Impact of COVID-19 Pandemic on Open Fractures: a Retrospective Multi-centre Cohort Study in the Different Risk Periods of China

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Research article

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Abstract

Background

The COVID-19 pandemic has had a significant impact on orthopaedic trauma worldwide, but the extent of this impact regarding the low-risk period is still unclear. This study aims to evaluate the epidemiology of open limbs fractures during the different risk periods and the effect of routine prevention and control measures.

Methods

A retrospective multi-centre cohort study was conducted in three different level trauma centres. Three 60-day periods were analyzed: the high-risk period - 2020/1/24-2020/3/24, the low-risk period - 2021/1/24-2021/3/25, and the no-risk period as a control group for comparison - 2019/1/24-2019/3/25. Demographic data, medical history, and surgery and antibiotic therapy data at presentation were collected and evaluated.

Results

A total of 123 patients met the inclusion criteria. We observed a significant "J" shaped change in the total number of patients, with fewer patients in 2020 (n=34, -17%) and more in 2021 (n=48, +17%) compared to 2019 (n=41). However, fewer patients visited the level I centre in the low-risk period (82.9% 2019 vs. 70.6% 2020 vs. 56.3% 2021, P=0.024). Meanwhile, longer antibiotics therapy period (≥48 hours) were more prevalent in low-risk period (39% 2019 vs. 58.8% 2020 vs. 68.8% 2021, P=0.018). Regarding definitive closure type, increase in direct closure was observed in high-risk period (51% 2019 vs. 78.9% 2020 vs. 63.5% 2021, P=0.024).

Conclusion

During the high-risk period, the total number of patients was expected to decline, whereas in the low-risk period, the number may increase. They preferred the lower level II and III centre for patients during the pandemic rather than the higher level I centre. For surgeons, they were prone to direct closure and a more extended antibiotic therapy period. Routine prevention and control measures seem not adversely affect the treatment outcomes and process of open fractures.

Trial registration

ChiCTR, ChiCTR 2100046151. Registered 5 May 2021, http://www.chictr.org.cn/edit.aspx?pid=123490&htm=4.

Introduction

Since the COVID-19 coronavirus was first detected in December 2019 and flared up in the Chinese city Wuhan in January 2020, the pandemic has swept the globe, posing a significant burden on health systems worldwide [1]. Although countries have actively responded to the pandemic and introduced various vital prevention and control measures, there has been a resurgence in some countries[2].

China has been performing strict prevention and control measures and was the first to emerge from the quagmire of the pandemic. One of the critical strategies was travel restriction and home isolation order in the high-risk period (e.g., 2020) across the country. On the other hand, in the low-risk period (e.g., 2021), risk assessment was made for different country regions to implement various level prevention and control measures, especially procedures for admission of urgent patients to a clinical institute[3]. A study by Lv et al.[1], who analyzed the data in the high-risk “lockdown” period (2020) found a significant decrease in the number of acute open fracture cases. However, the data remains unclear in the low-risk period.

Open limbs and pelvic and acetabular fractures are often caused by high-energy violence and require emergency debridement and fixation. Patients with severe or multiple injuries need immediate attention and transfer from the emergency department to the operating room, with no time to wait for most blood test results. However, to identify potential patients with COVID-19, various departments of medical institutions usually need to add a series of prevention and control measures, which increase the preoperative preparing time and delay the treatment, including the surgery and the application of antibiotics[4]. Meanwhile, clinical guides by the National Health Service suggest that all patients who are 'obligatory inpatients' must have their 'treatment expedited' to avoid pre-op delay and expedite rehab to minimize the length of stay[5]. Therefore, in the low-risk period, the impact of a series of regular prevention and control measures on the first aid of open fractures is still unclear.

The purpose of this article is to evaluate the epidemiology of open fractures during the different risk periods of the pandemic and to clarify whether regular prevention and control measures will adversely affect open fractures. Finally, this article will add to the debate and share some experience with medical institutions in ease period for the open fractures treatment process.

Materials And Methods

Institutes

This is a retrospective multi-centre cohort study conducted in three hospitals in the Chengdu area of China. Chengdu is one of the national core cities with more than 16 million people. As of March 24, 2021, there were a total of 158 confirmed cases with COVID-19.

(https://voice.baidu.com/act/newpneumonia/newpneumonia/?from=osari_aladin_banner&city=%E5%9B%9B%E5%B7%9D-%E6%88%90%E9%83%BD).

