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ORIGINAL ARTICLE

ENDERS NAILING A NOVEL TECHNIQUE

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ABSTRACT: 30 paediatric cases of tibial and femoral fractures between ages of 2 to 12 years have been treated by enders nailing during the period between May 2012 and April 2014 at our institute of Resident Dept. of Orthopaedics Rangaraya Medical College, Kakinada. The cases were stratified and meticulously studied and the results were analyzed both anatomically and functionally. The results were methodically compared with previous studies. The technique of enders nailing is having an easy learning curve and promising results are being attained with respect to conservative mode of treatment avoiding fracture disease.

KEYWORDS: Intramedullary fracture fixation, E04.555.300.300.300, Femoral fractures, C26.404.061, C26.558.276, Tibial fractures, C26.404.875, C26.558.857.

INTRODUCTION: Femoral shaft fractures, including subtrochanteric and supracondylar fractures, represent approximately 1.6% of all bony injuries in children. The male to female ratio of femoral fracture is 2.6:1 with a bimodal distribution.[1] The first peak occurs in early childhood and the second in mid-adolescence. A review of the Maryland Hospital Discharge Database by Hinton et al confirmed the bimodal distribution with peak incidences at 2 and 12 years of age.[2] Tibial and fibular fractures are the third most common pediatric long bone injuries (15%) after femoral and radial/ulnar fractures.[3] The prevalence of tibial fractures in both boys and girls has increased since 1950.[4] The average age of occurrence is 8 years. Fractures of the proximal humerus are relatively uncommon injuries of childhood, with an incidence of 1.2 to 4.4 per 1,000 per year, fewer than 5% of all pediatric fractures.[5] These fractures have been managed with wide variety of methods in past. Historically treatment with closed means in above knee casting plaster spica cast, either immediately or after a period of traction, has yielded acceptable results for these fractures.[6,7,8] This treatment produces undue physical and psychological stress for patient and family.[9,10,11] Furthermore, in certain complex fractures and sometimes in subtrochantric fractures, with tendency for marked flexion of proximal fragment, closed reduction and its maintenance is often unsuccessful.

Last few decades has seen increasing trend towards operative management of femoral and tibial shaft fractures in paediatric patients but opinion regarding optimal method of fixation of these fractures remains divided.[12] External fixation, although producing acceptable results, is fraught with many complications as is plate osteosynthesis and rigid intramedullar nailing which may also require a second major surgery for removal of implant.[13] Flexible intramedullary nailing introduced for femoral fractures by Nancy group in 1982, has become popular with many orthopaedic surgeons. Stabilization follows the three-point fixation principle that provides internal elastic support in the presence of cortical contact and an intact soft-tissue envelope.[14] The technique offers several advantages, including better reduction, dynamic axial stabilization,

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shorter hospitalization with early rehabilitation and low rate of complications.[15] It remains the treatment of choice for these fractures at our institute due to its favourable results and lack of serious complications.Conservative management/other operative modalities for diaphyseal fractures in this age group affect the financial status of families. Image Intensification (C-ARM): is needed for closed insertion of enders nailing. It is a primary requirement and common equipment at any orthopaedic hospital. Enders nailing needs minimal instrumentation like hammer, bone awl twisting guider and hook for extraction. Rural population usually prefers conservative management. This modality of treatment truly surpasses the need by avoiding casting. Early mobilization prevents joint and muscle stiffness/ contractures and also avoids plaster disuse.

AIM: 1) To evaluate the role of enders nailing in fixing long bone fractures by minimally invasive technique and biologically fixing long bone fractures in children aged 2 years to 12 years. 2) To study the biomechanical advantage of rotational and angulation stability provided by this procedure with minimally invasive technique resulting in good functional outcome.

