Out Come of Knee Arthrodesis with Ilizarov Method

Karim Bakhsh, Farid Ullah Khan Zimri, Amanullah, Attiq ur Rehman, Eid Mohammed

ABSTRACT

Objectives: To determine the functional and radiological outcome of arthrodesis of the knee using the Ilizarov method.

Methods: This descriptive study was conducted in Bolan Medical Complex Hospital Quetta and National Institute of Rehabilitation Medicine Islamabad from January 2016 to January 2019.All patients meeting the inclusion criteria were operated with Ilizarov for knee arthrodesis. Clinical evaluation was conducted at follow up with assessment of post-operative pain and patient's ability to ambulate. Progressive bone fusion and limb alignment were evaluated on serial radiographs. The criterion for a complete arthrodesis was bone bridging on at least two views.

Results: The total number of patients in our study were 11 with mean age 35.2 ± 13.6(range 23 to 70) years. All the patients were male. The indications for arthrodesis were post-polio fixed flexion contracture of the knee in 3(27.3%) patients, failed knee arthrodesis with other methods in 2(18.2%),sever knee trauma in 2(18.2%),sever knee pain in 1(9.1%),tuberculosis of knee in 1(9.1%), septic arthritis in 1(9.1%) and Charcot arthropathy in 1 (9.1%) patient. Patients were allowed to had partial weight bearing day after surgery. Full weight bearing was allowed a mean of 145 days (range105-195 days). The average follow up from frame removal was 21 months (range, 12-24months). In all 11(100%) a stable arthrodesis clinically and radiologically was achieved after a mean Ilizarov external fixator time of 147days (range120-195 days). Minimal complications were noted despite early weight bearing and no further surgeries were required.

Conclusion: Knee arthrodesis with Ilizarov resulted in stable arthrodesis and pain free mobility. The technique offers several advantages compared with other arthrodesis methods because of fixation versatility, stability and early weight bearing. It had a high union rate and minimal post-operative complications.

Key Words: Arthrodesis, Ilizarov method, Post-polio contracture, tuberculous arthritis

This article may be cited as: Bakhsh K, Zimri FK, Amanullah, Rehman A, Mohammed E. Out Come of Knee Arthrodesis with Ilizarov Method**.** J Pak Orthop Assoc 2019;31(3):

INTRODUCTION

Arthrodesis of the knee is widely accepted surgical salvage procedure for various severe knee joint pathologies, including infected or failed total knee replacement, septic arthritis, inflammatory arthritis like gout and rheumatoid arthritis, tumors around the knee joints, post traumatic, degenerative arthritis, and in some paralytics disorders.[1-5] Primary arthrodesis is rarely done for severe comminuted intra articular fractures.[6] Knee arthrodesis in acceptable position, is compatible with an excellent functional result.[7,8] Arthrodesis was first performed by Albert in 1878 and later on by Hibbs in 1911.[7, 9,10] New techniques have been reported for the arthrodesis of the knee with varying success (29% to 100%). [4, 7,10] Arthrodesis with plate is not recommended in infected knee cases and intramedullary nailing cannot be used to achieve arthrodesis if significant bone loss prevents compression at the opposing surfaces. Intramedullary technique allows early rehabilitation and weight bearing and a high fusion rate without any pin tract infection. However, there are few disadvantages of Intramedullary nailing like dissemination of infection, fat embolism, increased blood loss, more infection rate and potential obstacle in obtaining correct limb alignment.[10] The Ilizarov method offers a reliable solution for all such problems.

Department of Orthopaedics, Bolan Medical Complex Hospital Quetta and National Institute of Rehabilitation Medicine Islamabad
Correspondence to: Karim Bakhsh
Email: drkarimbakhsh71@gmail.com

The objective of our study was to determine the functional and radiological outcome of arthrodesis of the knee using the Ilizarov method.

