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Prevalence and Associated Factors of Nonunion in Open Tibial Shaft Fracture among Patients Treated with External Fixation in Tibebe Ghion Specialized Hospital

Abiy Misganaw[1], Worku Belay[2], Getachew Hailu[3], Tadesse Misganaw[4]*

[1]Department of Surgery, Dessie Comprehensive Specialized Hospital, Ethiopia
[2]Department of Orthopedics & Trauma Surgery, School of Medicine, College of Medicine and Health Sciences, Bahir Dar University, Ethiopia
[3]Department of Epidemiology, School of Public Health, College of Medicine and Health Sciences, Bahir Dar University, Ethiopia
[4]Department of Medical Laboratory Sciences, College of Health Sciences, Woldia University, Ethiopia

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***Correspondence:**
*Mr. Tadesse Misganaw, Department of Medical Laboratory Sciences, College of Health Sciences, Woldia University, Ethiopia;
Email: taddesse.m@wldu.edu.et, ymisganaw5@gmail.com;
ORCID-ID: 0000-0001-7994-3797

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Soft tissue reconstruction
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Abstract

Background: The definitive treatment of open tibial shaft fractures remains challenging and nonunion after treatment of open tibial shaft fractures with external fixation complicates a significant proportion of cases. There are varying rates of occurrence of nonunion and the prevalence is not well known in Ethiopia. The objective of the study is to assess the prevalence and associated factors of nonunion in open tibial shaft fractures treated with EX FIX in TGSH.

Methods: The study was conducted using a cross-sectional study in patients with open tibial shaft fractures who were admitted and treated with external fixation in the Tibebe Ghion Specialized Hospital orthopedics department from January 1, 2019, to January 29, 2021. The study involved 75 patients, which was the total number of cases in the study period and fulfilled the inclusion criteria. Bivariate and multiple variable logistic regression analyses were used to analyze the association between variables. The degree of association between variables was determined at the p-value of <0.05.

Results: The overall prevalence of nonunion in open tibial shaft fractures treated with external fixation in TGSH was 21.3%. The severity of the injury, presence of wound infection, and treatment factors affect the occurrence of nonunion. It occurs in 9 of 19 (47.4%) Gustilo-Anderson grade IIIB fractures and 6 of 48 (12.5%) Gustilo-Anderson grade IIIA fractures. A delay in soft tissue covering of Gustilo-Anderson grade IIIB fracture of 15 days or more increases the nonunion rate to 72.7%. Nonunion occurred in 41.7% of cases with SSI and 11.8% of cases without SSI. Gustilo-Anderson grade (AOR=4.85, CI 95%: 1.31-18.01), surgical site infection (AOR=4.12, CI 95%: 1.11-15.26), and time until coverage of bone of Gustilo-Anderson grade IIIB fracture (AOR=18.23, CI 95%: 1.17-284.8) have statistically significant association with nonunion.

Conclusion and Recommendation: External fixation use for definitive treatment of open tibial fractures should be disfavored as the prevalence of nonunion in open tibial shaft fractures treated with EX FIX is higher than other previous studies done in European and Asian countries. Gustilo-Anderson grade of injury, surgical site infection, and time from injury to bone coverage of Gustilo-Anderson grade IIIB fractures were found to be statistically significantly associated with the occurrence of nonunion. Therefore, attention should be given to early soft tissue reconstruction of exposed bones to establish a favorable environment for bone healing and to make treatment with internal fixations possible. Better management of wounds to minimize surgical site infections is required for better healing of open tibial shaft fractures. Prospective studies are also recommended on the issue.

Introduction

Background

Fractures are very common and are a major social and financial burden in many countries[1]. Fractures are classified as open or closed based on the integrity of soft tissue coverage at the fracture site[1]. An open fracture is defined as an injury where the fracture and the fracture hematoma communicate to an epithelial surface through a traumatic defect in the surrounding soft tissues and overlying skin[1]. Open lower leg fractures are the most common open fractures accounting for 63% of open fractures in the locomotor system and are associated with many complications, nonunion being one of them[2].

