Original Article

Indian Journal of Public Health Research & Development
Volume 13 Issue 3 July-September 2022
DOI: http://dx.doi.org/xxxxx/ijphrd.xxxx.13221.1

Disability Adjusted Life Year (DALY) loss in open tibia fracture treated with External vs Internal fixation

Bhukya Tejkumar

Assistant Professor, Mamata Medical College, Khammam

How to cite this article: Bhukya Tejkumar et al. Disability Adjusted Life Year (DALY) loss in open tibia fracture treated with External vs Internal fixation. Volume 13 Issue 3 July-September 2022

Abstract

Background: Tibial fractures are the most prevalent long bone fractures, with around a quarter of them being open. Due to the tibial shaft's lack of soft tissue covering and blood flow, managing these fractures can be difficult. The degree of initial bone displacement, comminution, and soft tissue injuries all influence the prognosis.

Objectives: To compare the loss of DALY in open tibia fracture patients treated with external versus internal fixation.

Methods: 50 patients with open tibia fractures – 25 patients treated with external fixation and 25 patients with internal fixation. On admission, demographic information was collected, and a comprehensive history was conducted to determine the mode of injury and any co-morbidities. To examine other connected injuries and open wounds, a general systemic and local examination was performed, followed by radiological evaluation in AP and Lateral views. After the diagnosis has been established, the patient was informed of the fracture and the necessity for surgery. The consent is obtained, and pre-operative planning is done. The mean DALY was calculated based on the union of fracture.

Results: External fixation resulted in an average DALY loss of 8.40 months, while internal fixation resulted in a DALY loss of 4.9 months. When compared to External Fixation, Internal Fixation clinical union occurs in a significantly shorter time.

Conclusion: The outcome of the study shows that Internal fixation outperformed External fixation in terms of DALY loss, with External fixation losing considerably more DALYs than Internal fixation.

Keywords: DALY, Tibia fracture, Gustilo anderson grading, External fixation, Internal fixation

Introduction

Open tibial fractures have a bimodal pattern, with low-energy and high-energy processes involved which are commonly caused by automobile accidents, sports accidents, and high-energy falls.[1] The fracture pattern is determined by the mode of injury. The majority of fractures have been comminuted. Pedestrians impacted in the upper and middle thirds of the tibia suffer bumper injuries. A fall from a great height often results in distal tibial and plafond fractures. A torsional force, indirect trauma leading in spiral fractures, and/or a fibular fracture at a different level with a minimum soft-tissue injury are all examples of low-energy injuries. Direct trauma generally results in wedge or short oblique fractures with substantial comminution, and it can be linked with soft-tissue injury, compartment syndrome, bone loss, and ipsilateral-skeletal injury.[2]

In a developed western civilization, Behrens et al observed a rate of two open tibia fractures per 1000 injuries per year in a specified demographic group; this equates to 0.2 % of all injuries. In the developing world, the prevalence and severity of the disease may be significantly higher.[3]

Tibial fractures are the most prevalent long bone fractures, with around a quarter of them being open.

Due to the tibial shaft's lack of soft tissue covering and blood flow, managing these fractures can be difficult. The degree of initial bone displacement, comminution, and soft tissue injuries all influence the prognosis.[4] To achieve bone and soft tissue healing, advanced bone repair and soft tissue covering are frequently necessary. As a result, open tibial fractures have a high prevalence of sequelae; infection, non-union, and limb loss are the most common causes of morbidity.[5] In order to achieve rapid healing and early ambulation for the patient, the care of these fractures necessitates a multidisciplinary approach. The Gustilo-Anderson classification is the most generally used, and it divides open wounds into three severity categories depending on the size of the open wound, the degree of contamination, and the amount of soft-tissue injury.[6]

The disability-adjusted life year is used to assess disease burden (DALY). A DALY is the loss of one year's worth of full health. Years of life lost due to premature mortality (YLLs) and years of healthy life lost owing to disability (YLDs) due to prevalent cases of a disease or health condition in a population are calculated as DALYs.[7]

Materials and Methods

Sample size : 50 patients with open tibia fractures – 25 patients treated with external fixation and 25 patients with internal fixation.

