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Outcome Of Non-Elective Covid Positive Orthopaedic Injury Procedures In Two Tertiary Care Hospitals

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ABSTRACT

Objective: To evaluate the outcome of COVID-positive orthopaedic injury patients operated as emergency cases regarding overall disease progression, laboratory parameters and fracture healing.

Study Design: Prospective longitudinal study.

Place and Duration of Study: Pak Emirates Military Hospital Rawalpindi and Combined Military Hospital Malir Karachi Pakistan, from Apr to Nov 2020.

Methodology: All the orthopaedic injury patients with no other injuries who tested positive for COVID-19 were included in the study. The demographic data, time of injury and surgery, co-morbidities and values of inflammatory markers such as C-reactive protein (CRP), Total Leukocyte Count (TLC), Serum Ferritin and Neutrophil percentage were noted pre-op and on the fifth-day post-operation. The bone fracture, its severity, and the type of orthopaedic intervention were also noted.

Results: A total of 17 patients were included in the study, out of which 12 were males (70.6%), and 5 were females (29.4%), with a mean age of 49.06±18.78 years. There were 9(52.9%) cases of mild COVID-19, 3(17.6%) cases of moderate and 5(29.2%) cases of severe disease among orthopaedic injury cases. The most common fracture was of the femur in 12(70.6%) patients, followed by tibia/fibula in 3(17.6%) and 2(11.8%) cases of radius and ulna. In addition, there were 2(11.8%) cases of non-union and 5(29.4%) delayed union. Only 2(5.2%) health professionals developed mild COVID.

Conclusion: Orthopedic emergency operations of COVID-19-positive patients can be performed safely following strict COVID-19 protocols.

Keyword: COVID-19, Orthopaedic injury, Reverse transcriptase polymerase chain reaction (RT-PCR).

How to Cite This Article: *Anwar SF, Mushtaq A, Faraz SS. Outcome Of Non-Elective Covid Positive Orthopaedic Injury Procedures In Two Tertiary Care Hospitals. Pak Armed Forces Med J 2023; 73(2): 422-426. DOI: https://doi.org/10.51253/pafmj.v73i2.7488*

INTRODUCTION

In orthopaedic surgery, cases were categorized in 3 ways: (1) elective and non-urgent, (2) elective and urgent, and (3) emergency.[1,2] At PEMH (Pak Emirates Military Hospital), we had postponed all elective cases and focused on COVID-19-positive type 3 procedures last year before the American College of Surgeons guidelines were revised.[3] Before we proceeded with operations, the associated risks due to COVID-19 disease & the benefits of surgery were assessed. COVID-19 can lead to respiratory failure and mechanical ventilation in up to 5% to 10 % of patients.[4] Asymptomatic carriers are a source of transmission to health-care workers; several steps were taken to minimize this risk.[5,6] Firstly, the patients were screened for symptoms of COVID-19 (i.e., fever, dry cough, fatigue, etc.).[7,8] at Combined Military Hospital Rawalpindi (CMH RWP) followed by COVID-19 throat and nasal swab testing by PCR at Armed Forces Institute of Pathology at Rawalpindi. The HRCT chest was carried at the radiology department of CMH RWP. COVID-19-positive cases were referred to PEMH for operative or conservative orthopaedic management.

The aim of this study was to evaluate the outcome of COVID-positive orthopaedic injury patients operated as emergency cases in terms of overall disease progression, laboratory parameters and fracture healing. Moreover, a risk assessment would also be done by monitoring the transmission among health-care staff to ascertain the efficacy of in-vogue standard operating procedures for COVID-19-positive patient care. Finally, this study would help evaluate the possible effects of COVID on bone healing and may serve as an initial study to formulate a comprehensive guideline for orthopaedic injury cases suffering from COVID.

METHODOLOGY

The prospective longitudinal study was conducted on all the orthopaedic injury patients who came to Accident and Emergency (A&E) PEMH and CMH Malir, from April to November 2020. The Ethical

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Received: 06 Nov 2021; revision received: 25 Dec 2021; accepted: 31 Dec 2021

Committee approval was taken prior to the start of this research (IERB number PEMHRWP/00121).

Inclusion Criteria: All the orthopaedic injury patients with no other injuries tested positive with Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) for COVID-19 or showed signs of infection on Computed Topography (CT) Scan Chest were included in the study.

Exclusion criteria: The remaining orthopaedic cases who were COVID-19 negative or had polyinjury and fractures were excluded from the study.

