ISSN: 3033-3504

Journal of Clinical Medicine and Regenerative Medicine

SCIENTIFIC Research and Community

Review Article

Open Access

Treatment of Firearm Injuries Through an External Fixator

Elona Hasalla[1]*, Ilda Taka[2], Elona Dybeli[3], Blerta Hasalla[3], Sulejman Baha[3], Irena Xhaferri[3], Elda Ruçi[3] and Brandi Fahriu[3]

[1]Department of Pre-Clinic Subjects, Faculty of Medical Sciences, University of Elbasan, Albania

[2]Department of Medical Ecology and Hydroclimatology, Istanbul Faculty of Medicine, Istanbul University. Istanbul, Turkey

[3]Department of Technical Medical Specialties, University of Florence, Italy

ABSTRACT

Introduction: The incidence of gunshot wounds has increased significantly in our country, especially after 1997. Gunshot wounds, although with little kinetic energy, destroy soft tissues and should be treated as closed fractures.

If the damage has caused unstable fractures, they should be treated through internal stabilization, whereas permanent fractures should be treated through functional support

Goal: The purpose of this study is to underline the importance of using the external fixator in injuries from extensor arms, as well as increasing the quality of treatment of these patients.

Methodology: Our study is retrospective and belongs to the period January 2020 to June 2023. We have studied 43 patients with fractures caused by extensor arms. The basic treatment has been their immobilization with external fixator, followed by wound treatment and application of general therapy. Of these patients were: men 32-81%, (under 18 yrs) 3- 7%; female 8-19%. Age: maximum 67 years; minimum 5 years; average 31 years. Female / male ratio 1; 4.34.

Conclusions:

- In all the presented cases the biological union of the bones was achieved for a maximum period of 12 months.
- The use of external fixator in the treatment of these patients was necessary and was seen as the best possible treatment.
- It is also important to treat wounds and use adequate therapy to improve patients as soon as possible.

Recommendations:

- The treatment of open fractures in wounds with a gun is complex and requires the cooperation of all medical personnel.
- The use of external fixator provides the optimal solution for the immobilization of the fracture and the fastest possible start of the osteosynthesis process.
- Wound treatment and application of adequate therapy are the basic condition for the patient to heal as quickly as possible.

***Corresponding author**
Elona Hasalla, Department of Pre-Clinic Subjects, Faculty of Medical Sciences, University of Elbasan, Albania.

Received: July 03, 2024; **Accepted:** July 08, 2024, **Published:** November 30, 2024

Keywords: Open Fracture, Wound, Elbow Joint, External Fixator, Osteosynthesis

Entry

The incidence of gunshot wounds has increased significantly in Albania especially after 1997. Surgeons and nurses in urban trauma centers are increasingly encountering these types of injuries. Gunshot injuries with little kinetic energy and little soft tissue destruction should be treated as closed fractures.

The treatment of choice for unstable fractures is early internal stabilization, while for stable fractures treatment is by means of functional support.

Figure 1: External Fracture and External Fixator

The Purpose of the Study

The purpose of this study is to analyze the use of the temporary

extern fixator in the management of extremity injuries from firearms.
Documenting our experience and spreading it across all surgical services.
This will also affect the increase in the quality of treatment for these types of injuries that are still present even in modern times.

Material and Working Method
Our study belongs to the period January 2020 to June 2023. The material was taken from the file of the regional hospital "Xhaferr Kongoli" in Elbasan and from Trama Hospital in Tirana.

In the period from January 2020 to June 2023, 43 patients with injuries from firearms were treated. The main treatment of fractures was their immobilization with an external fixator. So in all 43 patients or in 100% of them. Complementary treatment was the treatment of wounds and the application of general therapy.

Data Analysis
Among these patients were:
Men. 32-81%
Boys (under 18 years). 3-7%
Women 8-19%
With age:
Maximum 67 years
Minimum 5 years
Average 31 years old
Distribution of patients according to fracture location

Femoral fractures in different locations. .....12 - 28 %
Cartilage fractures with different locations. . . . 7 - 16%
Fractures of the humerus with different locations. . 9 - 21%
Metacarpal fractures. . . ..5 - 12%
Pylon fractures. . . . . 9 - 21 %
Bicondylar femoral fracture. . . . . 1 - 2%
In total. 43---100%

Female: male ratio ....1 to 4.34
Associated damages
Damage to the fibular nerve. . . . . 3 - 7%
Femoral vascular injuries. . . . . .2 - 5%
Large wounds with skin defects. . . . 6 -14%
Large bone defects. . . . . .3 - 7%
Complementary osteoplastic operations. .1.- 2%
Limb amputations from infection. . . . . 1 - 2%
In total. . . . . .16 -37 %