Bone healing is an elegant but complex and unique biological process of repair[1,3]. It progresses in five stages, namely hematoma formation, inflammation, formation of soft and then hard callus, and finally remodeling[1,3]. Although fracture healing usually occurs unencumbered, it may be adversely affected or interrupted in many ways[1]. Different agents or pathological processes may affect all of these stages or only one[3].

Fracture nonunion is one of the most common complications of fracture[4]. It is a condition when a fracture has failed to heal in the expected time and is not going to heal without surgical intervention[1]. Nonunion is classified as hypertrophic, oligotrophic, and atrophic based on the presence of callus formation and as septic and aseptic based on the presence of infection at the fracture site[1]. The establishment of a nonunion can also be defined based on a lack of complete bone healing in a specified time frame, commonly 6 to 8 months, but this is arbitrary[1]. The rate of fracture nonunion varies greatly in different anatomical locations of the fracture, with an average incidence rate of 4.93%[1,4]. Good blood supply is an important condition for fracture union[4]. Compared to other long bones with abundant blood vessels and soft tissue, the tibia with a longer subcutaneous boundary normally has a poorer blood supply[4]. Therefore, tibial fracture has a higher risk of nonunion due to its special structure and blood supply[4]. The extent of soft tissue damage in open fractures, comminution of the fracture, surgical extension of the wound, and fracture of the ipsilateral fibula were found to play an important role in the development of nonunion of tibial fractures treated with external fixation[5]. Fracture nonunion is a chronic condition that leads to functional and psychosocial disability with economic burdens[4]. Nonunion of some fractures can reduce the quality of life, negatively affect health, and even increase the risk of death[1,4].It was found that the single cohort's mean utility score was 0.68, which is well below that of illnesses such as type I diabetes mellitus (0.88), stroke (0.81), and acquired immunodeficiency syndrome (0.79)[1].

Operative treatment of the tibial shaft fractures usually leads to healing, without any consequences on life and working ability[6]. Intramedullary nails, conventional AO compression plates, and external fixators are the most common methods used in treating tibial shaft fractures[1]. Currently, IM fixation is the preferred method of fracture stabilization in general but in distal tibial fractures, plate is a viable option[7]. External fixation is appropriate in open fractures with severe contamination and in the setting of damage-control orthopedics[7].The external fixator in open fractures not only solves the problem of managing soft tissue injuries but also provides a reasonable fixation for the bone to heal[6]. Conversion to IM nailing should occur within 28 days after injury, with a safety interval employed before IM nailing when pin-tract infection is suspected[7]. With the AO external fixator, it is possible to use safe and effective techniques of external fixation, avoid damage to vital structures, have access to wounds, and adopt the fixator so that it is biomechanically compatible with the fractures[6].

Treatment of open leg fractures includes profuse wound irrigation, removal of all foreign bodies, debridement of avital tissues, fracture stabilization using external skeletal fixation, early reconstruction of soft tissue defects, antibiotic and tetanus prophylaxis, and physical therapy[2]. Prompt, definitive soft-tissue coverage within 7 days decreases the rate of deep infection and should be a priority[7].

The definitive treatment of these open tibial shaft fractures remains challenging[7-9]. These fractures should be classified at the time of surgical debridement according to the system of Gustilo and Anderson to guide treatment and predict outcomes[7]. Despite improvements in antibiotic prophylaxis, fracture stabilization, orthobiologics, and plastic surgical techniques, open lower leg fractures are associated with many complications, the most important of which are nonunion (both septic and aseptic) and osteitis[2,7]. Injury severity and patient psychosocial factors have the greatest impact on overall functional outcomes as well as infection and union rates[7]. Closed reduction and MIPPO have low risks of nonunion for the treatment of tibial fractures[4].

Orthopedic surgery practice has been growing in TGSH since its establishment in December 2019 with yearly growth in the number of orthopedic surgeons and serving the increasing number of trauma patients. Various methods of surgical treatment are in practice and are broadly classified as internal and external fixations[1]. External fixation is used as temporary stabilization means in polytrauma patients with pulmonary contusion and as definitive treatment in open fractures which are at higher risk of infection and when soft tissue reconstruction procedures are not done timely to allow internal fixation, especially in open tibial shaft fractures[1,7]. External fixation is used as definitive management in TGSH, and Ethiopia in general more than developed countries. Unfortunately, many cases of nonunion are observed in open tibial shaft fractures when EX FIX is used as definitive management. The study was conducted in this Ethiopian hospital where the lack of epidemiological data and knowledge about region-specific risk factors is an important gap in the scientific literature.