OBJECTIVES: 1) To undertake the procedure that is effective and least time consuming for the most common type of fractures seen in children (2-12yrs age groups) i.e., diaphyseal fractures of long bones (closed, compound type I, II,III A & III B). 2) To eliminate the problems of pin traction and prolonged bed rest like bed sores, Urinary tract infection, thrombo embolic diseases, pulmonary embolism, stiffness of adjacent joints and pin track infection. 3) To overcome the problems of non-operative treatment and plate fixation i.e. implant failure, osteomyelitis and loosening of screws, etc.

MATERIAL AND METHODS: A Study of 30 patients who had fractures of various long bones in children age ranged from 2 years to 12 years were undertaken in Govt. General hospital, Kakinada under Rangaraya Medical college from May 2012 to April 2014.

Cases were selected on the basis of a fixed inclusion and exclusion criteria.

Inclusion Criteria:

1. Fracture shaft of femur (AO 32 A, B & C).
2. Tibialdiaphyseal fractures (AO 42 A, B & C).
3. Fracture shaft of humerus (AO 12 A, B & C).
4. Compound Fractures up to Gustillo Anderson Type III B.
5. Patients aged between 2 to 12 yrs.

Exclusion Criteria:

1. Patients below 2yrs of age and above 12yrs of age.
2. Compound Fractures Gustillo Anderson Type III C.
3. Patients associated with co morbid conditions like compartment syndrome.
4. Unmotivated patients.

SURGICAL PROCEDURE: All the cases were operated under general or spinal anaesthesia on anaesthetists descision. All femoral fractures were fixed with retrograde nailing technique with juxta epiphyseal entry points mediolaterally to lower femoral epi physis (Figure 11a, b). If only

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one nail is used a lateral entry point is chosen. All the tibial fractures fixed were nailed anterograde with medio lateral juxta epiphyseal entry points to upper tibial epiphysis (Figure 11c). Whenever C arm was not used fracture was reduced by direct means of open reduction. Length of nails was determined by measuring the contra lateral normal limb and subtracting 4 cm for both epiphyseal thickness. Diameter of nails to be used was assessed by the lateral radiographic view of the fractured bones. Post operatively the patients were allowed active range of movements limited by pain all the patients were serially followed up to 24 weeks post operatively with monthly roentgenographs of the fixations. Complete weight bearing was allowed at 6 weeks post operatively.

RESULTS & OBSERVATIONS: Age ranged from 2 years to 12 years mean 7 years. Diaphyseal long bone fractures in the age group 2-6 years comprising of 13 cases and age group 7 -12 years comprising of 17 cases in the present study (Figure 1) Nineteen cases involved on right side and eleven cases involved on left side. 10 female and twenty male patients comprised the study (Figure 2). 86.33% cases were done under general anaesthesia (Figure 3). Mean duration of surgery war 35 minutes range from 20 minutes to 50 minutes (Figure 4). Mean hospital stay at our institute was 18 days range 8 to 28 days. Out of 30 patients majority had a hospital stay between 1-3 weeks (77.77%) (Figure 5). 90 percent of the patients had less than 50 ml blood loss during operation. Average blood loss was 40 ml (Figure 6). 20 percent of the patients were able bear full weight by the end of 6 weeks whereas all patients were able to bear full weight by the end of 12 weeks post operatively (Figure 7) 66.66% of fractures united within 9 to 16 weeks with a mean duration of 7.3 weeks including the remaining which have united in less than 9 weeks. (Figure 8). In this study the average number of nails used per fracture fixation was two.

Results were evaluated both anatomically and functionally according to the following criteria.

Anatomical: Excellent: No shortening or deformity clinically or radiologically. Good: Up to 2cms shortening. No rotational deformity. Fair: 2 to 4cms shortening. Slight rotational deformity. Poor: more than 4cms shortening. Obvious rotational deformity. Excellent results were obtained in 90 percent cases whereas 6.66 percent patients had good anatomical results. 3.33% patients had fair results (Figure 9).

