

The Impact of COVID-19 Pandemic on Orthopaedic Trauma Practice and Patient Care at Tertiary Care CentreVivek Kumar Kori¹, Harshdeep Singh^{2*}, Vinod Rawat³, Deepak S. Maravi⁴¹Assistant Professor, Department of Orthopaedics, Gandhi Medical College, Bhopal, MP, India²Post Graduate Resident, MS Orthopaedics, Department of Orthopaedics, Gandhi Medical College, Bhopal, MP, India³Post Graduate Resident, MS Orthopaedics, Department of Orthopaedics, Gandhi Medical College, Bhopal, MP, India⁴Professor, Department of Orthopaedics, Gandhi Medical College, Bhopal, MP, India

Received: 25-09-2023 / Revised: 23-10-2023 / Accepted: 18-11-2023

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Conflict of interest: Nil

Abstract:**Background and Objectives:** This study has been undertaken to find out how the COVID-19 pandemic has affected patient care and orthopedic trauma practice at a tertiary care center.**Method:** In this retrospective comparative observational study, we have observed four periods from "1st march 2020- 28 Feb 2021 and 1st march 2021- 28 Feb 2022" as period III and IV i.e. COVID pandemic period compared with "1st march 2018-28 Feb 2019 and 1st march 2019- 29 Feb 2020" as period I and II i.e. non covid pandemic period. Demographic details and epidemiological parameters of trauma were collected and compared.**Results:** Due to the lockdown, there has been a reduction in the total number of patients coming to the trauma center, from 7.65 patients per day in Period I to 4.45 patients per day in Period IV. The cases of road traffic accidents decreased from 55.01% in Period I to 38.02% in Period IV, and a reduction in pediatric trauma cases from 18.02% in Period I to 12.01% in Period IV was noted. Conservative treatment increased from 45.20% in Period I to 57.97% in Period IV, while operative intervention decreased from 54.79% in Period I to 42.02% in Period IV. Forearm injury also showed an increase from 4.87% in Periods I to 8.37% in Periods 4. Injury around the elbow also increased, whereas shoulder injury decreased in Periods 3 and 4. Foot and ankle injuries increased, while leg injuries showed a decreasing trend in Periods 3 and 4. Injury around the knee did not show a significant difference, but thigh and hip injuries decreased in COVID Periods 3 and 4. Spine injuries also decreased from 7.98% and 8.76% in Periods 1 and 2, respectively, to 5.98% and 7.39% in Periods 3 and 4.**Conclusion:** Due to the lockdown, people were forced to stay at home, which led to an increase in the incidence of household injuries. There was a decrease in outdoor activities, resulting in increased trauma around the elbow and wrist among the pediatric age group. During the pandemic period, there was a shift in treatment pattern from operative to conservative methods. The main lessons learned for the next pandemic are that orthopedic departments need to remain flexible in infrastructural re-organization to increase critical care capacity, facilitate outpatient management by taking proper precautions, and provide proper patient exposure for undergraduates. Precise clinical drill training may also improve the clinical skills of upcoming doctors, enabling them to face any pandemic like COVID-19 with basic clinical skills.**Keywords:** COVID-19, Lockdown, Pandemic Period, Basic Clinical Skills.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

An orthopedic trauma unit primarily deals with the treatment of injuries due to road traffic accidents, falls from height, domestic violence, and others, with numerous cases of compound/open, closed fractures, and amputated limbs. Road traffic injuries (RTIs) contribute significantly to mortality and morbidity, responsible for more lost years of life than most human diseases in the pre-COVID era. However, COVID-19 arrived in India around January 30, 2020, a few months after the WHO

declared it a pandemic on March 11, 2020. The Indian government invoked the 123-year-old Epidemic Disease Act, 1987, to improve preparedness and containment of the viral disease. Implementation of lockdown led to a remarkable decline in public mobility and mortality. The incidence of RTAs decreased during the COVID-19 epidemic compared to the non-COVID-19 era, but household and do-it-yourself (DIY) injuries during

cooking, gardening, tree climbing, and other activities appear to have increased.

