Comparative study of orthopaedic trauma pattern in covid lockdown versus non-covid period in a tertiary care centre

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ABSTRACT
Objectives: Patterns of trauma during the covid-19 lockdown were reviewed.
Methods: Epidemiological factors, mechanism and pattern of injuries of 235 patients during the lockdown were compared with 627 patients during similar time frame in 2019. Protocols followed in treating these patients were reviewed.
Results: Significant increase were noted in domestic injuries due to slip and fall at home, fall from height, trees, snake bite and hip and spine fractures during the lockdown.
Conclusion: Though the type of injuries during the lockdown were different, they warrant treatment on urgent basis even during the covid times to avoid long term morbidity.

1. Introduction

The first case of corona virus was reported in India on January 30, 2020 in Kerala which rose to three cases by 3rd February 2020, who were all students returned from Wuhan. The first case in our district was detected on March 23, 2020, in a person who had returned from Dubai. The lockdown in the nation started on 22nd March 2020 and our planning to prepare and contain the patients based on the guidelines by Indian Council of Medical Research (ICMR) and World Health Organisation (WHO) took shape. This pandemic and lockdown is a new experience for this generation of health care workers in order to prepare, plan and implement unprecedented health care measures in any health setting.

The role of an orthopaedic surgeon in such an epidemic as compared to field of infectious diseases and emergency medicine may appear limited and disparate (1). However as primary care providers in emergency situations of trauma related fractures, dislocations, hand and soft tissue injuries, bone tumours, joint infections, spine injuries and infections, the role of an orthopaedic surgeon is crucial. During the times of lockdown associated with the covid-19 pandemic, although the number of road traffic accidents (RTA) may have reduced, household injuries and do it yourself (DIY) injuries during cooking, gardening, tree climbing etc., appear to have increased due to more involvement of people in such activities (3). Falls in elderly is also a constant issue which needs urgent management to avoid complications of recumbence.

The patients who present with such trauma may also be potentially infected from the virus. Hence the treating orthopaedic surgeon is a ‘Front line physician’ in this situation. 1 Most of the orthopaedic surgeries involve drilling, reaming and using a saw which are associated with aerosol generation. This can be a focus of infection for the operating orthopaedic surgeon as well. 2

Hence in this situation the clinical practice of orthopaedic surgeons are channelled by the following principles 2:

1. Recognition of emergency and essential patients who need urgent clinical intervention
2. Safety of patients who need admission and of residents and consultants involved in patient care
3. Judicious and protocol based use of health care resources to avoid shortage at times of essential need.

1.1. This article aims to address and review the following

1. The epidemiology and mechanism of injuries in patients with orthopaedic related trauma presenting to the emergency department during the lockdown period.
2. The patterns of presentation of hip and long bone fractures, spine fractures, hand and soft tissue injuries.

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3. To compare these injury patterns with a cohort of patients who presented in 2019 during the similar time frame.
4. The triage and treatment guidelines followed at our hospital which could potentially guide practising surgeons in the future in similar healthcare set-up.

2. Materials and methods

2.1. Our hospital response model

Our tertiary care hospital is situated in the western coastal area of southern part of India with a patient draining area of 500 kilometer radius. We have a main teaching hospital of 2032 beds with a subsidiary hospital of 150 beds approximately five kilo-meters away. In our set-up, the main hospital was reserved for emergency and essential services and the subsidiary hospital for isolation and treatment of covid-19 patients once the lockdown was announced.

Our department is a primary care and referral centre catering to all sub specialties, including hand and microvascular surgery, paediatric orthopaedic surgery, spine surgery, arthroscopy and arthroplasty, foot and ankle and all trauma related injuries. Our orthopaedic leadership team decided to stop all elective surgical case and in accordance with guidelines received from Ministry of Health and Family Welfare (MoHFW) to dedicate all the staff, residents, interns to emergency and essential services and to reduce cross infection rates amongst patients and health care providers.

