

## Complications of Ilizarov Fixator in 105 Cases

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### Abstract

**Objective:** The objective of this descriptive study was to assess the complications of locally made Ilizarov fixator.

**Study Design:** Descriptive study.

**Place and Duration of Study:** This study was conducted in Combined Military Hospital Quetta and Combined Military Hospital Rawalpindi over a period of 3 years from January 2007 till January 2010.

**Patients and Methods:** One hundred five patients requiring Ilizarov fixator fixation for various indications were studied. We included all the patients who required Ilizarov fixation as a definitive means of treatment. Locally made Ilizarov fixator was used and

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Schanz screws were inserted without pre drilling. Records were kept in microsoft access database.

**Results:** Male population dominated our sample by 95 (90.5%) with mean age of 32.16 years. Road traffic accident was most common aetiology affecting tibia in 77 (73.33%) cases. Average fixator time was 17.9 weeks, minimum 7 and maximum 48. We achieved satisfactory union in 102 (97.14%) patients with outcome graded as excellent in 69 patients (65.71%), good in 27 (25.71), fair in 6 (5.71%) and poor in 3 (2.85%) as per ASAMI criteria. Total complications were 78 (74.38%), infection in 33 (31.42%) cases, of which 17 (16.2%) were minor pin tract infections and 16 (15.3%) were major infections which require curettage. We had joint stiffness in 16 (15.3 %) patients. We had limb shortening of more than 2.5 cm in 5 (4.76%) patients and valgus or varus deformity of more than 7 degree deformity in 19 (18.09%). 1 (0.95%) patient had progressive dislocation of the knee joint, while Schanz screw breakage was observed in 1(0.95%) patient.

**Conclusion:** Complications encountered can be reduced by observing Ilizarov principles. Pin tracts must be cleaned as per standard protocols, joint stiffness can be minimized by vigorous range of motion exercises and weight bearing. Neurovascular injuries are avoided by respecting their planes. Although complications are common, still this is an effective tool for treating complex skeletal disorders which at time require amputations.

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**Keywords:** Pin tract infections, joint stiffness, Ilizarov fixator.

## Introduction

The multiplanar Ilizarov external fixator apparatus is a versatile system which was pioneered by Professor Gavril Ilizarov in mid 1960s. It can be used to lengthen long bones and correct angular deformities, and to treat pilon fractures, non-unions, pseudarthroses, Lisfranc's fractures, fractures with short periarticular fragments and calcaneal fractures. Similarly osteomyelitis can be treated by resection and bone transport; and the diabetic Charcot foot can be reconstructed.<sup>1,2</sup> There are several postoperative treatment stages following the application of the external fixator including latency period, distraction or compression, consolidation, dynamization, physiotherapy and functional recovery. The technique is surprisingly well tolerated by the patient, with little associated pain. Outcome is good in majority of case but there are certain complications.

A complication is defined as any untoward occurrence to a patient either during the course of treatment or after removal of the fixator. These complications can be classified into true or sequelae, major and minor.<sup>3</sup> True or sequelae is a complication that remains untreated after the completion of the treatment like such as malunion, deformation of new bone, joint contracture or stiffness or nerve palsy. A major complication is considered one that is corrected by an additional operative procedure such as malunion, major joint contracture or pin tract infection, pin loosening or ring sequestrum requiring curettage. A minor complication is one that responds to non operative treatment such as transient decreased joint range of motion, paresthesia or minor pin track infection.<sup>4</sup>

The associated complications are described by different authors. These are pin tract infections, joint contractures, edema, cellulitis, deviation of new bone regenerate and malunion<sup>5</sup> Delayed union, nonunion and osteomyelitis<sup>6-10</sup> and major neurovascular injury with gas gangrene.<sup>11</sup> Problems associated with new bone regenerate are premature consolidation, poor consolidation and deviation. Sympathetic dystrophy, poor flap healing,<sup>12</sup> over and under lengthening are also observed. The technique has a high rate of complications when used for femur as compared to tibia.<sup>13</sup>

## Patients and Methods

This study was conducted in Combined Military Hospital Quetta and Combined Military Hospital Rawalpindi over a period of 3 years from January 2007. 105 patients requiring Ilizarov fixator as a definitive mean of treatment were included in the study, while all other fixators like AO, NA and Orthofix and fixators used for soft tissue management were excluded. The consent for study was taken from patients and hospital ethical board and records were kept in a custom built Microsoft access database.