Studies show that open leg fractures are associated with a nonunion rate of 14.71% when treated with EX FIX[2]. A series of factors like age and gender of the patient, smoking, use of NSAIDs, medical problems like DM, GA grade of injury, time of debridement, and antibiotic administration after injury play a role in the development of nonunion[10].

Methods and Materials

Study Area

This study was conducted in the department of orthopedics & trauma surgery in Tibebe Ghion Specialized Hospital, which is one of the biggest specialized university hospitals in the Amhara region and the country at large.

Study Design

A cross-sectional study design was used to conduct the study on patients admitted to TGSH from January 1, 2019, to January 29, 2021, with the diagnosis of open tibial shaft fractures and treated with EX FIX and their charts were reviewed and analyzed.

Study Period

The study was conducted from January 1, 2019 to January 29, 2021

Source and Study Population

All Patients admitted with a diagnosis of open tibial shaft fractures and treated with EX FIX at TGSH from January 1, 2019, to January 29, 2021.

Inclusion Criteria

- Patients whose operations are fully documented on the charts.
- Patients whose follow-up status and interventions are known (clearly documented on follow-up chart).

Exclusion Criteria

- Patients with EX FIX changed to other methods of treatment for any reason before the expected time of healing.
- Patients who were not followed until the time of healing (discontinued follow-up at TGSH) for any reason.
- Patients who reached the expected time of healing but healing status not well documented.

Sample Size

In a previous study, the prevalence of nonunion in open tibial shaft fractures treated with EX FIX was 14.71%, the sample size was calculated for the dependent variable; nonunion prevalence from the previous study[2]. The minimum number of samples required for this study was determined by using a single population proportion formula.

$$n = \frac{p(1-p)Z^2}{d^2}$$

n = the minimum required sample size

p = the percentage occurrence of a state or condition (nonunion in this case) = 14.71% = 0.1471= ~0.15

d = absolute precision or tolerable margin of error= 5 % (0.05)

z = the value corresponding to level of confidence required = 95% = 1.96

Sample size : $n = \frac{p(1-p)Z^2}{d^2} = \frac{0.15(1-0.15)x1.96^2}{(0.05)^2}$ = 195.9==196

The total source population during the study period was 94, which is below the calculated number. So, all were included as source populations.

Sampling Technique

All patients admitted to TGSH with a diagnosis of open tibial shaft fractures and managed with EX FIX from January 1, 2019, to January 29, 2021, fulfilling the inclusion criteria were studied by reviewing their charts from hospital records.

Data Collection Procedures

Data was collected from charts from hospital records from June 1 to July 15 by two data collectors (two GPs) after training the GPs ahead of data collection in the study period. A data collection checklist containing variables was prepared.

Study Variables

Dependent Variable

Nonunion of open tibial fracture after EX FIX (Yes/No)

Independent Variables

Age, Sex, Mechanism of injury, Location of fracture, GA grades (I-IIIC), Time of exposed bone coverage, Prophylactic antibiotics administration, Time from injury to antibiotic administration, Time from injury to surgery, Surgical site infection. The independent variables are chosen from the scientific fact that they influence the process of bone healing and the probability of occurrence of nonunion.

Operational Definitions

Nonunion: a condition when a fracture has failed to heal in the expected time and is not going to heal without surgical intervention based on the surgeon's assessment.

External fixation: a surgical method of immobilizing bones by placing pins that are secured together outside of the skin using a series of clamps and rods known as the external frame.

Follow-up: a patient who was at least once seen by a treating orthopedic surgeon(s) after the operation with EX FIX is considered to have a follow-up.

