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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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No 11 (344) 2023

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RANDOMIZED COMPARATIVE STUDY OF DEFINITIVE EXTERNAL FIXATION VERSUS ORIF IN PILON FRACTURES: AN EARLY CLINICAL OUTCOME REPORT

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Abstract.

Background: Repairing Pilon fractures remains challenging. ORIF allows direct anatomical reduction, but at the expense of soft tissues dissection which are associated with recovery. On the other hand, External Fixation allows indirect reduction and causes less soft tissue damage. However, a few studies conclude that External Fixation is associated with high rates of malunion.

The objectives were to evaluate and compare: Primary outcome measure: ankle hindfoot function (AOFAS at 9 months) ,and secondary outcome measures: quality of reduction, bone union, arthritic changes, other potential complications and ultimately the optimum management for pilon fractures.

Methods: A prospective randomized comparative clinical study. 40 Patients were included in the study with comminuted closed Pilon fracture. Patients were randomized by closed envelope technique into two groups: Group (1) Included 20 patients managed by external fixation with limited internal fixation. Group (2) Included 20 patients managed by open reduction and internal fixation. Skeletally immature, type 43A AO/OTA, Open fractures, compartment syndrome, Pathological fractures were excluded.

Results: There was no significant difference between External fixation and ORIF as methods of fixation for Pilon fracture in the functional activity of the patient after 9 months as evidenced by AOFAS score (P=0.547) and the development of complications (P =0.227). However, there was statistically significant difference (P <0.001) regarding the time to weight bearing between both groups, and statistically significant difference (P =0.042) regarding time to union.

Conclusions: The best surgical modality to treat Pilon fractures is still debatable. While external fixation is used by many to avoid major complications, it has been associated with high rates of malunion, and osteoarthritis.

Key words. Pilon-Distal, Tibia-Intraarticular-Tibial, Plafond-Staged ORIF-Ilizarov.

Introduction.

Tibial pilon fractures are increasing in incidence [1,2], usually caused by high energy trauma, whereas their management remains still challenging and debatable. Over the past decades, many strategies have emerged like open reduction and internal fixation mainly with plates (ORIF), external fixation of different kinds (ExFix), and minimally invasive treatment options [3,4]. The goal of treatment is to achieve a balance between soft tissue envelope integrity as much as possible while avoiding articular incongruence. ORIF aims to recreate the anatomic structure of the bone through direct reduction, on the expense of extensive dissection which may affect recovery [5]. On the other side, ExFix relies on indirect reduction and thus keeps the soft tissue envelope intact. However, a few studies criticized ExFix to be associated with high rates of malunion [6,7]. This study compares between treatment of pilon fractures with definitive external fixation (group 1) and ORIF either early or delayed after temporary spanning external fixation (group 2). The objectives were to evaluate and compare:

primary outcome measure: ankle hindfoot function (AOFAS at 9 months), and secondary outcome measures: quality of reduction, bone union, arthritic changes, other potential complications and ultimately the optimum management for pilon fractures.

Patients and Methods.

A prospective randomized comparative clinical study including 40 Patients with comminuted closed pilon fracture were included. Assuming a standard deviation of 10, a sample size of 34 was required to obtain 80% power to identify a difference of 10 points in AOFAS score as statistically significant. Therefore, each group should include 17 participants. To compensate for lost patients, each group was set to 20 patients. The study was performed at Kasr Al-ainy university hospital, Nile hospital for health insurance-Cairo-Egypt in the period between May 2019 and May 2022 with a mean follow up of 24.7±3.07 months for Exfix and 23.8±3.12 months for ORIF. The primary outcome measure was the AOFAS at 9 months.

Patient selection and randomization:

Patients who consented to participate were randomized by closed envelope technique to receive either External Fixation or ORIF into two matched groups: Group (1) 20 patients were treated by definitive external fixation. Group (2) 20 patients were treated by open reduction and internal fixation. Inclusion criteria were patients older than 18 years, fracture types 43B and 43C per AO/OTA classification and types II & III per Rüedi and Allgöwer classification. Exclusion criteria excluded those with open fractures, compartment syndrome and pathological fractures.

All patients were subjected to clinical assessment, laboratory, and radiological investigations (plain x ray and CT scan) to assess the degree of fracture comminution, fracture pattern according to Rüedi and Allgöwer and OTA/AO classifications, and to exclude unsuitable patients from the study, Surgical interventions were performed by a single surgeon, the first author.

Surgical interventions.

External fixation (Ilizarov): A non-bridging frame was applied by two proximal fully circular rings attached to the proximal segment to provide stable anchorage for the distal ring, one full ring with tensioned wires attached to the distal articular segment and 3 or 4 connecting rods between each ring (Figure 1).

