

OUTCOME OF INTERLOCKING INTRAMEDULLARY NAILING OF THE OPEN FEMORAL DIAPHYSEAL FRACTURES IN PATIENTS WITH GUNSHOT INJURY

Muhammad Imran Haider*, Saeed Ahmed**, Muhammad Hamayun Hameed***, Kashif Siddiq*, Adnan Nazir*, Muhammad Imran Anjum*.

*Department of Orthopedics, Bahawal Victoria hospital, Bahawalpur, Pakistan.

**Department of Orthopedics, Nishtar Medical University, Multan, Pakistan.

*** Department of Orthopedics, Bolan Medical Complex, Quetta, Pakistan.

Abstract

Background: We conducted this study to find out the outcome of interlocking intramedullary nailing of the **open** femoral diaphyseal fractures in patients with gunshot injury. Intramedullary nailing has become the treatment of choice for **close diaphysial** fractures of the femur in recent years. **Materials & Methods:** A total of 91 patients with open diaphyseal fracture of the femur after gunshot injury, 20 to 50 years of age of both genders were included in the study. Patients with fracture of the femoral neck, previous h/o femur fracture and h/o malignancy were excluded. All the patients were operated by a consultant orthopaedic surgeon. Outcome was assessed at 16 weeks by measuring the length of two limbs and noting any shortening, non-union and infection. **Results:** The mean age was 38.75 ± 6.78 years. Out of 91 patients, 72 (79.12%) were males and 19 (20.88%) were females with male to female ratio of 3.8:1. Limb length discrepancy was seen in 04 patients (4.40%), Non-union was seen in 05 cases (5.49%) and infection was noted to be present in 11 (11.09%) patients. So, the acceptable outcome (achievement of union without any limb length discrepancy, non-union or infection during 16 weeks) was seen in 71 (78.02%) patients.

Conclusion: Our study results have observed higher rates of acceptable outcomes in terms of achievement of union without any limb length discrepancy, non-union or infection during 16 weeks with limb length discrepancy after interlocking intramedullary nailing of the open femoral diaphyseal fractures among patients with gunshot injury.

Keywords: Femoral fractures, nailing, union, infection.

INTRODUCTION

Firearm injuries are commonly encountered in accident and emergency departments which are associated with an increase in crimes related to violence, ethnic disparities, escalating social and sectarian conflicts, economic exploitation and easy availability of the weapons. Orthopedic surgeons have

to deal and manage such survived patients as most of these injuries involve extremities.

Fractures resulting from high velocity gunshot injuries are always complex type of open fractures which are often limb threatening and even in many cases potentially life threatening.

Femoral fractures resulting from gunshot wounds are a surgical challenge for treating surgeons because of difficulties to maintain acceptable reduction¹. Most of

the surgeons prefer to manage such fractures using skeletal traction due to the unacceptable results of external fixators, plates and screws/intramedullary nails. Furthermore different underlying conditions such as contamination of blood vessels and nerves, tracks of missiles, having open fractures and soft tissue injuries complicate the management and pose a challenge to expertise of the surgical team. General outcomes in these patients having open femoral fracture have improved significantly in recent years due to early damage control surgical interventions and aggressive treatment modalities which allow early functional rehabilitation.²

The ultimate objective of these treatments in such patients remains prevention of infection, restoration of function as well as limb alignment and proper fracture healing.³ Moreover external fixator's application in open fractures is not considered to be a good choice for the treatment for union of the bone and increasing complications rates including "pain tract infections, non – unions, osteomyelitis, joint stiffness and mal – union" have been documented with such external fixators.⁴ Recently, in patients with close diaphysial femoral fractures, closed intramedullary nailing have gained popularity and is preferred by orthopedic surgeons while treating these patients. However it may lead to profound shortening around the nail particularly in comminuted fractures and those presenting with loss of bone.

Primary goal of interlocking nailing is to merge desired outcomes produced by closed intramedullary nailing along with additional transfixing screw fixation to eradicate rotation and axial sliding.⁵

In comparison with plate osteosynthesis, interlocking nailing procedures have certain biomechanical and biological advantages. In the management of femoral shaft fractures, close interlocking nailing requires extensive pre – operative management, prophylactic measures such as use of antibiotics, good institutional facilities which demand skills and expertise of the surgical team and yet is not without complications.⁶

In a study conducted in 68 patients with gunshot injury in Peshawar⁷, limb length discrepancy was seen in 2 patients (2.94%), Non-union was seen in 4 cases (5.88%) and infection was noted to be present in 7 patients (10.33%). Excellent results with complete union without any limb length discrepancy, angulation or infection were noted in 42 patients (61.76%). In

another study conducted by Nicholas et al⁸ 14 femoral fractures caused by gunshot injuries were treated with locked intramedullary nailing within 8 hours of injury, out of 14 fractures treated, 1 (7.14%) had non-union while 9/14 (64.28%) fractures had an excellent outcome without any limb length discrepancy, infection or angulation.