Data Quality Assurance

The quality of data was assured through careful design, translation and retranslation, and pretesting of the data collection checklist, proper training of the data collectors, supervision of the data collecting procedures, and proper categorization and coding of the data. The principal investigator checked the accuracy and reliability of the data collection process and gave clarifications when ambiguity occurred during data collection.

Data Processing and Analysis

Data were coded, entered, and analyzed using IBM SPSS Windows version 24. Frequency and cross-tabulation were used to summarize descriptive statistics. Means and percentages were used for numerical variables. Tables and graphs were used for data presentation and dissemination. Associated factors for the occurrence of nonunion were assessed using bi-variable and multi-variable logistic regression analysis to identify competent variables and assess the presence or absence of association between the dependent and independent variables.

Ethical Clearance

Ethical clearance was obtained from the IRB of the BDU research ethics committee. The data collected from patients' charts was used for the study and every data was kept confidential by securing personal information with passwords.

Results

From January 1, 2019, to January 29, 2021, 94 open tibial shaft fractures were treated with EX FIX in TGSH. Of these, 11 patients didn't fulfill inclusion criteria and the medical records of 8 patients couldn't be retrieved. Therefore, 75 patients were included in the study.

Table 1: Distribution of potential patient-related characteristics of open tibial shaft fractures treated with EX FIX, TGSH, Bahir Dar, Amhara Region, Ethiopia, Jan.2019- Jan 29, 2021 (N=75).

Variable	Category	Frequency (N)	Percent (%)
Age (years)	<40years	51	68.0
	≥40years	24	32.0
Gender	Female	24	32.0
	Male	51	68.0
Mechanism of injury	Bullet	27	36.0
	RTA	30	40.0
	Fall down	7	9.3
	Stick, stone, or log	11	14.7

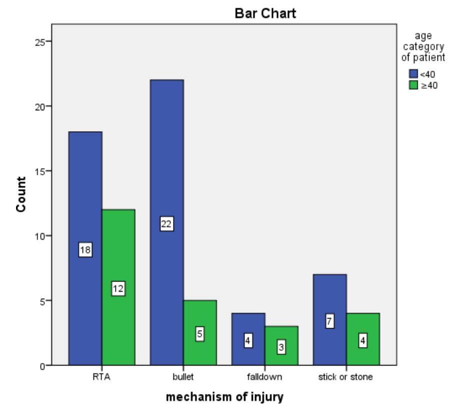

Figure 1: Frequency distribution bar chart showing the relationship between age and mechanism of injury in the study participants in TGSH, Bahir Dar, Amhara Region, Ethiopia, Jan 2019- Jan 2021.

Patient-related characteristics

The study population age was distributed in the range of 12 to 75 years. Open tibial shaft fractures occurred in males twice as in females and significantly affected the young population with the mean and median age of 35 years and 30 years, respectively. (Table 1)

Bullet injury contributed the highest to the predominance of the problem in the young population. (Figure 1)

Injury-related and associated characteristics

The distal third of the tibial shaft was the most involved site accounting for 54.7% (N=41) and most cases were GA grade IIIA fractures which account for 64% (N=48) of the fractures followed by IIIB fractures with 25.3%. There was SSI in in one-third of all cases and the rate of infection was higher among patients with bullet injury with 11 of 27 (40.74%) such cases developing SSI. (Table 2 and Figure 2)

Treatment-related characteristics

Most cases with open tibial shaft fractures were given prophylactic antibiotics after 6 hours of injury due to delay in presentation to health institutions and two cases were not given as they presented after a week of injury with

Table 2: Distribution of potential injury-related and associated characteristics of open tibial shaft fractures treated with EX FIX, TGSH, Bahir Dar, Amhara Region, Ethiopia, Jan.2019- Jan 29, 2021 (N=75).