These types of patients who needed surgical treatment or were already under treatment were entirely neglected due to a lack of facilities as priority was given only to COVID-19 patients. Many challenges arose due to the sudden shutdown of routine surgeries by the government, including a lack of medical facilities to attend to patients other than COVID-19 patients, delays in surgery, fear of COVID-19 contamination and patient isolation, all in the absence of timely government advisory. Hence, fracture surgery of patients with COVID-19 infection was a challenging procedure from the pre-operative period up to rehabilitation. It was thought that the majority of orthopedic procedures require drilling, reaming, and sawing, all of which produce aerosols.

Converting hospital buildings into a dedicated COVID center made tertiary centers unable to provide proper treatment to trauma patients. Therefore, trauma patients were completely neglected from treatment. In our retrospective study, we have identified four periods to compare injury patterns during the COVID-19 period with a cohort of patients who presented in 2018-2019 during a similar time frame. Our comparative analysis study finds out the variation in the pattern of orthopedic trauma patients who visited the orthopedic department in a tertiary care center during the COVID-19 period. This study is necessary to understand the impact of lockdown on orthopedic practice and patient care in a tertiary care center during the COVID-19 period, formulate new guidelines for how orthopedic surgeons will act while dealing with the same situation in the future, and identify further scope for the betterment of healthcare services in the institute.

Materials and Methods

The study was conducted retrospectively at a tertiary care center, Hamidia Hospital associated with Gandhi Medical College, Bhopal, Madhya Pradesh. Data was collected from hospital department records, data entry registers in emergency, wards, and Hospital Management Information System (HMIS). The study included patients who presented to the orthopedic emergency department with fresh injuries or those referred for tertiary level management. The variables collected included demographic profile, date of injury, mode of injury, diagnosis, investigations, treatment, admission and

operative intervention, and associated injuries. However, the study did not include follow-up data of patients.

Four periods were studied, including

Period I (1st March 2018 to 28th Feb 2019),
Period II (1st March 2019 to 29th Feb 2020),
Period III (1st March 2020 to 28th Feb 2021), and
Period IV (1st March 2021 to 28th Feb 2022).

During the lockdown period, patients requiring admission had to undergo COVID-19 testing and were sent to designated areas as per protocol. The data for the corresponding time frames from 2019 were used as the baseline to evaluate changes in patterns and management protocols.

The study was approved by the departmental review board as a descriptive observational study, and data was collected and analyzed using Microsoft Excel (version 2016) spreadsheet.

Inclusion Criteria: All patient came during March 2018 - March 2022.

Exclusion Criteria:

- Patients without any history of trauma.
- All patients those having trauma not visited to orthopaedics department during this period.

Observation and Results

In our study we have observed that there is reduction in total number of patient coming to emergency department. In Period 1, our study shows that 2792 patients came, i.e., 7.65 patients per day, and in Period 2, a total of 2420 patients came, i.e., 6.63 patients per day. The number of patients decreased to 1169 (3.20 patients per day) in Period 3 and 1623 (4.45 patients per day) in Period 4. In Period 1, there were 1719 male patients and 1073 female patients. In Period 2, there were 1449 male patients and 971 female patients. During the first year of the COVID-19 pandemic (1st March 2020 to 28th February 2021), 785 were male and 384 were female. In the second year of the COVID-19 pandemic (1st March 2021 to 31st March 2022), 1089 were male and 534 were female. We have also found a reduction in pediatric trauma from 18.02% and 15.99% in Periods 1 and 2 to 8.04% and 12.01% in Periods 3 and 4, respectively. Additionally, there was an increase in adult trauma cases from 81.98% and 84.01% in Periods 1 and 2 to 91.96% and 87.99% in Periods 3 and 4, respectively (Table 1).

