Central Medical College Journal
Vol 8 No 2 July 2024
DOI:https://doi.org/10.3329/cemecj.v8i2.81912

Case Report

# Complex Forearm Fracture with Osteomyelitis: A Case Report of Successful Treatment Using the Ilizarov Technique

Hamid K[1], Hasan MM[2], Begum R[3], Rahaman MA[4], Pervin S[5], Shariar AH[6]

## Abstract

***Background:*** *Complex forearm fractures in pediatric patients, particularly those complicated by osteomyelitis, require a multidisciplinary approach to achieve favorable outcomes. This case report presents the successful management of a 13-year-old boy with a Gustilo-Anderson Grade IIIA open fracture of the left forearm complicated by methicillin-resistant Staphylococcus aureus (MRSA)-associated osteomyelitis. Initial infection control was achieved through fasciotomy, debridement, and targeted antibiotic therapy. Definitive reconstruction utilizing the Ilizarov ring fixator facilitated distraction osteogenesis, addressing bone defects and restoring function. This report highlights the effectiveness of the Ilizarov technique in managing complex cases involving infection and significant bone loss, emphasizing the importance of timely intervention, infection control, and rehabilitation in achieving excellent clinical and functional outcomes.*

***Keywords:*** *Forearm fracture, Osteomyelitis, Ilizarov technique, Pediatric orthopedics,*

**Introduction:** Open fractures of the forearm in pediatric patients pose significant challenges due to their susceptibility to complications such as infection, nonunion, and functional impairment. The Gustilo-Anderson classification system is widely used to categorize the severity of open fractures, with Grade IIIA injuries being particularly prone to complications due to extensive soft tissue damage and contamination. Osteomyelitis, especially when caused by methicillin-resistant Staphylococcus aureus (MRSA), further complicates the clinical management of such injuries, requiring a multidisciplinary approach to achieve favorable outcomes[1,2].

The Ilizarov technique, introduced by Gavriil Ilizarov, has emerged as a powerful method for managing complex orthopedic conditions, including infected fractures and large bone defects. By utilizing the principles of distraction osteogenesis, this technique facilitates bone regeneration, corrects deformities, and restores limb function. Here, we report the successful management of a pediatric patient with a complex forearm fracture complicated by osteomyelitis, highlighting the role of the Ilizarov method in achieving infection control and functional recovery.

## Case Report

A 13-year-old boy presented with an open fracture of the left distal radius and ulna following a fall from playground equipment. The injury was classified as a Gustilo-Anderson Grade IIIA open fracture (Fig:1). The patient initially received treatment at a local hospital, where an open reduction and percutaneous pinning were implemented (Fig:1). However, it was ineffective, and the fracture did not unite (Fig:2) and he was discharged the following day. 2 months post-injury, the patient was referred to Central Medical College for further management.

01. ***Dr. Kawser Hamid,*** *Associate Professor, Department of Orthopedics, Central Medical College, Cumilla, Bangladesh.*
02. ***Dr. Mohammad Mainul Hasan,*** *Associate Professor, Department of Orthopedics, Central Medical College, Cumilla, Bangladesh.*
03. ***Dr. Rahima Begum,*** *Assistant Registrar, Department of Obs. & Gynae, Cumilla Medical College, Cumilla.*
04. ***Dr. Md. Arifur Rahaman,*** *Assistant Professor, Dept. of Pediatric Surgery, Central Medical College, Cumilla, Bangladesh.*
05. ***Dr. Shanaz Pervin,*** *Assistant Professor, Dept. of Obs. & Gynae, Central Medical College, Cumilla, Bangladesh.*
06. ***Dr. Hasan Al Shahria,*** *Assistant Registrar, Department of Orthopedics, Central Medical College, Cumilla, Bangladesh.*

***Correspondence:*** ***Dr. Kawser Hamid,*** *Phone:01714-975506, Email:dr.kawserhamid@gmail.com*

Received date: 30 December 2024
Accepted reviewed version date: 18 January 2025

Central Medical College Journal
Vol 8 No 2 July 2024
DOI:https://doi.org/10.3329/cemecj.v8i2.81910

Upon arrival, the patient exhibited severe pain, swelling, difficulty in movement and elevated intramuscular compartment pressure of 60 mmHg on the palmar forearm. Volksmann ischemic contracture, pain, and discharge sinus were diagnosed, necessitating an emergency fasciotomy. The wound was irrigated, and regular dressing changes were performed.

