Comparative Study of Hip Spica Cast versus Titanium Elastic Nail: The Treatment of Diaphyseal Femoral Fracture in Children

Harish Kumar Jain, Suresh Dhakar, Manoj Sharma, Mukul Jain, Hemlata Sharma

AIMS & OBJECTIVES – To compare the end results of treatment of diaphyseal femoral fractures in children up to 10 years, by conservative method with operative method (Close Reduction & Titanium Elastic Nailing [TEN]). MATERIAL & METHOD: Study was conducted at SRG Hospital of Jhalawar Medical College, Jhalawar (Rajasthan). Out of 153 Patients of diaphyseal fracture femur, 108 were treated conservatively by spica cast & 45 were treated with TEN. Follow up done regularly up to one year of injury with taking into account, various parameters. RESULTS: All diaphyseal fractures of femur healed, whether treated conservatively by spica cast or treated operatively with Titanium Elastic Nail. The level of satisfaction was very high on the part of patients as well as on the part of doctors. Happiness of parents of operated children delighted the orthopaedic surgeons. CONCLUSIONS: Results of TEN turned out to be far superior to traction & spica cast treatment in paediatric femoral fractures. Rate of complications was far low with operative than conservative Treatment.

Femoral-shaft fractures are among the most common fractures of the lower extremity in children, with an annual incidence of up to 1 per 5,000. Hinton RY et al [1], Buess E et al [2]. Orthopaedics comes across the diaphyseal femoral fractures in day to day life very frequently. These fractures are more common in rural children than in children of cities because of frequent playing and climbing on trees. Various factors play role in choosing the line of treatment. Such as age, financial status of parents, literacy of child as well as parents, vision of future, hesitancy to operative procedures, inconvenience of spica cast, boldness of patient as well as parents. The spica cast treatment is very old treatment existing since last many centuries, while TEN is new modality of new era, and is in use for last 30-40 years. We tried to compare the end results of both modalities of the treatment of diaphyseal fracture femur and found the operative treatment stands far superior to age old traditional cast treatment.

With the increasing literacy rate and day by day extension of reach of television to remote areas, the rural population is now readily accepting the newer fancy method of treatment (TEN) for the femoral shaft fractures of their children.
2. Material and Methods

Prospective study was conducted in the department of orthopaedics, SRG Hospital of Jhalawar Medical College, Jhalawar (Rajasthan). Study period was from April 2008 to December 2010 i.e. 2 years and 9 months.

Children with closed femoral shaft fracture, age ranging between 5 to 10 year were included in this study. The selection of mode of treatment whether operative or conservative was purely based on the choice of parents, out of these two options. Cases with comminuted fracture (Winquist type III and type IV), patients with neuromuscular dystrophy, cerebral palsy, metabolic bone disease, pathological fracture and Anderson Gustilo grade II & III open fractures were excluded from this study.

Every patient included in this study was managed initially with below knee skin traction. For patients in TEN operation group the standard technique was applied according to the method described by Flynn and colleagues. The operations were done in O.T. with full aseptic precautions, under GA/SA on a fracture table. After a linear incision given at supracondylar region about one centimeter in length, fascia was cut and muscle fibres were split to reach up to the bone. An entry hole was made with awl one centimeter above the growth plate under C-arm. Then 2 TE nails having approximate 40% diameter of narrowest part of diaphysis were selected and inserted retrogradely reaching up to the trochanteric region.

Our patients received cephalosporin antibiotics preoperatively 12 hours before surgery and continuously for 3 days after surgery. No supportive plaster slab was given in operative group. Patients were discharged after 3 days with the advice to attend OPD after 2 week for stitch removal.

Spica cast group was also managed initially with skin traction. Once edema subsided, early one & half spica cast was applied under general anaesthesia. Limb was fixed in spica cast with hip joint at 20° to 30° flexion & knee joint at 10° to 15° flexion with 10° to 15° external rotation of lower limb.

