

## The use of modified humeral intramedullary interlocking nail in adolescent and elder children femoral shaft fracture

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### INTRODUCTION

Diaphyseal femoral fractures in children have long been treated conservatively and orthopaedic surgeons have long maintained that all children recover well with minimal treatment and that the remodeling capacity of paediatric femur can compensate for a less than perfect reduction<sup>(1)</sup>.

Time and experience of many clinicians have shown that children with diaphyseal fracture do not always recover with conservative treatment. Angulation, shortening and malrotation are not always corrected effectively.<sup>(2,3,4,5,6,7)</sup>

Management dilemmas are frequent. Fracture complications are common in the treatment of children with multiple system injuries, head injuries, multiple fractures and children with pathological fractures through osteoporotic bone. Management dilemmas also occur in the treatment of children with isolated femur fractures. Children with open fractures, dermatologic disorder or preexisting pulmonary dysfunction present complicated scenarios for which standard traction casting treatment techniques may not be effective. Children >10 years old will occasionally have femur fractures that cannot be reduced or held an acceptable alignment by traction and casting. These patients require operative management.<sup>(4,5,8,8,10,11)</sup>

Children > 10 years of age with an isolated femoral shaft fractures have been reported to have better results if treated surgically. Recent reports have even suggested social indications for operative treatment of children with an isolated femur fractures<sup>(2,8,18,14)</sup>

New trends are being set by improved operative techniques, changes in the economics of patient care and reduced patient tolerance of minor residual deformity. For economic and psychological reasons, prolonged hospitalization has become less acceptable. These

developments along with a greater appreciation of the importance age differences play

in management decisions have changed fracture management over the past decade. No longer in the immature child routinely treated with 3 to 4 weeks of inpatient traction.

Surgical options include external fixation or internal fixation with plates or intramedullary nails.

Closed intramedullary nailing is the preferred method of many authors to compression plate as it allows for early weight bearing and walking with more rapid return of normal function, less stress protection of bone, less dissection is required for their insertion and less scarring. Insertion and removal is easier with very low complication rates including. Infection, refracture, malunion, and non-union<sup>(16)</sup>

Compared to traction treatment, it allows for earlier mobilization and return to normal function with shorter hospitalization time and less disruption of the family life<sup>(15)</sup>.

### Aim of the Work

The aim of our study is to evaluate the results of closed modified humeral intramedullary nailing in the treatment of Diaphyseal femoral shaft fractures in children.

### Patients and method

This study carried out on 10 children with 10 fractures of the femoral shaft through the period from Mars. 2015 to Mars. 2016. Cases were among those admitted and managed in Sohag university Hospital. Cases were received in the emergency room and examined clinically and radiologically and the first aid management was done

**Clinical assessment:** This includes

**History :** Name, age, sex occupation, residence, mechanism of injury and time elapsed before presentation.

**Clinical Examination for**

- Diagnosis of the fracture by the presence of deformity, swelling and tenderness and whether it is open or closed.

- Neurovascular state of the limb.

- Associated injuries whether skeletal in the same or other limbs or extraskelatal as head injury, cardiothoracic or abdominal injuries. Diagnosis of associated injuries is considered the most important point in the clinical evaluation of child with fracture femur as it is often the single variable that determine the time of operation.

- The presence of any limb deformities or diseases that may indicate pathological fracture.

**Radiological assessment:**

Radiographs anteroposterior and lateral views including both hips and knees were taken in the resting position of the limb before traction so that the initial amount of overriding was accurately measured .The value of the x-rays was, to confirm the diagnosis, to detect the direction of fracture displacement, initial amount of overriding, level and pattern of the fracture.

**First aid measurements:**

After initial evaluation, the limb was splinted on a Thomas splint till the time of surgery.

