May External Fixator Be an Appropriate Alternative Therapeutic Option in Pediatric Femur Fractures?

Pediatrik Femur Kırıklarında Eksternal Fiksatör Uygun Bir Tedavi Alternatifi Olabilir mi?

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ABSTRACT Objective: Our aim was to evaluate the outcome of external fixation in pediatric femur fractures. **Material and Methods:** Seventeen children (11 males, 6 females) with isolated closed fractures were treated on the day after admission by closed reduction and unilateral external fixator. Fourteen cases had fractures on left side, nine were due to traffic accident and the rest was due to fall. All of the fixators were routinly dynamized at sixth week of surgery. Mean age was 8.3 (range: 6-11), and mean follow-up period was 12 months (range: 7-18). **Results:** Mean operation time was 27 minutes (range: 18-40), and mean duration of hospitalization was 1.7 days (range: 1-3). External fixators [nine Orthofix type, eight limb reconstruction system (LRS) type, randomly] were applied with cortical contact and all were removed by a mean healing time of 73 days (range: 51-95). Five cases (29.4%) developed pin-tract infection and treated with oral antibiotics and by changing wound dressing frequently. On follow up, no cases of nonunion, malunion, or limitation in range of motion for hip and knee joints were noted. Rotational deformity were not seen in any cases, and average angulation at fracture site was 3.4 degrees in anteroposterior plane and 3.8 degrees in lateral plane radiographs (range 0-8 degrees). One child (5.9%) had mid diaphyseal refracture two months after removal of fixator. There was no overgrowth but three patients (17.6%) had a true shortness of 0.5 cm. **Conclusion:** Hip spica casting is still the most commonly used method in pediatric femur fractures. Nonetheless, in order to avoid complications secondary to such methods and to allow for early ambulation, we believe that osteosynthesis via external fixator can be a good alternative in the treatment of pediatric femur fractures.

Key Words: Femoral fracture; external fixator

ÖZET Amaç: Amacımız, pediyatrik femur kırıklarında eksternal fiksatör uygulamasının sonuçlarını değerlendirmekti. **Gereç ve Yöntemler:** Onbiri erkek, altısı kız izole kapalı femur kırığı olan 17 hastaya hastaneye başvuru gününde kapalı redüksiyon ve unilateral eksternal fiksatör uygulandı. Olguların 14'ü sol taraflıydı, dokuzu trafik kazası ve diğerleri düşme nedenliydi. Tüm fiksatörler rutin olarak altıncı haftada dinamize edildi. Ortalama yaş 8.3 (aralık: 6-11), ortalama takip süresi 12 ay (aralık: 7-18) idi. **Bulgular:** Cerrahi süresi ortalama 27 dakika (aralık: 18-40), hastanede kalış süresi ise ortalama 1.7 gündü (aralık: 1-3). Randomize olarak dokuz orthofix tipi, sekiz uzuv rekonstrüksiyon sistemi (LRS) tipi fiksatör kortikal temasla uygulandı ve tümü ortalama iyileşme süresi 73 günde (aralık: 51-95) çıkarıldı. Pin dibi enfeksiyonu gelişen beş vaka (%29.4) sık pansuman ve oral antibiyotik ile tedavi edildi. Takipte hiçbir olguda kaynamama, yanlış kaynama, komşu eklemlerde hareket kısıtlılığı gözlenmedi. Rotasyonel deformite izlenmezken, direkt grafide kırık hattında anteroposterior planda ortalama 3.4 derece, lateralde 3.8 derece açılanma (aralık: 0-8) mevcuttu. Bir vakada (%5.9) fiksatörün çıkarılmasından iki ay sonra mid diyafizyel refraktür gelişti. Hiçbir olguda uzunluk artışı gözlenmezken, üç hastada (%17.6) 0.5 cm gerçek kısalık tespit edildi. **Sonuç:** Pelvipedal alçı, pediyatrik femur kırıklarında halen en sık kullanılan yöntemdir. Bununla beraber, diğer yöntemlere ikincil komplikasyonlardan kaçınmak ve erken mobilizasyonu sağlamak için, bu kırıkların tedavisinde, eksternal fiksatör ile osteosentezin iyi bir tedavi alternatifi olacağına inanıyoruz.