The requisite information and data were acquired from clinical notes of patients of PEMH Rawalpindi and CMH Malir through a non-probability consecutive sampling technique. The demographic data, time of injury and surgery, co-morbidities and values of inflammatory markers such as C-reactive protein (CRP), Total Leukocyte Count(TLC), Serum Ferritin and Neutrophil percentage were noted preop and on the fifth-day post-operation. The bone fracture, its severity, and the type of orthopaedic intervention were also noted. In addition, CT severity score and signs of disease progression as saturation levels and oxygen requirement, were also part of the study. The CT severity score was the sum of scores from 20 lung regions. Each region was given scores of 0, 1, and 2 depending on whether parenchymal opacification involved 0%, less than 50%, or equal to or more than 50%, respectively. The total score was 40.[8,9] The patients were followed for two months to assess bone healing.All the data was collected in a designated Proforma. The healthcare providers managing these patients were followed closely for any signs of COVID-19. As per the hospital policy, healthcare providers would perform their duties as per the roster for 07 days. After that, they would undergo COVID-19 RT-PCR and rest for one week. The COVID-19-positive patients were isolated and treated as per protocol.

Statistical Package for Social Sciences (SPSS) version 23.0 was used for the data analysis. The quantitative variables were represented in mean and standard deviation and compared by one-way ANOVA. The nominal variables were represented in percentages and compared by chi-square test. The *p*-value of ≤0.05 was taken as significant.

RESULTS

There were 17 patients in the study, out of which 12 were males (70.6%), and 5 were females (29.4%). The age ranged from 24 to 82 years, with a mean age of 49.06±18.78 years. The mean time between admission and surgery was 1.53±1.01 days. 10(58.8%) patients had no co-morbidities, 4(23.5%) had diabetes mellitus, 2(11.8%) had asthma and 1(5.9%) had hypertension. There were 15(88.2%) cases of lower limb fractures and only 2(11.8%) upper limb fractures. Their further distribution is shown in the Figure. The further distribution of various surgical procedures performed in the cases is shown in Table-I.

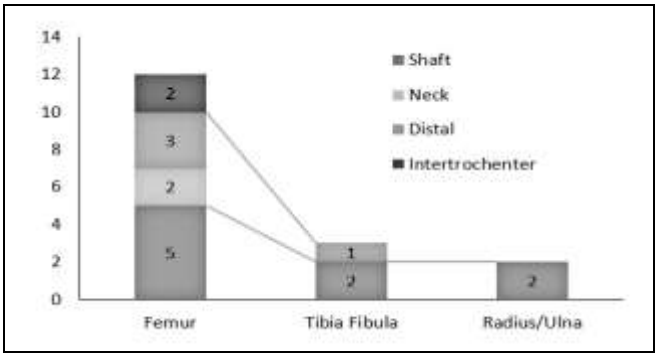

Figure: Distribution of Fractures among COVID-19 Patients (n=17)

Table-I: Various Surgical Procedures performed on Fractures (n=17)

Fracture	Cases	Classification	Surgery
Shaft femur-Closed Shaft Femur-Open	3	32A2(b)	Interlocking Nail
	2	32C2 Gustilo 3B	External Fixator
Neck of Femur	2	31A1	Hemiarthoplasty & Total Hip Replacement
Femur Intertrochanteric	2	31A2	CRIF-DHS
Femur Distal	3	33A3	Distal Locking Compression Plate
Tibia/Fibula-Shaft Closed	1	42C1	Interlocking Nail
Tibia/Fibula-Shaft Open	1	Gustilo 3B	External Fixator
Tibia/Fibula-distal	1	44C1.1	ORIF-1/3rd tubular LCP
Radius/Ulna-Shaft Closed	1	2R2B 2U2B	Plating
Radius/Ulna-Shaft Open	1	2R2A3 Gustilo 3 A	External fixator

There were 9(52.9%) cases of mild COVID-19, 3(17.6%) cases of moderate and 5(29.2%) cases of severe disease among orthopaedic injury cases. Four out of five severe cases were of femur fractures, all males. 6(35.3%) patients were asymptomatic, and 11 (64.7%) had symptoms. Fever was the most common

symptom present in 9(52.9%) patients. 5(29.2%) patients required oxygen support, and one patient had to be intubated for three days, after which he recovered completely. The mean duration of oxygen therapy was 5±4.2 days. Table-II shows the severity of the disease by comparing means of inflammatory markers and other variables pre and 5th-day post Operative. The outcome of fractures after two months of follow-up is shown in Table-III. The two non-unions reported were mild cases of COVID-19. One was a male with a gunshot wound and an open femur fracture, and the other was a female with a fractured shaft of the tibia/fibula. There were a total of 38 healthcare workers involved in the treatment of these patients. Only 2(5.2%) tested positive for COVID-19, both mild cases. One worker developed PTSD, and appropriate treatment was initiated.

