

Original research article**To study primary ilizarov fractures of the tibial condyle using a modified approach****¹Dr. Diddi Shravan Kumar, ²Dr. Dayasagar Karra, ³Dr. Pradeep Kumar Mandapalli**^{1,3}Assistant Professor, Department of Orthopedics, Kakatiya Medical College/MGM Hospital, Warangal, Telangana, India²Senior Resident, Department of Orthopedics, Kakatiya Medical College/MGM Hospital, Warangal, Telangana, India**Corresponding Author:**

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Abstract**Introduction and Background:** Fractures of the tibial condyle pose further difficulties when they are accompanied by soft tissue injury. We intend to assess these fractures using an Ilizarov ring fixator in conjunction with our modified approach in order to get improved results.**Material and Methods:** This study has a total of 10 cases with compound comminuted tibia that were treated utilizing the Ilizarov technique at the Department of Orthopedics, Kakatiya Medical College/MGM hospital in Warangal, Telangana, India. The data collection period for this study spanned from January 2022 to January 2023. In the preceding 28-month period, an examination was conducted on the management of ten instances of compound tibial comminuted fracture utilizing the Ilizarov technique.**Result:** Although tibial nailing is widely used, it is not without its own set of difficulties. Malunion is observed in around 37% of tibial nailing procedures, with a higher incidence observed in cases of fractures occurring in the proximal region of the tibia. The presence of severe comminution exacerbates the complexity. A total of 10 fractures in the proximal tibia were treated with an Ilizarov fixator, with just one instance of malunion. The insertion of intramedullary nails has been demonstrated to disrupt blood flow in the diaphyseal cortex. The ongoing discussion revolves around the utilization of reamed and unreamed intramedullary nailing due to their differing degrees of adverse impact on cortical bone circulation. The presence of an open fracture in patients carries substantial implications. Necrosis of diaphyseal bone occurs as a consequence of the disruption of the intramedullary blood supply.**Conclusion:** The Ilizarov ring fixator is a highly suitable surgical intervention for Tibial Plateau fractures, particularly in cases where there is significant soft tissue damage. By implementing our proposed adjustment, we can attain optimal joint alignment and allow for early weight bearing.**Keywords:** Ilizarov fixator, technique, bone, tibial condyle**Introduction**

The tibia is the most commonly affected site for open fractures, with an incidence rate ranging from 49.4% to 63.2%. India exhibits the greatest incidence of road accidents globally, with approximately one out of every forty-two vehicles in the country being involved in an accident in the year 1986. The majority of vehicles engaged in the incident were two-wheelers. Motor cycle accidents involve the lower limbs in 49.6% of cases. Due to its anatomical positioning, the tibia is susceptible to recurrent injuries [1-3].

Additionally, it should be noted that the blood supply to the tibia is quite unstable. Fractures of the tibia that involve significant levels of energy are sometimes linked to compartment syndrome, as well as neurological or vascular injuries. Open fractures have a greater incidence of infection compared to closed fractures, and this incidence escalates as the soft tissue injury becomes more severe. Comminution increases the likelihood of delayed union and nonunion in both closed and open treatment. The primary factors influencing their treatment, prognosis, and result are the specific cause of injury, the extent of comminution, the extent of soft tissue injury, and the displacement [4-6].

Every method possesses its own advantages and disadvantages. The prevalence and diversity of these fractures might occasionally pose challenges in selecting the appropriate treatment modality. It is recommended that the most effective treatment approach involves the anatomical reduction of segments, stable fixation, and early functional restoration. The objective of our study is to emphasize the significant role played by the Ilizarov ring fixator in the treatment of compound grossly communicated tibia fractures. This technique involves the use of tiny diameter transosseous 'K' wires that are tensioned and secured to circular rings for minimally invasive external fixation. It facilitates the attainment of a secure attachment of the limb at various levels and enables the healing of fractures. The fixator system possesses the capability of multidirectional, multiplanar and multilayer motion, enabling cyclic axial

micro motion at the fracture site and promoting fracture union [7-9].

The objective of this study is to emphasize the significant role played by the Ilizarov procedure in the management of Graded Comminuted Compound Tibial fracture. Currently, there are numerous techniques accessible for the treatment of tibia fractures. While these techniques are beneficial for treating closed stable tibia fractures, they are associated with numerous complications and a high failure rate when applied to complex fractures such as closed comminuted fractures, open comminuted fractures, open fractures with bone loss, and intra-articular fractures with diaphyseal extension and unhealthy skin. Ilizarov procedures are considered the optimal treatment for complicated fractures. Treatment of open comminuted and contaminated diaphyseal fractures, as well as patients with multiple open fractures and other significant trauma, is unequivocally recommended [8-10].