Variable	Category	Frequency (N)	Percent (%)
Fracture site	Proximal third	6	8.0
	Middle third	28	37.3
	Distal third	41	54.7
Injury severity (GA grade)	I	1	1.3
	II	6	8.0
	IIIA	48	64.0
	IIIB	19	25.3
	IIIC	1	1.3
Surgical site infection	No	51	68.0
	Yes	24	32.0

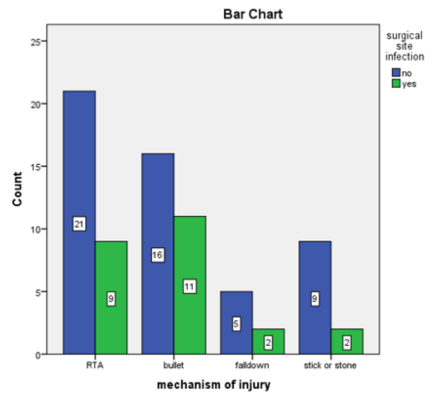

Figure 2: Frequency distribution bar chart showing the relationship between mechanism of injury and surgical site infection in the study participants in TGSH, Bahir Dar, Amhara Region, Ethiopia, Jan 2019- Jan 2021.

Table 3: Distribution of potential treatment related characteristics of open tibial shaft fractures treated with EX FIX, TGSH, Bahir Dar, Amhara Region, Ethiopia, Jan.2019- Jan 29, 2021 (N=75).

Variable	Category	Frequency (N)	Percent (%)
Time from injury to prophylactic antibiotic administration	<6hours	31	42.5
	>6hours	42	57.5
Time from injury to surgery	<24hours	40	53.3
	>24hours	35	46.7
Time from injury to bone coverage for GA IIIB fractures	<15days	7	38.9
	≥15days	11	61.1

already established infection of injury site. In most cases, surgery for debridement and EX FIX was done within 24 hours of injury. In 11 of 18 patients (61.1%) with GA grade IIIB fractures, the exposed bone was covered with flaps 15 days or later after injury. (Table 3)

The mean time of coverage of the exposed bones was 21.3 days with two outliers excluded during calculation and the median was 20 days. The outliers were two cases who were given the option of referral to plastic surgery setup but stayed for 150 and 180 days due to failures to afford to go to such setups. Table 3 shows the statistics of time-to-bone coverage.

Occurrence of nonunion in open tibial shaft fractures treated with EX FIX

In a 25-month study of 75 cases of open tibial shaft fractures treated definitively with EX FIX, there were 16 cases of nonunion with a prevalence of 21.3% (Figure 3). It varies greatly with the GA grade of injury being higher in GA IIIB fractures. It further varies with the time of coverage of exposed bones in GA grade IIIB injuries, with delays in coverage increasing the occurrence of nonunion. There was only one case of GA grade IIIC fracture which ended up with nonunion. (Table 4)

Association between potential associated factors and the occurrence of nonunion

Associated factors for the occurrence of nonunion were assessed using bi-variable and multi-variable logistic regression analysis to identify competent variables and assess the presence or absence of association between the dependent and independent variables.

Four variables (age category, GA grade, SSI, and time to coverage of GA grade IIIB injuries) had a p-value of <0.20 from the results of bi-variable binary logistic regression analysis and entered into a multivariable binary logistic regression analysis model.

In multiple binary logistic regression analysis models, GA grade, SSI, and time to coverage of GA grade IIIB injuries were found to be significantly associated with the occurrence of nonunion with a p-value of <0.05. (Table 5)

The odds of nonunion in GA grade IIIB &IIIC fractures were 4.85 times (AOR=4.85; 95%CI: 1.31-18.01) higher than GA grade I-IIIA. The odds of nonunion in cases with

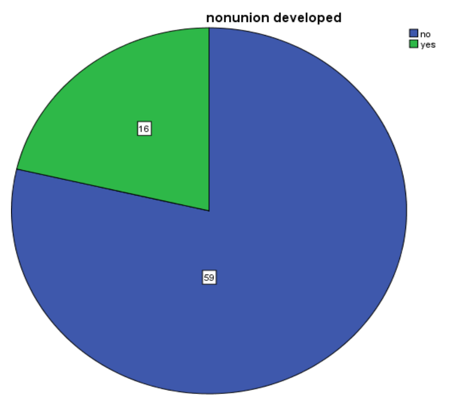

Figure 3: Pie chart showing the prevalence of nonunion in open tibial shaft fractures treated with external fixation, TGSH, Bahir Dar, Amhara Region, Ethiopia, Jan 2019- Jan 2021 (N=75).