MATERIAL AND METHODS

This descriptive, case series study was done at emergency and Inpatient Department of Orthopaedics, Nishtar Hospital, Multan from August 2014 to 10th February 2017. A total of 91 patients having open femoral diaphyseal fractures in patients with gunshot injury (the region of thigh with an obvious wound in that region which had exposed some part of the bone. Fracture was confirmed on X-ray femur in the Anteroposterior and lateral view with visible fracture lines) of either sex, aged 20 – 50 years having duration of injury less than 24 hours were included using Non-probability, consecutive sampling technique. Patients with fracture of the femoral neck with previous history of femur fracture, having any malignancy and having decompensated cardiopulmonary disease were excluded from our study. Investigations including blood complete, serum creatinine, urea, electrolytes, glucose, liver function test and anterolateral as well as lateral x-rays of the femur was done in all the patients to confirm the diagnosis.

All the patients were operated by the same consultant orthopedic surgeon with a post fellowship experience of 10 years. Patients were kept and monitored for 1 week in the orthopedic department with daily wound examination to note any complications like pain or infection. Patients were discharged thereafter and were weekly followed up for 16 weeks after discharge. Outcome was assessed at 16 weeks by measuring the length of two limbs and noting any shortening, non-union and infection.

Acceptable outcome was defined as achievement of union without any limb length discrepancy (if it affects limb length < 2cm as compared to the length of the normal limb at 16 weeks), non-union (visible fracture line with or without callus formation (incomplete callus) on Anteroposterior and lateral X-rays of the femur at 16 weeks) and/or infection (Erythema, swelling, induration and sinus tract formation on the site of the fracture within 30 days of surgery).

RESULTS

Age range in this study was from 20 to 50 years with mean age of 38.75 ± 6.78 years. Majority of the patients 39 (42.86%) were between 41 to 50 years of age. Mean duration since injury in our study was 13.32 ± 5.37 hours with majority of patients i.e. 49 (53.85%), were >12-24 hours duration. Out of 91 patients, 72 (79.12%) were males and 19

(20.88%) were females with male to female ratio of 3.8:1. In our study, limb length discrepancy was seen in 04 patients (4.40%), Non-union was seen in 05 cases

(5.49%) and infection was noted to be present in 11 (11.09%) patients. So, the acceptable outcome (achievement of union without any limb length discrepancy, non-union or infection during 16 weeks) was seen in 71 (78.02%) patients.

Table No. 1

Stratification of acceptable outcome according to age groups

Age (in years)	Acceptable outcome		P-value
	Yes	No	
20-30	16 (88.89%)	02 (11.11%)	0.340
31-40	27 (79.41%)	07 (20.59%)	
41-50	28 (71.79%)	11 (28.21%)	

Table-No. 2

Stratification of acceptable outcome according to gender

Gender	Acceptable outcome		P-value
	Yes	No	
Male	56 (77.78%)	16 (22.22%)	0.931
Female	15 (78.95%)	04 (21.05%)	

Table No. 3

Stratification of acceptable outcome according to duration since injury

Duration since injury (hours)	Acceptable outcome		P-value
	Yes	No	
<12 hours	36 (85.71%)	06 (14.29%)	0.101
>12-24 hours	35 (71.43%)	14 (28.57%)	

DISCUSSION

Orthopedic surgeons in recent years prefer intramedullary nailing as it is one of the effective modes of the treatment among patients having diaphyseal fractures across the world. It is associated with higher rates of union as well as lower rates of complications and desired outcomes are achieved after the advent of modern techniques and implants for femoral nailing at a given starting point while adherence of the meticulous surgical technique remains most important feature of the management⁹.

We have conducted this study to find out the outcome of interlocking intramedullary nailing of the open femoral diaphyseal fractures in patients with gunshot injury. The mean age of patients in our study was 38.75 ± 6.78 years with majority of the patients 39 (42.86%) were between 41 to 50 years of age which was very much comparable to studies of Afsar SS et al¹⁰ in his study has found mean age of 33 years and Olasinde AA et al¹¹ reported mean age of 32 years. On the other hand, Ferracini AM et al¹² and Ali MA et al¹³ had found mean age of 27 & 29 years respectively in their studies which is much lower compared to our

study. Kimmatkar N et al¹⁴ who had found a mean age of 36 years.