Intra-departmental reallocation and a rota system was followed for all the healthcare workers in the hospital. Three teams were made, each team consisting of consultant and residents in-charge of specific responsibilities such that the team members wouldn’t meet physically and distancing was maintained. For example, Team one would manage out-patient services, emergency triage and ward admissions, Team two would manage the cases posted for operation theatre and Team three would be the back-up team at home. The teams would alternate on-call duties every week. This was made to ensure rota flexibility such that if any of the members fell sick, the backup team would step in their place.

The out-patient department (OPD) was re-adjusted to maintain social distancing norms amongst patients in the waiting area and between patient and doctor in the consulting area. The working hours were reduced to half day services from 9am to 1pm to prevent over burdening the emergency triage and to conserve use of resources available. Designated areas were established outside the out-patient department and emergency triage to screen all patients presenting to the hospital for covid-19.

Our institute has five dedicated Operation Theaters (OT) for elective and emergency orthopaedic surgery in two separate blocks of the hospital. Two OTs in one of the blocks were designated for emergency surgery on suspected covid-19/diagnosed covid-19 patients. The other three OTs in a different block was reserved for emergency surgery on non-covid patients.

The ‘tele-medicine and tele-rehabilitation services’ was adopted to provide un-interrupted patient care. These services are known to improve patient satisfaction, pain and outcome scores significantly. The patients without alarming signs were assessed over the phone and the out-patient department and the emergency triage. Patient risk categories of patients during the same period in 2019.

Patterns of injuries like fractures and dislocations, hand injury, spine injury and soft tissue injuries during the lockdown period from March 10, 2020 to May 17, 2020. These factors were compared with a similar cohort of patients during the same period in 2019.

A common screening protocol was followed for patients presenting in the out-patient department and the emergency triage. Patient risk categories, covid-19 case definition, screening protocol was done in accordance with ICMR guidelines as shown in Tables 1 and 2 for non-acute cases respectively.

2.2. Statistical analysis

Statistical package for social sciences software for Windows (SPSS) version 20.0 was used for analysis. The comparison of injuries with respect to age groups was done using McNemar test and noted to be statistically significant. The gender groups were analysed using the chi-squared test and found not statistically significant. The comparison of mechanism of injuries was performed using the McNemar test and found to be statistically significant.

3. Results

The Emergency Department which manages the emergency services in our hospital received a total of 6552 cases during the non-lockdown period in 2019, of which 627 cases (9.5%) were orthopaedic related trauma. During the lockdown period in 2020, a total of 3574 patients were received of which 235 cases (6.5%) were orthopaedic related trauma. There was a reduction of 46% in the total number of cases and 3% reduction in the orthopaedic related trauma cases in the lockdown period.

All patients were screened (Table 1, Table 2, Fig. 1) for covid-19 and then triaged into:

1. Yellow zone – for non-acute cases
2. Blue zone – for acute cases

We noted that the number of orthopaedic related trauma cases that presented to our emergency triage reduced 2.7 times in the yellow area (473 patients in non-lockdown period to 173 patients in lockdown period) and by 2.4 times in the blue area (154 patients in non-lockdown period to 62 patients in lockdown period). Overall, there was a reduction of 62.6% in the number of Orthopaedic related trauma cases in the lockdown period as compared to the non-lockdown period.

3.1. Injury with respect to age (Fig. 2)

The most common age group affected during the non-lockdown as well as the lockdown period was similar at 30–50 years (46.7% in 2019 and 46.8% in 2020).

A 6% reduction was noted in patients in the 0–20 year age group in the lockdown period as compared to the non-lockdown period. A 6% increase was noted in the 60–90 year age group in the lockdown period as compared to the non-lockdown period. The comparison of injuries with respect to age groups was found to be statistically significant.