Spica cast was kept for 6 to 8 weeks depending upon the age of patient. After removal of spica cast, non weight bearing hip, knee and ankle mobilizing exercises were advised for 3 to 4 weeks. After this period protected weight bearing was allowed.

All patients were followed up at 2 week for stitch removal or assessment of spica cast, then at 6 weeks for assessment of union, limb alignment, rotation, range of motion of lower limb joints, operative site. Patients were followed up later every month. Details of Hospital stay duration, fracture union time, non weight bearing time, partial weight bearing time and complications were recorded.

Angular and rotational alignment was assessed postoperatively and in subsequent visits by AP & lateral radiographs. Final assessment in both groups was done at six months follow up with Flynn criteria.

Fracture union was defined clinically by ability of painless full weight bearing and radiologically by bridging callus visible at atleast 3 cortices.

Delayed union was defined by persistence of pain & tenderness, and no visible callus after 3 months of fracture treatment. Non union was considered by painless movements in 2 planes and absence of visible callus on skiagrams. Angular malalignment was defined by more than 10° angulation in coronal plane & more than 15° angulation in sagittal plane. Wall EJ et al (2008).3. Rotation greater than 10° was defined as rotational malalignment. Limb length was measured with tape & compared with normal limb to decide limb length discrepancy. Final outcome was assessed using Flynn criteria. Flynn J et al (2001)4.

3. Results

Initially 153 patients were included in this study with informed consent. 108 patients were treated with early spica cast (Within one week) and remaining 45 patients were treated with closed reduction & internal fixation with Titanium Elastic nail under C-arm control. Eighteen patients from spica cast group and 3 patients from operative group lost from follow up were excluded from this study.

Remaining 132 patients were followed up properly up to 6 to 18 months after the application of spica or TE nailing. In spica cast group 74 were male and 16 were female child. Mean age of this group was 7.8 years. In operative group 29 were male and 13 were female child with mean age of 8.2 years.

Follow up period in spica cast group was 10 to 18 months and in operative group it was 6 to 13 months. Average time of union in spica cast group was 8 to 14 weeks (mean 10.2 weeks). In operative group average union time was 7 to 10 weeks (mean 8.4 weeks). Mean range of knee joint motion in spica cast group was 137.4° ± 5.4° and in operative group it was 127.3° ± 9.6°.

Two patients developed infection in operative group and none in spica cast group. Infection was superficial and was cured with oral antibiotics.

Pressure sore were found in 9 patients (10 %) of spica cast group at the time of cast removal.

In 6 patients (6.67%) of spica cast group delayed union was noted where all patients in operative group got union within 3 months time.

Fourteen patients (15.55%) in spica cast group got malunion whereas in operative group malunion was noticed not even in a single case.

1.5 cm shortening to 1cm lengthening was noted in 10 patients (11.11%) of spica cast group. Transient Paroneal Nerve Injury was noted in 1 patient (1.11%) of spica cast group.
Table: 1. Comparison of outcomes between groups

<table>
<thead>
<tr>
<th></th>
<th>Spica cast n = 90</th>
<th>TEN n = 42</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Mean = 7.8</td>
<td>Mean = 8.2</td>
</tr>
<tr>
<td>Male/female</td>
<td>74 (82.2%) / 16 (17.8%)</td>
<td>29 (69%) / 13 (31%)</td>
</tr>
<tr>
<td>Hospital stay (days)</td>
<td>20.5 ± 5.8</td>
<td>6.9 ± 2.9</td>
</tr>
<tr>
<td>Time to start walking with aids (weeks)</td>
<td>6 to 11</td>
<td>Mean = 9.8</td>
</tr>
<tr>
<td>Time to start walking independently (weeks)</td>
<td>8 to 14</td>
<td>Mean = 10.2</td>
</tr>
</tbody>
</table>