Materials and Methods

This study has a total of 10 cases with compound comminuted tibia that were treated utilizing the Ilizarov technique at the Department of Orthopedics, Kakatiya Medical College/MGM hospital in Warangal, Telangana, India. The data collection period for this study spanned from January 2022 to January 2023. In the preceding 28-month period, an examination was conducted on the management of ten instances of compound tibial comminuted fracture utilizing the Ilizarov technique.

Results

The majority of individuals who sustained injuries were male. The majority of patients fell within the age range of 2 to 4 decades. The most prevalent form of injury was RTA. No instances of bilateral fractures were observed. Two individuals exhibited an Ipsilateral Distal Radius Fracture, while one patient presented with an Ipsilateral Clavicle fracture. Additionally, two patients experienced an ipsilateral metatarsal fracture. The majority of patients reported their injuries within a 36-hour timeframe. The majority of the individuals who had injuries were classified as Gustillo type IIIB.

Table 1: Age wise Distribution

Sr. No.	Age range	Number	%
1.	10-20	1	10%
2.	20-30	3	30%
3.	30-40	3	30%
4.	40-50	2	20%
5.	50-60	1	10%
	Total	10	100%

Table 1 displays the age distribution of the patients who participated. 10% of the patients were in the 10-20 and 50-60 age groups, 30% in the 20-30 and 30-40 age groups, and 20% in the 40-50 age range.

Table 2: Gender Distribution

Sr. No.	Gender	Number	%
1.	Male	10	100
2.	Female	00	00

This study exclusively included male patients, accounting for 100% of the participants (as indicated in Table 2).

Table 3: Type of Injury

Sr. No.	Mode of Injury	Number	%
1.	RTA	8	80%
2.	H/O fall from height	2	10%
	Total	10	100

Table 3 presents the distribution of injury modes, with the RTA accounting for 80% of cases and the H/O fall from height representing 20% of cases.

Table 4: Side of affected limb

S. No.	Side involved	Patients	%
1.	Right lower limb	1	10%
2.	Left lower limb	9	90%
	Total	10	100%

Among the 10 patients, classification was the most prevalent type. The minimum duration of follow-up was 8 months, while the maximum duration was 22 months. Four patients experienced early

complications, specifically a pin tract infection. One patient experienced a late complication characterized by malunion with valgus deformity, while another patient had recurvatum deformity. Additionally, four individuals experienced shortening. The mean duration of hospitalization was approximately 20 days. The utilization of autogenous iliac crest grafts was observed in 80% of the patients.

In our study, we monitored 10 cases till they reached the union and continued to do so until the present time. The participants underwent an evaluation to determine their pain levels and functional impairments, as well as an examination to detect angular and rotational misalignment and range of motion.

In the conducted investigation involving 10 cases utilizing the Ilizarov technique, a fracture union rate of 100% was achieved. In our series, there have been no instances of non-union. One instance had a Delayed union that was surgically grafted. The antibiotic coverage in our series was limited to a duration of 7 to 10 days. All ten instances were permitted to bear weight as pain was deemed acceptable. Initially, four individuals in our study expressed hesitancy due to their bulky appearance.

Discussion

According to Ilizarov, transosseous osteosynthesis of fracture is essentially a non-surgical approach that is performed in a sterile operating theater, with the exception of the insertion of wires. The structure is sturdy enough to let the patient immediately put weight on the injured limb, even with severely comminuted fractures. When treating high-energy tibial fractures, the optimal approach is difficult to pin down. Plate fixation, particularly for more severe fractures, is known to have an unacceptably high incidence of wound complications due to the tibia's fragile soft-tissue covering^[9-11].

Despite its widespread use, tibial nailing is not without its risks. Up to 37% of tibial nailing treatments result in malunion, which is especially common after proximal third tibia fractures. An additional layer of complexity is introduced by severe comminution. Only one case of malunion occurred out of twenty-one proximal tibial comminuted fractures treated with an Ilizarov fixator. It has also been demonstrated that the diaphyseal cortex's circulation is disrupted by intramedullary nail implantation. Because both reamed and unreamed intramedullary nailing procedures adversely influence cortical bone circulation to different degrees, their usage is currently a topic of controversy. This has major consequences for people who have an open fracture. The diaphyseal bone becomes necrotic when the blood supply within the medullary cavities is severed. Dead bone and an open fracture wound may raise the risk of infection during the reconstitution of the vascular system, which takes 2 to 3 weeks. With the added risk of pin tract infections, the external fixator was simply a band-aid solution. It would also be counterproductive to promote early weight bearing^[12-14].