**Definitive treatment:**

Children > 8 years were left of the Thomas splint and primarily received closed nailing using modified intramedullary nail of humerus

**Results**

The youngest patient in our study was 8 years and the oldest one was 13 years with a mean age of 11.5 years. Patients were classified into two groups, those between 8-10years and those between 11-13 years. 6cases (60%) were 8-10 years and 4cases (40%) were within the age group 11-13 years

**Sex Incidence:** 6patients out of the 10 cases were male with an incidence of 60% and 4 patients were female with an incidence of 40%. The male to female ratio was 3:2

**Side Incidence:** Out of the 10cases 7cases (70%) were on the right side and 3cases (30%) on the left side

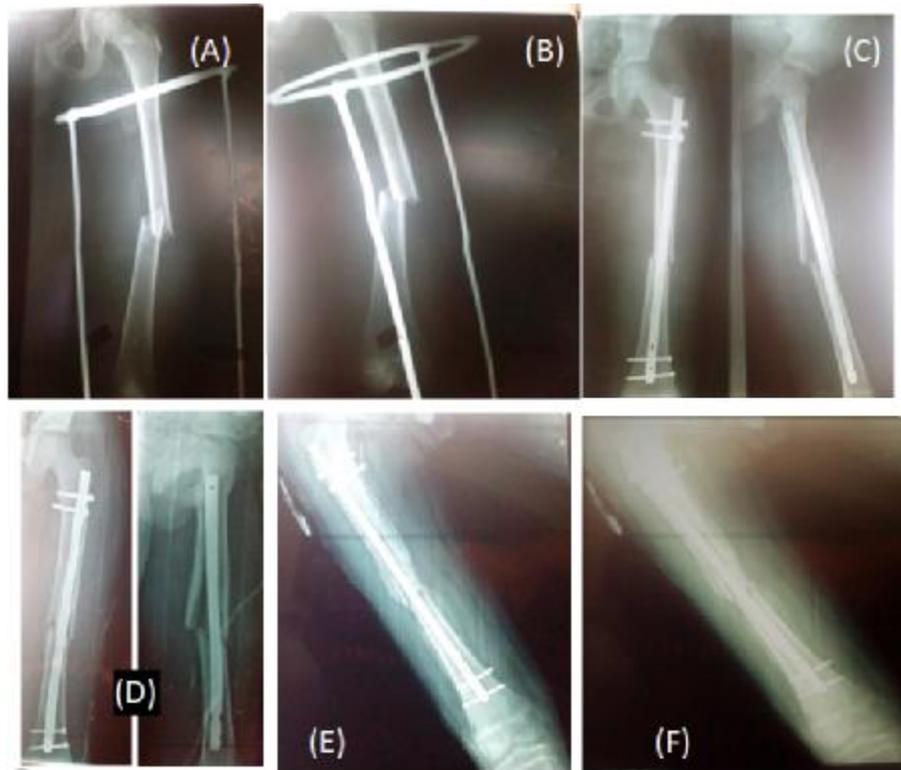
**Fracture Type:** In our study, 8cases were closed and 2 cases were open

**Level of the fracture:** Fractures were classified according to their level into 3 groups, upper, middle and lower thirds. Middle third fractures have the highest incidence. It occurred in 7 cases, with an incidence of 70% Upper third fractures came next and occurred in 2 cases, with an incidence of 20%. Lower third fracture have the least incidence being occurred in only one case (10%)

Fractures were classified into transverse, oblique and comminuted. Transverse fracture were found in 6 cases (60%), oblique fractures were found in 3 cases (30%) and comminuted fractures were found in one case (10%)

**Mechanism of injury:** Most of injuries were due to falling from height. It accounted for 7 cases (70%) of the causes of injury. Motorcar accident accounted for 3 cases (30%)

**Associated injuries:** Associated injuries were found in 2 cases (20%). Associated injuries included head trauma, compound fracture of both leg bones and fracture surgical neck femur.