All hospitals are trauma units providing trauma care as a part of a general hospital. They are (1) the West China Hospital in the central city (level I trauma centre), and (2) the West China Airport Hospital in the suburbs (level II trauma centre), and (3) the West China Jintang Hospital in satellite city (level III trauma centre). All three hospitals have 24-hour emergency services, imaging, operating rooms and affiliated majors.

This study was performed in line with the principles of the Declaration of Helsinki. The study was approved by the Biomedical Research Ethical Committee of West China Hospital of Sichuan University.

Patients

The study period covered three same periods, including the initial Chengdu lockdown - 2020/1/24-2020/3/24 (60 days high-risk period), regular prevention period - 2021/1/24-2021/3/25 (60 days low-risk period), and pandemic-free period as a control group for comparison - 2019/1/24-2019/3/25 (60 days no-risk period). Patients' inclusion criteria are (1) acute open limb or pelvic or acetabular fractures; (2) more than 14 years old. Exclusion criteria are (1) refusal to emergency surgery; (2) post-operative patients in another hospital before admission; (3) pathological fractures caused by infection or tumour; (4) Incomplete medical records.

Emergency treatment measures

All patients must conduct an investigation, including symptoms, signs, and epidemiological history in the emergency department. Routine blood tests and throat swabs for COVID-19 nucleic acid tests are mandatory, and antibody tests and chest CT examinations are required if necessary.

The patient needs to provide a negative result of the COVID-19 nucleic acid before admission. If patients need emergency rescue or surgery, the nucleic acid test is not performed, or the test result is not available for them. They will be treated differently: (1) those with epidemiological history should be admitted to a separate fever clinic for rescue. The operating room is a specially set up negative pressure operating room; (2) those without epidemiological history should be admitted to the buffer ward of the trauma unit. The operating room is a 24-hour emergency service.

Data

Demographic data, medical history, and surgery and antibiotic therapy data at presentation were collected. Demographic data were collected, including patient source, age, gender and COVID-19 RNA test result.

Medical history included injury mechanism, duration from injury to the emergency department, injury site, and Gustilo-Anderson (G-A) severity grading.

For all trauma, six categories have been defined: road accident, fall from height, fall from standing, sharp injury, crush injury and gunshot/animal bites.

Surgery and anaesthesia information is consists of the American Society of Anesthesiologists (ASA) score, duration from admission to the initial surgery, first surgery duration, the total number of operations, definitive closure type, initial fixation type of fracture.

There are four types of wound coverage: direct closure, skin graft, flap and amputation. For fracture fixation, four categories have been defined: external fixation, nailing/plating, K wire/tension band and plaster.

The application of antibiotics included the period of antibiotics therapy ($\leq$48 hours or >48 hours).

Finally, we calculated and compared hospital stay, infection rate, mortality and readmission rate in 30 days in different risk periods.

Statistical analysis

Statistical analysis was conducted using the SPSS (version 21.0) for Windows (IBM Corp. Armonk, NY, USA). Continuous data were tested for normality using the Shapiro–Wilks test and all found to be non-normal. Thus data from different groups were compared using the Kruskal–Wallis test. Categorical or interval data were compared using either a chi-square test or a Fisher's exact test. In all cases, a P-value of less than 0.05 was considered significant.

Results

Demographic data

No patients in this study had a positive COVID-19 nucleic acid test, and no hospital death occurred. Meanwhile, patients with open pelvic or acetabular fractures, open clavicle or scapula fractures were not included. However, we observed a significant "J" shaped change in the total number of patients, with fewer patients in the high-risk period 2020 (n=34, -17%) and more patients in the low-risk period 2021 (n=48, +17%) compared to 2019 (n=41). There was a statistically significant change in the proportion of patients visiting the level I trauma centre with 56.3% in the low-risk period compared to 82.9% and 70.6% for the no-risk and high-risk period, respectively (P=0.024). The time from injury to the emergency department in 2020 was less than that in the same months 2019 and 2021. However, the changes did not reach statistical significance (389.3±360.9 mins 2019 vs. 252.3±233.5 mins 2020 vs. 291.9±301.8 mins 2021, respectively). No statistically significant difference was observed in terms of age, sex ratio, hospital stay, readmission rate within 30 days of hospitalization, and infection rate across the three periods (Table 1).

