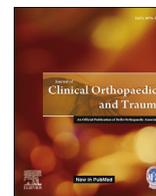




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## Lockdown imposition due to COVID-19 and its effect on orthopedic emergency department in level 1 trauma center in South Asia

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### ABSTRACT

**Background:** The coronavirus pandemic brought the entire world to a standstill. One of the most stringent lockdowns in the world was implemented in India. With the entire healthcare system being stretched, emergency orthopaedic services also take a hit. We studied the trends in patient presentation, testing, management, and restructuring of doctors at a tertiary care orthopaedic centre and compared them with the data from the same time period the previous year (2019).

**Method:** Data was collected separately for all the 5 different phases of lockdown and unlock, as well as for the same duration of months in 2019, and was analysed for epidemiological trends.

**Results:** A rapid fall in the total number of cases was seen during the lockdown, followed by a skewed rise during the unlock. Forearm, wrist, and hip fractures were the most common fractures. Once nucleic acid testing of all patients intended to be admitted was started, a steep rise in coronavirus positivity was seen. There was a reduction in the total number of cases compared to 2019, but it was not as significant as would have been expected due to the complete standstill of activity during the lockdown.

**Conclusion:** During a pandemic, with the healthcare system under a crisis of workforce and infrastructure, there needs to be a separate task force for catering to orthopaedic emergencies since all fractures cannot be managed conservatively and the numbers of trauma-related patients did not show a stark fall as compared to normal months of last year.

**Level of evidence:** Level 3 Retrospective Case Series

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## 1. Introduction

The first case of COVID-19 was reported in India on January 30, 2020, long before it was declared as a pandemic by the WHO on March 11, 2020.<sup>1,2</sup> Taking cognizance of the seriousness, the Indian government evoked the 123-year-old Epidemic Disease Act, 1987, to enhance preparedness and containment of the viral disease. The first 100 cases were confirmed on March 15th, 2020. Accordingly, on March 22nd, a one-day Janta curfew (public curfew) was observed and air travel was banned as a measure to contain the spread. Meanwhile, following the lead of other countries, a nationwide lockdown was imposed beginning March 25th and lasting 21 days until April 14th. Taking leads from other countries, a nationwide lockdown was implemented from 25th March onwards for 21 days till 14th April. Due to the continuing spread and

multiple super-spreader incidents, the lockdown was further extended till May 30th, in 4 staged phases. On May 30, 2020, the government of India announced the return of services in a phased manner, except in containment zones. This was termed "Unlock 1.0."<sup>3</sup>

As of July 2021, India had more than 3.13 crore cases (active and cured) of COVID-19 and 4.19 lakh reported deaths. There have been two massive waves of the pandemic and multiple new variants of the virus.

The rapid spread and high number of cases needing observation, testing, screening, admission and ventilatory support have brought the healthcare systems all over the world to a crunch, India being no exception. From the lack of hospital beds to the rapidly increasing number of healthcare workers testing positive, health care has taken a major hit. This necessitated redistribution and restructuring of healthcare facilities, space as well as the work force for efficient and continued functioning of other hospital services. The orthopaedics practise did not stay unaffected, with prompt

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suspension of all outpatient department services (OPD's) and elective surgeries.

A major chunk of orthopaedic patients were comprised of trauma victims suffering from fractures. While some fractures could be managed conservatively, quite a few needed prompt management and surgery for life or limb saving measures. Road traffic accidents and industrial trauma have always constituted a major chunk of the trauma cases in our country. However, during the pandemic, particularly during the lockdown, the elderly hip fractures caused by a fall at home and necessitating immediate intervention were on the rise.

The goal of this study was to examine the epidemiological data of trauma patients who presented to a level 1 trauma centre during the lockdown phases of the first wave of the COVID-19 pandemic, analyse how the pandemic caused us to manage the patients differently, and identify areas for improvement, particularly in terms of minimising exposure and optimising resource usage in the management of such emergency patients and in the event of a future such healthcare crisis. Also, we compared the data with that of a similar time period from one year before, during the non-pandemic scenario, to see how the patients' presentations had changed due to the virus.