In our study, out of 91 patients, 72 (79.12%) were males and 19 (20.88%) were females with male to female ratio of 3.8:1. These results coincide with results of many previous studies which have shown the male predominance.^{13,14} This male predominance in our study is also because of the male dominated society and less active participation of females in day-to-day life activities especially outside the house in our society.

In our study, limb length discrepancy was seen in 04 patients (4.40%), Non-union was seen in 05 cases (5.49%) and infection was noted to be present in 11 patients (11.09%). So, the acceptable outcome (achievement of union without any limb length discrepancy, non-union or infection during 16 weeks) was seen in 71 (78.02%) patients. The incidence of infection, delayed union and non-union in our series were comparable with reports of interlocking nailing in closed femoral shaft fractures.¹⁵⁻¹⁷ In another study conducted in 68 patients with gunshot injury in Peshawar⁷, limb length discrepancy was seen in 2 patients (2.94%), Non-union was seen in 4 cases (5.88%) and infection was noted to be present in 7 patients (10.33%). Excellent results with complete union without any limb length discrepancy, angulation or infection were noted in 42 patients (61.76%).

In a study by Nicholas et al⁸, 14 femoral fractures caused by gunshot injuries were treated with locked intramedullary nailing within 8 hours of injury, out of 14 fractures treated, 1 (7.14%) had non-union while 9/14 (64.28%) fractures had an excellent outcome without any limb length discrepancy, infection or angulation. Nowotarski P et al¹⁸ has shown infection rate in 2.1%, non-union in 5.1% and nerve palsy in 5.1% patients while Grosse A et al¹⁹ reported these in 2.6%, 3.7% and 1.7% patients respectively.

In another study conducted in 65 patients in Karachi²⁰, limb length discrepancy was seen in 1 patient (1.53%), Non-union was seen in 4 cases (6.15%) and infection was noted to be present in 4 patients (6.15%). Sie EJB et al²¹ showed acceptable outcome in 82.2% patients with predominant complications were infection (3.2%), nonunion (5.5%), implant failure (7%), and malunion (17.3%). The intramedullary nail is a load sharing device, allowing early mobilization of patients, joint mobility and early discharge from hospital.

Locked intramedullary nail fixation has become the standard treatment for all categories of femur shaft fracture with reported union rates between 88- 100%.^{22, 23} Limb length discrepancy can result from comminution or cortical splitting that occurs during nailing. To minimize shortening, it is important to use a nail length measured from the intact femur and not adjust the length based on intraoperative findings because in such cases the femur will often end up short.²⁴

Afsar SS¹⁰ et al in his study has found four cases (9.1%) of infection; (two superficial and two deep wound infections), one case (2.3%) of up to 2.5cm limb shortening, 42 (95.4%) patients achieved union and two (4.5%) patients had non-union. In another study by Olasinde AA et al¹¹ has reported wound infections in five (15.2%) cases, limb length discrepancy in two (6.5%), breakage of the distal screw in one (3.2%) and delayed union in one (3.2%) case.

CONCLUSION

Our study results have observed higher rates of acceptable outcomes in terms of achievement of union without any limb length discrepancy, non-union or infection during 16 weeks with limb length discrepancy after interlocking intramedullary nailing of the open femoral diaphyseal fractures among patients with gunshot injury. Our study results recommend that interlocking intramedullary nailing should be preferred in the treatment of open femoral diaphyseal fractures in patients with gunshot injury in order to achieve good outcome and reduce complications.

REFERENCES

1. Mohammad AK, Shah RK, Syed A, Gupta P. Interlocking intramedullary nailing in comminuted femoral shaft fractures. J Nobel Med Coll. 2012;1:50-4.
2. Poyanli O, Unay K, Akan K, Guven M, Ozkan K. No evidence of infection after retrograde nailing of supracondylar femur fracture in gunshot wounds. J Trauma. 2010;68(4):970-4.
3. Kreb DL, Blokhuis TJ, van Wessem KJP, Bemelman M, Lansink KWW, Leenen LPH. Intramedullary nailing without interlocking