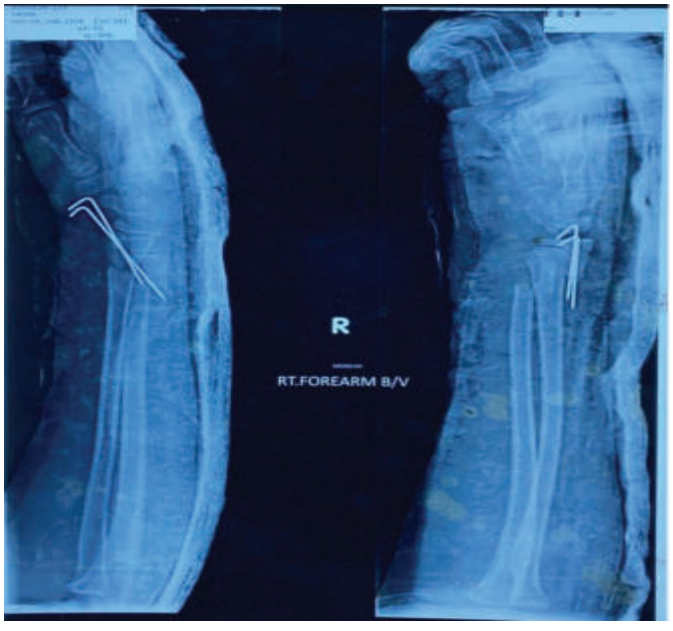
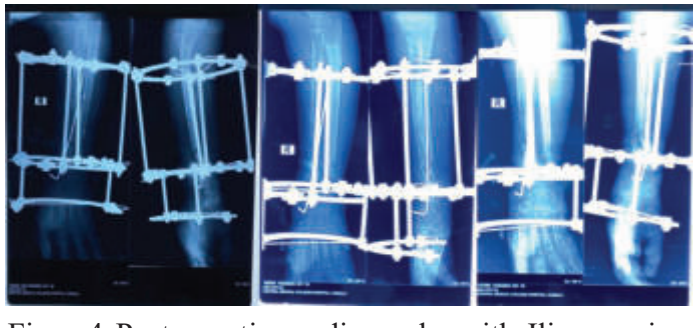



**Figure 1:** Unilateral external fixator with pinning at 6th June 2024

**Figure 2:** Fracture did not reunite after unilateral external fixator and pinning were implemented

Four weeks after the injury, the patient developed erythema, tenderness, and inflammation around the pin sites, raising concerns about infection. Radiographs revealed bone destruction in the distal radius diaphysis with periosteal reaction, and surgical exploration confirmed osteomyelitis. Purulent discharge and necrotic bone were observed. Methicillin-resistant Staphylococcus aureus (MRSA) was identified as the causative pathogen. Antibiotic management included intravenous vancomycin (15 mg/kg every 8 hours for 6 weeks) followed by oral linezolid (10 mg/kg every 12 hours for 2 weeks). Serial monitoring of inflammatory markers, including C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR), showed normalization by week 8, indicating effective infection control.

After achieving infection control, definitive reconstruction was performed three months post-injury using the Ilizarov ring fixator. This advanced orthopedic technique was chosen due to its ability to address the significant bone defect and promote bone regeneration through distraction osteogenesis. During surgery, circular rings were placed both proximally and distally to the defect. Tensioned Kirschner wires were inserted into the bone fragments at angles of 60–90 degrees, providing stable fixation. The wires were secured to the rings, which were connected by threaded rods. A latency phase of 5–7 days was observed post-osteotomy to allow initial callus formation. Subsequently, distraction osteogenesis was initiated with a controlled rate of 1 mm per day, achieved through adjustments of 0.25 mm four times daily to promote gradual bone formation This technique facilitated gradual bone lengthening and regeneration in the defect area. Radiographic monitoring guided the distraction process and ensured proper alignment (Fig:4).