Table 1: Demographic profile of patients presenting with orthopaedic trauma

Period	Period 1	Period 2	Period 3	Period 4
Totalno of patients (no./day)	2792 (7.65 patient /day)	2420 (6.63 patient/day)	1169 (3.20 patient /day)	1623 (4.45 patient /day)
Male	61.57% 1719	59.88% 1449	67.15% 785	67.10% 1089
Female	38.43% 1073	40.12% 971	32.85% 384	32.90% 534
Paediatric (0-18 yrs) trauma	18.02% 503	15.99% 387	8.04% 94	12.01% 195
Adult (>18 yrs) trauma	81.98% 2289	84.01% 2033	91.96% 1075	87.99% 1428

Our study shows a reduction in road traffic accidents, from 55.01% in Period 1 and 44.01% in Period 2 to 20.02% and 38.02% in Periods 3 and 4, respectively. There was an increase in slip and fall accidents at home, from 24.00% in Period 1 and 28.02% in Period 2, to 38.49% and 31.98% in Periods 3 and 4. Additionally, there was an increase in fall from height accidents, from 12% and 16.99% in Periods 1 and 2 to 29.94% and 20.02% in Periods

3 and 4, respectively. Assault cases showed an increase from 4.01% in Period 1 and 5.00% in Period 2 to 10.01% in Period 3 and 7.02% in Period 4. Machine injuries accounted for 2.01% in Period 1 and 1.98%, 1.03%, and 1.97% in Periods 2, 3, and 4, respectively. The rate of associated injuries was 3.01% in Period 1, 4.01% in Period 2, 0.51% in Period 3, and 0.99% in Period 4 (Table 2)

Table 2: Comparison of mode of trauma

	Period 1	Period 2	Period 3	Period 4
RTA	55.01% 1536	44.01% 1065	20.02% 234	38.02% 617
Slip and fall at home	24.00% 670	28.02% 678	38.49% 450	31.98% 519
Fall from height	12.00% 335	16.99% 411	29.94% 350	20.02% 325
Assault/Domestic violence	4.01% 112	5.00% 121	10.01% 117	7.02% 114
Machine injury	2.01% 56	1.98% 48	1.03% 12	1.97% 32
Associated injury	3.01% 84	4.01% 97	0.51% 6	0.99% 16

Open fractures that comes under gustilo-anderson classification were 44.2% in period-1 and 47.19% in period-2, 39.78% in period-3, 40.11% in period-4 were as closed fractures were 55.8% in period-1 and 52.81% in period-2, 60.22% in period-3, 59.89% in period -4 (Table 3).

Table 3: Comparison of open vs close wound

	Period 1	Period 2	Period 3	Period 4
Open Fractures	44.2 % 1234	47.19% 1142	39.78% 465	40.11% 651
Close Fractures	55.8 % 1558	52.81 % 1278	60.22 % 704	59.89 % 972

The data shows the types of associated injuries with their respective percentage in each period. For instance, head injury accounted for 19.05%, 24.74%, 33.33%, and 25% in periods 1, 2, 3, and 4, respectively. Abdomen injury was 26.19%, 26.80%, 16.67%, and 18.75% in periods 1, 2, 3, and 4,

respectively. Chest injury was 21.43%, 21.65%, 33.33%, and 25% in periods 1, 2, 3, and 4, respectively, while bladder injury was 33.33%, 26.80%, 16.67%, and 31.25% in periods 1, 2, 3, and 4, respectively (Table 4).