METHODS

We conducted this descriptive study in Bolan Medical Complex Hospital Quetta and National Institute of Rehabilitation Medicine Islamabad from January 2016 to January 2019. All adults patients with knee pathologies requiring knee arthrodesis as salvage procedure were included in our study. Those patients with bilateral knee pathologies and those not willing for surgery were excluded. The study protocols were approved by the hospital Ethical committee and informed consent of the patients were taken. Complete history, clinical examination and relevant investigations were done in all patients.

Surgical Technique

Under general or spinal anaesthesia, the knee was approached through anteromedial parapatellar incision. Joint debridement was done. In the cases where infection was present culture swab samples were taken for microbiological studies. No bone graft was used and maximum bone on tibial and femoral surfaces was tried to be preserved. A minimal of two rings per fragment and two or three crossed wires were placed on each ring. In few cases where the bone was very osteoporotic, hydroxyl apatite coated Schanz screws were used. The two opposing surfaces were exactly approximated. Ilizarov arches were applied to the femur where extra stability was required especially in obese patients and patients with osteoporotic bone. Threaded rods and hinges were used so that per operatively compression was achieved and post operatively rate of compression was 1 mm every third day. Hinges were placed in frame construction and the fix flexion contracture was corrected. Patients with knee contracture had second surgical intervention where the rings were retained and the knee joint was opened as for other cases and arthrodesis was done.

Clinical evaluation was conducted at follow up with assessment of patient's ability to ambulate, pin site care and stability of the arthrodesis. Progressive bone fusion and limb alignment was evaluated on serial radiographs. The criterion for a complete arthrodesis was bone bridging on at least two views. Antibiotics were given according to culture and sensitivity results in infected cases for at least six weeks. Complete anti tubercles treatment was given according to WHO criteria to patient who had tubercles arthritis of the knee. When callous was noticed on x-ray and patient had minimal discomfort, the arthrodesis was termed as clinically united. No post-operative cast was applied. Patients were encouraged to bear partial weight day after surgery and full weight bearing was allowed after radiological bone union. The Ilizarov frame was dynamized at 6 weeks before removal. Rings were removed after complete union.

Data was analyzed with SPSS version 20. Frequency and percentages of important variables were calculated and data presented in table where necessary.

RESULTS

We applied Ilizarov ring fixator to 11 patients with mean age 35.2 ± 13.6(range 23 to 70) years. Right knee was involved in 7(63.6%) and left in 4(36.6%). All the patients were male. The indications for arthrodesis were post-polio fixed flexion contracture of the knee in 3(27.3%) patients, failed knee arthrodesis with other methods in 2(18.2%),sever knee trauma in 2(18.2%),sever knee pain in 1(9.1%),tuberculosis of knee in 1(9.1%), septic arthritis in 1(9.1%) and Charcot arthropathy in 1 (9.1%) patient. Pre Ilizarov ring application, 1(9.1%) patient had plating for attempting arthrodesis and the other had plating and external fixator for arthrodesis but both were unable to achieve solid union. We allowed our patients for partial weight bearing day after surgery. Full weight bearing was allowed a mean of 145 days (range105-195 days). The average follow up from frame removal was 21 months (range, 12-24months). In all 11(100%) a stable arthrodesis clinically and radiologically was achieved after a mean Ilizarov external fixator time of 147days (range120-195 days). Pin tract infection was noted in 7(64%). Pin site infection had a mean of 3 pin site infection and all were superficial. These infections were more common in the proximal femoral pin sites and the frequency of the infections increased the longer the patient had the frame. All the pin site infections were treated successfully with proper pin site care and first generations oral cephalosporins. No patient needed readmission to the hospital for pin site infection treatment and no wires or pins needed to be removed. Transient peroneal nerve palsy was noted in 2(18.1%) patients and resolved completely in 8 to 12 weeks without any surgical intervention. During the post-operative period 8(72.7%) patients reported mild pain which was successfully treated with oral

Paracetamol and Tramadol Hydro Chloride. No patient required post-operative cast or brace. No refracture, on union and mal union was reported. (fig I(A) & I(B).