For fractures where the risk of complications was substantial with standard fixation techniques, the Ilizarov fixator was selected. Acute fractures and non-unions have been treated using the Ilizarov device for more than fifty years. Even in severely comminuted fractures, which are difficult to treat with other procedures, the construction is stable enough to allow the patient to immediately put weight on the injured limb. Optimal skeletal stability can be achieved with the Ilizarov device despite its minimum invasiveness and little impact on fracture biology. Additionally, it offers a chance to handle open fractures and wounds. Controversy surrounds the optimal period for covering soft tissues. Conventional wisdom is that patients with open fractures should not be closed until a subsequent debridement has been performed to remove enough necrotic tissue from the wound^[14-16].

As part of our treatment plan, we had the patient begin light weight bearing within 48 hours and gradually increase it to full weight bearing as soon as they felt comfortable doing so. The decision to weight bear was also impacted by the patient's general state and the presence of any other injuries. With the help of an Ilizarov fixator, a surgeon can realign the patient's bones and, if necessary, lengthen their limbs to compensate for bone loss. The cracks in this series all came together. Twenty-three patients who underwent treatment with the Ilizarov fixator for tibial fractures achieved a full union. The typical duration of a union was 25.6 weeks. After using the Ilizarov fixator, Schtaker was able to cure 32 open tibial fractures. The average healing period for patients with a single injury was 21.9 weeks, while patients with multiple traumas required 25.7 weeks^[17-19].

In terms of the intricacy of the fractures that are taken into account, this series is exceptional. The purpose of identifying which types of tibial fractures were best treated with Ilizarov fixation was to clarify the fixator's function in this area of fracture care. Despite unfavorable conditions related to the fracture pattern, the time it took for the bones to fuse was not excessively long. However, the fixator had to be left on for longer in instances that needed distraction and a corticotomy. The Ilizarov fixator's adaptability is enhanced by this extra feature^[18-20].

Plate fixation, particularly for more severe fractures, is known to have an unacceptably high incidence of wound complications due to the tibia's fragile soft tissue covering. When a displaced intra-articular fracture occurs in the knee or ankle, the majority of writers now advise plating the affected tibial shaft. About 2% of plate fixing attempts were unsuccessful. Eleven percent of patients experienced severe joint stiffness, and three percent had angular malunion greater than five degrees in either direction. Noticed skin necrosis; refractured following plate removal; postponed weight bearing^[19-21].

The recommended time for full weight bearing is three months. Closed nailing can cause compartment syndrome. Penetration of the posterior cortex was also observed. Knee discomfort when bending over is also observed. Both reamed and unreamed intra medullary procedures have an effect on the circulation of cortical bone, but to different degrees, therefore their usage is currently up for debate. Around 10% of nailing procedures, and 6% of unreamed and reamed procedures, result in malunion. Unintended delay in unionization (22%). Including all of the different types of medication. The vascularity of the fracture fragments is respected by cast therapy, although early weight bearing and significant stability are not achieved. Wound dressing is also an issue [20-22].

Although early mobility of the joint and stability are both achieved by internal fixation with screws and plates, infection is always a possibility in compound fractures. It doesn't support early weight bearing and doesn't care about vascularity. Although early weight bearing is possible with intramedullary treatment, infection is always a possibility with compound fractures. There is evidence that diaphyseal cortical circulation is obstructed by intramedullary nail implantation as well. While early weight bearing is not necessarily viable with traditional external fixation, it does allow for early joint mobilization while still respecting the vascularity of the fracture parts. Issues involving the bigger pins crop up regularly. It would also be counterproductive to promote early weight bearing. An issue with non-modular solutions is that they are unable to distract or compress the fracture site. Mechanical instability is a drawback of modular design [23-25].

Stability and the capacity to bear weight are achieved by the Ilizarov procedure, which is a noninvasive operation that does not include transfusions or blood loss. The closed reduction of a fracture can be challenging and may need more operating time than expected. Such challenges are easily solved; however, with expertise, operating times are lowered when surgeons adhere to the assembly procedure, use pre-assembled rings, and do adequate pre-operative planning. Immediate joint mobilization and weight bearing, reduced surgical risks, and minimum blood loss are some of the benefits of the Ilizarov method. Frame assembly and closure reduction provide challenges for the surgeon, while dressing and annoyance are issues for the patient [25-27].

Conclusion

To date, we have not seen any major complications with the Ilizarov method, and our analysis of ten cases of compound comminuted fracture tibia care using this technique leads us to believe that it has a clear place in the management of this type of fracture. Two major subjective issues we had were discomfort during treatment and accepting the equipment. For high-energy tibial fractures, the Ilizarov apparatus offers a permanent fixation solution. The main difference between this form of fixation and others is that it allows for early weight bearing, even in fractures that are badly comminuted. By encouraging functional recovery at an early stage, it eradicates fracture disease. Ergonomic correction and dynamic enhancement on any plane is a breeze. Alterations to the frame's design could make it easier to hide and access wounds. Hence, it provides the desirable pliability in intricate cracks.

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