Research Article

INTERNATIONAL RESEARCH JOURNAL OF PHARMACY

www.irjponline.com

ISSN 2230-8407 [LINKING]

RESEARCH ON THE USE OF ILIZAROV METHODS IN HARD ORTHOPAEDIC CONDITIONS

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How To Cite: Sakhuja R. Research On The Use Of Ilizarov Methods In Hard Orthopaedic Conditions. International Research Journal Of Pharmacy. 2023, 14:7:26-31.

10.56802/2230-8407.1303706

ABSTRACT

Background: The Ilizarov external fixator has completely changed the field of orthopaedic surgery by making it simple to cure challenging orthopaedic diseases that were previously incurable while still preserving limb function and mobility.

Aim: Analysis of the Ilizarov external fixator's use in challenging orthopaedic circumstances is the goal. **Methods**: A review of history has been done. Together with clinical and radiological information, a thorough case history and results were displayed.

Results: 20 cases of infected non-union tibia, five cases of infected non-union femur, four cases of congenital pseudarthrosis, one case of non-union of humerus, one malunited supra-condylar fracture of femurs, one CTEV, one equinus deformity, three comminuted tibia fractures, and one case of non-union of humerus were treated in the study. 8 fixed flexion abnormalities of the knee, 1 non-union of the ulna, 1 pilon fracture, 1 segmental fracture of the humerus, and 1 tibial condyle fracture.

Conclusion: Despite the technical difficulty of this treatment, its usefulness can be further increased by hybridization with an intramedullary nail or an AO external fixator. By lowering the quantity of rings needed to be applied and improving comfort when administered close to the shoulder and hip, it also improved effectiveness. This approach was proven to be beneficial with a greater success rate and lower morbidity, despite modest difficulties.

Keywords: humerus, Ilizarov external fixator, femur, orthopaedic diseases.

INTRODUCTION

A new chapter in the principles of managing compound fractures, infected non-union, limb length discrepancy, flexion deformities, and osteomyelitis has been initiated by the Ilizarov external fixator, which has alleviated the pain of numerous orthopaedic patients. The field of orthopaedics is full of pivotal moments. "According to Ilizarov, "this dynamic apparatus could solve most of the orthopaedic conditions, if not all of them." Its future will be heavily dependent on the attention and care that its users provide for it. New concepts have worked wonders, from Kuntscher's intramedullary nailing to the AO group's ideas of the biomechanical components of fracture healing. This ring fixator device bears the name of Prof. G. A. Ilizarov, a Russian scientist who invented it in 1951, has worked wonders in the treatment of a wide range of orthopaedic issues.3. This technique can be referred to as "the orthopaedic invention of the 20th century" because to its unprecedented success rate and flexible application in the treatment of orthopaedic issues.

We believe that the Ilizarov ring fixator system will provide a solution in the future for the treatment of infected non-union, limb lengthening, deformity correction, fracture management, and congenital pseudoarthrosis because to its high success rate among previously unsuccessful and complex patients. The goals of this study were to

examine the fundamentals of the Ilizarov external fixator, assess its issues, challenges, and difficulties, and analyse the data in order to make conclusions.

MATERIALS AND METHODS

This was a retrospective observational study. In our series, 50 patients ranging in age from 6 years old to 60 years old had the Ilizarov external fixator placed. 38 males and 12 females, with 27 on the right and 23 on the left, made up the 50 patients that were treated. This may be a short series to get a good picture of the occurrence of sex. To design the assembly, pertinent radiographs from before surgery were examined. All of the patients received preoperative antibiotics. Every tool and part required for the procedure was stored ready for use. Every patient's frame was pieced together step-by-step during surgery. Under anaesthesia, the Ilizarov external fixator was used in accordance with standard operating procedures. The pin location was covered with sterile dressings. Patients were forced to walk as soon as they awoke from anaesthetic following surgery. Regular checks were made for frame integrity and wire tension.