Table 4: Comparison of associated injuries

	Period 1	Period 2	Period 3	Period 4
Head Injury	19.05% 16	24.74% 24	33.33% 2	25% 4
Abdomen Injury	26.19% 22	26.80% 26	16.67% 1	18.75% 3
Chest injury	21.43% 18	21.65% 21	33.33% 2	25% 4
Bladder injury	33.33% 28	26.80% 26	16.67% 1	31.25% 5

We have also evaluate patients come to our hospital in emergency we treated conservatively 45.20% in period-1 and 43.63% in period-2, 67.66% in period-3, 57.97% in period-4 and operated cases were 54.79% in period-1, 56.36% in period-2 and 32.33% in period-3, 42.02% in period-4 (Table 5).

Table 5: Conservative vs Operative

	Period 1	Period 2	Period 3	Period 4
Conservatively managed patients	45.20% 1262	43.63% 1056	67.66% 791	57.97% 941
Total Operated Patients	54.79% 1530	56.36% 1364	32.33% 378	42.02% 682

We have also calculated time interval between patients visited hospital and operation done. Operation done within a week is 62.03% and 51.98% in periods 1 and 2 decreased to 42.06% and 46.04% in periods 3 and 4. Operation done in second

week is 23.99% and 37.98% in periods 1 and 2, 39.95% and 37.98% in periods 3 and 4. In more than 3 weeks 13.99%, 10.04%, 17.99%, 15.98% operations done in periods 1,2,3 and 4 respectively (Table 6).

Table 6: Comparison between Time Interval

Time interval	Period 1	Period 2	Period 3	Period 4
< 1 week	62.03% 949	51.98% 709	42.06% 159	46.04% 314
1 st week – 2 nd week	23.99% 367	37.98% 518	39.95% 151	37.98% 259
> 3 rd week	13.99% 214	10.04% 137	17.99% 68	15.98% 109

Out of total patients admitted operation done in routine cases increased from 51.90% and 50.63% in period I and II to 64.15% and 62.23% in period III and period IV and decrease in emergency cases from 48.09% and 49.36% in period I and II to 35.84% and 37.76% in period III and period IV.(Table 7)

Table 7: Routine OT vs Emergency-OT

	Period 1	Period 2	Period 3	Period 4
Routine OT	51.90% 1280	50.63% 1360	64.15% 612	62.23% 992
Emergency OT	48.09% 1186	49.36% 1326	35.84% 342	37.76% 602

Trauma pattern has shown significant change. Injuries around the wrist show an increasing trend from 7.27% and 8.67% in periods 1 and 2 to 10.26% and 9.98% in periods 3 and 4 respectively. Forearm injuries also show an increasing trend from 4.87% and 5.08% in periods 1 and 2 to 9.92% and 8.37% in periods 3 and 4 respectively. Injuries around the elbow increased, while shoulder injuries decreased

in periods 3 and 4. Foot and ankle injuries increased, while leg injuries showed a decreasing trend in periods 3 and 4. Injuries around the knee didn't show much difference, but thigh and hip injuries decreased in Covid periods 3 and 4. Spine injuries is also decreased from 7.98% and 8.76% in periods 1 and 2 to 5.98% and 7.39% in periods 3 and 4 respectively (Table 8)

Table 8: Comparison of trauma pattern of injury during non-COVID and COVID period

	Injury Pattern	Period 1	Period 2	Period 3	Period 4
Upper limb	Hand injury	8.66% 242	10.82% 262	9.58% 112	9.18% 149
	Injury around wrist	7.27% 203	8.67% 210	10.26% 120	9.98% 162
	Forearm injury	4.87% 136	5.08% 123	9.92% 116	8.37% 136
	Injury around elbow	3.61% 101	4.46% 108	7.52% 88	8.50% 138
	Arm injury	3.86% 108	4.62% 112	6.15% 72	7.33% 119
Lower limb	Shoulder injury	7.59% 212	10.28% 249	11.63% 132	8.00% 130
	Foot injury	6.87% 192	5.22% 142	7.18% 84	7.45% 121
	Injury around ankle	5.80% 162	5.49% 133	6.84% 80	6.96% 113
	Leg injury	8.56% 239	8.34% 202	8.38% 98	6.22% 101
	Injury around knee	8.73% 244	6.81% 165	6.15% 72	6.71% 109
	Thigh injury	11.17% 312	9.21% 223	5.30% 62	7.57% 123
	Hip injury	14.97% 418	11.52% 279	5.38% 63	6.28% 102
Spine injury	7.98% 223	8.76% 212	5.98% 70	7.39% 120	

Discussion

The COVID-19 pandemic had a major and unexpected impact on different areas of life, including the healthcare system. This led to a surge in COVID-19 care workload, which required a complete overhaul of the system.

