ABSTRACT

Purpose. To evaluate the treatment outcome of skin traction followed by spica casting for closed femoral shaft fractures in children.

Methods. Between September 1997 and December 2001 inclusive, outcomes of 63 children aged one month to 15 (mean, 5.3) years with closed femoral shaft fractures managed with skin traction and spica casting were reviewed. Depending on age, patients were kept in traction from 2 to 15 (median, 9) days, then in spica casts for 2 to 8 (median, 5) weeks.

Results. Bony union took 3 to 12 (median, 6) weeks. There were no malunion, nonunion, or rotational deformities. Nor were there any significant limb length discrepancies, pressure sores, or nerve palsies. On no occasion was a spica cast removed and reapplied for loss of fracture reduction. At final follow-up, limb length discrepancy was noted in 14 (22%) of the patients, but none had a discrepancy of greater than 1.5 cm or a short-legged gait.

Conclusion. Skin traction followed by spica casting for closed femoral shaft fractures in children is safe, cost-effective and associated with a low complication rate. It is effective in children below 5 years of age and no less effective in older children, except in instances of open fracture, multiple fractures, or older children with large statures, which conditions render them intolerant to spica casts.

Key words: femoral fractures; traction

INTRODUCTION

Traditionally, paediatric femoral shaft fractures have been treated with skeletal traction followed by spica cast immobilisation. Over the past decade, there has been a shift towards surgical fixation and early spica casting, because the latter procedure enables shorter traction time and hospital stay and quicker rehabilitation. The advent of new implants such as the flexible intramedullary nail contributes to such trend. The enthusiasm for surgical fixation and early spica casting has been tempered by various complications such as infection, necrosis, and implant failure. Given the excellent fracture healing potential in children, we believe that skin traction followed by spica casting achieves favourable outcomes and should not be excluded as a viable treatment option in older children.

METHODS

Between September 1997 and December 2001 inclus-
ive, 63 children with closed, isolated femoral shaft fractures managed conservatively in our hospital were retrospectively reviewed. Patients with neuromuscular disorders or metabolic bone diseases predisposing to recurrent falls or fractures were excluded. Shortly after admission, the injured limbs were immobilised in skin traction using weights appropriate for age. Children who weighed <10 kg (<2 years old) were put on Gallows traction, while those who weighed >10 kg (≥2 years old) were put on Russell’s traction. Radiographs were taken after 24 to 48 hours with the patient in traction to evaluate fracture alignment.

After 7 to 14 days in traction when signs of fracture consolidation were confirmed by absence of tenderness at the site, a one and a half hip spica was applied under general anaesthesia. Radiographs were taken after 24 to 48 hours with the patient in traction to evaluate fracture alignment.

After 7 to 14 days in traction when signs of fracture consolidation were confirmed by absence of tenderness at the site, a one and a half hip spica was applied under general anaesthesia. At the time of spica casting, radiographic shortening of ≤2 cm was considered acceptable. Acceptable coronal alignment was deemed as <10° valgus and <5° varus; acceptable sagittal alignment was <10° recurvatum and <20° procarvatum.

Before discharge from hospital, patients’ caregivers received spica cast care instructions. The patients were followed up in the out-patient clinic with radiographs taken at each review to monitor fracture alignment. After the spica cast was taken off and the fracture had united, a clinical examination was performed to evaluate gait abnormalities, limb length discrepancy, rotational malalignment, and significant deformity. Any functional limitations were also documented.

RESULTS

Of 67 children admitted with femoral shaft fractures, 4 were managed surgically (3 had associated ipsilateral tibial fractures and one sustained a contralateral open femoral fracture). The remaining 63 were managed conservatively with a minimum follow-up of at least 6 months. The mean age of the patients was 5 years (range, one month to 15 years; Table 1); 42 were males and 21 females. 32 (51%) were Chinese, 27 (43%) were Malays, and 4 (6%) were Indian. 35 (56%) patients had fractured the right femur and 30 (48%) the left femur. 34 (54%) of the patients was a fall, in 17 (27%) it was a road traffic accident; 30 (48%) were injured at home, 6 (10%) in school, and the remaining 30 (48%) at various locations outside their homes such as the playground (Table 2).

Depending on age, patients were kept in traction for 2 to 15 (median, 9) days, then in spica casts for 2 to 8 (median, 5) weeks. Bony union took 3 to 12 (median, 6) weeks (Table 3). There were no instances of malunion, nonunion, significant residual limb length discrepancy (>1.5 cm) or rotational deformities. Nor were there any pressure sores or nerve palsies. On no occasion was a spica cast removed and reapplied for loss of fracture reduction. At final follow-up, limb length discrepancy was noted in 14 (22%) patients (0.5 cm in 4, 1 cm in 8, 1.5 cm in 2; Table 4), but none had a discrepancy of >1.5 cm or a ‘short-legged’ gait.

DISCUSSION

Epidemiological studies of paediatric femoral shaft fractures reveal a bimodal age distribution with peaks occurring at the ages of 2 and 7 years. Fall
is the commonest cause of femoral shaft fractures in children younger than 6 years, while road traffic accident is the commonest in children older than 6 years and boys had >2.5 times the fracture rate of girls.5 Similar findings were noted in this study.