## 2. Materials and methods

This was a retrospective observational study in the setting of a Level 1 Tertiary Care Trauma Centre in the National Capital Region (NCR) of India.

different periods were studied, as enumerated below:

1. Lockdown 1.0 – March 25th – April 14th, 2020
2. Lockdown 2.0–April 15th to May 3rd, 2020.
3. Lockdown 3.0 – May 4th – May 17th, 2020
4. Lockdown 4.0 – May 18th – May 31st, 2020
5. Unlock 1.0–June 1st–June 30th, 2020

### 2.1. Lockdown 1

During this phase, there was a complete termination of all non-essential services, such as international and national travel, public transport, schools, colleges, shopping complexes, social, religious, political, or sports-related events, and leisure activities. This was the phase of complete lockdown in India. This phase also saw stringent contact tracing of all the cases that were being diagnosed.<sup>4</sup>

### 2.2. Lockdown 2

Similar guidelines of complete restrictions on public and non-essential activities were continued for another two weeks by the government of India. No relaxation was implemented during this period.

### 2.3. Lockdown 3

This phase saw the division of areas into zones depending on the number of cases – Green, Orange, and Red/Hotspots were identified. This phase saw some relaxation in the green and orange zones. People were allowed to travel in four-wheelers (only two people), standalone shops were allowed to open up, curfew timing was relaxed from 7pm to 7am only, construction activities were allowed, private offices were started with 33% of their staff, and all government offices were opened up. Interstate travel, train travel, and flight travel were still restricted. No leisure activities were allowed.

### 2.4. Lockdown 4

This phase of the lockdown saw a further relaxation for the general public. Public transport, shops, and non-essential shops were allowed to open, and private work places with full staff, as well as restaurants for take away, were opened. This saw a large number of people stepping out of their houses, finally being allowed to do so. Restricted domestic air flights were also restarted, with international flights still on hold.<sup>5</sup>

### 2.5. Unlock 1

This phase saw the opening of all major businesses, including shopping complexes, malls, restaurants, dine-in, domestic travel by road, rail, and air, as well as restricted religious and social gatherings in a phased manner. Masks and social distancing were made compulsory, like all the previous phases.

The appropriate ethical clearance was obtained from the Institute Ethics Committee via reference number IEC-1227/2020. The inclusion criterion for our study included patients of any age presenting to the Accident and Trauma Emergency Department of our Tertiary Trauma Centre in New Delhi, India and needing any orthopaedic consult. If the same patient visited the emergency room more than once for follow-up of the same condition, the subsequent visits were not included.

The variables collected were: age, gender, diagnosis, COVID RT-PCR status, admitted for surgery, discharged.

Screening was done for COVID-19 on the basis of a questionnaire which stratified the patients into high or low risk on the basis of recent history of cold, cough/fever, contact with a positive patient, recent history of travel, or residing in a hotspot area. Ma et al. have shown and used a similar questionnaire for emergency patient screening and showed it to be helpful.<sup>6</sup> From lockdown 4.0 onwards, we started testing every patient presenting to the emergency department and planned for admission as per revised hospital protocol. The test used primarily was RT-PCR for the novel coronavirus.

Similarly, as a comparison cohort, the data from the previous year (2019) of patients presenting to orthopaedics and trauma departments during the same time duration was also collected. This data was used as a comparison group to see the effect of the pandemic and the lockdown on the orthopaedic patient population.

### 2.6. Statistical analysis

A descriptive analysis was conducted, overall as well as in every phase. A mean and standard deviation were used for normally distributed data. An ANOVA test was used for comparison across the four groups, and the results were depicted via graphs. The data was compiled in Microsoft Excel© for Macintosh and analysed using ©SPSS version 24 for Macintosh (IBM Inc., Chicago, IL, USA).