Pain was treated with analgesics administered as pills and injections. X-rays were obtained, and based on the culture sensitivity results, appropriate antibiotics were used to treat pin track infections. It was encouraged for all patients to walk about the hospital to foster a healthy environment. To avoid joint stiffness, nearby joints were moved. When necessary, compression-distractions were performed on a regular basis, and the procedure was even taught to some patients. Every patient was monitored on a regular basis. Fixator was activated two days before to extraction. Depending on the circumstances, plaster casts were placed for a little time after the fixator was removed. Follow-up periods varied from six to eighteen months.

RESULTS

Here is a list of the observations and a thorough analysis of the results. In the current study, the effectiveness of the Ilizarov external fixator was evaluated in treating a variety of limb deformities that provide challenges for orthopaedic surgeons. The outcomes of the therapy were meticulously documented and examined.

It was discovered that the male to female ratio was greater in the majority of series. 35 cases had a traumatic origin, 1 had an infectious cause (polio), 1 was the result of a snake bite, 6 had congenital causes, 4 had rheumatoid arthritis, and 3 had hemophilic arthritis. Only four instances—three involving the humerus and one involving the forearm (ulna)—included the upper limb out of the 35 cases with traumatic aetiology. The remaining 26 cases involved the tibia and five the femur.

Of the six congenital malformations, five affected the tibia and one included the foot. All eight repaired flexion deformities involved the knee. A patient had equinus deformity as a result of sloughing off their leg's lateral conformation from a snake bite.

All other non-unions were infected, with the exception of one case each of non-union of the ulna and humerus. All non-union patients, with the exception of one, had undergone prior implant or Ex-fix surgery. There are fifteen plates, six nails, and six ex-fixes. Treatment for every patient who had an implant included debridement of the wound, refreshing of the fracture ends, and removal of the device. To close the gap, corticotomies were performed on four of the non-union patients.

In order to close the surgically produced gap at the pseudoarthrotic location, corticotomies were performed on all four congenital pseudoarthrotic individuals. A lower humeral oblique corticotomy was performed on a patient with cubitus valgus in order to address the deformity. In every instance, we carried out a closed corticotomy.

The most frequent side effects seen in this series were pin track infections, neuropraxia, oedema, and intolerance, which in one patient with an infected non-union of the femur even reached the point of suicidal ideation. Axial deviations, translational angular delays, delayed consolidation, and joint contractures—all of which were detected early and treated—were additional issues that were noted throughout the course. No intraoperative complications, such as neurologic or vascular damage, were noted over the course of the trial. Achieving identical leg length in all patients who attended for follow-up.

- Following that, the outcomes were ranked as outstanding, good, fair, or bad. Of the twenty infected non-unions of tibia, two had fair results, twelve had good results, and two had terrible results.
- Of the five infected nonunions of the femur, one had an excellent outcome, two had a fair outcome, and two had a terrible outcome.
- The four individuals with congenital pseudoarthrosis all had outstanding outcomes.
- The outcome of the one non-union humerus treatment was outstanding. A single malunited supracondylar fracture of the humerus that was treated showed satisfactory repair.

- The abnormalities in 1 out of 1 CTEV patient were fairly corrected. One patient with an Equinus foot deformity achieved an excellent repair.
- Of 3 patients with comminuted fracture Tibia had good 2 had fair and 1 had a poor outcome.
- One of the two Tibial condyle fractures healed nicely, while the other one fared fairly.
- Good correction was made for 8 out of 8 repaired flexion deformities of the knee.
- One of the one ulna non-unions had a superb union and the wrist and elbow mobility were preserved.
- The prognosis for the one patient with the disparity in limb length was great.
- One patient out of one with a tibia Pilon fracture had a favourable result.
- One segmental fracture of the humerus healed well.
- Our results were subpar due to the patient's noncompliance, since they stopped their medication after a month.

Technical: Although distraction was mild and gentle, it caused some temporary paraesthesia when treating flexion abnormalities.

- It was controlled by lowering the frequency or lowering interruptions.
- Elevating the leg was used to treat oedema, or swelling.
- Joint contracture: in limb lengthening, joint contracture was resolved by slanting and doing intense joint mobilisation exercises to keep the joints in a neutral posture.
- There was no evidence of premature regenerative consolidation.
- Delayed consolidation - this was resolved by ceasing the diversion whenever it was noticed for a week.
- Appropriate hinged, rotating, and translation devices were used to rectify the axial and angular deviation.