SSI were 4.12 times (AOR=4.12; 95%CI: 1.11-15.26) higher than in cases with no SSI. The odds of nonunion in GA grade IIIB fractures whose exposed bones were covered 15 days or later were 18.23 times (AOR=18.23; 95%CI:1.17-284.8) higher than in that coverage was done before 15 days.

Discussion

This study showed that the prevalence of nonunion in open tibial shaft fractures treated with EX FIX in TGSH is 21.3%. It was higher than the prevalence found in the study done in Serbia in 2016 at the Clinic of Orthopedics and Traumatology, Clinical Center Nis, which was 14.71%[2]. It is also slightly higher than the prevalence (20.3%) reported in a retrospective review in Greece in 2001[10].

It was found to be higher in GA grade IIIB fractures (47.4%) and the single case of GA grade IIIC fracture also developed nonunion. On the other hand, only 6 of 48(12.5%) patients with GA grade IIIA fractures developed nonunion. None of the GA grades I & II fractures developed nonunion though there were small numbers of such cases (1 & 6, respectively).

The rate of nonunion in higher-grade injuries (GA IIIB AND IIIC) was 4.85 times the rate in lower-grade injuries (GA I-IIIA). This is consistent with a study done in 2006 in Serbia[6], in the Regional General Hospital of Alexandropoulos, Greece, published in 2016[5], and a systematic review and meta-analysis done in China in 2019[4]. This is due to the high-energy nature of the injury.

Nonunion was observed to be even higher when the exposed bone in GA grade IIIB fractures was covered with a flap delayed more than 15 days (72.2%) as compared to when it was done within 15 days (14.3%). Those covered 15 days or more after injuries were 18.3 times more likely to develop nonunion than those covered before 15 days. This is consistent with the review article published in 2006 in the British Bone & Joint Journal which showed early soft-tissue restoration to improve the outcome of these fractures although this article doesn't specify the extent of delay for flap that leads to nonunion and any magnitude was not shown[12]. The result is justified by the progressive ischemic damage to the bones devoid of soft tissue cover.

This study showed that nonunion was 4.1 times higher in open tibial shaft fractures that developed SSI than those that didn't. Nonunion occurred in 10 of 24 fractures that developed SSI (41.7%) as compared to that in 6 of 51 fractures without SSI (11.8%). This high prevalence is in line with the study in the Regional General Hospital of Alexandropoulos, Greece, published in 2016[3,4]. This is because of damage to the regenerating tissues by the infection itself and the repeated debridement required to control the infection.

Table 4: Summary of occurrence of nonunion and associated factors, TGSH, Bahir Dar, Amhara Region, Ethiopia, Jan.2019- Jan 29, 2021 (N=75).

Variable	Category	Nonunion (16 cases)	
		Frequency	Percent (%)
Age	<40 years	7	43.7
	≥40 years	9	56.3
Sex	Female	4	25
	Male	12	75
Mechanism of injury	RTA	7	43.75
	Bullet	7	43.75
	Fall down	0	0
	Stick, stone & log	2	12.5
Fracture sites	proximal	1	6.25
	Middle	7	43.75
	Distal	8	50
GA grade	I-IIIA	6	37.5
	IIIB & IIIC	10	62.5
Prophylactic antibiotic administration	Yes	16	100
	No	0	
Time from injury to antibiotic administration	<6hours	5	31.25
	>6hours	11	68.75
Time from injury to surgery	<24hours	8	50
	>24hours	8	50
Surgical site infection	No	6	37.5
	Yes	10	62.5
Time to bone coverage with a flap (out of 9 cases with exposed bone and developed nonunion)	<15days	1	11.1
	≥15days	8	89.9

Table 5: Bi-variable and multi-variable binary logistic regression analysis of factors related to nonunion at TGSH, Bahir Dar, Amhara Region, Ethiopia, Jan.2019- Jan 29, 2021 (N=75).