Preliminary fibular fixation or the use of a temporary bridging frame aided reduction. Reduction wires (with olives) were considered for interfragmentary compression and reduction for the articular component. "Dropped" olive wires in-between proximal and distal rings were applied to optimize diaphyseal reduction. This was additionally augmented by limited internal fixation with screws (Figure 2).

Open reduction and internal fixation (ORIF): Either primary (early) ORIF or delayed ORIF after initial (uniplanar) delta frame application once soft tissues have healed usually in 14 to 21 days (Figure 3).

In addition to the anteromedial and anterolateral approaches (Figure 4) for the distal tibia, the lateral approach for the fibula and posterolateral approach for both the tibia and fibula were utilized. In most of the patients (15 cases, 75%) the universal anteromedial approach was used.

Postoperative components.

1) Postoperative management:

▪ **Antibiotics:** All patients received single dose of (cefazolin 2 g) intravenous within 60 minutes prior to incision and continued for 2 days postoperatively.

Figure 1. *Non bridging Ilizarov frame for distal tibial fractures.*

Figure 2. *Intraoperative fluoroscopic image shows the proximal and distal rings assembly.*

Figure 3. *Skin condition after trauma and 14 days after spanning with Delta frame.*

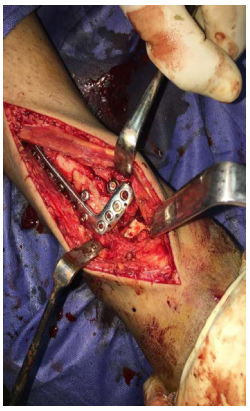

Figure 4. *Intraoperative photo showing anterolateral plate applied through anterolateral approach.*

▪ **Wound condition:**

In external fixation cases:

- The pin/wire-insertion sites should be kept clean. Any crusts or exudates should be removed. The pins/wires may be cleaned with saline and/or disinfectant solution/alcohol. The frequency of cleaning depends on the circumstances.
- No ointments or antibiotic solutions were used for routine pin-site care.
- Dressings were not usually necessary once wound drainage has ceased.
- The patient or the carer were teached to apply the cleaning routine.

Postoperative rehabilitation.

Weight bearing and Motion:

- All patients were advised to be non-weight bearing.
- All patients were advised to start range of motion exercises of the knee and the ankle the next day after operation to avoid equines posture of the foot.
- Weight bearing was delayed for 6 weeks in External fixation group until union of the articular component after which partial weight bearing is allowed. The fixator is left on the tibia until solid union is evident radiographically. Dynamization is sometimes done by loosening of the locking nuts in the external fixator after callus formation.
- In the ORIF group we are guided by the radiological signs of union usually.

2) Follow up:

- Follow up by plain x-ray every month until fracture healing occurred.
- Then follow-ups were continued every 3 months until 9 months.

3) Postoperative assessment:

Fracture union: Bony union was defined as both clinical and radiographic healing (using plain x rays and CT scan), with no pain or tenderness on palpation of the fracture, full weight bearing and three bridging cortices on orthogonal radiographs. Nonunion was defined as a lack of evidence of clinical and radiographic union at 9 months [2]. Malunion was defined as >7 degrees valgus, varus or >10 degrees procurvatum/recurvatum on the final radiographic evaluation.

Infection: Infection is considered when there are signs and symptoms of infection around the wound. Pin tract infection was diagnosed when signs and symptoms of infection around a pin that required increasing the frequency of local cleansing, protecting the pin site with dressing, using antibiotic, removing the pin, or performing surgical debridement.

Ankle hindfoot function: Was measured using AOFAS score [3] after 9 months. The maximum score was 100 points. A value of more than 87 points was considered to be a good to excellent result.

Objective and subjective outcome measures were recorded by a single surgeon, who was unaware of treatment allocation.

Statistical analysis:

Data was coded, entered, and processed on a personal computer using SPSS software. The cut-off value for significance was set at $p < 0.05$. Student t test was used to assess the

statistical significance of the difference between two population means involving independent samples. A paired t-test was used to assess the statistical significance of the difference between two population means involving matched or paired samples.

Results.

Age ranged from 19 to 53 years, among the 40 cases males were predominant (34 cases).

33 cases were Non-smokers and only 7 cases were smokers.

As regard the mechanism of injury, fractures as a result of axial loading were (27 cases) and those as a result of twisting injury were (13 cases).

There was no significant difference (P=0.547) between External fixation and ORIF as methods of fixation for pilon fracture in the functional activity of the patient after 9 months as evidenced by AOFAS score where the mean in (External fixation) group was 80.20 ± 9.61 range (60-95), and in (ORIF) group was 81.75 ± 6.12 range (70-90), and There was no significant difference

(P =0.227) in the development of complications such as infection, malunion, arthritic changes and wound complications (Table 1).

