RESEARCH ARTICLE

Ilizarov fixator pin site infection: A comparison between transverse wires and half pins

Asadullah Makhdoom, Raheel Akbar Baloch, Muhammad Faraz Jokhio, Syed Muhammad Ali, Zameer Hussain Tunio, Jehanzaib, Tahir Ahmed

Abstract

Objective: To evaluate the difference in the infection rates between Ilizarov wires and half-pins in routine practice.

Methods: This was an observational, prospective; single-centre study approved by the institutional ethics committee. Hundred cases were treated from June 2014 to May 2018 at Ilizarov Surgery Unit, Department of Orthopaedic Surgery & Traumatology Liaquat University of Medical & Health Sciences Jamshoro Sindh Pakistan. All patients were subjected to an evaluation of half-pins and Ilizarov wires. Patients with monolateral fixators were excluded from the study. The demographic data included patient's age and sex, surgical indication, application and removal of Ilizarov fixator, follow-up duration and type of pin (transverse wire or half pin) used. Non probability consecutive sampling technique was used and sample size was calculated randomly.

Result: Of the total 100 cases, 79(79%) were male and 21(21%) were female with a mean age of 42.8±8.2 years. A total of 890 pins were applied in 100 patients with 170(19.10%) Half pins and 720(80.89%) wires. The transverse wire's infection rate according to Paley's grading system of Pin tract infection was, 46(53.48%), 25(29.06%) and 15(17.44%) in Grade I, Grade II and Grade III respectively. In case of half pin's infection, the majority of the cases were categories in grade II 22(55.0%) followed by Grade I 12(30.0%) and Grade III 06(15.0%).

Conclusion: The tensioned transverse wires had a significantly low infection rate as compared to half pins.

Keywords: Ilizarov Fixators, Transverse wires, Half pins, Pin infection. (JPMA 71: S-55 [Suppl. 5]; 2021)

Introduction

The magician of Kurgan (Russia), Prof. Gravil Ilizarov revolutionised the treatment of complicated musculoskeletal disorders.[1] He is the first to discover the biological principles of modern distraction osteogenesis by its successful technique of Ilizarov, now the key tool in numerous orthopaedic conditions.[2] The Ilizarov fixator is widely used for fracture fixation and stabilization, deformity correction, limb lengthening and reconstructive surgery.[3] A number of fixator systems are available ranging from the tensioned fine wire circular fixators (Monticelli-Spinelli, Ace-Fischer), to the axially dynamic unilateral designs to which the Orthofix and AO fixators belong.[4] However, Ilizarov's original ring fixator design, by virtue of its inherent versatility and biocompatibility, remains the most uniquely suited to the tasks of lengthening, simultaneous or staged three dimensional deformity correction, and intercalary bone transport.[5] Though the management by Ilizarov fixation is well established, nevertheless, its use is also associated with significant rates of pin tract infection.[6] It is the most common expected orthopaedic problems, or even an almost inevitable complication, may mainly arise from percutaneous pins or wires. In comparison with the results of various studies, the pin infections range from 10 to 100%.[7,8] The discrepancy in the infection range is mainly due the study duration, the external fixator application technique, patient population, and the pin site care protocol used. Thus, PTI remains a clinical challenge, specifically in cases of limb lengthening or deformity correction. Ilizarov frame is a form of ring fixator, traditionally constructed using transverse wires. The transverse wires can cause damage to nerves and blood vessels, whereas, half pins in comparison with transverse wires is safer and easier to apply.[9] Whereas in case of pin infections, according to the past literature, the rates of wire and half-pin infection for external fixation ranging from 0.5 to 30% and more common in half pin as compared with the transverse wires.[10] There are multiple studies conducted on the Ilizarov frame technique reflecting the importance and evaluating the clinical outcome of Ilizarov fixator,[11] but there are limited data for the comparison of pin site infection in

Department of Orthopaedic Surgery & Traumatology, Liaquat University of Medical & Health Sciences, Jamshoro, Sindh, Pakistan.

Correspondence: Asadullah Makhdoom. Email: asadmakhdoom@gmail.com

transverse wires and half pins especially in case of the local Pakistani population. The aim of this study was to evaluate the difference in the rates of Pin site wound sepsis between transverse wires and half-pins in patients with Ilizarov circular fixator.

Methods

It was a single-centre, prospective, observational study on 100 patients who underwent distraction osteogenesis using Ilizarov circular fixator. The study was conducted at the Orthopaedic department of Liaquat University of Medical & Health Sciences (LUMHS), Jamshoro from the period of June 2014 to May 2018. Non probability consecutive sampling technique was used and sample size was calculated randomly.

As per study exclusion criteria, patients with pre-existing infection and co-morbidities that may enhance the risk of getting pin site wound sepsis such as diabetes mellitus, renal and liver failure, tumours and smoking were excluded. The study population consisted of all skeletally mature patients who underwent distraction osteogenesis using Ilizarov circular fixator. After the application of Ilizarov external fixation, the first dressing of wires and pins was applied after 48 hours and appropriate intravenous antibiotic was given for 3 days followed by 5 days of an oral antibiotic if required. The patients were reassessed after every 72 hours. The pins and wires were cleansed with a single gauze soaked with pyodine solution, or hydrogen peroxide if the pin tract infection developed. The designed CRF recorded the patients' medical and demographic data including age and sex, surgical indication, application and removal of Ilizarov fixator, follow-up duration, type of pin (transverse wire or half pin), total number of wires and half pins found infected. Grading was done according to Paley's classification and treated according to the given guidelines.[12]

All patients were trained to clean their wires and pins during their stay in the hospital. After discharge, patients were followed up every 2-weeks through the outpatient department until the fracture was united and pins and wires were removed.