Figur 4 Postoperative radiographs with Ilizarov ring fixator in place


Received date: 30 December 2024
Accepted reviewed version date: 18 January 2025

**Figure 5**: Postoperative photographs with Ilizarov ring fixator in place

Meticulous pin site care was emphasized, with daily cleaning and biweekly follow-ups to assess alignment, bone healing, and potential complications. Rehabilitation included early joint mobilization, progressive weight-bearing, and physiotherapy to restore range of motion (Fig:5).
post-reconstruction, radiographs confirmed robust callus formation with proper alignment of the radius and ulna. Patient is now in regular follow up until complete bone consolidation is going to achieve and allowing for Ilizarov frame removal. In radiograph no deformity or recurrence of infection has been seen (Fig:6).

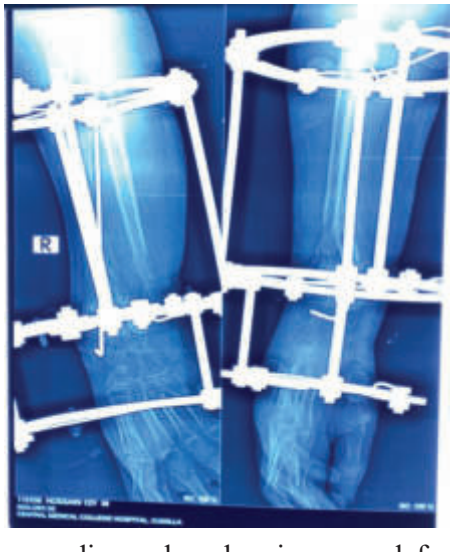


**Figure 6**: radiographs showing no deformity or recurrence of infection

This case highlights the successful management of a complex pediatric forearm fracture complicated by osteomyelitis using a multidisciplinary approach. The Ilizarov ring fixator proved to be a powerful tool for addressing bone loss and facilitating recovery. Timely intervention, appropriate infection management, and a structured rehabilitation program were key to achieving excellent clinical and functional outcomes.

## Discussion

The management of open fractures with osteomyelitis in pediatric patients requires a comprehensive approach encompassing early surgical intervention, effective infection control, and advanced reconstruction techniques. This case underscores the efficacy of the Ilizarov technique in addressing these challenges and achieving favorable outcomes.

### Initial Challenges and Infection Control

The initial treatment failure in this case highlights the importance of timely and appropriate surgical intervention. Acute compartment syndrome, diagnosed shortly after the injury, was managed with an emergency fasciotomy, which prevented further ischemic damage and preserved limb function. Early recognition and treatment of compartment syndrome are crucial in preventing long-term complications[3,4].

The subsequent development of osteomyelitis caused by MRSA necessitated an aggressive antibiotic regimen tailored to the pathogen. Intravenous vancomycin followed by oral linezolid successfully eradicated the infection, as evidenced by normalization of inflammatory markers such as C-reactive protein and erythrocyte sedimentation rate. These findings align with established guidelines emphasizing culture-specific antibiotic therapy in managing osteomyelitis [5, 6].

### Role of the Ilizarov Technique

Definitive reconstruction using the Ilizarov ring fixator was pivotal in addressing the significant bone defect and restoring limb function. The technique's ability to stabilize bone fragments and promote distraction osteogenesis makes it particularly valuable in managing complex pediatric fractures. The controlled distraction process facilitated gradual bone lengthening and alignment, while radiographic monitoring ensured proper progression of callus formation [7,8].

Received date: 30 December 2024
Accepted reviewed version date: 18 January 2025

In addition to its mechanical advantages, the Ilizarov method's emphasis on stable fixation and gradual regeneration aligns well with the biological principles of fracture healing. Pediatric patients, with their superior regenerative capacity, are particularly suited to benefit from this technique. Moreover, the structured rehabilitation program, including early joint mobilization and physiotherapy, contributed to the restoration of function and prevention of joint stiffness, ensuring an excellent functional outcome [9].