- screws for femoral and tibial shaft fractures. *Arch Orthop Trauma Surg.* 2013;133;1109-13.
4. Dougherty PJ, Gherebeh P, Zekaj M, Sethi S, Oliphant B, Vaidya R. Retrograde versus antegrade intramedullary nailing of gunshot diaphyseal femur fractures. *Clin OrthopRelat Res.* 2013;471(12):3974-80.
 5. Cannada LK, Jones TR, Guerrero-Bejarano M, Viehe T, Levy M, Farrell ED, et al. Retrograde intramedullary nailing of femoral diaphyseal fractures caused by low-velocity gunshots. *Orthopedics.* 2009;32(3):162.
 6. Poyanli O, Unay K, Akan K, Guven M, Ozkan K. No evidence of infection after retrograde nailing of supracondylar femur fracture in gunshot wounds. *J Trauma.* 2010;68(4):970-4.
 7. Ali MA, Hussain SA, Khan MS. Evaluation of results of interlocking nails in femur fractures due to high velocity gunshot injuries. *J Ayub Med Coll Abbottabad.* 2008;20(1):16-9.
 8. Nicholas RM, McCoy GF. Immediate intramedullary nailing of femoral shaft fractures due to gunshots. *Injury.* 1995;26(4):257-9.
 9. Ricci WM, Gallagher B, Haidukewych GH. Intramedullary Nailing of Femoral Shaft Fractures: Current Concepts. *J Am Acad Orthop Surg.* May 2009;17(5):296-305.
 10. Afsar SS, Gulzar M, Babar IU. A one year review of various complications in fracture shaft of femur managed with closed intramedullary interlocking nail. *J Postgrad Med Inst.* 2013; 27(3):336-41.
 11. Olasinde AA, Ogunlusi JD, Ikem IC. Outcomes of the treatment of gunshot fractures of lower extremities with interlocking nails. *SA Orthop J.* 2012;11(4):33-7.
 12. Ferracini AM, Faloppa F, Daltro GD, Júnior DCC, dos Reis FB, et al. Prospective and randomized study of patients with open fractures of the femoral shaft, treated with plate or open intramedullary locked nail. *Acta Ortop Bras* 2008;16(2):<http://dx.doi.org/10.1590/S1413-78522008000200008>.
 13. Ali MA, Hussain SA, Khan MS. Evaluation of results of interlocking nails in femur fractures due to high velocity gunshot injuries. *J Ayub Med Coll Abbottabad.* 2008;20(1):16-9.
 14. Kimmatkar N, Hemnani JT, Hemnani TJ, Jain SK. Diaphyseal Femoral Intramedullary Nailing: Closed or Open Intervention? *Intl J Sci Study.* 2014;1(5):15-8.
 15. Wiss DA, Brien WW, Becker V Jr. Interlocking nailing for the treatment of femoral fractures due to gunshot wounds. *J Bone Joint Surg Am.* 1991;73:598-606
 16. Brumback RJ, Uwagie-Ero S, Lakatos RP, Poka A, Bathon GH, Burgess AR. Intramedullary nailing of femoral shaft fractures. Part II: Fracture-healing with static interlocking fixation. *J Bone Joint Surg Am* 1988;70:1453-62.
 17. Templeman D, Sweeney C, Chapman MW. Critical analysis of the management of open femur fractures at two regional trauma centers. *Orthop Trans* 1990;14:675-9.
 18. Nowotarski P, Brumback RJ. Immediate interlocking nailing of fractures of the femur caused by low- to mid velocity gunshots. *J Orthop Trauma.* 1994;8(2):134-41.
 19. Grosse A, Cluistie J, Taglang G, Court-Brown C, MeQucen M. Open adult femoral shaft fracture treated by early intramedullary nailing. *J Bone Joint Surg.* 1993;75B:562-5.
 20. Rehman A, Khani GMK, Ahmed N, Ishtiyaque M. Management of Type-II Open Fracture Shaft of Femur with Intramedullary Interlocking Nail. *J Surg Pak (International).* 2013;18(3):131-34.
 21. Sié EJB, Kacou AD, Traoré A, Séry BL, Lambin Y. Primary Unreamed and Unlocked Intramedullary Nailing of Femoral Shaft Fractures. *Malays Orthop J.* 2012;6(3):13-7.
 22. Zlowodzki M, Prakash JS, Aggarwal NK. External fixation of complex femoral shaft fractures. *Int Orthop.* 2007;31:409-13.
 23. Bhandari M, Guyatt GH, Khera V, Kulkarni AV, Sprague S, Schemitsch EH. Operative management of lower extremity fractures in patients with head injuries. *Clin OrthopRelat Res.* 2003;187-98.
 24. Karapinar L, Kaya A, Ozturk H, Altay T, Kayali C. Leg length discrepancies in adult femoral shaft fractures treated with intramedullary nailing. *Turkish J Trauma Emerg Surg.* 2009;15:256-61.