Functional: Excellent: Full range of joint movements. No disability. Good: Slight limitation (10-20%) of joint movements. Other disability hardly appreciable. Fair: Considerable limitation (20-50%) of joint movements. Mild to Moderate disability. Poor: More than 50% limitation of joint movements. Moderate to Severe disability. Excellent results were obtained in 80 percent of patients, 16.66 of patients had good functional results and 3.33 percent patients had fair results. (Figure 10).

Complications: The complications observed were shortening which was seen in 2 cases. Slight to considerable limitation of joint movements were seen in 6 patients. Rotational deformity was seen in 1 patient. In the present study there were 3 cases of infection. No patient died during the

post-operative period. None of the cases reported any complications like migration of nail, infection, bed sores and implant failure. None of them required any secondary procedure.

DISCUSSION: Paediatric diaphyseal fractures had been traditionally treated with non-operative methods.[6,7,8] However over the past two decades operative treatment has been increasingly tried in order to avoid prolonged immobilization and other complications of earlier methods. Most popular of these operative treatments have been internal fixation with plate, rigid fixation with intra medullary nail, external fixation and more recently flexible intra medullary nailing.[16] Each of these methods has its advantages and disadvantages. Plating of the femur demands extensive soft-tissue dissection and has been related with hardware failure, infection and greater blood loss.[17] Oh et al reported 16 isolated fracture femur cases & 12 fracture femur with associated injury.[18] Aktugluet al reported 14 cases of poly trauma out of 30. The average operating time in the present study was 40 min.[19] Iwegbu and Patel in 1981 reported the average operating time of 40 minutes.[20] Whereas Pass off and Schein in 1980 reported average operating time of 100 minutes.[21] This is marked contrast to the other types of fixation like interlocking nailing and plating techniques. Average time taken for radiological union in the present study was 7.3 weeks. Ozturkmenet al reported 6.6 weeks average period for union (6-12wks).[22] Linhart reported average 4 wks for union.[23] Heybeliet al reported average 7.4wks (5-12wks) for union.[24] Oh et al reported average 10.5 weeks for union.[18] There was no case of delayed or non-union in our series. Narayanan et al also did not report any union difficulties.[12] Luhmann et all observed one hypertrophic non-union in 43 treated femoral shaft fractures.[25] In our study, average time for union was 9 weeks (6-12wks).

CONCLUSION: The following conclusions have been arrived at after comparing the overall results of this study with that obtained by other works. Ender's nailing is ideally suited not only for the children and younger age groups but also in biologically old, fragile, high anaesthesia risk and osteoporotic patients Hence it can aptly be called as "A friendly to paediatric, geriatric and younger age groups." This method is less traumatic, gentle and one of the simplest methods known. This method is based on sound biomechanical principles. The intramedullary position of the implant places it more in line with the weight bearing forces thereby reducing the tendency of the fracture to settle in a deformed position. The excellent biomechanics is reflected by the absence of implant failure. No case of delayed or non-union in the present study. Bilateral entry portals and criss crossing of the nails each other twice in the canal improve the bending and rotational strength. So it is a misconception to believe that fixation with Ender's nails is inherently unstable. Early ambulation is one of the advantages of the Ender's nailing. This helps to minimize the duration of hospital stay and complications of enforced bed rest like pneumonias, bed sores, UTI, thrombo embolic phenomenon, etc. The risk of infection is negligible as the incision is far away from the Fracture. The high incidence of complications in unstable fractures necessitates a certain degree of caution to be exercised. Few weeks' protection often required post operatively. There is a high incidence of knee stiffness with this procedure which can be minimized by proper placement of entry portal and rigorous physiotherapy in the postoperative phase. Nails are low cost and most affordable by many people in developing countries, under developed countries.

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Operative time is less. Patients are more comfortable from 1st post-operative day onwards because of least traumatic in nature. In segmental fractures Ender's nailing eliminates the torsion of the middle segment, so chances of necrosis of the middle segment is minimised. Ender's technique can be carried out by an average Orthopaedic surgeon.