Injury-related data

For the injury mechanism, we observed a reduction in the frequency of road accidents in high-risk period (39% 2019 vs. 20.6% 2020 vs. 29.2% 2021, P=0.219) but this change was not statistically different. The sharp injury rates increased from 19.5% in 2019 to 29.4% and 20.8% in 2020 and 2021, respectively, but

the changes did not reach statistical significance. (P = 0.548)(Table 2). For injury severity, we observed a reduction in the frequency of G-A grade III injury in 2020 compared to 2019 and 2021, respectively (72.5% 2019 vs. 52.6% 2020 vs. 63.5% 2021, P=0.154), even though there was no statistical difference. The frequency of open femoral fractures decreased dramatically from 11.8% in 2019 to 0 and 5.8% in the respective 2020 and 2021, but this change was not statistically different (P = 0.065). Similarly, the frequency of the most severe G-A grade IIIc was reduced comparatively in the high-risk period (43.3% 2019 vs. 25% 2020 vs. 33.3% 2021, P=0.368) (Table 3). In addition, there was no significant difference in ASA scores between the three periods.

Type of surgery and antibiotic therapy

We observed that duration from admission to initial surgery was significantly extended from 407.9±184.8 minutes in 2019 to 581.9±368.1 minutes in 2020 and 497.3±346.2 minutes in 2021, respectively, but this change was not statistically different (P=0.103). When compared, the three groups were similar regarding duration from admission to the initial surgery, the total number of surgeries and the length of the initial surgery during the three periods of hospitalization, thus demonstrating the usual workload at our service. Our study observed a large percentage increase in direct closure as the definitive wound closure type in high-risk periods (51% 2019 vs. 78.9% 2020 vs. 63.5% 2021, P=0.026). In addition, in terms of the duration of antibiotic application, the proportion of therapeutic use of antibiotics (actual medication time> 48h) in 2021 has increased significantly compared to previous periods (39% 2019 vs. 58.8% 2020 vs. 68.8% 2021, P=0.018) (Table 4).

Discussion

To our knowledge, this study is the first to compare the effects of COVID-19 on open limbs fractures during the no-risk, high-risk and low-risk periods.

There is currently no uniform definition of risk level. However, according to the Chinese government website (http://bmfw.www.gov.cn/yqfxdjcx/), high risk refers to the cumulative number of COVID-19 cases exceeding 50 or a cluster of pandemics occurring within 14 days. Low risk refers to no confirmed COVID-19 cases or no new cases within 14 consecutive days. The primary basis is that the most prolonged incubation period of COVID-19 is 14 days. In Sichuan Province, the first-level response of pandemic prevention and control was launched on January 24, 2020. Until March 24, 2020, the level lowered to the third. Therefore, this study defined the period from January 24 to March 24 as a high-risk period.

During the high-risk period, transportation and residential areas adopt restrictive and isolation measures. However, during the low-risk period, the restrictions on traffic were lifted, and regular life order was fully restored. Moreover, the nucleic acid test has gradually sped up, reducing the waiting time for admission. An epidemiological history and a throat swab of a COVID-19 nucleic acid negative result within seven days need to be provided.

Compared with 2019, the total number of patients in 2020 has declined, especially in severe open fractures and long bone fractures of the lower limbs, consistent with data from a British study [6]. A possible explanation could be the traffic control, factory shutdowns, and agricultural production pauses in lockdown. Under normal circumstances, high-violence injuries, such as traffic injuries and power tools-related injuries are the leading causes of open limbs fractures. We found an increase in both sharp injuries and hand trauma in 2020, compared with 2019 and 2021, even though there was no statistical difference. This growth is likely related to the long-time daily life of people in isolation at home (such as cooking, fruit cutting, woodworking, etc.), in line with recent literature by Pichard et al. [7]. Their study suggested that the primary cause of hand injuries during lockdown was also domestic accidents. Finally, our study observed a significant percentage increase in the total number of patients in 2021, compared to 2019. This growth was probably due to the lack of skills as people have not worked for a long time, and the rush to work to a deadline leading to increased errors.