3.2. Gender (Fig. 3)

We observed more injuries in males as compared to females during

| Table 1 Risk categories. |
|-------------------------|
| **Category** | **Type of patients** | **Location** |
| Very high risk | Confirmed/suspected covid-19 cases (based on current case definitions and exposure history) | Dedicated 150 bedded subsidiary hospital |
| High risk | Severe Acute Respiratory Illness (SARI), Influenza like illness (not fulfilling above criteria) | SARI dedicated ICUs in the main hospital |
| Moderate risk | Mild to moderate respiratory disease | Routine wards |
| Low risk | Any other patient (not anyone of the above) | Other patient care areas |
4. Discussion

In accordance with national policies, during the lockdown period there was a strict curfew imposed on vehicular transport and mobility. The district borders were sealed except for health emergencies and all public places, malls, places of worship, restaurants were closed to maintain social distancing norms and contain the viral spread. Due to these factors, various authors have hypothesized that there would be a significant reduction in the number of emergency and orthopaedic-related trauma during this period. In our study, the observations were noted to be in accordance with this. The orthopaedic related trauma cases, albeit reduced and of different mechanisms and patterns during the covid-19 lockdown period, were significant in nature. The constancy of trauma related injuries and management of these cases on an urgent basis even during the covid-19 period is pivotal to reduce morbidity and mortality amongst patients. Hence the role of the orthopaedic department in such situation is crucial.1, 3

Orthopaedic trauma related patient demographic group is very varied as trauma can occur in patients of extremes of ages also.5,6 In the lockdown period we noted an increase in trauma amongst population more than 40years. Slip and fall at home - in the bathroom, kitchen, garden and during household activities was the most predominant mechanism. Owing to strict household confinement a lot of people were known to engage in household cleaning activities associated with climbing ladders, climbing the rooftops of their house and hence there was a significant increase in such injuries.

In our district, climbing trees for coconut harvesting, picking arecanut, fruits and flowers are a major source of income for the general population. During the lockdown, due to the unavailability of professionals, people engage in doing these activities by themselves, thus exposing them to higher risk of injuries. We noticed an increase in rates of fall from tree as compared to the non-lockdown period last year.

Our district being in the shadow of the Western Ghats are endemic to certain snakes. People are also known to engage in gardening and farming activities as part of their livelihood and also as a hobby. During the lockdown there an increase in snake bite related injuries mainly due to increase in such activities.

Road traffic accidents usually contributes to significant amount of orthopaedic related trauma in our country. The rate of such injuries was lesser than last year during the similar time frame. In our district a brief window period of lockdown relaxation was allowed from 7am to 11am for people to procure their daily needs like newspaper, milk, groceries, vegetables etc. Most of the RTAs occurred during this time frame.

During the lockdown period all industries were shut down and their activities were abandoned. Hence a reduction was noted in such injuries. In our country sports like cricket, football, and hockey are a form of passion and hobby to majority of the population. People were not allowed to play outdoor sport during the lockdown period and hence such injuries were lesser than last year.

Fractures around the hip predominated the injuries that were observed during the lockdown. Slip and fall at home was the major contributing mechanism for such fractures with a significant increase as compared to last year. Though these fractures are not absolute orthopaedic emergencies, they are essential to be operated to ensure faster mobilization and avoid complications of being bed ridden. 45 of 47 such fractures (95%) were operated upon during the lockdown. The patients who were not operated were the ones who were unwilling for treatment due to insurance and other financial issues. We also observed that three patients with fractures of the proximal femur presented with a delay of more than 1month following injury owing to the restrictions in mobility and fear of the disease. Such delayed presentations are more difficult to manage as it may take longer duration of surgery, more blood loss and are associated with sub-optimal outcomes in the post-operative period. Although, in our scenario no complications were observed in the peri and post-operative period in surgeries on these patients.

In the lockdown period there was an increase in total number of spine injuries, but occurred more commonly due to fall from height and fall from tree as compared to RTAs. 80% of these spine injuries were operated upon in our hospital. The other patients did not have a clear
surgical indication. There was relatively lesser high velocity injuries like lower limb and upper limb long bone fractures, open fractures and poly-trauma in the lockdown period as compared to the non-lockdown period.

A total of 135 cases were operated upon in the lockdown period in our hospital. Our hospital being a tertiary care referral centre, cases which required surgical care were the only ones referred. All patients in whom there was a suspicion of the covid-19 infection on initial screening were tested and isolated in designated facility. They were operated upon only when they tested negative. However all appropriate precautions as advocated by ICMR and MoHFW were taken. If emergent surgery was required in such patients, it was performed in the designated theatres.