Mechanical:

- Bending of the 6 mm connecting rods during joint arthrodiastasis and when weight bearing is permitted.
- When drilling, especially at the diaphysis for long bones, K-wires and Olive wires blunt.

Patient tolerance:

A few patients demonstrated heightened resistance to keeping the frame in place for more than three months. For many people, the pain associated with the pins becomes unbearable. Children are able to endure the frame for extended periods of time.

DISCUSSION

A 1992 study by "The Journal of the American Medical Association" had 25 orthopaedic surgeons and 7 paediatric orthopaedic surgeons on the panel.Six demonstrated and proved the efficacy of the Ilizarov procedure in treating conditions such as bone defects without deformity, bone defects with associated deformity, angular/rotational deformity of the long bones, and limb length discrepancy without deformity.

The current study likewise came to the same conclusion. In 1995, Ebrahein NA treated nine patients who had an angular deformity and non-union of the tibia; eight of these patients had the deformity corrected.7. He came to the conclusion that an option for treating tibia non-union in conjunction with angular abnormalities is the Ilizarov external fixator. Five non-union tibia with angular deformity were included in the current study; they were repaired, and a satisfactory union was attained.

Herzenberg studied 14 knees that were repaired by progressive distraction using an Ilizarov external fixator and an Orthofix external fixator in 1994. He concluded that even if there is still residual stiffness, the surgery corrects the contracture and improves limb function overall. Three instances of hemophilic arthritis, four cases of rheumatoid arthritis, and one case of post-polio residual paralysis with fixed flexion deformity were included in the current study. Every patient had excellent correction, resulting in a better gait and full range of motion.

Thirteen Pilon fractures treated with diaphyseo-epiphyseal procedures of Ilizarov external fixation were studied by Mc Donald MG, et al in 19969. After surgery, 84% of fractures healed after 16 weeks. The majority of patients had minimal or no discomfort. No deep infections were present. He came to the conclusion that this method of treating tibial pilon fractures is efficient. The current investigation of one example of a pilon fracture revealed excellent union after 12 weeks and painless attainment of the ankle joint's complete range of motion. P. L. Kristiansen et al[10] described the treatment of “Schatzker type VI Tibial plateau fractures and the Ilizarov circular external fixator” and found it to be useful in treating such cases. One example of a tibial metaphyseal fracture treated well by an Ilizarov external fixator was included in the current investigation. The literature does not discuss the use of the Ilizarov procedure for treating malunited supracondylar fractures. One example of a malunited supracondylar fracture with a cubitus valgus deformity that was fixed with an Ilizarov external fixator was included in the current series.

When S. A. Green (1994) compared two different approaches to treating segmental skeletal defects, he found that the treatment times for both groups were the same and that each group had specific issues. The study involved 15 patients treated with the open bone graft (Papineau) technique and 17 patients treated with intercalary bone transport (Ilizarov). Graft fracture, morbidity at the donor site, and restricted graft availability are issues for bone grafted groups.

The primary issues facing the bone transfer group were joint contractures and the docking site's inability to combine without an additional graft. Eight of the nine situations in the current series were transports, and nine more required corticotomies. Not a single patient had bone grafting. Joint stiffness, early mobilisation, delayed consolidation, early weight bearing, premature consolidation increasing the rate of distraction, proper resection of the docking site in case of non-union, resurfacing of the fracture ends, early recognition of deformity, and corrective splinting all helped to prevent potential complications.

The repair of complicated foot abnormalities by various distraction osteotomies was documented by Paley Dror et al. in their 199212 paper titled "The correction of complex foot deformities using Ilizarov's distraction osteotomies."

In the current study, there was one instance of congenital talipes equinus varus deformity and one case of equinus deformity of the foot as a result of doughing of the lateral compartment of the leg after a snake bite. No osteotomy was done in either case, and the deformity was successfully corrected.

In 1998, M. Raschike and colleagues reported a successful case of non-union of the humerus after intramedullary nailing, which was addressed using Ilizarov hybrid fixation. One case of non-union of the humerus due to a mid diaphyseal fracture with a K nail in situ was included in the current investigation. Good fracture union was attained after applying the Ilizarov external fixator in situ with a K nail. By keeping the nail in place, you may utilize two rings instead of four.