Fig I (A): A 70 years old patient with Ilizarov for knee arthrodesis.

Fig I (B): Radiograph of the knee joint.

DISCUSSION

In literature more studies can be seen on arthrodesis secondary to failed infected arthroplasty than primary arthrodesis.[2,4,5] In our local circumstances total knee replacement is infrequently done, instead there are many other general orthopaedic conditions like post-polio deformity, septic arthritis of the knee, tumors around the knee joints and neglected trauma for which arthrodesis of the knee is required as a salvage procedure. There are very few studies on Ilizarov application for knee arthrodesis internationally and nationally.

Knee arthrodesis is done less frequently after many failed surgical procedures. It is essential to achieve solid fusion and avoid major complications because these patients usually have multiple co-morbidities and are often elderly.[1] Methods used for arthrodesis have many complications like persistent infection, inadequate fixation, deficient bone stock, and second surgery for removal of implant and in most cases solid bone union was not achieved.[1,2]

Arthrodesis with external fixator has some advantages like less blood loss and easily application when there are broad cancellous surfaces. The Ilizarov fixation rings are applied away from neuropathic or infected joint. There are reports of less re current infection using Ilizarov fixation compared with internal fixation.[1,6,11] There are some disadvantages of external fixator like pin tract infection, dissatisfaction of the patient, early removal before union and cast or brace immobilization after removal. Fusion rates with external fixator are less as compared to intramedullary nailing in cases of fusion after failed total knee arthroplasty. On the other hand, fusion rates of 100% have been achieved in patients of primary arthrodesis with Ilizarov fixator.[1,6,7,12]

Arthrodesis of knee after failed total knee arthroplasty and infected total knee with extensive bone loss is difficult to achieve even with modern external fixators. It is also difficult in those patients who have previous multiple procedures.[1,13] Furthermore patients with multiple surgical procedures before knee fusion are somewhat reluctant and tired of frequently visiting their operating surgeon after external fixator.[1,3]

Longer intra medullary nails are technically demanding, nails are usually not easily available and sometimes surgical access to the greater trochanter is difficult especially with ipsilateral hip arthroplasty.[1,4,14] In addition there are some other disadvantages like increase risk of fat embolism, infection, blood loss and intra modularly dissemination of infection.[1,5,14] Lucas and Murry used dual plates (one plate anteriorly and one plate medially) for arthrodesis of the knee while Nichols used one plate medially and one laterally.[1,6,14]

Both reported good results but additional benefit of easy wound closure was noted by Nichols. Dual plating avoids the complications of pin tract infection and loosening but not recommended in knees with acute infection.[1,14] The combination of intramedullary nailing and plating for knee arthrodesis in eight cases have been reported in literature but recommended as salvage in complicated cases only.[2,3,14]

The Ilizarov method provides almost the ideal method of arthrodesis except that it is considered cumbersome according to some authors.[1,2] It has numerous additional advantages. Since extensive bone loss is an important factor influencing outcome in knee arthrodesis and bone grafting cannot be done due to infection, Ilizarov fixator is the ideal techniques which can overcome bone deficiency. This improves the quality of bone formation at the arthrodesis site. The Ilizarov frame provides more rigid fixation due to its circular configuration. The surgeon can increase or decrease the ring rigidity by adding or removing wires. In the patients requiring knee arthrodesis who have significant limb length shortening, limb lengthening can be done with Ilizarov method by either bifocal or trifocal methods. The Ilizarov method also offers the ability to correct alignment at the arthrodesis site by using hinges.[6,7,9]

In our study we achieved solid fusion with Ilizarov without any major complication although some of our patients had confirmed infection. No patient of failed knee arthroplasty was included in our enrolled subjects which is otherwise a common indication for arthrodesis in rest of the world. The Ilizarov external fixator however, is the only solution in certain complex and challenging cases needing surgical fusion but with concomitant infection, poor bone quality, soft tissue or bone loss, deformity, failed total knee replacement and usually precluding the use of internal fixation.[10,12,14]

One important limitation of our study was the limited number of cases but this is because of the rarity of the need for this salvage procedure and the lack of willingness of some of the patients to consent for this salvage procedure.