From the distribution of patients in tertiary trauma centres, we observed that the total number of patients showed a clear "J"-shaped change from 2019 to 2021. However, fewer patients visited the highest level I trauma centre, whereas more patients visited the level II and III trauma centres during the high-risk period. This trend continued and strengthened in the low-risk period. It is suggested that during the pandemic period, the priority treatment strategy for patients with open fractures was to choose the nearest clinic instead of a faraway highest-level medical institution. There may be one reason behind this. Nearby treatment can effectively reduce the flow and gathering of people, thus avoid exposure to COVID-19. Therefore, except for severe open fractures, other mild patients tend to choose the nearby hospital.

Multiple studies suggest that the meantime from injury to surgery was prolonged during lockdown[8–10]. In a study in India, the author found that the time from injury to the emergency department was greatly extended. The reason may have been isolation measures. However, the time from hospital admission to surgery did not change significantly[4]. In contrast, although without statistical significance, we found that the time from injury to emergency department shortened, whereas the time from admission to surgery dramatically extended in the high-risk period. This finding suggested that prevention and control measures in different countries may extend the preoperative waiting time. The difference was that some rose the pre-hospital first aid time, while others improved the in-hospital first aid time.

Although the infection rate and 30-day readmission rate in this study did not increase significantly in 2020, it is undoubtedly worth encouraging the reduction of waiting time preoperatively. Therefore, we suggest that different countries formulate strategies based on their actual conditions, such as simplifying procedures, accelerating nucleic acid testing, and opening rapid channels. It should be emphasized that these strategies still need to be based on a set of guidelines for screening potential patients with COVID-19.

In terms of the definite wound closure type, patients in the high-risk period are more often covered by direct closure. This phenomenon may be related to the high percentage of G-A I, II, and IIIa grading during this period (totally 71%). These three levels are prone to direct closure. In terms of the duration of

antibiotic application, the proportion of therapeutic use of antibiotics (actual medication time > 48h) in 2021 has increased significantly compared with that in previous periods. This change was most likely due to surgeon's concern about repeated debridement surgery. Besides, guidance to surgeons for COVID-19 stated that "alternative techniques [should be considered] for patients who require soft tissue reconstruction to avoid multiple operations or the need for critical care input"[11].

The fight against the COVID-19 is still the most pressing problem facing various countries. It is recommended that when formulating prevention and control measures in the future, decision-makers should conduct comprehensive evaluations from multiple dimensions such as the proportion of patients in the total population, the growth rate of local cases or the rate of spread of the disease, the proportion of vaccination, and the prevention. It helps to avoid two extreme mistakes. The first is to weaken the prevention and control measures in advance before the pandemic is effectively controlled, resulting in a counterattack or "second wave" of the pandemic. The second is to adopt high-level measures when the pandemic is already at a low-risk period. Intensive preventive measures and isolate management would cause an inconvenience on people's lives, waste medical resources and result in a long-term social and economic downturn.

The strengths of this study include the comparison of the COVID-19 lockdown cohort into two separate control groups, thus reducing the effect of seasonal variation in the patterns of patient presentation. Moreover, this study is a multi-centre study, thus reducing the potentially generating sampling bias. There are several limitations in the present study. First, this study is a retrospective cohort study. Second, there was only one hospital representing each level of the three-level trauma system. Third, the total number of included cases is insufficient. Fourth, the impact of patient-related factors, such as smoking, alcohol habits, concomitant internal disease, is unclear.

Conclusion

During the high-risk period, the total number of patients was expected to decline, whereas in the low-risk period, the number may increase. During the pandemic, patients preferred the lower level II and III centre rather than the higher level I centre. For surgeons, they were prone to direct closure and a more extended antibiotic therapy period. Routine prevention and control measures seem not adversely affect the treatment outcomes and process of open fractures.

List Of Abbreviations

COVID-19 Coronavirus disease 2019

G-A Gustilo-Anderson

ASA American Society of Anesthesiologists

SD Standard deviation

Declarations

Ethics approval and consent to participate

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Biomedical Research Ethical Committee of West China Hospital of Sichuan University. (Date: March 3, 2021/No. 2021-406). Informed consent was obtained from all individual participants included in the study.

Consent for publication

Patients signed informed consent regarding publishing their data.

Availability of data and materials

The original data of this study are available from the corresponding author for reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

JLC designed the study and analyzed study data, and drafted the manuscript. RL and GZ corrected study data and searched relative literature. ML revised the manuscript and supervised the study. All authors read and approved the final manuscript.