Variable	Category	Nonunion		p-value	COR (95%CI)	AOR (95%CI)
		No	Yes			
Age category	<40years ≥40years	44 15	7 9	0.369	1 3.77(1.19-11.89)	1 0.17(0.20-3.41)
GA grade	I-IIIA	49	6		1	1
	IIIB & IIIC	10	10	0.018	8.17(2.41-27.65)	4.85(1.31-18.01)
SSI	No	6	45		1	1
	Yes	10	14	0.034	5.36(1.65-17.37)	4.12(1.11-15.26)
Time to bone coverage	<15days	6	1		1	1
	≥15days	3	8	0.038	16.00(1.32-194.6)	18.23(1.17-284.8)

The systematic review and meta-analysis done in China in 2019 showed that advanced age was a predisposing factor for nonunion[4]. But, our study showed that the association between age and nonunion to be insignificant. This study showed that the prevalence of nonunion is higher in patients aged 40 years and above, but multivariate logistic regression analysis showed the association to be insignificant. This is explained by the fact that the patients in this study were predominantly younger than 40 years and the type of injuries were mainly low energy types in the older groups.

Delay in prophylactic antibiotic administration of more than 6 hours and delay for surgical debridement and application of EX FIX more than 24 hours had increased risk of nonunion but the association was not significant with p-values >0.05. However, a high rate of SSI was observed in these conditions and the SSI being an intermediate factor for nonunion, the effect of the delays for prophylactic antibiotics and surgery when cut points are longer are not studied.

Limitations of the study

- It is a single-centered study.
- As a secondary source of data, documentation problems forced the omission of some variables.
- Medical record-keeping problems and failure to retrieve charts of some patients contributed to reduced sample sizes.

Conclusions and Recommendations

Conclusions

The prevalence of nonunion in open tibial shaft fractures treated with EX FIX in TGSH is high. GA grade of injury, surgical site infection, and time from injury to bone coverage of Gustilo-Andersen grade IIIB fractures were found to be significantly associated with the occurrence of nonunion. The majority of open tibial shaft fractures were caused by rod traffic accidents followed by bullet injury in the highly productive young age group, predominantly males.

Recommendations

- Attention should be given to patients with high energy (GA grade IIIB and IIIC) open tibial shaft fractures for early soft tissue reconstruction procedures.
- Vascular surgery for early revascularization of GA IIIC fractures shall be improved.
- More work is required to minimize SSI of open tibial fractures with improved and early debridement and wound care service.
- Health education to tackle community bullet injuries in collaboration with gun control authorities.
- Emphasis on road traffic accident reduction, in collaboration with road safety authorities.
- Modern wound care technologies like vacuum-assisted closure (VAC) should be available in hospitals.
- We recommend researchers study prospectively some variables that were found difficult retrospectively (smoking, NSAID use ...).

Abbreviations and Acronyms

AO: Arbeitsgemeinschaft für Osteosynthesefragen (an association of Swiss general and orthopedic surgeons)

BDU: Bahir Dar University

DM: Diabetes Mellitus

EX FIX: External fixation

GA: Gustilo-Anderson

IM: Intramedullary

IRB: Institutional Review Board

MIPPO: Minimally Invasive Percutaneous Plate Osteosynthesis

NSAID: Non-steroidal Anti-inflammatory Drug

ORC: Referral Clinic

PI: Principal Investigator

PVD: Peripheral Vascular Disease

RTA: Road Traffic Accident

SIGN: Surgical Implant Generation Network

TGSH: Tibebe Ghion Specialized Hospital

Declarations

Availability of Data

The datasets used and/or analyzed in this study are available from the first author and last author (Abiy Misganaw and Tadesse Misganaw) on reasonable request.

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Authors Contributions

AM, WB, and GH collaborated on the conception and design of the study. AM and TM contributed to the collection of the data. AM, WB, GH, and TM performed the statistical analysis. TM drafted the manuscript.

Ethics Approval

This study received ethical approval from the Institutional Review Boards of Bahir Dar University (236/2021). A Legal permission letter was obtained from Bahir Dar University, Tibebe Gion hospital management. Any information obtained from the patient card is secured and labeled only by study number.

Consent for Publication

Not applicable.

Competing Interests

The authors declare that they have no competing interests.

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