CONCLUSION

Knee arthrodesis with Ilizarov resulted in stable arthrodesis and pain free mobility. The technique offers several advantages compared with other arthrodesis methods because of fixation versatility, stability and early weight bearing. It had a high union rate and minimal post-operative complications.

Conflict of interest: None
Funds/Grants: None

REFERENCES

1 White SP, Porteous AJ, Newman JH, Mintowt-Czyz W, Barr V. Arthrodesis of the knee using a custom made intramedularly coupled device.J Bone Joint Surg [British] 2003;85-B;57-61.

2 Oostenbroek HJ, Van Roermund PM. Arthrodesis of the knee after infected arthroplasty using the Ilizarov method. J Bone joint Surg [Br] 2001;83-B:50-40.

3 Riouallon G, Molina V, Mansour C, Court C, Nordin JY. An original knee arthrodesis technique combining external fixator with Steinman pins direct fixation. Orthopedics and Trauamatology: Surgery & Research 2009;95: 272-277.

4 Salem KH, Keppler P, Kinzl L, Schmelz A. Hybrid external fixator for arthrodesis in Knee sepsis. Clinic Orthop Relat Res 2006 Lipincott Williams & Wilkins November 451,pp. 113-120.

5 Panagiotopoulos E, Kouzelis A, Matzaroglou C, Saridis A, Lambiris E. Intramedullary Knee Arthrodesis as salvage procedure after failed Total Knee Replacement. International Orthopaedic 2006;30(6):545-549.

6 Spina M, Gualdrini G, Fosco M, Giunti A. Knee arthrodesis with the Ilizarov external fixator as treatment for septic failure of knee arthroplasty.J Orthopaedic Traumatol 2010;11:81-88.

7 Eralp L, Kocaoglu M, Tuncay I, Bilen FE, Samir SE. Knee arthrodesis using a unilateral external fixator for the treatment of infectious sequelae. Acta Orthop Traumatol Turc 2008;42(2):84-89.

8 Calif E, Stein H, Lerner A. The Ilizarov external fixation frame in compression arthrodesis of large, weight bearing joints. Acta Orthop. Belg 2004-70;51-56.

9 Damsin JP, Ghanem I. Treatment of severe flexion deformity of the knee in children and adolescents using the ilizarov technique. J Bone joint Surg [Br]1995;77-B:140-4.

10 Mabry TM, Jacofsky DJ, Haidukewych GJ, Hanssen AD. Comparison of Intramedullary Nailing and External Fixation Knee Arthrodesis for the Infected Knee Replacement. Clin Orthop Relat Res 2007-464:11-15.

11 Paley D, Catagni MA, Argnani F, Villa A, Benedetti GB, Cattaneo R, et al. Ilizarov treatment of tibial

nonunions with bone loss. Clin Orthop Relat Res 1989;241:146-65.

12 Monzott A, Pullen C, Guerreschi F, Catagni MA. Knee arthrodesis and limb lengthening in the treatment of infected total knee arthroplasty: Case report. The Journal of Trauma 2003;52.(2)3:359-363.

13 Rozbruch SR, Ilizarov S, Blyakher A. Knee arthrodesis after infected total knee arthroplasty using the Ilizarov method. Clinic Orthop Relat Res 2001;389:143-149.

14 William E. Albers. Arthrodesis of the knee In : Canale ST, Beaty JH, editors. Campbell's Operative Orthopaedics 12th ed. Philadelphia: Elsevier Mosby 2013; 2013.

Authorship and Contribution Declaration

Karim Bakhsh, Conception and design of the study, acquisition of data
Farid Ullah Khan Zimri, Revised the manuscript critically for important intellectual content
Amanullah, interpreted the data
Attiq ur Rehman, Drafted the manuscript,
Eid Mohammed, Final approval of the version for publication