Anahtar Kelimeler: Femoral kırık; eksternal sabitleyiciler

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Diaphyseal fractures of femur comprise 1.6% of all skeletal fractures in children.[1] It was shown that like all child fractures, these were rapidly healed and always ensured remodeling even with angulation.[2] Although some authors reported that these fractures should be treated with an alternative surgical method, pelvipedal casting is the most commonly performed procedure in pediatric femur fractures. Among surgical methods, external fixator is minimally invasive, can be applied easily and allows joint motion earlier than casting.

In our study, our aim was to evaluate the results of external fixation on the rate of union, malunion, limb length discrepancy, refracture and complications in pediatric femur fractures.

MATERIAL AND METHODS

We evaluated a total of 17 closed pediatric femoral shaft fractures (11 male and 6 female patients) presented to our clinic between June 2006 and December 2008. Mean age was 8.3 (range: 6-11), and mean duration of follow-up was 12 months (range: 7-18). Most of the fractures (58.8%) were mid diaphyseal, four (23.5%) of them were within proximal third and the rest were in distal third without any physeal involvement. Patients underwent surgery on the day they were admitted to hospital. Under general anesthesia, after closed reduction with fluoroscopy, external fixators (Tasarımmed Ltd. Co., İstanbul) with 5 mm hydroxyapatite-coated tapered Schanz pins (2 proximal, 2 distal to the fracture site) were applied on the lateral aspect of the thigh with small insicions. Less than 1 cm shortening, <5° of angulation with cortical contact in both the anteroposterior (AP) and lateral planes were allowed for reduction. Any rotational deformity was not accepted. The day after operation, partial weight bearing with either crutches or arm support was allowed and increased as patient tolerated. Twice daily pin care with sterile saline was routinely performed by the parents. Children were called for outpatient clinic visit in 2-week intervals and followed with direct lower limb AP and lateral views. All cases were dynamized on sixth week of surgery and when complete healing was shown on direct views, fixators were removed under sedation in outpatient settings. Protected weight bearing with either crutches or arm support for additional six weeks was necessary after fixator removal. Limb length discrepancy, mechanical axes and angular deformities were also measured with comperative direct AP and lateral views of lower extremities on follow up visits.

RESULTS

Mean operation time was 27 minutes (range: 18-40), and mean duration of hospitalization was 1.7 days (range: 1-3). External fixators [nine orthofix type, eight limb reconstruction system (LRS) type randomly] were applied with cortical contact and removed by a mean healing time of 73 days (range: 51-95). Five cases (29.4%) developed Dahl Grade II pin-tract infection in proximal pins and treated with oral antibiotics (sefadroxil monohidrat, 30 mg/kg/day for 7 days) and by changing wound dressings frequently. Seven patients refused to flex their knees over 90 degrees because of pain in first few weeks postoperatively. By the first month of fixator removal, all the patients had full range of motion in hip and knee joints of the affected side (Figure 1, 2, 3). On follow up, no cases of nonunion, malunion, or limitation in range of motion for hip and knee joints were noted. Rotational deformity was not seen in any cases, and average angulation at fracture site was 3.4 degrees in AP plane and 3.8 degrees in lateral plane radiographs (range 0-8 degrees). One child (5.9%) had mid diaphyseal refracture two months after removal of fixator due to a second fall. There was no overgrowth but three patients (17.6%) were detected to have true shortness of 0.5 cm which was measured on direct views.

DISCUSSION

It is well known that healing and remodeling even with angulation ensue in all pediatric fractures. For this reason, hip spica casting is most commonly used method in pediatric femoral fractures.[3-5] Besides difficulty in control of alignment and limb shortening, limitation in joint motion and ambulation are the disadvantages of casting. Some authors

FIGURE 1: Preoperative and postoperative roentgenograms and functional status of our case.