4.1. Differentiating points during covid-19 lockdown in patient management as compared to non-lockdown period

1. A checklist was prepared for all patients undergoing surgery explaining the risks and complications of getting operated during this period. This also included a covid-19 related special consent along with the routine consent.
2. Aerosol generating procedures like general anaesthesia and intubation were avoided by the anaesthesia team – regional blocks, spinal anaesthesia were preferred.
3. The use of positive pressure versus negative pressure in operation theatres is a matter of constant debate. Reverse engineering routine positive pressure ventilation is difficult as well as costly. In our set up, surgeries with the routine laminar air flow was performed in the dedicated operation theatre.
4. Aerosol/splash generating methods like electro-cautery, pulse lavage, electric saw and burr were avoided.
5. Absorbable suture materials were used so that the patient review and contact is minimized.
6. Fumigation of the operation rooms, corridors, patient contact areas post-surgery.
7. Use of intra-op c-arm for radiographic images to limit patient intra hospital patient transport and reduce work of radiographers.
8. Operated patients were asked to review with a local doctor if suture removal was required. They were asked to avail the telemedicine services as much as possible.

4.2. Exit strategy towards resuming normal functioning and precautions

The post pandemic impact and recovery into normal functioning is an integral part of planning.

- Surgical backlog of cases – due to cancellation of elective appointments in the lockdown period, these patients could pile up in the post lockdown period. Also in sub-specialities of paediatric orthopaedics the management plan would change as a result of these cancellations. More extensive procedures may be needed for management of same problems which could have been managed in a simpler way.
Table 3
Comparison of hip fractures with respect to mechanism of injury.

| Mechanism of injury | 2019 (non-lockdown period) (n = 627) | 2020 (lockdown period) (n = 235) | McNemar test |
|---------------------|--------------------------------------|----------------------------------|--------------|
| 1. Slip and fall at home | 50 (8%) | 78 (33%) | p < 0.01 |
| 2. Fall from height | 22 (3.5%) | 30 (12.7%) |   |
| 3. Fall from tree | 11 (1.9%) | 22 (9%) |   |
| 12 Household injuries | 13 (2%) | 11 (4.6%) |   |
| 13 Snake bite injuries | 4 (0.6%) | 6 (2.6%) |   |
| 14 Others | 5 | 8 |   |

Table 4
Mechanism of injury - Reduction.

| Mechanism of injury | 2019 (non-lockdown period) (n = 627) | 2020 (lockdown period) (n = 235) | McNemar test |
|---------------------|--------------------------------------|----------------------------------|--------------|
| 1. Road traffic accident | 471 (75%) | 71 (30%) | p < 0.01 |
| 2. Machine cut injury | 25 (4%) | 6 (2.5%) |   |
| 3. Sports injuries | 17 (2.7%) | 2 (0.8%) |   |
| 4. Assault | 9 (1.5%) | 1 (0.42%) |   |

Table 5
Comparison of injury patterns in lockdown versus non-lockdown period.

| Injury patterns | 2019 (non-lockdown period) (n = 627) | 2020 (lockdown period) (n = 235) |
|----------------|--------------------------------------|----------------------------------|
| 1. Fractures around the hip | 32 (5.1%) | 47 (20%) |
| 2. Fractures around the knee | 17 (2.7%) | 7 (2.9%) |
| 3. Fractures around the ankle and foot | 27 (4.3%) | 8 (3.4%) |
| 4. Lower limb long bone fractures | 116 (18.5%) | 22 (9.3%) |
| 5. Fractures around the shoulder | 25 (3.9%) | 2 (0.8%) |
| 6. Fractures around the elbow | 11 (1.7%) | 3 (1.2%) |
| 7. Fractures around the wrist | 18 (2.8%) | 8 (3.4%) |
| 8. Upper limb long bone fractures | 17 (2.7%) | 11 (4.6%) |
| 9. Hand injuries | 60 (9.5%) | 13 (5.5%) |
| 10. Spine injuries | 47 (7.4%) | 20 (8.5%) |
| 11. Open fractures | 36 (5.7%) | 8 (3.4%) |
| 12. Hip dislocation | 2 (0.3%) | 1 (0.45%) |
| 13. Knee dislocation | 1 (0.1%) | 0 |
| 14. Shoulder dislocation | 11 (1.7%) | 8 (3.4%) |
| 15. Elbow dislocation | 0 | 2 (0.85) |
| 16. Multiple bone fractures, polytrauma | 35 (5.5%) | 4 (1.7%) |
| 17. Other soft tissue injuries | 208 (33.1%) | 79 (33.6%) |

