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Original Article

Treatment of grade IIIB opens tibial fracture by ilizarov hybrid external fixator

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Abstract
Objective: We evaluated the results of patients who were treated with Ilizarov hybrid external fixator for type IIIB open tibial fractures.
Materials and methods: 35 Gustilo grade IIIB tibial fractures of age between 18 to 42 years (22 male and 13 female) in which 12 distal fourth tibia (D/4) of C1.1 (6), C1.3 (6), 12 upper fourth Tibia (U/4) of A2 (8) and A3 (4) according to AO classification and 11 Tibial plateau fractures of Schatzker type VI (5) , V(5), IV(1) . All tibial plateau, proximal fourth fractures and lower fourth fractures of tibia and fibula (Reversed Hybrid), treated with Ilizarov hybrid fixator using two Ilizarov 5/8 rings and AO External fixator were followed up to 12-52 months.
Results: D/4 fractures were united at 31.1667±8.3046 wks, U/4 at 24.00±5.2915 and Tibial plateau at 15.545±4.160 weeks (p-0.00). ROM in tibial plateau type IV 130°±00, type V 124°±8.94° , type VI 125°±7.0711°, D/4 of type C1.1 (50°±0.00), type C1.3 (43° ±5.7755) whereas full ROM in U/4 fractures. Pin tract infection occurred in 21% of cases. Pain on walking in 20% of cases of type VI tibial plateau fractures and 80% of cases of type IV and V. Problem free in rest of parameter of function of VI and 100% problem in IV and V. Pain at rest observed in 20% of cases in type V. In 66.67% U/4 fractures had pain on walking but no other functions were compromised. In 33% D/4 fractures of C1.1 type had pain on walking only and had 1cm of shortening.
Conclusion: On the basis of our experience, we suggest adopting this method for functional limb salvage after extensive complex high-energy injuries. This fixator is safe and versatile, effective in providing stability and allowing early rehabilitation, although the indications for its use are very relatively specific.

Key words: Ilizarov hybrid external fixator, tibial plateau, upper fourth and distal fourth fractures, Clinical and Functional outcome.

The use of circular external fixator for acute trauma of the upper and lower extremities is common in Russia and part of Western Europe and increasing in North America.[4] Metaphysical fractures may have extension into the joint and diaphysis that greatly increases the complexity of their management. [1] The presence of Gustilo type I or II open wound does not alter basic treatment guidelines. However, a type III wound, especially III B, favours stabilization with an external fixator. Less exposure is needed if performing a limited open reduction and external fixation, decreasing the amount of soft tissue dissection and limiting local vascular injury. Stabilization of short periarticular fragments is possible with a circular external fixator. Because the wires are tensioned and supported circumferentially, a "trampoline" of fixation is provided.[1] Fixation is rigid enough to allow early motion and partial weight bearing. The comminuted fractures are one the most difficult to treat with open reduction and internal fixation. The distal fragment is usually small and many times fragmented. This versatile external fixator is an excellent tool for these fractures. Skin conditions are bad and more complicated when the fracture is open as in many cases. Open reduction and stabilization are very difficult or impossible. This ring fixator with its inherent advantage is useful. We evaluated the results of patients who were treated with Ilizarov hybrid external fixator for type IIIB open tibial fractures. The spectrum of injuries to the tibial plateau is so great that no single method of treatment has proven uniformly successful. Despite improvement in imaging technique and less invasive surgical methods, the management of tibial plateau fractures remains controversial.[15] We analysed the clinical effectiveness and function recovery of ilizarov hybrid external fixation in the acute treatment of acute tibial fractures.

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Material and methods

This study involved a consecutive series of 35 open grades IIIB tibial fractures treated at BPKIHS, Dharan, NEPAL during August 2000 to August 2004 .The age between 18 to 42 years of 22 male and 13 female. Twelve had a distal fourth fractures of tibia and fibula of six C1.1 and six C1.3 and 12 upper fourth tibia and fibula of A2 eight and A3 four, according to AO classification, 11 Tibial plateau fractures of Schatzker type VI five, type V five, one type IV fractures were followed up to 12-52 months, . Initial resuscitation, splintage and primary care for the wound was provided in the emergency room. Any protruding bone fragments were covered with sterile dressing. The patients were then taken to the operating room and treated by pulse lavage and wound debridement followed by external fixation of the fracture. All tibial plateau, all proximal fourth fractures and all lower fourth fractures of tibia and fibula (Reversed Hybrid), treated with Ilizarov hybrid fixator using two Ilizarov 5/8 rings and AO External fixator. We used schanz pin in proximal fragments of distal fourth fractures and distally in upper fourth and tibial plateau fractures. Acute shortening was done in distal fourth fractures after removal of loose detached small fragments. Acute shortening helped in primary and delayed primary closure of wound. Accuracy of reduction was routinely controlled with an image intensifier. Every attempt was made to cover the exposed part of bone with soft tissue. Protection of the soft tissue envelope is important principles in the management of severe injuries .Regular pin tract cleaning was advised (twice a day minimally) with a betadine solution or spirit. All patients were made to stand with support after 48 hours, in all cases of Tibial plateau fractures knee mobilization started within limits of pain and partial weight bearing after 3 months for tibial plateau fracture only and full weight bearing after 6 months after clinicoradiological assessment, in all cases of upper fourth and lower fourth tibial fractures toe touching were permitted as per the stability of the fixation diagnosed radiologically. Partial weight bearing with support was started within 2 weeks of fixation for upper and lower fourth tibial fracture. Wounds were inspected at the interval of 48 –72 hours and repeat debridements were done whenever required. Split thickness grafting was performed within 3 weeks of primary surgery. The progress of bony union was assessed clinically and radiologically at 6 weeks intervals, till union was sound. The radiological bony union was accepted when exited good evidence of periosteal bridging and obliteration of the fracture line by endosteal callus formation. The clinical assessments of the union were mainly based on complete absence of pain and tenderness at the fracture site. Satisfactory wound healing and good amount of endosteal and periosteal callus formation were taken as the criteria for removal of fixator. Clinical and functional assessments were done after union by asking the question, do you have pain on walking, getting out of chair, going up, going down, pain at rest and need for support of cane and stability was checked by physician. Since the pain was measured long period after it's actually occur. The measurement of pain after union on visual analogue is inappropriate. Hence the more stable measurement of frequency of pain YES or NO was used. Our aim was to determine the clinical effectiveness and safety of Ilizarov hybrid external fixation for the acute treatment of severely comminuted extra-articular tibial fractures, tibial plateau fractures.