## 3. Results

A total of 5485 orthopaedic trauma patients presented to our centre during the duration of 80 days. Of these, 505 (lockdown 1), 517 (lockdown 2), 524 (lockdown 3), 740 (lockdown 4) and 1437 (unlock 1) patients presented during different phases (Table 1). The number of patients in the unlock 1 period increased significantly as compared to the other phases ( $p < 0.05$ ). The mean age was 31–32 years old during all the phases without any significant differences amongst the phases ( $p > 0.05$ ). The majority of the patients belonged to the 16–49-year age group. About 1% of the patient population in each phase was octogenarian. Sex distribution was

**Table 1**  
Tabulation of epidemiology of patients presenting during the pandemic.

	Lockdown 1	Lockdown 2	Lockdown 3	Lockdown 4	Unlock 1.0
Total no. of patients	505	517	524	740	1437
No. of admissions for surgery	32	41	49	54	105
Age groups(years)					
<15	88	86	69	79	180
16-49	318	332	367	553	1054
50-79	93	93	85	102	195
>80	6	6	3	6	8
Most common fractures	Hip - 23, proximal tibia -16	Forearm,/wrist-60, Hip- 21	Forearm and wrist - 56, Hip - 17	Forearm and wrist - 67, Hip - 29	Forearm and wrist - 126, Proximal tibia/Tibia shaft - 71, Hip - 25
Mean age(years)	32.8	32.6	32.7	31.8	31.7
Sex distribution	340:165, 67:33	360:157,69:31	376:148,71:29	546:194,73:27	1097:340, 76:24
COVID +	0	0	0	3	26
Compound	7	7	6	10	84
Population >80	6	6	3	6	8

70:30 (men: women) across all the phases without any significant difference ( $p > 0.05$ ). Open fractures saw a steady increase as we advanced along the phases, and there was a significant rise in the number of open fractures during unlock 1 ( $p < 0.05$ ). The most common modes of injury were road traffic accidents, followed by assaults, domestic violence, and falls at home, in that order. None of these showed a significant difference. ( $p > 0.05$ ) Forearm/wrist and hip fractures were the commonest fractures without any significant differences amongst the five phases ( $p > 0.05$ ) (Fig. 1). The number of admissions also increased with the advancing phases but showed no significant difference ( $p > 0.05$ ). A stark rise in COVID + cases was detected during the unlock 1.0, which was statistically significant compared to the previous phases. ( $p < 0.05$ )

3.1. The epidemiology of previous year's cases presenting during the same time period

A total of 6241 patients were presented during the same time period in the previous year (Table 2). This number did not show a statistical fall during the pandemic. ( $p > 0.05$ ) Of these, 584 patients were admitted for surgical intervention, which was significantly higher than the admission advised during the pandemic ( $p < 0.05$ ). The majority of the patients belonged to the 16–49 year age group, the same as the pandemic population. Octogenarians constituted 1% of the entire patient group. The mean age was 44 years. The sex ratio was 60:40, male to female. There were 466 (7.4%) compound cases. The most common mode of injury was a road traffic accident, followed by a fall from a height. Road traffic accidents were significantly more frequent than all other modes of injury ( $p < 0.05$ ). The most common fractures were shaft of femur and wrist fractures, closely followed by hip fractures, although the

**Table 2**  
Epidemiology of patients presenting to emergency during same months in 2019 (one year before).

Total no. of patients	6241
No. of admissions for surgery	584
Mean age (years)	44.27
Most common fractures	Shaft femur - 214 Wrist - 256 Hip - 188
Sex distribution	61:39
COVID +	None
Compound	466
Population >80	74

mean age of the hip fracture group was less than the mean age of the hip fracture group which presented during COVID times.

4. Discussion

India was one of the few countries to impose a strict lockdown extending over 2 months starting from March 2020 itself. All travel, businesses, industries, as well as elective hospital visits were halted.<sup>4</sup> The strict lockdown was considered essential to flatten the curve of the rapidly spreading pandemic, especially considering the population density and poor living standards in India. Hospitals also had to implement a sudden discontinuation of all elective surgeries, out-patients, inpatients, or operative admissions.<sup>7</sup> There was immediate initiation of restructuring healthcare workers, resources, doctors, and preparation for the upcoming pandemic in terms of arranging supplies, resources, manpower, and space. Orthopaedic departments faced distinct structural and financial effects that had never been seen before in the orthopaedic world.<sup>8–10</sup> Soni et al. have shown how even pre-hospital care, like traction and antibiotics, was delayed for orthopaedic patients during the pandemic, leading to poorer outcomes even after surgeries.<sup>8</sup>