Advantages of the Extern Fixator
• Creates optimal conditions for the continuation of local and general treatment.
• Removes necrotic tissue from complicated wounds.
• Allows spaces for the application of plastic interventions.
• Definitively fixes the fracture away from its focus.
• It can be used in infected osteosyntheses as a continuation of treatment

Disadvantages of the External Fixator
• Difficulty in the application of the external fixator related to the reposition of the fracture after working at a distance from it.
• The fixation of the bone fragments was not done along the entire length of the bone but only in two main solid points, which creates weak points in mobilizing the fracture as a whole.
• Risk of damage to the growth areas from the placement of spears.

Medical Management of the External Fixator
There are many risks associated with the use of the external fixator, including those of the device itself, as well as the initial injuries that require fixation at the site of the spears with the very serious consequence that leads to the installation of osteomyelitis.
• Deep venous thrombosis resulting in pulmonary thromboembolism (PE).
• Aseptic loosening of fixation shafts
• Fracture or non-union of existing fractures.
• Loss of bone mass.

Nursing Management
- Nursing management is related to the education of the patient with fracture wounds from firearms. This includes advice and the attention of the injured to all the health problems he may have. This should be done in the pre-operative and post-operative phase
- Care for fixed spears by moistening them with alcohol. The beginning of wetting of the skin at the point of contact with the spear is the first sign of the beginning of the infection.
- Care for the general condition, the application of therapy and especially of antiaggregate and antithrombotic medications.
- Care for the application of general therapy, local medication and taking radiographs according to the protocol
- The beginnings of rehabilitation through isometric exercises, isotonic exercises, contractions of the quadriceps femoris muscle, for the prevention of articular rigidities and muscle contractures.

Possible Complications
Gunshot fractures being of varying degrees associated with massive soft tissue and bone damage have a high potential for:
- Non-adhesion, infection, trophic wounds, etc.
- Osteomyelitis can be encountered in its classic acute, subacute and chronic forms.
- Infection can also occur where the fixator pins are embedded in the bone.

The Results Achieved
- The primary goal in our study series (biological bone union) was achieved in all cases in a maximum period of 12 months.
- Considering that gunshot wounds occur more in the inferior side, the final result is related to the activity of the injured in daily life. In our cases this goal has been fully achieved.

Conclusions
- Fractures caused by firearms have also increased in Albania, and in their treatment, which is complex, nursing cooperation is also required.
- It is very necessary to facilitate the application of the external fixator as the optimal possible treatment in these cases.
- The role of the nurse in the management of post-operative situations, care for the general condition, for wounds, the condition of the fixator spears, as well as the follow-up of the injured, is absolutely necessary [1-41].

Recommendations
- The application of external fixator in wounds and fractures from firearms is an optimal solution that provides immobilization at the focus of the fracture by applying the means of fixation away from it and ensuring a stable osteosynthesis.
- Nursing care is an absolute condition for the success of this type of treatment.