The wound's infectious status: according to Ilizarov, "infection burns in the fire of regenerate." This statement is supported by the observations made throughout this investigation, where every case that came in for a follow-up appointment had their infection under control.

Corticotomy: Just closed corticotomies were done for this investigation, and the results showed that it was satisfactory. Closed corticotomy was used to treat abnormalities, fill up bone deficiencies, and promote equality of limb length.

Regional variations: It was noted throughout the current investigation that treating diseases affecting the femur and humerus presents a comparatively greater challenge for the implementation of this technology. Hybridization procedures were employed in due course to enhance patient comfort, since this aligns with prior observations.

Patient Tolerance: Younger patients and those with tibial disorders showed superior tolerance to the fixator, particularly when the upper femoral arch was utilised. Hybridization made this better.

Number of rings and hybridization: By employing the intramedullary nail hybrid approach, the number of rings needed to treat mid-diaphyseal non-union was reduced from four to two.

The most frequent side effects seen in this series were pin track infections. One patient with an infected non-union of the femur experienced neuropraxia, oedema, and intolerability to the point of suicidal ideation. Axial deviations, translational angular delays, delayed consolidation, and joint contractures—all of which were detected early and treated—were additional issues that were noted throughout the course.

No intraoperative complications, such as neurologic or vascular damage, were noted over the course of the trial. Identical leg length observed in all patients who attended for follow-up.

CONCLUSION

This method modifies the regeneration capacity of tendons, muscles, nerves, and bones.
In order to address challenging problems such non-union with deformity, infection, bone loss, and repair of congenital and acquired abnormalities, the Ilizarov technique offers a straightforward and efficient surgical treatment. It has removed the need for soft tissue covering treatments and bone grafting. Technically, it is challenging. It has a lower risk of complications and calls for both patient cooperation and the treating surgeon's tolerance to wait longer for better results. Some patients have more difficulty keeping the frame in place for extended periods of time. Youngsters are more tolerant of the fixator. The Ilizarov external fixator preserves articular function and weight bearing while achieving union, correcting deformity, eliminating infection, regaining limb length, and eliminating bone abnormalities.

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TABLES

Complication	**Minor -1**	**Serious-11**	**Severe-111**
Pin site problems	Minor infection	Ring sequestrum	
Infection	Superficial wound	Deep wound	Osteomyelitis
Vascular			Vascular laceration or occlusion require repair
Neurologic medical	Hyperesthesia	Neuropraxia e.g. DVT, pneumonia	Permanent palsy e.g. cardiac arrest
Psychological			Requires change in treatment
Premature consolidation		Requires repeat corticotomy	
Delayed union/non union		LI>2/per adult or >1.5/child	Bone graft or retreatment
Fracture		Repeat fixation	Osteotomy
Axis deviation >5˚		6˚-10˚	>10˚
Subluxation		Temporary	Permanent
Contracture	<10˚	11˚-20˚	>20˚ and/or gait disturbance
Did not equalize	<2.5cm	2.5-5.0cm	>5.cm

Table 1: Complications

Case	**No**	**Result**				**M**	**F**	**R**	**L**
		E	G	F	P				
INUT	20	2	12	4	2	18	2	13	7
INUF	5	-	1	2	2	5	0	1	4
CPAT	4	4	-	-	-	1	3	0	4
NUH	1	1	-	-	-	1	-	-	1

MUSFH	1	-	1	-	-	0	1	1	-
CTEV	1	-	0	1	0	1	-	1	-
EQ	1	-	1	-	-	1	-	0	1
CFT	3	-	0	2	1	3	-	1	2
TCF	2	-	1	1	0	2	-	2	0
FFDK	8	-	8	-	-	2	6	5	3
NUU	1	1	-	-	-	1	-	-	1
LLD	1	1	-	-	-	1	-	1	-
PF	1	0	1	-	-	1	-	1	-
SFH	1	0	1	-	-	1	-	1	-

Table 2: summary of observations