Table 6
Comparison of hip fractures with the respect to age.

| Age groups | 2019 (non-lockdown period) (n = 32) | 2020 (lockdown period) (n = 47) |
|------------|--------------------------------------|----------------------------------|
| Less than or equal to 50 years | 26 (81.25%) | 30 (63%) |
| More than 50 years | 6 (18%) | 17 (36%) |

Table 7
Comparison of hip fractures with respect to mechanism of injury.

| Mechanism of injury | 2019 (non-lockdown period) (n = 32) | 2020 (lockdown period) (n = 47) |
|---------------------|--------------------------------------|----------------------------------|
| Road Traffic | 22 (68.7%) | 15 (31.9%) |
| Accident | 6 (18.75%) | 27 (57.4%) |
| Slip and fall at home | 2 | 3 |
| Fall from height | 2 | 2 |
| Fall from tree | 2 | 3 |

Table 8
Comparison of spine injuries with respect to age.

| Age groups | 2019 (non-lockdown period) (n = 47) | 2020 (lockdown period) (n = 20) |
|------------|--------------------------------------|----------------------------------|
| Less than or equal to 50 years | 39 (82.9%) | 14 (70%) |
| More than 50 years | 8 (17%) | 6 (30%) |

Table 9
Comparison of spine injuries with respect to mechanism of injury.

| Mechanism of injury | 2019 (non-lockdown period) (n = 47) | 2020 (lockdown period) (n = 20) |
|---------------------|--------------------------------------|----------------------------------|
| Road Traffic | 25 (53%) | 4 (20%) |
| Accident | 2 (4.2%) | 1 (5%) |
| Slip and fall at home | 11 (23.4%) | 8 (40%) |
| Fall from height | 9 (19.1%) | 7 (35%) |

• Negative consequences of treatment during the lockdown period – as per recommendations, the non-operative means of treatment was preferred to the suspicious/covid positive cases in non-life/limb threatening injuries. This could lead to increase in rate residual deformities, non-unions which may need to addressed aggressively.

5. Conclusion

• The covid-19 related lockdown was associated with significant changes in age groups, mechanisms of injury and patterns of injury of Orthopaedic related trauma.
• Injuries were observed to occur across all groups. However the rate of such injuries were significantly higher population more than 50years.
• In such population, the rate fractures around the hip and spine were much higher than the non-lockdown period.
• Although the rate of injuries caused by road traffic accidents was lesser and of lower velocity magnitude, the fractures that occurred secondary to these were significant. A shift of mechanism towards domestic injuries, fall from height, fall from tree was noted. Such injuries warrant treatment on urgent basis even during the covid times to avoid long term morbidity in such patients.
• Orthopaedic surgeries should never be done as ‘fix and forget’. Follow-ups and reviews are pivotal in managing possible complications. The tele-rehabilitation and tele-medicine services offered to patients were extremely beneficial during the pandemic in this regard.
• Orthopaedic surgeons are often ridiculed upon when considered as front line warriors during this pandemic. However, the amount of injuries that have been observed even during this period are significant. Hence the role Orthopaedic workforce is paramount in such situation. Owing to the sterility techniques learnt during joint replacements, arthroscopy and surgery on trauma cases, Orthopaedic surgeons are possible flag bearers in advocating norms regarding Operation Theatre protocols and sterility techniques even for surgeons of other fields.
5.1. Limitations

- Comparison of results with other departments of the hospital during covid-19 lockdown could not be performed.

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Author contribution

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Anil K Bhat and Siddarth Kamath K. Both authors have read and approved the final manuscript.

Declaration of competing interest

No conflict of interest was noted between any of the authors.

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