Inclusion Criteria

- Patient with age>15 years with open tibia fractures
- Patient presenting with grade II, IIIa and IIIb open tibia fracture

Exclusion Criteria

- Patients with closed fractures were excluded
- Patient having associated vascular injury, Fracture involving epiphysis,
- Patients not willing for surgery
- Patients not giving informed consent

On admission, demographic information was collected, and a comprehensive history was conducted to determine the mode of injury and any co-morbidities. To examine other connected injuries and open wounds, a general systemic and local examination was performed, followed by radiological evaluation in AP and Lateral views. After the diagnosis has been established, the patient was informed of the fracture and the necessity for surgery. The consent is obtained, and pre-operative planning is done and standard surgical procedure is done. Patients were followed up periodically. The mean DALY was calculated based on the union of fracture.

Follow-up radiographs were taken one month after the initial procedure to assess the progression of the fracture union. After that, gradual weight-bearing was permitted. Patients were then evaluated every two months for clinical and radiological evaluations until the fracture healed. When a sufficient bridging callus was observed on radiographs, full weight bearing was allowed. The appearance of a bridge callus in at least three cortices on the radiograph was considered evidence of fracture union, as was the absence of pain or tenderness across the fracture zone. After the fracture had fully healed, the external fixation device was removed as an outpatient procedure. During follow-up, significant data such as the time to full weight bearing and the time to complete bone union were recorded. All subjects were effectively followed up.

Statistical Analysis: All the data was entered in the Ms-excel and the SPSS 20 software was used to compute statistical analysis. The outcomes were presented in the form of Tables and graphs with Mean, Standard deviation and percentages. The p-value of <0.05 was considered statistically significant.

Observation and Results

Table 1: Distribution based on Gender and age group

	External fixation	Internal Fixation
Mean Age (years)	45.31+3.45	42.17+5.67
Gender		
Male, n (%)	16 (64%)	15 (60%)
Female, n (%)	9 (36%)	10 (40%)

Male predominance was seen in both the groups with 64% and 60% respectively. The mean age in external fixation group was 45.31$\pm$3.45 yrs and the mean age in internal fixation group was 42.17$\pm$5.67 yrs.

Table 2: Distribution based on Fracture type (AO system)

Fracture type (AO classification)	External Fixation	Internal Fixation
A - extra-articular	10 (40%)	10 (40%)
B - partial articular	9 (36%)	10 (40%)
C - articular	6 (24%)	5 (20%)

According to AO system of fracture classification, in both the group Type A was seen in 40% of the cases each, Type was seen in 36% in external fixation group and 40% in internal fixation group and Type C was seen in 24% of the cases with external fixation and in 20% of the cases in internal fixation group.

Table 3: Distribution based on Gustilo anderson grading

Gustilo-Anderson grading	External Fixation	Internal Fixation
I	7 (28%)	8 (32%)
II	13 (52%)	11 (44%)
IIIA	5 (20%)	6(24%)

According to Gustilo-Anderson grading, Type II - mild to moderate periosteal stripping, wound greater than 1 cm in length was seen in 52% of the cases with external fixation and 44% of the cases with internal fixation.

Type I - periosteal stripping, clean wound less than 1 cm was seen in 28% of the cases with external fixation and 32% of the cases with internal fixation.

Type IIIA - soft tissue injury, significant periosteal stripping with a wound that is usually greater than 1 cm in length with no flap required was seen in 20% of the cases with external fixation and 24% of the cases with internal fixation.

Table 4: Distribution based on DALY lost in Wound heal, Clinical and radiological union of fracture

Wound Healing DALY Lost (in months)	External Fixation	Internal Fixation
Wound healing	3.25 to 3.70	0.50 to 1.05
Clinical Union of fracture	7.40 to 7.90	2.4 to 4.6
Radiological Union of fracture	6.45 to 8.40	1.9 to 4.9

External fixation resulted in a DALY loss of 3.25 months, whereas internal fixation resulted in a DALY loss of 1.05 months. When compared to external fixation, internal fixation wound healing is significantly faster.

External fixation resulted in a mean DALY loss of 7.90 months, while internal fixation resulted in a mean DALY loss of 4.6 months. When compared to External Fixation, Internal Fixation clinical union occurs in a significantly shorter span.

External fixation resulted in an average DALY loss of 8.40 months, while internal fixation resulted in a DALY loss of 4.9 months. When compared to External Fixation, Internal Fixation clinical union occurs in a significantly shorter time.