These patients were operated under regional blocks or general anaesthesia. A pre assembled; locally made Ilizarov fixator was applied. All Schanz screws were inserted without pre-drilling. Nonunion site was freshened and compressed intra operatively. The lengthening was performed through osteotomy which was distracted at half millimeter twice a day after a latent period of 7 – 10 days. Post operatively pins were cleaned with twice a day cleaning of pin tracts with pyodine and twice a week bathing.<sup>14</sup> The patients were advised quantitative weight bearing.<sup>15</sup> The patients were also advised to do self range of motion exercises. Patients were followed after two weeks interval during distraction phase and after one month in consolidation phase. All fixators were dynamised and removed in operation theaters with curettage of pin tracts and plaster of Paris cast was applied for four to six weeks.

The complications were classified into category I minor, category II major and category III sequelae.<sup>3</sup> The category I complications were treated conservatively, category II with operation and category III left sequelae. The results were classified into excellent, good, fair and poor as per ASAMI Classification of bone and soft tissue healing.<sup>16</sup> Four criteria for bone healing were considered i.e. union, infection, deformity and limb length discrepancy. An excellent result was union with no infection, deformity of less than 7 degree and leg length discrepancy of less than 2.5 centimeter. A good result was defined as union plus any two of the last three features of excellent union. A fair result was union plus with any one of the latter features and a poor result was nonunion or a refracture or none of the latter features. Functional results were based on five criteria significant limp, equines rigidity, soft tissue dystrophy, pain and inactivity. An excellent result was fully active individual, good, fair and poor results indicate progressive lesser degree of activity and mobility.

## Results

Average age of the patients was 32.16 years with 29 (27.6%) in third decade of life. Male population was dominant, 95 (90.5%) while only 10 (9.5%) were females. Tibia was most commonly involved bone in 77 (73.33%) patients, femur in 22 (20.95%) and humerus, foot and forearm were affected in only a few cases (Fig. 1). Road traffic accident was most common etiology in 72 (68.57%) patients and firearm injury in 19 (18.01%) (Fig. 2). Average fixator time was 17.9 weeks, minimum 7 and longest duration of about 48 weeks. We achieved union in 102 (97.14%) patients with outcome graded as excellent in 69 (65.71%), good in 27 (25.7%) and fair in 6 (5.7%) as per ASAMI criteria (Table 1). Three (2.85%) patients remained nonunited and result was graded poor. Pin tract infections were most common complication in 33 (31.43%), minor in 17 (16.2%) (Fig. 3), major in 15 (14.28%) (Fig. 4) and chronic osteomyelitis in one patient. We had shortening of more than 2.5 cm in 5 (4.76%) patients and valgus or varus deformity of more than 7 degree in 19 (18.1%) (Fig. 5). Functional results were excellent in 52 (49.52), able to return to work with full functions and daily activity. Good in 39 (37.14%), active with limp due to union more than 7 degree in 19 (18.01%) cases, mild joint stiffness in 8 (7.61%) cases and muscle wasting or shortening less than 2.5 cm in other cases. Fair in 10 (9.52%) when limp was due severe joint stiffness in 8 (7.61%) cases and axial deviation in 2 (1.9%). We had 4 (3.8) poor results due to nonunion in 3 (2.85%) cases (Fig. 6 and 7) and knee dislocation in 1 (0.95%) case (Fig. 8). Total numbers of complications were 78 (74.28%) (Table 2). Category I, minor complications were observed in 44 (41.9%) patients, 17 (16.19%) minor infections, 19 (18.01%) united in varus or valgus of less than 7 degree and 8 (7.61%) transient joint stiffness treated with antibiotics and physiotherapy. Category II, major complications were in 28 (26.66%) cases, 15 (14.28%) major pin tract

infections treated with curettage, 8 (7.61%) severe joint stiffness, leg length discrepancy in 2 (1.9%) and one Shanz screw breakage (0.95%) (Fig. 9). Category III, sequalae were observed in 6 (4.76%) patients, 3 (2.85%) nonunions, significant leg length discrepancy in 2 (1.9%), and one (0.95%) chronic osteomyelitis, not cured with curettage.

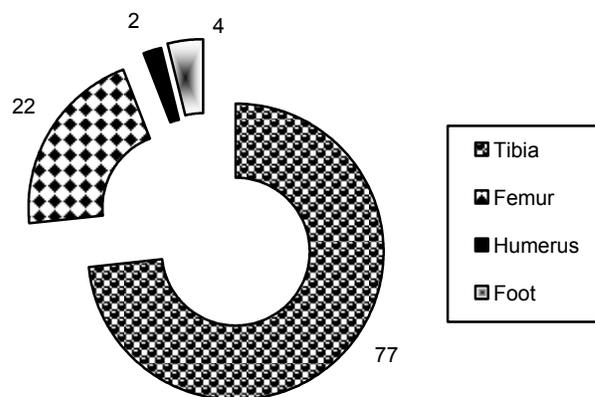


Fig 1: Bones affected.