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References

1. Lv H, Zhang Q, Yin Y et al (2020) Epidemiologic characteristics of traumatic fractures during the outbreak of coronavirus disease 2019 (COVID-19) in China: A retrospective & comparative multi-center study. Injury 51(8):1698-1704. doi:10.1016/j.injury.2020.06.022
2. Arshad F, Hanif U, Arshad A et al (2021) Orthopaedic Trauma Theatre Efficiency in the COVID-19 Pandemic: Are We Returning to Normality? Cureus 13(2): e13221. doi: 10.7759/cureus.13221
3. Xue H, Cao F, Li H et al (2020) Surgical management strategies for orthopedic trauma patients under pandemic of corona virus disease 2019. Chin J Trauma 36(2):124-128. doi:

10.3760/cma.j.issn.1001-8050.2020.02.005

4. Gupta R, Singhal A, Kapoor A, Dhillon M, Masih GD (2021) Effect of COVID-19 on surgical management of open fractures and infection rates: A tertiary care experience in Indian set-up. J Clin Orthop Trauma 12(1):16-21. doi: 10.1016/j.jcot.2020.10.050
5. NHS. Clinical guide for the management of major trauma patients during the coronavirus pandemic. 2020.https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/C0070-specialty-guide-major-trauma-clinical-guide-27-march-2020.pdf. Accessed April 15, 2021.
6. Campbell E, Zahoor U, Payne A et al (2020) The COVID-19 Pandemic: The effect on open lower limb fractures in a London major trauma centre - a plastic surgery perspective. Injury 52(3):402-406. doi: 10.1016/j.injury.2020.11.047
7. Pichard R, Kopel L, Lejeune Q, Masmoudi R, Masmejean EH (2020) Impact of the COronaVIrus Disease 2019 lockdown on hand and upper limb emergencies: experience of a referred university trauma hand centre in Paris, France centre in Paris, France. Int Orthop 44(8):1497-1501. doi: 10.1007/s00264-020-04654-2
8. Arafa M, Nesar S, Abu-Jabeh H, Jayme MOR, Kalairajah Y (2020) COVID-19 pandemic and hip fractures: impact and lessons learned. Bone Jt Open 1(9):530-540. doi: 10.1302/2633-1462.19.BJO-2020-0116.R1
9. Macey ARM, Butler J, Martin SC, Tan TY, Leach WJ, Jamal B (2020) 30-day outcomes in hip fracture patients during the COVID-19 pandemic compared to the preceding year. Bone Jt Open 1(7):415-419. doi: 10.1302/2633-1462.17.BJO-2020-0077.R1
10. Slullitel PA, Lucero CM, Soruco ML et al (2020) Prolonged social lockdown during COVID-19 pandemic and hip fracture epidemiology. Int Orthop 44(10):1887-1895. doi: 10.1007/s00264-020-04769-6
11. BOA. BOAST - Open Fracture. 2017. http://www.boa.ac.uk/resources/boast-4-pdf.html. Accessed April 15, 2021.

Tables

Table 1

Demographic details of patients.

	2019 no-risk period	2020 high-risk period	2021 low-risk period	P value
Patient number, n (%)	41 (100%)	34 (100%)	48 (100%)	
Level I trauma centre (West China Hospital)	34(82.9%)	24(70.6%)	27(56.3%)	0.024*
Level II trauma centre (Airport Hospital)	5(12.2%)	5(14.7%)	12(25%)	0.248
Level III trauma centre (Jintang Hospital)	2(4.9%)	5(14.7%)	9(18.7%)	0.139
Age(years), mean±SD	40.9±16.7	43.6±13.4	46.8±14.7	0.243
Gender, n (%)				0.455
Male	34 (82.9%)	29 (85.3%)	36 (75%)	
Female	7 (17.1%)	5 (14.7%)	12 (25%)	
Duration from injury to Emergency department (minutes), mean±SD	389.3±360.9	252.3±233.5	291.9±301.8	0.163
Hospital stay (days), mean±SD	13.4±13.8	13.2±12.6	10.4±9.3	0.457
Re-admission rate within 30 days, n (%)	0	0	1 (2.1%)	1
In-hospital mortality, n (%)	0	0	0	-
Infections rate, n (%)	7 (17.0%)	3 (8.8%)	3 (6.3%)	0.263

*P�0.05

Table 2

Distribution of open fractures according to injury mechanism.