| Parent satisfaction       | Excellent 8 (8.6%) / 22 (52.2%) | Good 59 (66.3%) / 20 (47.8%) | Moderate 8 (8.6%) / 0 | Weak 15 (16.6%) / 0 |

| Knee range of motion (degree) | 137.4 ± 5.4 | 127.3 ± 9.6 |

Table: 2. Comparison of complications between groups

<table>
<thead>
<tr>
<th>Complication</th>
<th>Spica cast n = 90</th>
<th>TEN n = 42</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection</td>
<td>0</td>
<td>2 (4.8%)</td>
</tr>
<tr>
<td>Pressure sore</td>
<td>9 (10%)</td>
<td>0</td>
</tr>
<tr>
<td>Delayed union</td>
<td>6 (6.67%)</td>
<td>0</td>
</tr>
<tr>
<td>Malunion</td>
<td>14 (15.55%)</td>
<td>0</td>
</tr>
<tr>
<td>Limb length discrepancy</td>
<td>10 (11.11%)</td>
<td>0</td>
</tr>
<tr>
<td>Paroneal N Palsy</td>
<td>1 (1.11%)</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure: 1 Preoperative and immediate postoperative radiographs.

Figure: 2 Postoperative radiograph at 4 weeks and 8 weeks.

Figure: 3 Radiograph before spica treatment

Figure: 4 Malunion after spica treatment

4. Discussion
Diaphyseal femoral fracture treatment with traction and spica cast is still standard treatment. But now a days such treatment in older children becoming less popular due to several reasons like...
greater percentage of complications, lesser patient compliance, panic in parents mind, demand of minimal hospital stay by patient and attendant these days.

An ideal device for treating paediatric femur fractures would be simple internal splint, allowing the mobilization and maintenance of alignment until bridging callus is formed. It will help in rapid healing and ability to remodel without hampering the blood supply to femoral head. Flynn JM et al [4]. TEN ensures this quality.

Duration of hospital stay in present study in spica cast group was higher than that in operative group. These findings are similar to those reported earlier. Flynn JM, Luedtke LM et al [5], Greisderg J et al [6], Herndon WA et al [7], Reeves RB [8].

Present study demonstrates higher rate of malunion in spica cast group. High incidence of malunion in children treated with spica cast have been reported earlier also Flynn [M, Luedtke LM et al [5], Pollak AN [9], Thompson JD et al [10]. Children in spica cast group had significantly higher limb length discrepancy than those treated with TEN at 6 months follow up. Higher incidence of limb length discrepancy with spica cast has been also reported by previous authors. Pollak AN [9], Martinez AG et al [11]. It has been reported by Flynn et al also. Flynn JM, Luedtke LM et al [5].

Early union and weight bearing was possible in operative group as compared to spica cast group due to near anatomical reduction and maximum fracture surface contact. Flynn JM, Luedtke LM et al [5], Greisderg J et al [6].

Flynn score was better in operative group. Common causes of poor Flynn score in spica cast group were malunion and limb length discrepancy. Patient and parents satisfaction level was much more higher in operative group than that in spica cast group.

5.Conclusion

In modern era of fashion and comfort, titanium elastic nail treatment stands far better than spica cast for treatment of diaphyseal femoral fractures. TEN takes lesser time for union, has minimal limb length discrepancy and malignment, allows earlier rehabilitation and return to activities of day to day life than spica cast treatment. Patient feels very much comfortable after TEN treatment as compared to spica treatment. Parents of children, treated with TEN, remained much happier than the other group. Convenience of micturition & defecation in TEN group, also make it superior than spica cast treatment for diaphyseal femoral fractures.

Acknowledgement

I am grateful to Dr. Sushma Pandey, superintendent, S.R.G. Hospital Jhalawar She has given me good cooperation on each & every point in present study.

I would like to pay thanks to Dr. P.K. Gupta, Dean Jhalawar Medical College, Jhalawar, for his persistent inspiration for this research work.

6.References