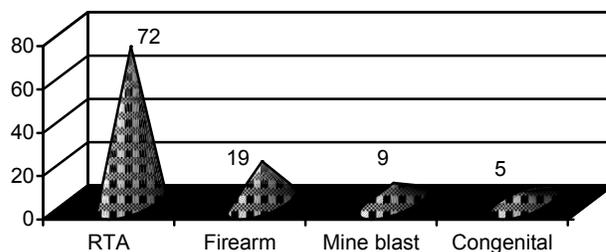
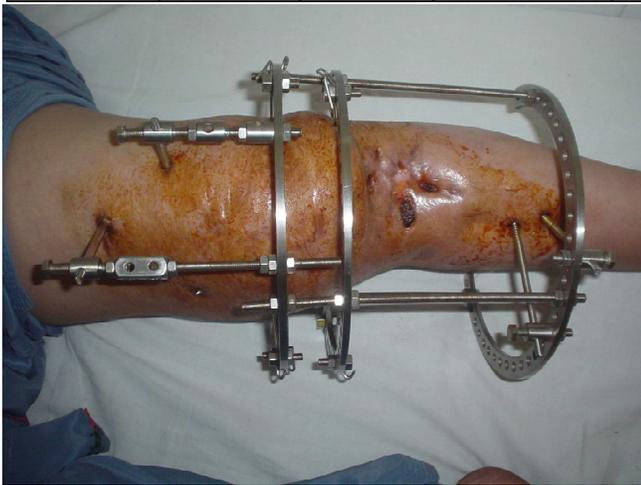


Fig. 2: Etiology.

Table 1: Results ASAMI Criteria.

Results	Union achieved	No Infection	Deformity less than 7 degrees	Leg length Discrepancy less than 2.5 cm	Total No.
Excellent	69	69	69	69	69
Good	27	18	10	26	27
Fair	6	0	4	2	6

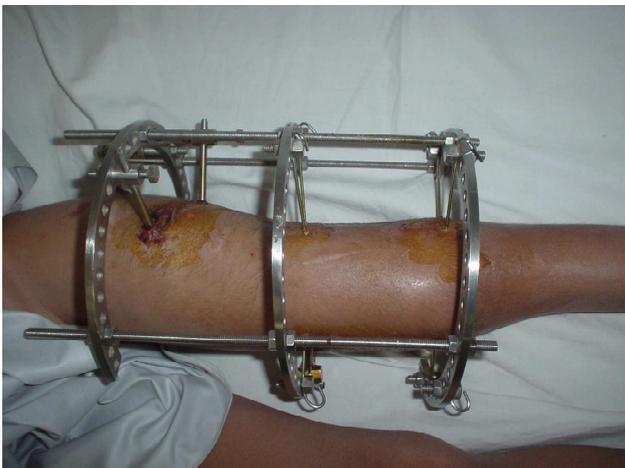
Poor	0	2	3	3	3
Total	102	89	86	100	105



**Fig. 3:** Minor pin tract infection.



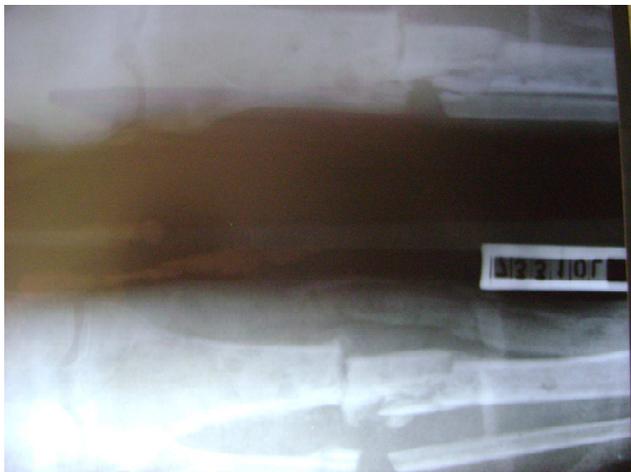
**Fig. 5:** Union in 20 degree angulation.