Table-II: Comparison of various Inflammatory Markers and other variables in COVID-19 (n=17)

Inflammatory Marker	Severe COVID	Moderate COVID	Mild COVID	*p*-value
Pre-Operative				
TLC	12.24±2.62	13.30±5.67	11.33±4.59	0.782
CRP	86.0±86.77	89.76±99.69	27.02±22.81	0.172
Neutrophils	78.0±5.56	79.0±16.52	71.1±10.43	0.385
Ferritin	429.2±129.43	211.3±147.09	188.1±92.10	0.005
Saturation	89.8±5.12	95.11±1.36	97.3±1.52	<0.001
CT-Severity Score	25.80±3.19	15.3±0.57	6.89±2.20	0.018
5th Day Post-Operative				
TLC	9.88±2.60	12.80±2.03	12.19±2.84	0.246
CRP	61.2±55.09	94.3±103.02	23.55±30.78	0.152
Neutrophils	74.8±7.56	78.0±7.55	73.44±25.47	0.943
Ferritin	342.8±126.92	258.6±135.69	226.1±110.75	0.169
Saturation	92.20±4.817	97.33±2.08	97.11±0.61	0.014
Oxygen requirement	5	0	0	<0.001

Table-III: Comparison between Severity of COVID and Fracture Outcome at 2 months Follow Up (n=17)

Severity of COVID	United	Delayed Union	Non-Union	*p*-value
Mild	4 (44.4%)	3(33.3%)	2(22.2%)	0.606
Moderate	2(66.6%)	1(33.3%)	-	
Severe	4(80%)	1(20%)	-	

DISCUSSION

Our study clearly demonstrated that orthopaedic emergency operations of COVID-19-positive patients could be performed safely following strict COVID-19 protocols in odds ratio with acceptable outcomes and pose little threat to healthcare providers. The COVID-19 pandemic has caused an unprecedented burden on all healthcare systems. The hospitals have been subjected to the dilemma of performing a lifesaving surgery on patients who were COVID-19 positive. This caused undue physical and psychological stress on health professionals. Around the globe, various strategies were devised to cope with this challenge.[10,11] In our hospitals' emergencies, orthopaedic emergencies were identified by orthopaedic surgeons. Quick COVID-19 protocol was initiated, which, after brief history, patients underwent nasopharyngeal and throat swabs for RT-PCR along with a High-Resolution CT scan (HRCT) of the chest. Patients having positive swab tests or findings suggestive of COVID-19 in HRCT were considered positive. The case was discussed in a meeting attended by an orthopaedic surgeon, anaesthetist, pulmonologist and intensivist. If the benefits of emergency operations outweigh the hazards, surgery was conducted by the COVID-19 team following stringent protocols. Our hospital devised an efficient way of screening emergency cases, reflected by a mean time of 1.53 ± 1.007 days between admission and surgery. A study by Keerio *et al*. in Sindh showed an average waiting time of 3.12 days for surgery as COVID-19 results were awaited.[12] Similarly study by Ma and colleagues showed an average time of 2.7 ± 2.5 days for COVID-19 screened patients.[13]

Interestingly, in our study, there were more severe cases of COVID (5) as compared to moderate (3) who were oxygen dependent. Only one patient required ventilator support in our study. He was extubated on 3rd Post Operative day and had an uneventful recovery. Previous studies demonstrated higher mortality in patients treated for femur fractures who were COVID-19 positive but were elderly.[14,15] Among other indicators, levels of serum ferritin (0.005), ambulatory saturation levels (<0.001) and Ct severity score (0.018) were significantly related to severe COVID-19 infection in the pre-operative period.16 While in the

post-operative period, only saturation levels (0.014) were significantly lower among severe COVID-19 cases. A meta-analysis showed that severe infections of COVID have higher levels of CRP and ferritin.[17]

Femur was the most common bone in our cases, and the shaft of the femur was the most common fracture. There were a total of four patients with open fractures, which required external fixators. In addition, four out of five severe cases were of femur fractures, and all were males. A study in England pointed out that male gender and severe may be associated with severe COVID-19.[18] In terms of outcome, ten fractures healed adequately, whereas 5 exhibited delayed union, and there were 2 cases of non-union. However, five cases of delayed/non-union in mild corona patients demonstrated no obvious relationship between bone healing and the severity of COVID. There is a paucity of data in international literature regarding the outcome of COVID-infected orthopaedic injury cases.[19]

There were only two cases of cross-infection among health staff and one case of PTSD. The global guidelines emphasize strict adherence to Standard Operating Procedures to prevent the spread of infection and regular psychological screening from identifying and treating vulnerable staff. 20 Our study outcomes show that COVID-19-infected patients can be managed safely and effectively with appropriate protective equipment.

LIMITATIONS OF STUDY

The current study had a small sample size, post-operative follow-up was also short. Moreover, the financial aspects of COVID-19 were not studied. Therefore, the author recommends a multicenter prospective cohort study of Corona positive and negative orthopaedic injury cases to evaluate the impact of Corona on orthopaedic outcomes.

ACKNOWLEDGEMENTS

The authors are extremely indebted to the Radiology and Pathology Departments for their timely response in providing reports.

CONCLUSION

Orthopaedic emergency operations of COVID-19-positive patients can be performed safely following strict COVID-19 protocols in OR with acceptable outcomes. In addition, the severity of COVID-19 may not impact fracture outcomes.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SFA: Data acquisition, data analysis, approval of the final version to be published.

AM: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

SSF: Conception, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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