	2019 no-risk period	2020 high-risk period	2021 low-risk period	P value
Category of injury mechanism, n (%)				
Road accident	16(39%)	7(20.6%)	14(29.2%)	0.219
Fall from height	1(2.4%)	1(2.9%)	2(4.2%)	1
Fall from standing	1(2.4%)	2(5.9%)	2(4.2%)	0.854
Sharp injury	8(19.5%)	10(29.4%)	10(20.8%)	0.548
Crush injury	15(36.6%)	13(38.2%)	19(39.6%)	0.959
Gunshot/Animal bites	0	1(2.9%)	1(2.1%)	0.738
Injury side, n (%)				
Left	23(56.1%)	20(58.8%)	31(64.6%)	0.705
Right	15(36.6%)	14(41.2%)	17(35.4%)	0.861
Bilateral	3(7.3%)	0	0	0.055
Upper limb open fractures, n (%)	25(49.0%)	24(63.1%)	28(53.8%)	0.412
Humerus	1(2%)	1(2.6%)	4(7.7%)	0.388
Radius and Ulna	3(5.9%)	3(7.9%)	2(3.8%)	0.746
Hand	21(41.1%)	20(52.6%)	22(42.3%)	0.511
Lower limb open fractures, n (%)	26(51.0%)	14(36.8%)	24(46.2%)	0.412
Femur	6(11.8%)	0	3(5.8%)	0.065
Tibia and Fibula	13(25.5%)	7(18.4%)	10(19.2%)	0.652
Patella	0	1(2.6%)	3(5.8%)	0.196
Foot	7(13.7%)	6(15.8%)	8(15.4%)	0.957

Table 3

Summary of anaesthesia outcomes and distribution of open fractures according to Gustilo-Anderson severity grading.

	2019 no-risk period	2020 high-risk period	2021 low-risk period	P value
ASA score, n (%)				
I	2(4.9%)	5(14.7%)	5(10.4%)	0.347
II	25(61.0%)	22(64.7%)	26(54.2%)	0.611
III	11(26.8%)	7(20.6%)	16(33.3%)	0.441
IV	3(7.3%)	0	1(2.1%)	0.243
V	0	0	0	-
Gustilo-Anderson severity grading, n (%)				
Grade I	0	2(5.3%)	2(3.8%)	0.312
Grade II	14(27.5%)	16(42.1%)	17(32.7%)	0.347
Grade III	37(72.5%)	20(52.6%)	33(63.5%)	0.154
Grade IIIa	11(29.7%)	9(45.0%)	7(21.2%)	0.187
Grade IIIb	10(27.0%)	6(30.0%)	15(45.5%)	0.241
Grade IIIc	16(43.3%)	5(25.0%)	11(33.3%)	0.368

Table 4

Summary of surgery and antibiotic therapy outcomes.

	2019 no-risk period	2020 high-risk period	2021 low-risk period	P value
Duration from admission to initial surgery (minutes), mean±SD	407.9±184.8	581.9±368.1	497.3±346.2	0.103
First surgery duration(minutes), mean±SD	109.0±75.0	121.6±70.9	104.0±101.2	0.116
Total number of operations, n (%)				
1	25(61%)	23(67.6%)	38(79.2%)	0.166
2	9(22%)	6(17.6%)	5(10.4%)	0.328
≥3	7(17%)	5(14.7%)	5(10.4%)	0.717
Definitive closure type, n (%)				
Direct Closure	26(51%)	30(78.9%)	33(63.5%)	*0.026*
Skin Graft	8(15.7%)	3(7.9%)	5(9.6%)	0.505
Flap	3(5.9%)	0	2(3.8%)	0.440
Amputation	14(27.5%)	5(13.2%)	12(23.1%)	0.266
Initial fixation type of fracture, n (%)				
External Fixation	7(18.9%)	4(11.8%)	9(22.5%)	0.481
Nailing Or Plating	1(2.7%)	3(8.8%)	2(5.0%)	0.514
K Wiring/Tension Band	15(40.5%)	14(41.2%)	11(27.5%)	0.372
Plaster	14(37.8%)	13(38.2%)	18(45.0%)	0.772
Period of antibiotics therapy, n (%)				0.018*
≤48 hours	25(61.0%)	14(41.2%)	15(31.3%)	
>48 hours	16(39.0%)	20(58.8%)	33(68.8%)	

*P<0.05