For analysis of the data, SPSS version 20 was used. A p value < 0.05 was considered significant. All variables were summarised using the number of observations, mean, standard deviation or standard error, median, minimum and maximum, ± 95% confidence intervals were provided in the inference tables where applicable. All hypothesis tests were two-sided and conducted using a 0.05 significance level unless otherwise stated.

Results

In this study, 100 cases were selected as per inclusion/exclusion criteria. The mean age was 42.8±8.2 years with 48(48.0%) patients between 18 and 35 years, 27(27.0%) between 36-50 years and 25(25.0%) patients were in the age group above 50 years. There were 79(79.0%) males, and 21(21.0%) females. The bones involved in the traumatic injury included, tibia as the commonest 60(60.0%) while the second most common bone was femur IE; 23(23.0%), followed by, humerus and radius/ ulna with a percentage of 14(14.0%) and 3(03.0%) respectively. Road traffic accident was the most common mode of injury in 70(70.0%) cases, while history of fall was recorded in 18(18.0%) patients, firearm injury in 08(08.0%) patients and 04(04.0%) patients were assaulted. Total pins applied were 890. Among them, half pins used were 170(19.10%) and wires were 720(80.89%). Of the wires used, 690(95.83%) were Plain wires and 30(4.16%) were beaded.

Half pins were found more infected as compared to wires. Of 170 half pins 40(23.52%) were infected, while out of 720 transverse wires, 86(11.94%) were infected. According to Paley's grading system of Pin tract infection, transverse wire's infection rate was found in: 46(53.48%) in the Grade I, 25(29.06%) in grade II and 15(17.44%) in Grade III. According to the Paley's grading system of Pin tract infection, half pin's infection rate was found in majority of the cases, 22(55.0%) in Grade II, followed by 12(30.0%) in Grade I and 06(15.0%) in Grade III.

Discussion

The Ilizarov frame provides a versatile fixation system, however the Pin site infection is almost an inevitable complication associated with this successful frame technique.[13] Its frequency ranges from 11.3 to 100%. Studies have shown figures of 24.1% by Grant et al, 52% by Schalamon et al, 26.25% by Ferreira N et al, 26% by Toksvig et al, 70% by Mostafavi et al, 25% by Rose R et al, 11.2% by Parameswaran et al, 18% by Chan CK et al and 85% by Aronson J et al.[10,14-20] In our study, the rate of transverse wire's infection was reported as 17% and majority of the cases (55%) had half pin infection and were placed in grade II category. The variation in the reported rates among studies is partly due to lack of a standardized, validated and comparable grading system.[14,21]

There are only a few studies which compare the infection rate between thin transverse wires and threaded half pins in patients with Ilizarov circular fixator. Some advocate there is the lowest rate of pin site wound sepsis in threaded half pins.[17,22] At the same time, there are several prior studies which have significantly higher

infection rate, but the raw data in all these studies demonstrated higher infection rate in half pin site.[19]

In a study carried out with 124 wires and 95 half pins sites in 21 patients, pin site wound infection was noted in 55(25%) pins, 6.3% of which developed in half pins and 18.7% in the wire sites. Of the 21 patients, 19(90.4%) had pin tract infections.[17] In our study, of the 100 patients, half pins were found more infected as compared to wires, as well as out of 170 half pins 40(23.52%) were infected, while out of 720 wires, 86(11.94%) were infected. Our study results were endorsed by a previous study which observed that the frequency of pin tract infection was higher with a half pin (8.0%) than with fine wires (5.3%) with the difference being significantly higher for half pin sites in the distal segment. Similarly, another comparative study on two different solutions reported that Half-pin sites were more likely to become infected than wire sites (25% vs 15%). In addition, Antoci V et al reported that the rate of pin tract infection to be significantly higher with half-pin site (78%) than that of fine wire site infection (33%) using fine wire site infection in hybrid external fixator.[7] Overall, the previous studies' results when compared with the transverse wire site, shows the half-pin site to be more prone to pin tract infection. Also, the rate of additional surgeries and interventions for treating pin site infection was higher with the half-pin site.

While the above mentioned studies support half pins infection, some studies reported no significant difference in infection between half pins and transverse wires.[22] The study on 1093 half pins and 951 wires in 218 patients showed 3.11% half pin sites and 4.73% wire sites to be infected with no significant difference in infection rates between wires and half pins sites.[22]

The results of our study together with those of other researchers, showed that the exceptional circular fixator Ilizarov technique application is not only more stable than the conventional external fixture, but there is a discordance with another previous study which showed a lower risk for pin-site infections with the traditional Ilizarov.[23-25] Further comparing infection rates between pins and wire shows transverse wires to have a significantly lower infection rate as compared to half pins as noted in this study which is comparable to the results published in most other studies. However, a significant relationship was not noted between the location of the Ilizarov circular fixator and the development of pin site wound sepsis ($p>0.05$).

Conclusion

The circular fixator Ilizarov technique is more stable with a lower infection rate. The tensioned transverse wires had a significantly lower infection rate as compared to half pins.

Disclaimer: None.

Conflict of Interest: None.

Funding Disclosure: None.

Ethics Approval: The study protocol and follow-up analysis were approved by the Ethics Committee of LUMHS.

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