The management of femoral shaft fractures in children is controversial. Many surgeons advocate surgical modalities such as compression plates,6 flexible nails,7 and external fixation. Some suggest a management algorithm based on age: conservative management for children aged one to 5 years, surgery for children older than 11 years. Children between 6 and 11 years belong to the controversial age-groups for which there is little consensus, but a shift towards surgical intervention is evident.1,2

Surgical fixation of femoral fractures is not without risk of complications. With flexible intramedullary nails, prominent nail-ends at the entry points are often the source of discomfort, and implant removal is indicated after fracture union. Flexible nails do not control rotation and a hip spica is sometimes used to prevent such rotation at the fracture site. Rigid interlocking intramedullary nails risk producing femoral neck fractures and femoral head osteonecrosis, if inserted antegradely using the standard piriformis fossa entry point.8 Other complications associated with intramedullary nailing include septic arthritis after nail removal.9 Two common complications of plating are implant failure and periprosthetic fractures. For external fixation, the principal concern is pin tract infection.10,11 Different treatment modalities for 81 patients with paediatric femoral shaft fractures were reviewed12: 41% (9/22) treated with external fixation had pin tract infections, 9% (1/11) treated with flexible nails had nonunion, and 8% (1/13) treated with a reamed intramedullary rod had avascular necrosis of the femoral head.

Early closed reduction and hip spica casting has gained popularity as an effective treatment modality. Many studies comparing early casting versus traction and casting did not show any significant difference in outcomes.13–15 There were no rotational inequalities, leg length discrepancies, and gait abnormalities between patients treated with either treatment modality. However, an 18% incidence of unacceptable shortening (>2.5 cm) was reported in patients treated with early spica casting.16 Shortening of >2 cm was the commonest complication of early (within 7 days of injury) spica casting in 43% (22/51) of the patients.17 Patients with unacceptable shortening after spica casting required cast removal and traction for 2 weeks before recasting.17,18 Thus, surgeons should keep unacceptable shortening in mind when planning early spica casting for paediatric femoral shaft fractures. Frequent follow-up with repeated radiographs is required in the first 3 weeks to detect shortening and displacement of the fracture in the spica cast.

Many studies have shown good results when femoral shaft fractures were treated conservatively. Limb shortening, loss of reduction, peroneal nerve palsy, and angulation are potential complications of hip spica casting. Recovery of our patients was uneventful and with minimal complications. This may be attributed to careful evaluation of fracture alignment during traction, proper spica casting techniques, and careful evaluation of fracture reduction during the healing period. For the 6 to 11 years’ age-group in whom treatment of femoral shaft fractures remains controversial, we consider that surgical intervention is not indicated. Similarly, for adolescents of average stature, conservative management did not lead to a poor outcome, probably because of the smaller stature of our pre-adolescent children.

The shortcomings of traction and spica casting are prolonged hospitalisation as well as the discomfort

<table>
<thead>
<tr>
<th>Age-group (years)</th>
<th>No. of patients</th>
<th>Median time for traction (range) [days]</th>
<th>Median time for spica casting (range) [weeks]</th>
<th>Median time to union (range) [weeks]</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2</td>
<td>11</td>
<td>6 (2–11)</td>
<td>4 (2–8)</td>
<td>4 (3–6)</td>
</tr>
<tr>
<td>2–5</td>
<td>24</td>
<td>8 (4–14)</td>
<td>4 (3–8)</td>
<td>6 (3–10)</td>
</tr>
<tr>
<td>6–11</td>
<td>19</td>
<td>10 (6–14)</td>
<td>5 (4–8)</td>
<td>7 (4–12)</td>
</tr>
<tr>
<td>&gt;11</td>
<td>9</td>
<td>14 (8–21)</td>
<td>7 (4–8)</td>
<td>8 (6–10)</td>
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Table 3

<table>
<thead>
<tr>
<th>Limb length discrepancies (cm)</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil</td>
<td>49</td>
</tr>
<tr>
<td>0.5</td>
<td>4</td>
</tr>
<tr>
<td>1.0</td>
<td>8</td>
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<tr>
<td>1.5</td>
<td>2</td>
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Table 4

Patients with limb length discrepancies
of immobilisation and psychosocial impact of spica casting, despite having been effective in our local population with a low rate of complications.

Other surgical options often cost as much as or more than traction and spica casting despite patients on traction needing longer hospital stay.\(^{17}\) Costs of complications requiring a second surgery are also added to treatment costs. We compared 2 patients with femoral shaft fractures treated in our institution: one treated conservatively by traction and spica casting, the other surgically (with flexible intramedullary nailing). Both were of the same age and admitted to the same ward class and had uncomplicated hospital stays. Treatment with a flexible intramedullary nailing costed 1.5 times as much as traction and spica casting (Table 5).

<table>
<thead>
<tr>
<th>Patient age (years)</th>
<th>Treatment modality</th>
<th>Hospital stay (days)</th>
<th>Cost (Singapore $)</th>
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<tr>
<td>11</td>
<td>Traction and spica casting</td>
<td>9</td>
<td>$814</td>
</tr>
<tr>
<td>12</td>
<td>Flexible intramedullary nailing</td>
<td>5</td>
<td>$1444</td>
</tr>
</tbody>
</table>

CONCLUSION

Traction and spica casting is a safe treatment for closed femoral shaft fractures in children and even adolescents. It has a low risk of complications. We recommend its use except for open fractures, multiple fractures, or fractures in older children with large stature, for whom surgical intervention is indicated.

REFERENCES