Table 1. *Comparison between external fixation and ORIF groups regarding late complication sequels.*

Late sequel	External fixation		ORIF		Chi-square test	
	No.	%	No.	%	X^2	P-value
No	10	50%	16	80%	5.651	0.227
Malunion	4	20%	1	5%		
OA	2	10%	0	0%		
Infection	4	20%	1	5%		
Wound breakdown	0	0%	2	10%		

P > 0.05: NS

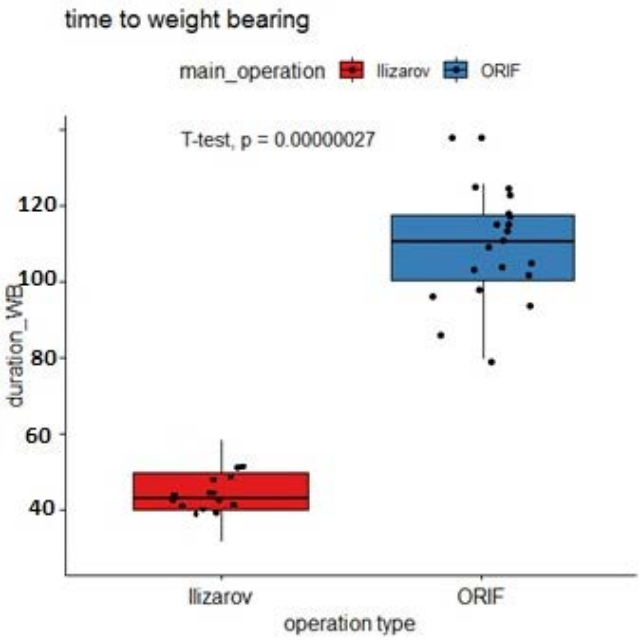

Figure 5. *Comparison between external fixation and ORIF groups regarding weight bearing.*

Figure 6. *Clinical photo shows wound infection after early ORIF.*

Figure 7. *Clinical photo shows wound breakdown and exposed plate after early ORIF.*

However, there was a statistically significant difference between both groups regarding time to weight bearing (P <0.001) shorter for external fixation group (45-60 days) than for ORIF group (88-126 days) (Figure 5) and a statistically significant difference between both groups regarding time to union (P =0.042) ranging from 3-4 months for external fixation group and 3-7 months for ORIF group.

In the External fixation group 4 cases (20 %) developed infection and 1 case (5 %) in the ORIF group (Figure 6). This was attributed to minor pin tract infection while only one deep infection in the ORIF group was identified. However, wound breakdown occurred in 2 cases (10%) in the ORIF group and resulted in exposed infected hardware after 4 months and 3 months which required culture specific suppressive antibiotic till union of fracture followed by removal of the implants followed by serial debridement till wound healing (Figure 7).

On the other side, malunion in External fixation group was recognized in 4 cases (20 %) and in 1 case (5 %) in the ORIF group. This was attributed to indirect periarticular fixation in the External Fixation group and secondary loss of reduction.

Discussion.

Pilon fractures remain a challenging injury, especially in multifragmentary fractures, with articular impaction, and complex metaphyseal or diaphyseal components, in addition to the soft tissue injuries that are frequently associated with these fractures which could affect the management plan and timing of surgery.

Over the past years, staged management, newer implants, and less invasive techniques have evolved to improve outcome [4].

In our study, infection in External fixation group occurred 4 times (4 cases representing 20 %) more than in ORIF group (1 case representing 5 %) although they consisted of minor pin tract infection and with only one serious deep infection in ORIF group. However, wound breakdown occurred in 2 cases of the ORIF group and resulted in exposed infected hardware after 4 months and 3 months which required culture specific suppressive antibiotic till union of fracture followed by removal of the implants followed by serial debridement till wound healing.

In our study, malunion in External fixation group occurred 4 times (4 cases representing 20 %) more than in the ORIF group (1case representing 5 %) and the External fixation cases were attributed to limited periarticular fixation and secondary loss of reduction.

Overall, our study concluded that there was no significant difference between External fixation and ORIF as methods of fixation for pilon fracture in the functional activity of the patient after 9 months as evidenced by AOFAS score (P=0.547) and the development of complications such as infection, malunion, arthritic changes and wound complications (P =0.227).

However, there was statistically significant difference (P <0.001) regarding the time to weight bearing between both groups in External fixation group was 47.47±4.489 range, and in ORIF group was 109.07 ± 13.14 range.

Regarding time to union P value was (0.042) in External fixation group range was (3.45 ± 0.51), and in ORIF group range was (4.05 ± 1.14).