Discussion

The World Bank and the World Health Organization have partnered to create Disability Adjusted Life Years (DALYs) as a measure of global disease burden. The DALY is a summary metric that combines time lost due to premature mortality and time spent in less-than-optimal health, sometimes known as "disability." The DALY is a broadening of the well-known Potential Years of Life Lost (PYLLs) metric to include lost health.[8]

The optimal treatment of unstable distal tibia without articular involvement remains controversial, despite the variety of treatment options which have been suggested for these injuries, including nonoperative treatment, external fixation, intramedullary nailing, and plate fixation. However, each of these treatment options has certain defects. Nonoperative treatment may be complicated by loss of reduction and subsequent malunion; external fixation of distal tibia fractures may result in insufficient reduction, malunion, and pin tract infection; there is some concern about the use of IMN in distal tibia fractures; ORIF results in extensive soft tissue dissection and may be associated with wound complications and infections.

Numerous studies have recently asserted that the MIPO approach is a safe and effective way to treat such fractures while avoiding some of the difficulties associated with traditional open plating. However, several research have shown flaws in the MIPO method. Although MIPO appears to be better for soft tissue and bone biology, Hasenboehler et al. found that simple fracture patterns had longer healing

times.[9] According to Khoury et al., reduction for the MIPO technique should be done with caution due to the risk of sagittal plane malreduction.[10] As a result, it's unclear if the MIPO technique's benefits outweigh ORIF. A tibial plafond fracture is a serious injury.

Tibial plafond fractures are serious injuries with a high rate of morbidity. These patients were previously treated with medial based open reduction and internal fixation (ORIF) of the tibia, with bone grafting as needed to achieve the aim of restoring the distal fibula length and articular surface.[11] This procedure had excellent outcomes and low complication rates, according to previous studies by Etter and Marsh et al.[12,13]

When compared to External Fixation, Internal Fixation wound healing, clinical union and radiological union occurred in a significantly shorter time. So, DALY loss was less in internal fixation compared to the external fixation.

Conclusion

The outcome of the study shows that Internal fixation outperformed External fixation in terms of DALY loss, with External fixation losing considerably more DALYs than Internal fixation.

References

1. Song P, Pu LLQ. The Soleus Muscle Flap: An Overview of Its Clinical Applications for Lower Extremity Reconstruction. Ann Plast Surg. 2018 Dec;81(6S Suppl 1):S109-S116.
2. Bezstarosti H, Van Lieshout EMM, Voskamp LW, Kortram K, Obremskey W, McNally MA, Metsemakers WJ, Verhofstad MHJ. Insights into treatment and outcome of fracture-related infection: a systematic literature review. Arch Orthop Trauma Surg. 2019 Jan;139(1):61-72
3. Behrens F, Searls K. External fixation of the tibia. Basic concepts and prospective evaluation. J Bone Joint Surg Br. 1986 Mar;68(2):246-54. doi: 10.1302/0301-620X.68B2.3514629. PMID: 3514629.
4. Sivasundaram L, Trivedi NN, Gatta J, Ning AY, Kim CY, Mistovich RJ. Demographics and Risk Factors for Non-Accidental Orthopedic Trauma. Clin Pediatr (Phila). 2019 Jun;58(6):618-626.
5. Stella M, Santolini E, Sanguineti F, Felli L, Vicenti G, Bizzoca D, Santolini F. Aetiology of trauma-related acute compartment syndrome of the leg: A systematic review. Injury. 2019 Jul;50 Suppl 2:S57-S64.
6. Kazley J, Jahangir A. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Aug 14, 2021. Tibia Diaphyseal Fracture.
7. Arnesen T, Nord E (1999). The value of DALY life. British Medical Journal.319:1423-5
8. Arnesen T, Kapiriri L (2004). Can the value choices in DALYs influence global priority-setting? Health Policy.70:137– 149.
9. Hasenboehler E, Rikli D, Babst R. Locking compression plate with minimally invasive plate osteosynthesis in diaphyseal and distal tibial fracture: a retrospective study of 32 patients. Injury. 2007; 38(3):365–370.
10. Khoury A, Liebergall M, London E, Mosheiff R. Percutaneous plating of distal tibial fractures. Foot Ankle Int. 2002; 23(9):818–824.
11. Ruedi TP, Allgower M. The operative treatment of intraarticular fractures of the lowerend of the tibia. Clin Orthop Relat Res. 1979; 138:105-110.
12. Etter C, Ganz R. Long-term results of tibial plafond fractures treated with open reduction and internal fixation. Arch Orthop Trauma Surg. 1991; 110:277-283
13. Marsh JL, Bonar S, Nepola JV, Decoster TA, Hurwitz SR. Use of an articulated external fixator for fractures of the tibial plafond. J Bone Joint Surg Am. 1995; 77:1498- 1509