Results

Bony union was significantly different between fracture types (p-0.00). Distal fourth tibial fractures took 31.1667±8.3046 weeks to unite, upper fourth tibia united at 24.00±5.2915 and Tibial plateau took 15.545±4.160 weeks to unite.

Total range of movement of the Knee in type IV tibial plateau were 130°±00, type V 124°±8.94° and type VI 125°±7.0711°. Total Range of movement of the distal fourth fracture tibia of type C1.1 (50°±0.00), type C1.3 (43° ±5.7755) and in the upper fourth tibial fractures there was no restriction of knee movements.

Distal fourth tibial fracture 30% had 1cm of shortening. They are managing to walk with shoe raise. Progressive lengthening was not attempted after shortening. One patient of type VI tibial plateau had pin tract dermatitis that was successfully treated by a dermatologist. One case of distal fourth tibia developed 10º of equines. He is managing to walk with high heel sandal. Pin tract infection occurred in 21% of cases and resolved after oral antibiotics and care of pin sites. There was no loosening of frame due to pin tract infection.

In the type VI tibial plateau fractures pain on walking only in 20% of cases, whereas type IV and V it was in above 80% of cases. There was no problem seen in walking with support, getting out of chair, going up, going down in type VI but 100% problem in type IV and V fractures. Pain at rest was observed in one out of five cases in type V fractures. In (33%) fracture of distal fourth of tibia of C1.1 type had pain on walking. In none of the other cases were problems in any function. In upper fourth of tibia only A2 type

fractures were treated in which 8 out of 12 had pain on walking? No other functions were compromised.

Discussion

Early aggressive debridement of nonviable tissues, stabilization with an Ilizarov external fixator, and either primary or delayed primary closure followed by early mobilization and weight bearing is a sound treatment method for plafond injuries.[17]Acute shortening, using the Ilizarov technique followed by progressive lengthening, is one of the methods used to deal with complex fractures combined with severe soft tissue injuries.[9] Despite technical difficulties and problems associated with pin-tract infections, the Ilizarov external fixator may be the preferred technique in open tibial fractures because of high union rates, the use of thin K-wires with minimal traumatic effect, and more successful functional results**.**[5] The most frequent complication was pin-tract infections.[5] This study suggests that the hybrid external fixator in standard configuration have stiffness characteristics similar to those of the conventional Ilizarov fixator when used to treat metaphysical and shaft fractures of the tibia.[8] Functional result were better in upper fourth and distal fourth tibial fractures and in type VI tibial plateau fractures only. Kumar A, Whittle AP compared with other series, and they believed it is appropriate for treatment of these complex tibial fractures (Schatzker Type VI**)** especially those with a poor soft-tissue envelope.[6] El Barbary H et al emphasizes the clinical success and low morbidity associated with the use of external fixation and minimal internal fixation for the treatment of complex tibial plateau fractures.[2] Roberts CS, Dodds JC et al showed that most dramatic improvements in the stability of hybrid frames used for proximal tibial fractures result from addition of an anterior, proximal half-pin.[13] The Ilizarov technique in combination with minimally invasive internal fixation is an effective method to treat

complicated tibial pylon fractures with severe soft tissue trauma.[3] This method for the treatment of distal tibial fractures yielded results comparable with previous studies using open reduction and internal fixation.[7] According to Mseddi MB et al results could be improved by better operative technique for the treatment of supramalleolar fractures. They advocate installing the patient in the supine position with transcalcaneal traction allowing good restitution of the leg axis. The assembly should be long, including the entire leg segment. [10] Total arc of movement of the joint is preserved better without bridging the ankle for the treatment of tibial plafond fractures that is comparable with our results.[11] This hybrid frame is easy to apply, versatile, and significantly less expensive than other commercially available adaptors and frames.[14] This hybrid frame

allows immediate functional stabilization of tibial diaphyseal fractures and postoperatively allows ease of fracture gap closure and compression. However, it should be remembered that, hybrid fixator models had less axial and bending stiffness than standard Ilizarov fixator model.

Application of the Ilizarov external fixator is slightly more complicated than traditional large pin fixator and requires more attention to detail intraoperatively and postoperatively, but can be a versatile tool in the management of complex tibial shaft fractures.[16]

Conclusion

Using this technique, we found some advantages. First, it permits definitive treatment using an external fixator device, enabling the possibility of early functional loading. Second, Functional results were better in upper fourth and distal fourth tibial fractures and in only type VI tibial plateau fractures. On the basis of our experience, we suggest adopting this method for functional limb salvage after extensive complex high-energy injuries. This fixator is safe and versatile, effective in providing stability and allowing early rehabilitation, although the indications for its use are very specific.[12]

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