Over the 4 lockdown periods, we did not see any statistical difference in the numbers, age, or sex distribution of the patients presenting to the emergency orthopaedic department. One percent of the patients were consistently over the age of 80, while 18%–20% were over the age of 50. This emphasises that with termination of movement, reduced vehicular transport as well as stoppage of industrial work, the group of young patients with high velocity trauma fractures had their fractures reduced as compared to pre-COVID times, but the old age osteoporotic group continued to have fractures after trivial trauma inside the home. This trend was seen worldwide. Hashmi et al. have shown in their study that paediatric and geriatric trauma were seen in higher numbers.<sup>9</sup> In

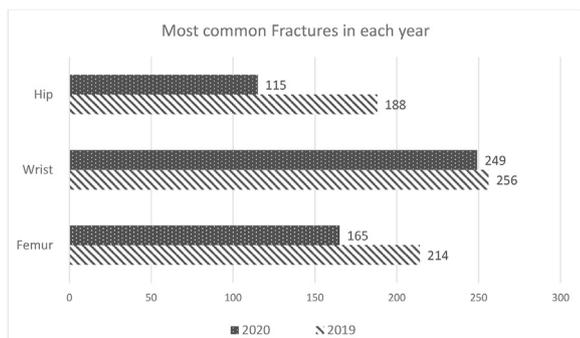


Fig. 1. Most common fractures in each year (2019 vs 2020).

their recent systemic review, Blum et al. showed that there was no reduction in hip fracture related referrals even during peak pandemic months.<sup>10</sup> They also mentioned that the number of road traffic accident-related injuries did not reduce significantly, since the roads were emptier and, thus, there were more episodes of high-speed and rash driving. We also saw a rise in geriatric trauma, which was equivalent to the numbers from the previous year, but a significant fall in road accidents in our population, similar to other developing countries. Also, a rise in domestic violence and assault cases was noticed.<sup>11–13</sup> A similar rise was also reported by Faldini et al. in Italy.<sup>14</sup> This can be attributed to the confinement, loss of livelihood, and an increase in episodes of depression and anxiety in the population.

The fact that distal end radius fractures were the most common fracture type, followed by fractures around the hip, both of which are fragility fractures and have a high prevalence in the older osteoporotic population, also hints that this population was continuously bearing the brunt of the pandemic. Maximum admissions were indicated for the fixation of fractures around the hip. This was a double edged sword, as most of the patients with hip fractures were elderly, with multiple comorbidities. These were also the patients who were highly prone to exposure and at risk of getting infected with nosocomial infections, especially coronavirus, which could be fatal at their age. At the same time, delays in hip surgery have been linked to higher 30-day mortality rates, according to previous research.<sup>15,16</sup> Catellani et al. have shown that early surgery in elderly patients with proximal femur fractures leads to overall physiological stability in coronavirus positive patients and early recovery.<sup>17</sup> Fisher et al. have shown a similar outcome in their series of trauma patients from New York.<sup>18</sup>

Another constant complaint of elderly patients was the discontinuation of their osteoporotic medications, including bisphosphonates, teriparatide injections, and calcium, due to the sudden implementation of lockdown and complete termination of civilian movement. We need to ensure that in such emergency situations, a stable supply-chain of medications that can prevent such fractures is maintained. Also, in the coming months, it seems like there could be a surge of osteoporotic fractures due to the vast load of patients who might have discontinued medications, skipped doctor visits (especially related to their vision related or neurological conditions), or were not able to buy medication. This trend of a high or equal number of osteoporotic fractures has also been highlighted in studies at other centres in the world, indicating it to be a universal problem.<sup>19,20,21</sup>