In 2019 Saad et al. [5] stated that MIPO technique can overcome some concerns with soft tissue insult while obtaining good articular reduction. Locked or conventional plates with lag screw fixation are utilized for complex articular injuries with or without fibular fixation. External fixation is generally used as a temporary measure but can be utilized as definitive fixation when indicated. There is an indication for acute arthrodesis in severely comminuted, osteoporotic, or arthritic ankles with poor healing potential.

Resch et al. [6] reported that medial stabilization leads to further trophic changes of the cartilage, and these results could explain the increased infection rate after early ORIF.

In 2001 M Blauth et al. [7] stated that ankle function can get better by early motion and partial weight-bearing, which provides better chance for nutrition of the articular cartilage and recovery, and this necessitate rigid stabilization to obtain this target. In his study, fractures which were stabilized secondary by internal fixation, after a mean of 17 days from the provisional treatment, had the best results. The apparently worse results are possibly caused by long-term immobilization with fixators and casts (for an average of 60 days).

Conversely, Hontzsch et al. [8] and Bone et al. [9] did not find any functional disadvantage, and Saleh et al. [10] and De Bastiani et al. [11] achieved good results with dynamic fixators.

Circular frames or hybrid systems applied in a non-spanning mode, may become useful tools [12] but do not always solve the problems in severe pilon fractures [13].

Manaf H Younis et al. [14] in in their meta-analysis concluded that, early postoperative major complications were not significantly affected by the method of fixation whether external or internal, Minor infections, on the other hand, were 2.8 times more likely to be connected with external devices, and this is related to the high frequency of superficial pin tract infections linked to these devices.

When treating pilon fractures with external fixation, the risk of delayed union and malunion is more than doubled and the risk of non-union is not significantly different from that of ORIF.

Due to the lack of anatomical articular reduction and rigid stabilization that are achieved by external fixation as compared to ORIF, long-term consequences indicated a high risk of arthritic alterations following different forms of external fixation.

Any method of external fixation, including uniplanar, circular, and limited internal fixation, produced these results.

In 2016 Yi-Chen Meng et al. [15] systematic review and meta-analysis included 11 studies, 1 prospective randomized and 10 retrospective cohort studies comparing ORIF versus External Fixation. The meta-analysis results suggested that there is no statistically significant difference of the infection between the ORIF and the External Fixation group.

Analysis of deep infection did not reveal a significant difference between both groups, but when only superficial infection was considered, the incidence increased in the external fixation group.

Union time was compared by four studies. One of them stated that ORIF required less time to union (p<0.05) without describing the standard deviation. Meta-analysis of other three studies revealed no significant difference between the two

treatment groups, but with a significant heterogeneity (I^2= 70%), which limited the reliability of the results. The heterogeneity is possibly owing to an Ilizarov frame, which may result in a reduced union time in External Fixation groups.

Their analysis showed no significant difference in the incidence of arthrosis between both groups (p = 0.87). There was a significant reduction of incidence of malunion in ORIF groups (4.3%) versus External Fixation groups (12%). Non-union is multifactorial and caused by unfavourable biomechanical and vascular status. The incidence rate of non-union was compared by six studies and meta-analysis showed a significantly higher risk of non-union in External Fixation groups with an acceptable heterogeneity (p = 0.02).

The best surgical treatment of pilon fractures remains debatable. While external fixation is used by many to avoid major complications, it may be associated with high rates of delayed union, non-union, malunion, and osteoarthritis.

Therefore, ORIF is recommended when the skin condition is favourable, to obtain accurate anatomical joint reduction, rigid stabilization of the articular surface, and restoration of distal tibia alignment. Concerns of soft-tissue complications can be addressed by meticulous preoperative planning, whether with an early or staged ORIF.

The advantages of ORIF include adequate exposure, solid fixation, accurate reconstruction of the articular surface, and convenient post operative care, while the advantages of External fixation include minimally invasive treatment, less wound problems, allowing postoperative adjustments and comparatively easier removal.

Conclusion.

The study showed no statistical differences in functional outcome between both methods of fixation regarding the AOFAS score at 9 months. There was a difference in the time before regaining the ability to bear weight and union time. Both methods necessitate accurate preoperative planning and surgical experience to reduce the risk of complications and hence revision surgery. Clinical outcome may largely depend on the technique rather than on the choice of implant.

Limitations in the study.

Although the sample size was calculated just enough to achieve a power of 80 percent it would be preferable to increase the sample size over a prospective multicenter study that controls for other variables to decrease the risk of error even further.

The majority of patients in this study were relatively young with good bone and immunity, hence results are mainly representative of that group.

Finally short term follow up didn't enable us to detect cases that needed to remove the internal fixation due to irritating hardware in the long run.

Conflict of interest.

The authors of the present study declare that there are no conflicts of interest, and no financing was received for research on which the study is based.

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