reduction in the proximal femoral shaft fractures is another indication for surgical intervention.

The surgical methods which are commonly used include plate osteosynthesis, external fixation and intramedullary nailing. Although the introduction of these surgical methods has been a major advance in the management of closed fractures of the proximal femoral shaft, they are not without complications. Infection, deformity, growth disturbance, delayed union and the need for another surgery have been frequently reported. We report our experience with use of the elastic stable intramedullary pinning technique (ESIP) for the treatment of closed fractures of the proximal femoral shaft in children.

Patients and methods. The medical notes of 14 children with closed fractures of the proximal femoral shaft treated with closed reduction followed by intramedullary K-wires fixation in King Khalid University Hospital during the period from January 1994 to January 1996 were reviewed.

Operative technique. Following closed reduction of fractures under general anesthesia and fluoroscopy guidance, two inch long skin incisions were made on the medial and lateral sides of the lower thigh and deepened to the bone. Using an awl, two holes were prepared in the medial and lateral cortices of lower femur at the same level and above the growth plate. Through the holes two thick K-wires (size 3 - 3.5 mm in diameter) were introduced with blunt bent proximal ends to prevent cortical penetration and facilitate the passage of the wires through the medullary canal. Under fluoroscopy, the wires were hammered up along the medullary canal passing the fracture site and crossing each other in a curved manner to provide double three point fixation. Care was taken during the wire's insertion to avoid rotational deformity. Skin was closed over the bent

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distal ends of the wires which are left deep in the muscles.

**Results.** There were 10 boys and 4 girls aged 5 to 14 years (mean 8 years) who sustained fractures of the proximal femoral shaft. Eleven patients were involved in road traffic accidents while 3 had a fall from height. Associated injuries were present in 7 patients, 5 had head injuries, one had abdominal injury and one had metatarsal fracture in the ipsilateral foot.

During the first week partial weight bearing ambulation with crutches was started as soon as the patient could tolerate. Duration of hospitalization ranged from three to five days with an average of four days. Full weight bearing was resumed 6 to 8 weeks after surgery. Skin necrosis with superimposed superficial skin infection over the protruded distal ends of the wires was seen in two cases. The infection was controlled and the wounds healed rapidly within one week after trimming the protruded wire ends. No other complications were seen. All fractures healed well within 6 to 10 weeks. The wires were removed under general anesthesia 3-6 months (mean 5 months) post surgery (Figs. 1, 2 and 3).

After a mean follow up of 18 months (range 12-24 months), all patients had full hip and knee motion. Limb length discrepancy which did not exceed 5mm was noticed in three patients, and residual varus or valgus angulation of less than 5 degrees was found in two patients. No other late complications were seen and the gait was normal in all patients.

**Discussion.** Fracture of femoral shaft is a common injury in children.\(^9\) These fractures are generally managed by conservative treatment in the form of traction and casting.\(^2\) However, traction often fails to align fractures of the proximal third of the shaf and to maintain reduction is usually difficult. Aronson et al (1987) reported angulation deformity of more than 15 degrees and limb length discrepancy of more than 13mm after non surgical treatment in 20% of cases with proximal third fracture which increases to 53%
in older children. The place of surgical management of this type of fracture is gaining strong support because it achieves good alignment of the fracture and significantly decreases the length of hospitalization.\textsuperscript{13,15}

Hansen et al. (1992) recommended the use of plate osteosynthesis.\textsuperscript{11} It has the disadvantage of increased risk of infection and delayed union, in addition to the need for another operation for the removal of the plate.\textsuperscript{6,7} Krettek et al (1991) suggested the use of external fixator which offers good stability and early mobilizations, but 25\% of his patients developed infection at the site of the Schanz screws and 19\% of patients were unhappy with the device.\textsuperscript{10} Intramedullary Künchter nail fixation affords good alignment, rigid fixation and allow early weight bearing with early hip and knee motion.\textsuperscript{13} However, it is not without complication. Added to the need for another surgery for nail removal it has the risk of infection, rotational deformity, avascular necrosis and growth disturbance. The use of I.M. rush pin and Ender's nail was preferred by some authors,\textsuperscript{7,13,18} but it is not elastic enough for treating children and may lead to straightening of the normal curve of the bone. Ligier et al (1988) used elastic stable intramedullary pinning technique (ESIP) using multiple thick K-wires for treating fractures of the femoral shaft in children.\textsuperscript{12}

In our study we used the principle of ESIP to treat fractures of the proximal femoral shaft with ordinary 2 Kirschner wires in children between 5 and 14 years of age. This technique provides a combination of stable and elastic immobilization. In contrast with techniques involving rigid fixation, stability is not only ensured by the wire but also by the bone and the surrounding soft tissues. Bone provides axial stability by cortical contact when the wires are anchored in the metaphysis. Rotational stability is achieved by the double crossing of the curved wires which provides three point fixation.\textsuperscript{14} Soft tissues, muscles in particular, serve as guy-ropes. This explains the spontaneous post-operative correction of slight angular deviation.\textsuperscript{12} Stability provided by living tissues allows rapid return of function and weight bearing without fear of secondary displacement. On the other hand, the elastic mobility allows a certain amount of movement at the fracture site stimulating external callus formation by reducing shear and converting it into compression and traction forces.

The results of the present study further supports the feasibility of using ESIP for fracture of the proximal femoral shaft in children. It encourages early mobilization during the first week post operatively without external splints, while allowing full weight bearing 6 to 8 weeks after surgery and formation of good callus, without evidence of delayed union. None of our patients developed avascular necrosis of the head of femur or growth disturbance. We think that the reason for this is the retrograde wire fixation which avoided injury to lateral ascending artery.\textsuperscript{19}

None of our patients had deep infection. We think the reason is due to the use of closed technique, while superficial infection over the distal end of the wires, which was seen in two cases in our series, was avoided in other cases by keeping the distal end of the wires deep in the muscles. This technique caused minimum cosmetic problem which was limited to two small scars at the sites of K-wires introduction.

**Conclusion.** Fractures of proximal third of femoral shaft in children are difficult to treat conservatively. These fractures can be successfully managed by closed reduction and intramedullary K-wire fixation under image intensifier. This technique has the following advantages: 1. It is a simple and minimally invasive technique. 2. The fracture site is undisturbed minimizing the risk of infection. 3. It encourages early weight bearing and mobilization of knee and hip joints. 4. It provides good alignment of the fracture with remote possibility of relevant deformity. 5. There is no potentiality for growth arrest. 6. Short hospital stay and the child can return to school earlier.

**References**

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