A more liberal approach to conservative management of fractures was adopted.<sup>22,23</sup> The absolute indications for fixation or fractures that would lead to early arthritis or compound fractures with gross contamination or loss of soft tissue coverage (Gustilo Anderson type 3)<sup>24</sup> were the only ones taken up for operative intervention. Any case that had close to acceptable or near acceptable reduction, joint alignment, or clean wounds after washing was considered for splintage and discharged to the home for conservative management, where possible.<sup>25,26</sup> Patients who were elderly but had severe life threatening medical complications, which would make their fitness for surgery a problem, were given the option of Boot and Bar splint and home nursing due to the high risk of exposure to coronavirus in the event of prolonged hospital admission. Although most of the fractures did not fall into this category, 12 out of 110 patients with hip/pertrochanteric fractures were given non operative treatment, considering the above scenarios and the patients' preference. This non-surgical management eventually leads to the pooling of patients and even more difficult surgical interventions after the pandemic, as shown by Saini et al. in their study.<sup>25</sup>

We adopted an approach of resident rotation, where residents

were divided into 4 teams of 25% resident strength each and called in on separate days. Such restructuring has been used almost at all centres to avoid complete exhaustion or positivity of the work force.<sup>27</sup> The residents who were exposed were quarantined without the risk of infecting others or causing a crisis in the workforce.

#### 4.1. Surgical protocols at our centre

At the same time, Standard Operating Procedures (SOP's) were created for patient management.<sup>28–30</sup> For the first three phases, all patients were screened on the basis of history and risk stratified as per the national guidelines.<sup>4</sup> Any high-risk suspect was kept in isolation wards till test results came in. To avoid cross infections, dedicated trolleys, lifts, and personnel were used for the transfer of these patients into isolation. If the test turned out to be negative, they were shifted to the non-suspect ward and operated on. If the patients tested positive, they were shifted to a dedicated COVID facility developed within the hospital campus but in a separate building to maintain best infection control practices.<sup>31</sup>

From phase 4, all patients were considered high risk. Thus, apart from wearing PPE such as N95 masks and disposable surgical gowns, social distance among patients and doctors was ensured at all times in the emergency department. Also, at this time, all patients were tested for COVID by the RT-PCR method, irrespective of history or age.<sup>29</sup>

COVID positive patients were operated on in a separate exclusive operation theatre (OT), reserved for surgeries of COVID-positive cases in a dedicated COVID centre. Standard sterile procedures, cleaning with hypochlorite, and fogging of OT were done at regular intervals. All healthcare workers wore tightly sealed PPE (coveralls, N95 masks, shoe covers, goggles, and face shields) in this facility. Patients were induced and regional anaesthesia was preferred over general anaesthesia to avoid aerosol generation as advised by other centres.<sup>30</sup> This was the protocol for patients who had tested positive but needed an urgent intervention like management of open fractures. Conditions that required emergent life- or limb-saving surgery that could not wait for the COVID test results were considered positive and operated upon in an OT dedicated for suspect cases. A similar protocol has been shown to be effective by other authors in their centres.<sup>32,33</sup>

Cases that could undergo delayed surgery, like proximal tibia fractures, were shifted to the COVID facility after inserting a pin for traction. On testing negative for corona and getting discharged from COVID hospital, these patients were readmitted by our department, and surgery was undertaken. Although this does make the surgical procedure more tedious, it minimises the risk of exposure to a number of healthcare workers and decreases the overall need for PPE. *These postponed surgeries came with their own set of complications, such as increased blood loss and transfusions, the need for bone grafting, and longer exposures. These complications of delayed surgeries due to COVID have also been shown in other studies.*<sup>25</sup>

Also, while we were screening patients on the basis of their history of travel, contact, and hot spots, we did not detect any positive cases during the first 3 phases. But when we started to test all patients who were planned for admission and fracture fixation, we started to detect many coronavirus positive patients, the majority of whom were asymptomatic. This is significant, because even if one positive patient gets operated on, it puts a large number of healthcare workers, doctors, nursing staff, and other patients at risk of exposure. Thus, mandatory testing for all patients to be admitted for any emergency surgery is the way forward, irrespective of their history of exposure, symptoms, age, or travel, since the stratification of risk based on screening failed constantly, with multiple patients who were considered low risk turning out to be

positive on RT-PCR during lockdown 4 and unlock 1. Thus, we stuck to the policy of universal testing since the fourth lockdown onwards.<sup>33</sup>