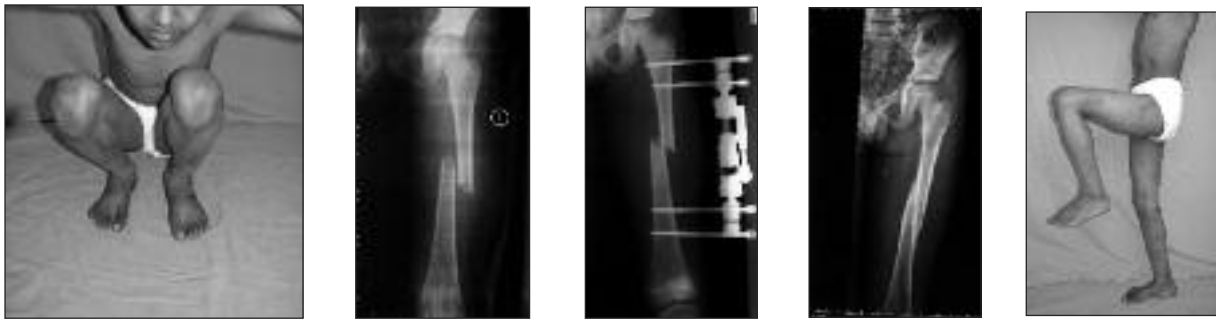

FIGURE 2: Preoperative and postoperative roentgenograms and functional status of our case.

FIGURE 3: Preoperative and postoperative roentgenograms and functional status of our case.

suggested various surgical methods alternative to hip spica casting. Most frequently suggested ones among them include elastic nail, osteosynthesis with plate, rigid intramedullary pin fixation, and osteosynthesis through external fixator. External fixation is an easily applicable and minimally invasive method which can be preferred in pediatric fractures. In our study, our aim was to evaluate the

results of external fixation on the rate of union, malunion, limb length discrepancy, refracture and complications in pediatric femur fractures.

It is proposed that early weight bearing and dynamization as soon as possible would promote callus mineralization. Hedin et al. and Miner et al. reported no nonunion, malunion or delayed union after external fixator application.[6,7] Although, it is shown that dynamization of external fixation for pediatric femur fractures had no significant effect on time to heal or frequency of complications,[8] we did not detect any nonunion, malunion or delayed union with routinely dynamized external fixation.

Tissue necrosis and soft tissue motion at pin site are two important factors contributing to pin site infection. Tolo and Alonso et al. reported pin-tract infection as the most common complication of external fixation (0.5-42%).[9,10] Both the frequency of pin site care and type of cleaning agent have been recently debated. In our study, Dahl Grade II pin-tract infection was seen in proximal pins of five children (29.4%) and resolved with oral antibiotics (sefadroxil monohidrat, 30 mg/kg/day for 7 days) and changing dressings frequently. Since excessive use of chemical irritants may result in an inflammatory response, we used sterile saline for cleaning the pins. Cure was ensured in all cases without progression to deep tissue infection. The use of hydroxyapatite-coated tapered pins has reduced the rate of pin tract infection. Furthermore, calling for frequent outpatient visits may play important role in improvement of personal hygiene and both patient and parents' compliance in case of pin care.

Tolo[9] noted that limb length discrepancy developed after various treatment modalities in pediatric femur fractures, however Kesemenli et al. reported that no such difference was present in these cases.[3,9] 0.5 cm true shortness was detected on direct views in only three of our cases, yet we think this percentage can be neglectable.

Although cases of limitation in knee and hip range of motion were reported in pediatric femur fractures undergoing external fixation,[6,7,9,11] we detected that our cases achieved complete range of motion in maximum three weeks after completion of the treatment.

We concluded that external fixator application in pediatric femur fractures could be a good alternative method in scope of less limb shortening and early mobilization with minor complications.

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