**Multidisciplinary Approach**

This case highlights the importance of a multidisciplinary approach involving orthopedic surgeons, infectious disease specialists, and physiotherapists. Collaboration among these disciplines was critical in addressing the multifaceted challenges posed by the patient's condition, ensuring a seamless transition from infection control to definitive reconstruction and rehabilitation. Such coordinated efforts are essential for achieving optimal outcomes in complex cases[10].

**Conclusion**

This case demonstrates the successful use of the Ilizarov technique in managing a complex pediatric forearm fracture complicated by osteomyelitis. Timely intervention, effective infection control, and advanced orthopedic techniques combined with structured rehabilitation were instrumental in achieving a favorable outcome. The Ilizarov method remains an invaluable tool in the management of challenging orthopedic conditions, particularly in the pediatric population.

**Declarations**

**Author Contributions**

Kawser Hamid analyzed the patient's data regarding the medical management of the case. He also interpreted and analyzed the patient's data regarding the medical management of the case, and Mainul Hasan Sohel, Rahima Begum, Md. Arifur Rahaman, Shanaz Pervin, Shariar AH helped to write the manuscript of the paper. All authors participated in the management of the patient at the hospital. All authors read and approved the final manuscript.

**Acknowledgments**

We want to thank all the clinical staff in the hospital who participated in the treatment of the patients.

**Conflict of Interest**

The authors state that they have no known conflicting financial interests or personal relationships that may be seen as having influenced the work described in this study.

**Consent**

The patient's father written approval was received prior to the publishing of this case report and its related photographs. Ethics statement: The Institutional Review Board of Central Medical College in Cumilla, Bangladesh, approved this study. A formal letter was provided as clarification for conducting this case review. For publishing the clinical details and photographs in this article, signed informed consent from the patient was acquired.

**Funding**

This research did not receive a particular grant from any governmental, private, or non-profit funding source.

**References**

1. Gustilo RB, Anderson JT. Prevention of infection in the treatment of one thousand and twenty-five open fractures of long bones. J Bone Joint Surg Am. 1976;58 (4):453-458. doi:10.2106/0000 4623 - 197658040-00004.

2. Ilizarov GA. The tension-stress effect on the genesis and growth of tissues. Part I. Clin Orthop Relat Res. 1989;(238):249-281. doi:10.1097/ 00003086-198911000-00038.

3. Spiegel DA, Schaeffer M. Pediatric orthopaedic infections: principles of management. Instr Course Lect. 2005;54:515-531. doi:10.2106/ 00004623-200505420-00009.

4. Matsen FA, Krugmire RB. Compartmental syndromes in children. J Pediatr Orthop. 1978;2(2):144-149. doi:10.1097/ 01241398-197802020-00004.

5. Lew DP, Waldvogel FA. Osteomyelitis. Lancet. 2004;364(9431):369-379. doi:10.1016/ S0140-6736 (04)16727-5.



Received date: 30 December 2024
Accepted reviewed version date: 18 January 2025

6. Lipsky BA, Berendt AR, Cornia PB. Infectious Diseases Society of America clinical practice guideline for the diagnosis and treatment of diabetic foot infections. Clin Infect Dis. 2012;54(12):e132-e173. doi:10.1093/cid/cis346.

7. Catagni MA, Guerreschi F, Lovisetti L. Distraction osteogenesis for bone loss due to trauma or infection. Orthop Clin North Am. 1999;30(4):621-637. doi:10.1016/ S0030- 5898 (05)70110-6.

8. Paley D. Problems, obstacles, and complications of limb lengthening by the Ilizarov technique. Clin Orthop Relat Res. 1990;(250):81-104. doi:10.1097/00003086-199005000-00012.

9. Sahu RL. The role of Ilizarov technique in infected nonunion of long bones. J Clin Diagn Res. 2016;10(11):RC05-RC08. doi:10.7860/ JCDR / 2016/21084.8857.

10. Sen C, Kocaoglu M, Eralp L. Principles of the Ilizarov technique in the management of complex orthopaedic conditions. Acta Orthop Traumatol Turc. 2004;38(Suppl 1):1-11. doi:10.3944/ AOTT.2004.38.S1.1.

Received date: 30 December 2024
Accepted reviewed version date: 18 January 2025