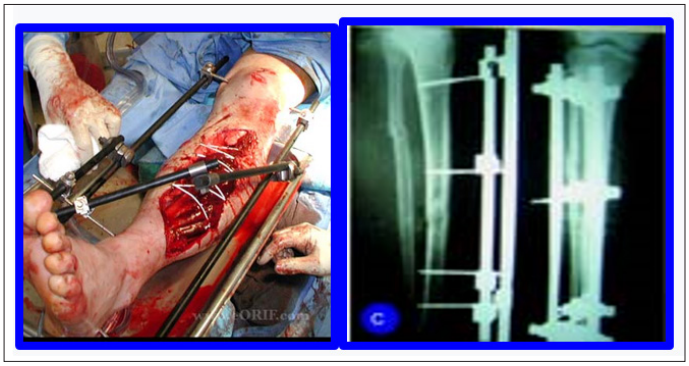

Figure 2: Use of External Fixator and Radiographic Control

References

1. Kirkpatrick AW, Ball CG, Campbell M, Williams DR, Parazynski SE, et al. (2009) Traumatic Injury during Long Duration Spaceflight: Light Years beyond ATLS. J Trauma Manag Outcomes 3: 4.
2. Manon J, Saint-Guillain M, Pletser V, Buckland DM, Vico L, et al. (2023) Adequacy of In-Mission Training to Treat Tibial Shaft Fractures in Mars Analog Testing. Available online: https://www.researchsquare.com/article/rs-2967843/v1.
3. Bertol MJ, Van den Bergh R, Trelles Centurion M, Kenslor Ralph DH, Basimuoneye Kahutsi JP, et al. (2014) Saving Life and Limb: Limb Salvage Using External Fixation, a Multi-Centre Review of Orthopaedic Surgical Activities in Médecins Sans Frontières. Int. Orthop 38: 1555-1561.
4. Kouassi KJE, Akobé JR, Kouassi AA, Fonkoué L, Detrembleur C, et al. (2022) Locally Developed External Fixators as Definitive Treatment of Open Tibia Diaphyseal Fractures: A Clinical Prospective Study Conducted in Ivory Coast. Int. Orthop 46: 7-87.
5. Kouassi KJE, Cartiaux O, Fonkoué L, Detrembleur C, Cornu O (2020) Biomechanical Study of a Low-Cost External Fixator for Diaphyseal Fractures of Long Bones. J. Orthop. Surg Res 15: 247.
6. Manon J, Detrembleur C, Van de Veyver S, Tribak K, Cornu O, et al. (2019) Predictors of Mechanical Complications after Intramedullary Nailing of Tibial Fractures. Orthop. Traumatol. Surg Res 105: 52-527.
7. Tzioupis C, Giannoudis PV (2007) Prevalence of Long-Bone Non-Unions. Injury 38: S3-S9.
8. Manon J, Detrembleur C, Van de Veyver S, Tribak K, Cornu, O, et al. (2019) Quels Sont Les Facteurs Prédictifs d'une Complication Mécanique Après Enclouage Centromédullaire d'une Fracture Diaphysaire Du Tibia? Rev. De Chir. Orthopédique Et Traumatol 105: 353-357.
9. Vico L, Collet P, Guignandon A, Lafage-Proust MH, Thomas T, et al. (2000) Effects of Long-Term Microgravity Exposure on Cancellous and Cortical Weight-Bearing Bones of Cosmonauts. Lancet 355: 1607-1611.
10. LeBlanc AD, Spector ER, Evans HJ, Sibonga JD (2007) Skeletal Responses to Space Flight and the Bed Rest Analog: A Review. J. Musculoskelet. Neuronal Interact 7: 33-47.
11. John RB, Charles HE (2001) Safe Passage: Astronaut Care for Exploration Missions. National Academies Press: Cambridge, MA, USA ISBN 978-0-309-50009-8.
12. Sibonga J (2022) Risk of Bone Fracture Due to Spaceflight-Induced Changes to Bone. In Human Health Countermeasures (HHC). National Aeronautics and Space Administration: Houston, TX, USA.
13. Lang TF (2006) What Do We Know about Fracture Risk in Long-Duration Spaceflight? J. Musculoskelet. Neuronal Interact 6: 319-321.
14. Nelson ES, Lewandowski B, Licata A, Myers J G (2009) Development and Validation of a Predictive Bone Fracture Risk Model for Astronauts. Ann. Biomed. Eng 37: 2337-2359.
15. Thirsk RB (2020) Health Care for Deep Space Explorers. Ann. Biomed. Eng 49: 182-184.
16. Saluja IS, Williams DR, Woodard D, Kaczorowski J, Douglas B, et al. (2008) Survey of Astronaut Opinions on Medical Crewmembers for a Mission to Mars. Acta Astronaut 63: 586-593.
17. Kirkpatrick AW, Campbell MR, Novinkov OL, Goncharov IB, Kovachevich IV (1997) Blunt Trauma and Operative Care in Microgravity: A Review of Microgravity Physiology and Surgical Investigations with Implications for Critical Care and Operative Treatment in Space. J. Am. Coll. Surg 184: 44-453.
18. (2023) Mars Desert Research Station. Available online: http://mdrs.marssociety.org/.
19. Pletser V, Foing B (2011) European Contribution to Human Aspect Investigations for Future Planetary Habitat Definition Studies: Field Tests at MDRS on Crew Time Utilisation and Habitat Interfaces. Microgravity Sci Technol 23: 199-214.
20. Terhorst A, Dowling JA (2022) Terrestrial Analogue Research to Support Human Performance on Mars: A Review and Bibliographic Analysis. Space Sci Technol 9841785.
21. Seligson D (2015) Evolution of the Hoffmann Fixators. Injury 46: S3-S6.
22. Schwechter EM, Swan KG (2007) Raoul Hoffmann and His External Fixator. J. Bone Jt Surg 89: 672-678.
23. Carroll EA, Koman LA (2011) External Fixation and Temporary Stabilization of Femoral and Tibial Trauma. J. Surg. Orthop Adv 20: 74-81.
24. Saint-Guillain M, Vanderdonckt J, Burny N, Pletser V, Vaquero T, et al. (2023) Enabling Astronaut Self-Scheduling Using a Robust Advanced Modelling and Scheduling System: An Assessment during a Mars Analogue Mission. Adv. Space Res 72: 1378-1398.
25. (2008) The SPRINT Investigators. Study to Prospectively Evaluate Reamed Intramedually Nails in Patients with Tibial Fractures (S.P.R.I.N.T.): Study Rationale and Design. BMC Musculoskelet. Disord 9: 91.
26. Milner SA, Davis TRC, Muir KR, Greenwood DC, Doherty M (2002) Long-Term Outcome After Tibial Shaft Fracture: Is Malunion Important? JBJS 84: 971.
27. Cartiaux O, Paul L, Docquier PL, Francq BG, Raucent B, et al. (2009) Accuracy in Planar Cutting of Bones: An ISO-based Evaluation. Int. J. Med. Robot. Comput. Assist. Surg 5: 77-84.
28. Claes L, Augat P, Suger G, Wilke HJ (1997) Influence of Size and Stability of the Osteotomy Gap on the Success of Fracture Healing. J. Orthop. Res 15: 577-584.
29. Marsell R, Einhorn TA (2011) The Biology of Fracture Healing. Injury 42: 551-555.
30. Green DP (2010) Rockwood and Green's Fractures in Adults. Lippincott Williams & Wilkins: Philadelphia, PA, USA ISBN: 1-60547-677-3.
31. Fang C, Luan Y, Wang Z, Shao L, Qu T, et al. (2022) Moderate External Rotation of Tibial Component Generates More Natural Kinematics Than Internal Rotation After Total Knee Arthroplasty. Front. Bioeng. Biotechnol 10: 910311.
32. Heinrich SD, Mooney JF, Beaty JH, Kasser JR (2006) Fractures of the Shaft of the Tibia and Fibula. In Rockwood Wilkin's Fractures in Children, 6th ed.; Lippincott Williams & Wilkins: Philadelphia PA USA 1033-1076.
33. Egol KA, Phillips D, Vongbandith T, Szyld D, Strauss EJ (2015) Do Orthopaedic Fracture Skills Courses Improve Resident Performance? Injury 46: 547-551.