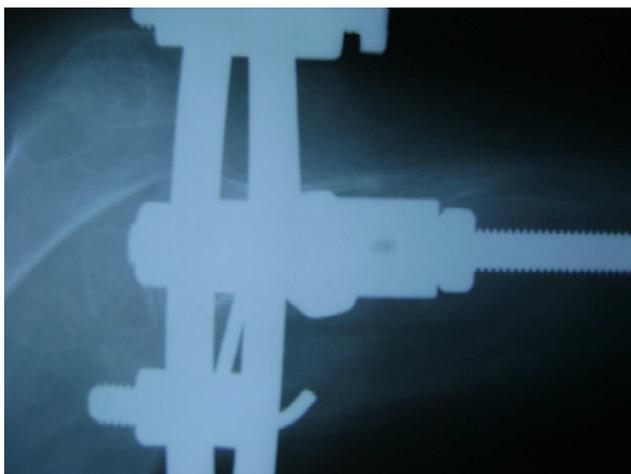
**Fig. 4:** Major Pin Tract Infection.



**Fig. 6:** Nonunion of femur.



**Fig. 7:** Nonunion of tibia.



**Fig. 8:** Knee joint dislocation.

**Table 2:** Complications.

Sr. No.	Complication	Category I Minor	Category II Major	Category III Sequelae	Total
1.	Pin tract infection	17	15	1	33
2.	Valgus / varus union	19			19
3.	Joint stiffness	8	8	0	16
4.	LLD Leg length Discrepancy		3	2	5
5.	Knee dislocation		1		1
6.	Schanz screw breakage		1		1
7.	Nonunion			3	3
Total		44	28	6	78





**Fig. 9:** Schanz Screw breakage.

## Discussion

Pin tract infection is a common complication, the incidence of which varies greatly. This can be avoided by careful pin tract cleaning and oral antibiotics. Deep infection is less common because most of the surgery is percutaneous; rarely an admission is needed for debridement of a pin site and intravenous antibiotics or removal or exchange of a pin. Different reports of this complication are 19% (17), 26.6% (18) and 40% (19). In present study it was 33 (31.42%) of which 17 (16.2%) were minor pin tract infections and 15 (14.3%) were major infections and one chronic osteomyelitis. Our pin tract infection was comparable to these studies although we used local Schanz screws without pre-drilling. This may be due to vigorous pin tract cleaning protocol and short mean fixator time of 17.9 weeks. C Sen noted 30% minor, 10% major with mean fixator time 8 months.<sup>20</sup> Axel et al noted 13% pin problems with mean fixator time of 38 weeks.<sup>21</sup> Holbrook et al noted 21% pin tract complications with mean fixator time of 2.2 months.<sup>22</sup> In our earlier experience using local stainless steel Schanz screws we reported 40.2% minor and 3.8% deep pin tract infections,<sup>23</sup> and in another study 42% pin tract complications were reported.<sup>24</sup>

Joint stiffness is another common problem. The reported frequency is 20%;<sup>19</sup> Modification of technique for pin placement has been shown to decrease the knee flexion loss during femoral lengthening.<sup>25</sup> Sometimes a frame is extended across a joint to correct or prevent a contracture occurring. Barker et al observed the pattern of recovery of knee range of motion in

35 patients undergoing lengthening and found that 88% of knee flexion was regained by 6 months, 92% in 12 months and 97% by 18 months.<sup>26</sup> We noted 8 (7.61%) minor and 8 severe stiffness of adjacent joints, treated by physiotherapy and manipulation under anaesthesia / tendoachillis lengthening respectively.

Premature consolidation is another complication of this technique. Poor new bone formation can occur and sometimes this can develop into a nonunion. In this situation modification of the frame may be necessary and bone grafting may have to be done to achieve bone union. Similarly if the fixator is removed too early then the new bone can refracture or deform. Over lengthening or under lengthening is possible but rare. We had shortening of more than 2.5 centimeters in 5 (4.76%). Paley D, reported one refracture of the docking site which required retreatment with the Ilizarov apparatus to achieve union.<sup>27</sup> Danziger et al reported 9 fractures in their series of 18 femoral lengthening.<sup>28</sup> We had 2 (1.9%) axial deviation of regenerate.

Major nerve or blood vessel injury can necessitate amputation as can limb threatening infections such as gas gangrene.<sup>11</sup> Vascular injury impedes soft tissue healing and has been shown to double the rate of anastomotic thrombosis during free flap reconstruction.<sup>12</sup> We did not have any neurovascular complication in the study because of observing Ilizarov principles and experience.

## Conclusion

- This is an effective tool for treating complex skeletal disorders which at time require amputations.
- Neurovascular injuries can be avoided by respecting their planes.
- Care of Pin tract must be done efficiently.
- Joint stiffness can be minimized by vigorous ROM exercises and weight bearing.
- Short fixator time is associated with fewer complications and femur is associated with more complications.

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