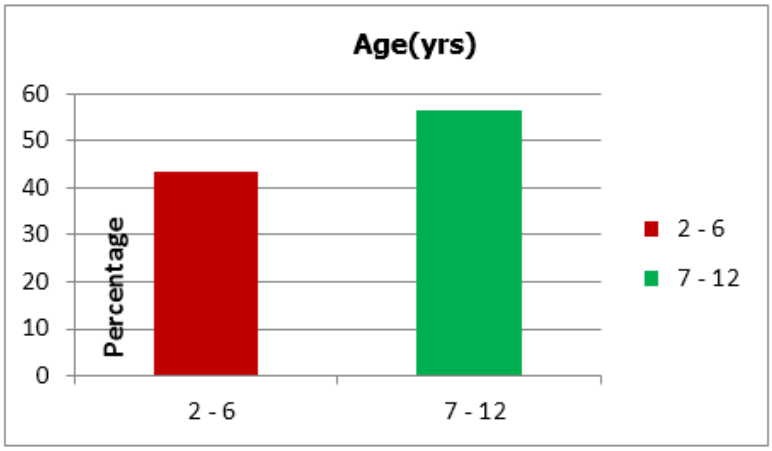

Figure 1: Age incidence

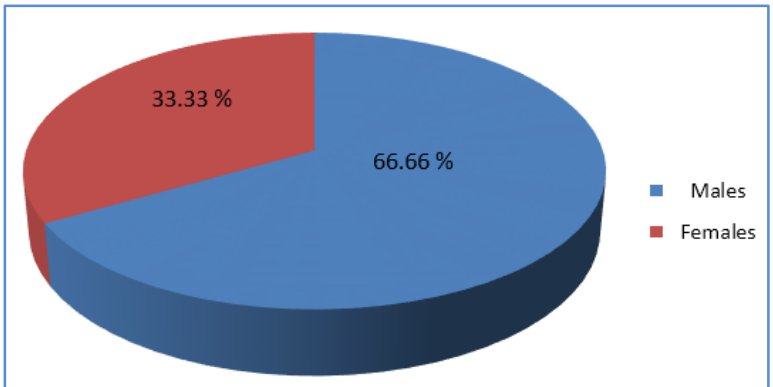

Figure 2: Sex incidence

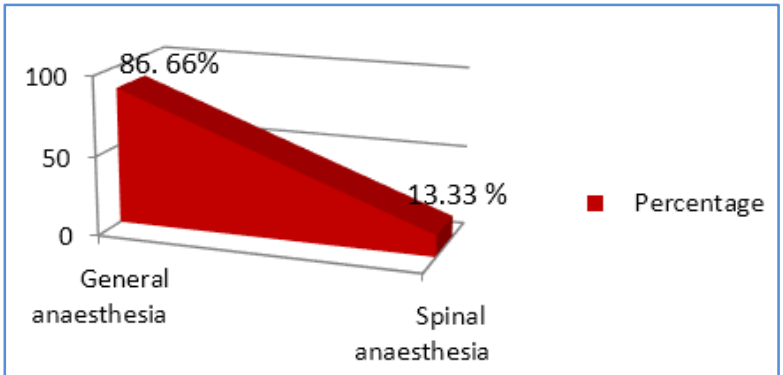

Figure 3: Type of anaesthesia used