34. Scalea TM, Boswell SA, Scott JD, Mitchell KA, Kramer ME, et al. (2000) External Fixation as a Bridge to Intramedullary Nailing for Patients with Multiple Injuries and with Femur Fractures: Damage Control Orthopedics. J. Trauma Inj. Infect. Crit Care 48: 613-623.
35. Bayrak A, Polat Ö, Ursavaş HT, Gözügül K, Öztürk V, et al. (2021) Which External Fixation Method Is Better for the Treatment of Tibial Shaft Fractures Due to Gunshot Injury? Orthop. Traumatol. Surg. Res108: 102948.
36. Haonga BT, Areu MMM, Challa ST, Liu MB, Elieza E, et al (2019) Early Treatment of Open Diaphyseal Tibia Fracture with Intramedullary Nail versus External Fixator in Tanzania: Cost Effectiveness Analysis Using Preliminary Data from Muhimbili Orthopaedic Institute. SICOT-J 5: 20.
37. Encinas-Ullán CA, Martínez-Diez JM, Rodríguez-Merchán EC (2020) The Use of External Fixation in the Emergency Department: Applications, Common Errors, Complications and Their Treatment. EFORT Open Rev 5: 204-214.
38. Dulchavsky SA, Henry SE, Moed BR, Diebel LN, Marshburn T (2002) Advanced Ultrasonic Diagnosis of Extremity Trauma: The FASTER Examination. J. Trauma Acute Care Surg 53: 28.
39. Kouassi KJE, Manon J, Fonkoue L, Detrembleur C, Cornu O (2021) Treatment of Open Tibia Fractures in Sub-Saharan African Countries: A Systematic Review. Acta Orthop. Belg 87: 85-92.
40. Kouassi KJE, Manon J, Fonkoue L, Kodo M, Detrembleur C (2019) Is the management of open leg fractures in a hospital structure in Ivory Coast a problem and why? Rev. From Chir. Orthopedic And Traumatol 105: 654-658.
41. Kouassi KJE, Manon J, Fonkoue L, Kodo M, Detrembleur C (2019) Is the Management of Open Leg Fractures in a Hospital Facility in Ivory Coast a Problem and Why? In Proceedings of the 38th Annual Meeting of the European Bone and Joint Infection Society (EBJIS), Antwerp, Belgium 12-24.