11 years old male child had motor car accident leading to transverse fracture of middle third left femur, closed reduction fails due to soft tissue interposition so open reduction and nail fixation Hospital stay was 5 days. Partial weight bearing started 4 weeks with progression to full weight bearing after 7 weeks. Complete union was result after 12 weeks with full range of knee motion. The case has shortening 0.5 cm but did not require and treatment. (A, B) showing pre xrays AP and lateral views, (C) showing post xrays, (D) showing 1.5 month follow up xrays, (E, F) showing 3 month follow up xrays.

### OPERATIVE TECHNIQUE

In the 10 cases, we followed the antegrade technique. As soon as the patient general condition allowed, under general anaesthesia, or spinal the child is positioned on the orthopaedic table in the supine position and traction was applied to the extremity. Reduction of the fracture was achieved by manipulating the fragments under the image intensifier. The size of the nail was determined according to the strength of the bone (as a rule, double the cortex for proper thickness of the pin<sup>(12,3)</sup> and by the width of the medullary canal at the isthmus<sup>(14)</sup>. Nails commonly used were 8 and 9 mm in diameter.

#### Incision:

small incision over greater trochanter, starting at the tip. The fascia lata was incised and the vastus lateralis retracted posteriorly at first thick k-wire introduced 5 mm. lateral to the tip of greater trochanteric physis. Drilling proximal femur through inserted k-wire then removal of the k-wire and guide introduced.

Reduction: Closed reduction was usually easy to achieve. By manipulating the fragments, they were aligned and the guide was introduced across the fracture into the distal fragment. Limited open reduction was done in only two cases. Soft tissue interposition by muscles was the cause in the two cases

After passing the fracture site, gradual reaming was done up to widest diameter that medulla can accommodate.

Rotational alignment was checked before final insertion of the locked screw. Ability to rotate the foot 20 degree internally and externally indicated good alignment<sup>(16)</sup>.

The wound were closed in layers and a crepe bandage was applied over the limb.

## POSTOPERATIVE CARE

- Usually no additional external immobilization was required.
- Mobilization of the knee started after improvement of pain.
- Partial weight bearing was usually started after two weeks after appearance of external bridging callus.
- Weight bearing was increased gradually according to progress of healing in the x-rays. Full weight bearing was usually allowed after 6 weeks.

## FOLLOW-UP

Union was defined by the presence of external bridging callus radiographically and absence of tenderness at the fracture site clinically.

### Limb length:

Leg length was evaluated on a clinical basis by noticing the patient gait and parent complaints and measuring the limb length by the tap method with patient supine. The measurement was done from the anterior superior iliac spine to the medial malleolus after ensuring that there is no flexion deformity at the hip or knee and comparing with the contralateral side. Limb length discrepancy was defined as > 0.5 cm difference between the affected and healthy sides.

### Malunion:

- Acceptable union was defined as <5° of angular deformity in sagittal plane (anterior, posterior angulation), <5° in frontal plane (varus/valgus angulation) and <5° malrotation (anteversion or retroversion).
- The rotation of the fracture was assessed on a clinical basis by noticing any gait abnormalities (in-toeing or out-toeing) and by measuring the foot progression angle and comparing with the contralateral side.

## Summary and conclusion

Femoral shaft fractures are common in children and adolescents. The standard for managing most of these fractures has always been conservatively with a period of traction to maintain the reduction until early stabilization by fracture callus followed by hip spica casting until fracture union. Early or delayed hip spica casting for pediatric femoral fractures produces excellent results in younger children and continues to be the treatment of choice, but in older children and in polytrauma children or after failure of conservative methods, operative is required

In the last 10 years the number is the preferred method of operative treatment in children.

We reviewed the anatomy of the femur, Biomechanics of Medullary fixation, the diagnosis and different methods of treatment of fractures of the shaft of the femur in children.

At a mean follow-up of 14 months, the results were acceptable in (100%) and no case with unacceptable result was found.

Complications include significant overgrowth over one cm & superficial infection.

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