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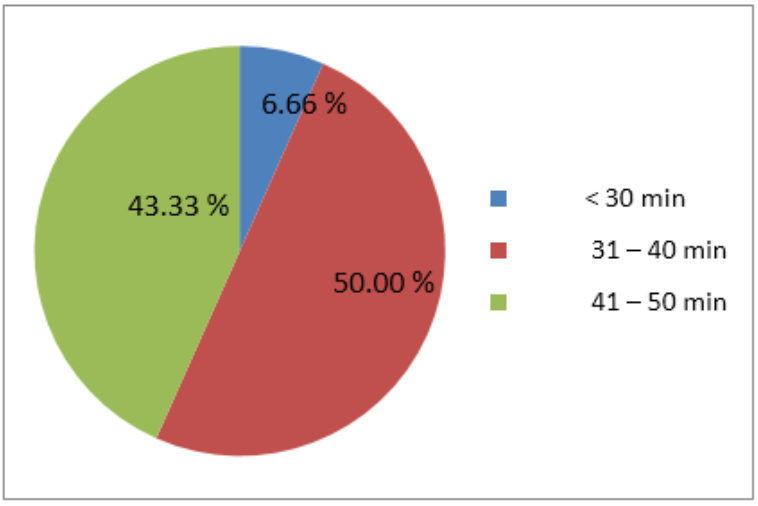
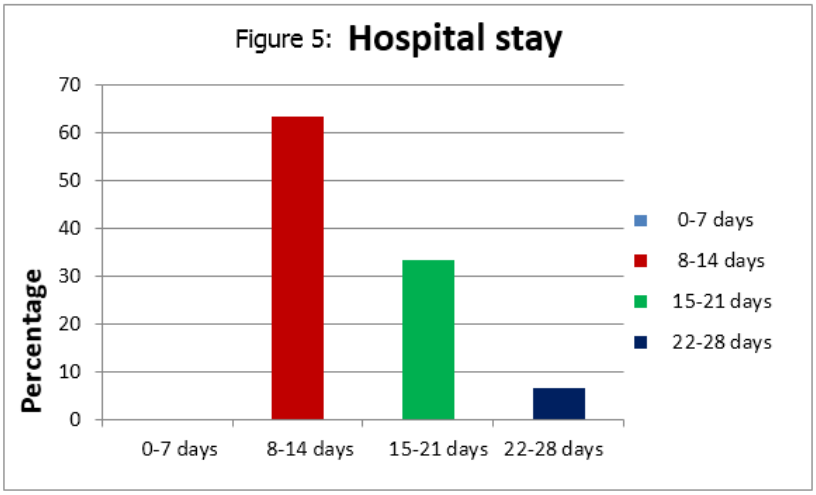
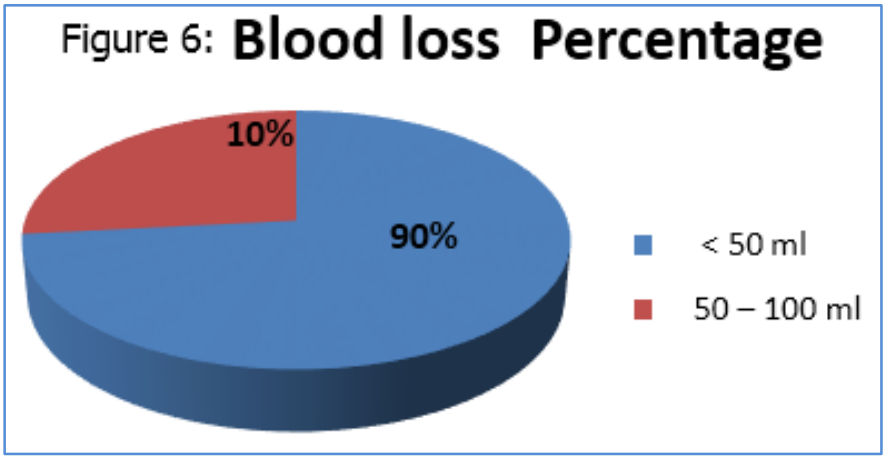