Another trend seen was the rising number of open fractures as the lockdown started to be eased and through unlock 1.0. Such patients do spend significant time in the hospital during their admission and management. Their wounds also need regular dressings and debridement procedures, which can be a source of aerosol spread and exposure for the doctors and other patients. These patients are also exposed to the risk of nosocomial infection. Special preventive policies need to be formulated in a timely manner to avoid or minimise such events. Furthermore, coordination between departments and quick discharge of such patients in order to protect the patient himself, other patients, and the healthcare workforce and to save medical resources that might be needed in other areas is vital. Wound management, dressing, and debridement bring the healthcare workers into close contact with the patient's fluids and aerosols for a considerable time and remain high-risk points of COVID-19 exposure and need to be looked into.<sup>34</sup> All elective or semi-elective cases were cancelled and this decision was based on the<sup>35</sup> Ohio Hospital Association principles for what is to be considered elective or emergency. OPDs were converted into online teleconsultations. Lal et al. have established protocols to run the OPD during such a pandemic.<sup>36</sup>

Our study showed that the number of patients presenting to our trauma center decreased by 12% after the implementation of lockdown, showing a fall in number but not statistically significant compared to the previous years ( $p > 0.05$ ). This was in stark contrast to most of the epidemiological studies that have been published around the world about trauma patients (Table 2). This could be possible because of only a few centres were providing comprehensive trauma care during the time of the pandemic. Most countries had used a "hub and spoke" model, with some hospitals designated as exclusive CoVID centres and others for non-CoVID patients. This model is a great way to efficiently ensure that competent trauma care is provided to this group of patients, who might be neglected during the surge of such a pandemic in future.<sup>37</sup>

Hip fractures constituted 3% of all cases during pre-COVID times, where-as during the months of the pandemic, hip fractures constituted only 2% of all the cases. Although the numbers did not show a significant difference ( $p > 0.05$ ), the average age of patients presenting with hip fractures was younger during the pre-COVID time as compared to the lockdown (43years vs. 64years). This could be due to the increased number of trivial falls due to home confinement, as well as the discontinuation of osteoporotic medication in the older population during the lockdown, and the fall in the number of high velocity traumas in the younger population.<sup>38</sup> This decrease in the number of cases, as well as the altered epidemiology of causation, type of fractures, and age groups that were more severely affected, has been demonstrated in multiple studies from other countries, indicating that this was an international trend.<sup>39–43</sup> We feel, that this pandemic and the subtle change in the epidemiology of trauma patients should guide us to better preparedness in case of future such events.

## 5. Conclusion

COVID-19 has stretched the capacities of the entire healthcare system internationally. A "two-hit" phenomenon engulfed the trauma and emergency services. These patients needed surgery as a part of their treatment, which needed to be done by the limited available healthcare manpower not involved in COVID care, limited resources, and, at the same time, protecting the healthcare workers as well as the patients from getting infected with the virus. The elderly and open fracture patients were at higher risk; the elderly

because of their compromised immunity and co-morbidities, and open fracture patients because of their prolonged hospital stay. Adequate protocols and guidelines have to be instated for the management of this "high-risk" population in an effective way to ensure preparedness for any such future crisis.

## 6. Limitations

A severe second wave of the coronavirus engulfed the Indian subcontinent (April 2021 to May 2021). The data from this wave has not been included in the present study and would give a better picture of the trauma care during different waves. Also, this study shows the high volume of trauma cases at one centre, but it would be even more descriptive if all the centres providing trauma care were included in this study. Thirdly, this study just shows an epidemiological presentation of the data and no data about patient follow ups or outcomes have been shown in this study. Such data would greatly increase the strength and value of this study.

## Declaration of competing interest

The authors have no disclosures or conflict of interest to disclose regarding the research or work done for publication of this article.

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