Figure 4: Duration of surgery excluding anaesthesia time





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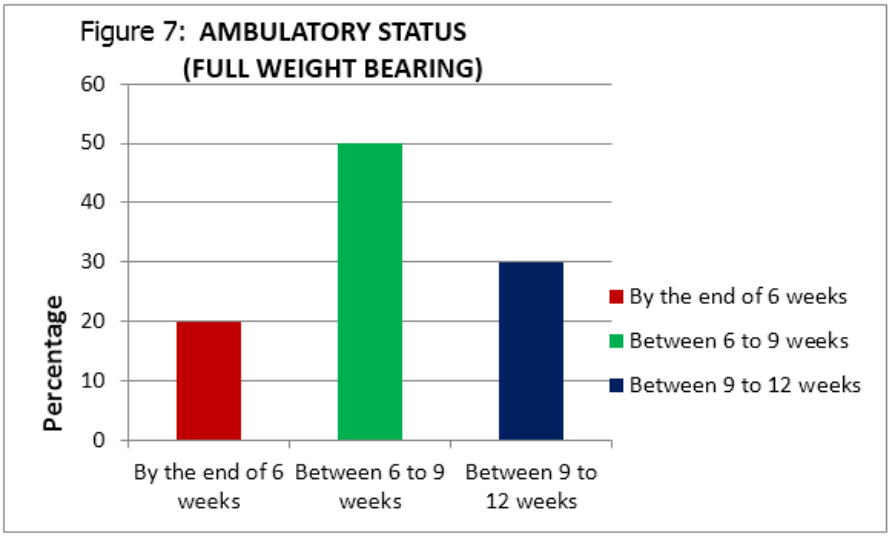


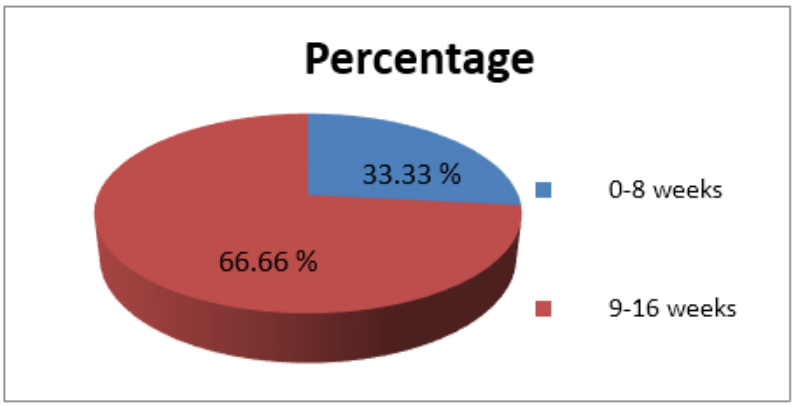
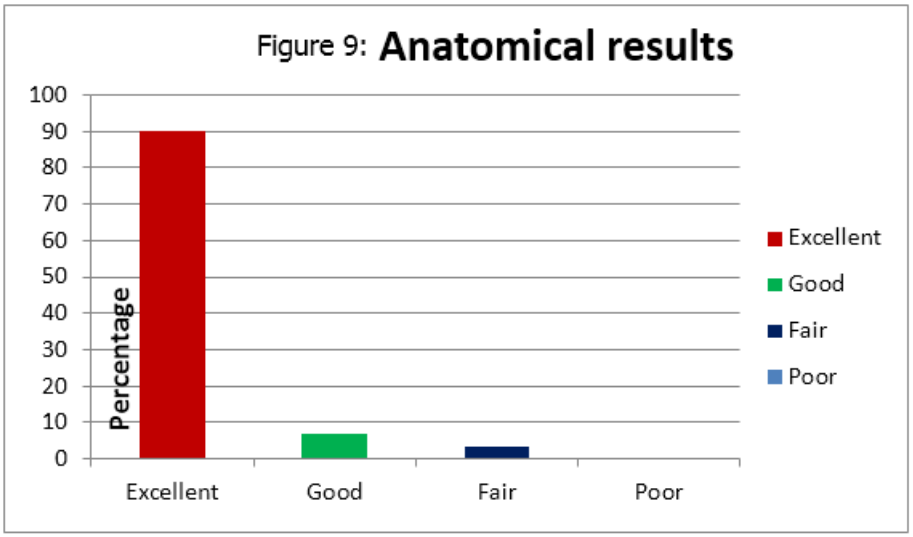


Figure 8: Duration for fracture union



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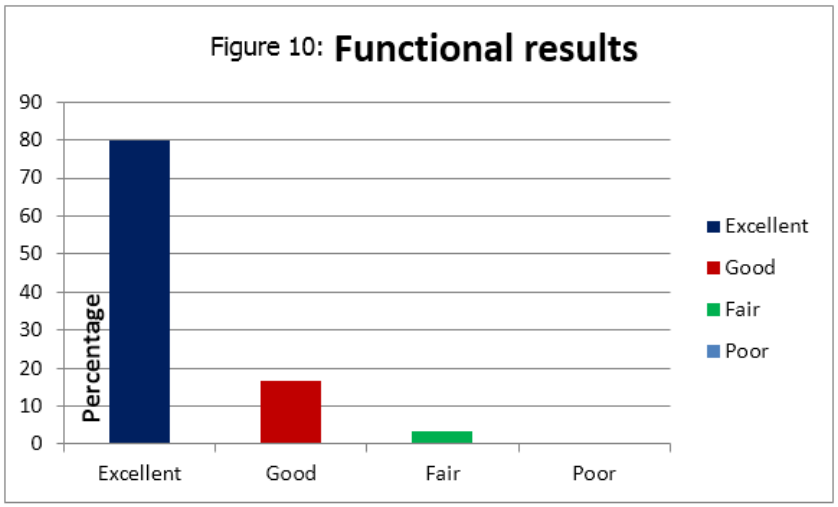

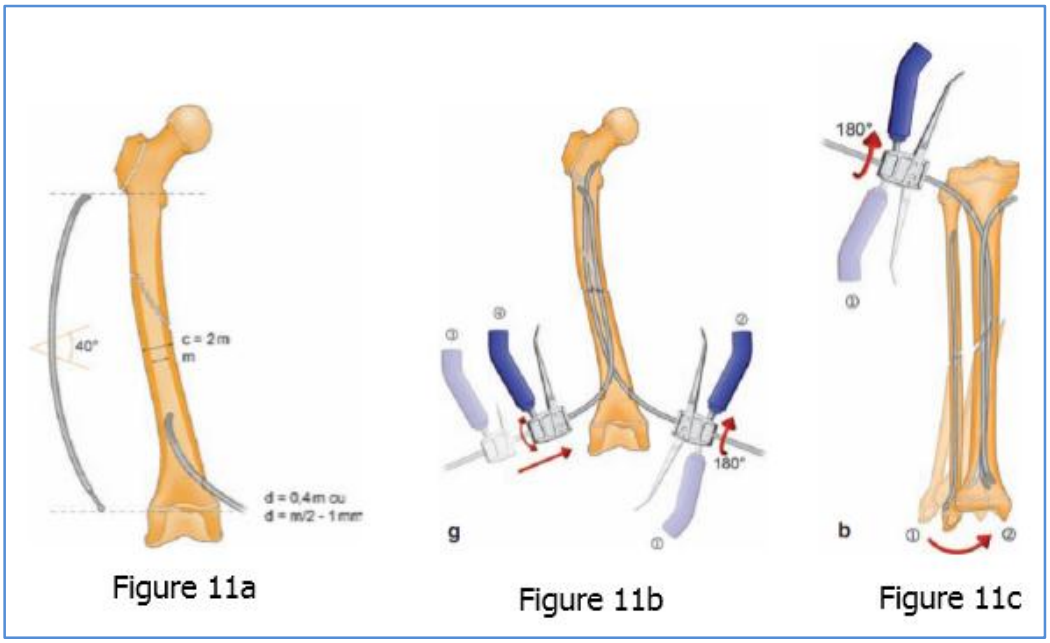

Figure 11a Figure 11b Figure 11c

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