To comply with the Ministry of Health and Family Welfare (MoHFW) guidelines, our tertiary care teaching hospital was designated as a covid care center in our locality. As a result, all departments had to be reorganized to pool staff, residents, and interns from various specialties to provide COVID-19 related services. To address the staff shortage and reduce the risk of infection transmission between patients and healthcare workers, all planned surgeries in our orthopedic department were delayed, and regular outpatient services were suspended for several months during phase-3. Only urgent and essential services were provided during the lockdown.

During the first year of Covid-19, there was a decrease in the number of trauma patients presenting in our region, with 3.20 patients per day in period 3 and 4.45 in period 4, compared to the corresponding time frame in periods 1 and 2. The most affected age group was the pediatric group, which showed a significant reduction of 9.98% in period 3 and 6.01% in period 4 compared to the non-Covid period 1.

This trend is similar to that observed by Ruzzini et al.[1,2]

There was a reduction of approximately 34.99% in road traffic accidents during period 3, with 16.99% of trauma cases being attributed to road accidents. Road accidents contribute significantly to deaths and injuries and are responsible for more lost years of life than most human diseases. Approximately 55.01% of trauma cases in period 1 were due to motor-vehicle accidents (MVA), but this declined to 20.02% and 38.02% in periods 3 and 4, respectively, due to extreme restrictions on leisure activities and movement of vehicles during the lockdown. A similar trend was found by Abhilash et al.[3]. However, there was a significant increase in trauma due to slip and fall in period 3 (38.49%) and period 4 (31.98%), probably due to people being confined to their homes and engaging in household activities such as cleaning, which involved climbing stairs or rooftops, playing, and other activities. Hampton et al. [3,4,5,6] also observed a decrease in orthopedic trauma consults, increased injuries due to gunshot wounds, and decreased automobile versus pedestrian accidents during the pandemic.

There was no significant difference in the incidence of open and closed wounds between all periods studied, but the proportion of upper limb trauma increased from 35.89% in period 1 to 54.75% and 51.39% in periods 3 and 4, respectively. This was probably due to slip and fall being the predominant

mechanism of injury during this time, as observed by Ruzzini et al. [2]. Similar to the findings of Singh et al. [4], the interval between the time of injury and presentation to the emergency room significantly increased during the lockdown period compared to the non-Covid period, possibly due to lack of resources, travel restrictions, non-availability of transportation, and fear of acquiring COVID-19 infection in the hospital.

Although there was a significant decrease in the total number of open and closed fractures during the lockdown, the rate of conservative management drastically increased from 45.02% and 43.63% in periods 1 and 2, respectively, to 67.66% and 57.97% in periods 3 and 4, respectively. This was due to the universal acceptance that it was better to accept sub-optimal post-traumatic outcomes rather than acquiring COVID-19 infection during their hospital stay.[7] Moreover, orthopedic procedures require the use of drills and saws that are aerosol-generating, so only life threatening or limb-saving surgeries were performed during this period. Similar observations were recorded in other parts of the world.

Conclusion

Our Retrospective Observational Study Concludes:

- The COVID-19 pandemic has had an unprecedented impact on orthopaedics with changes in outpatient, fracture, inpatient hospital admissions, elective and emergency operative procedures.
- There were reduction in number of overall cases. The incidence of RTA have decreased during the COVID-19 pandemic as compared to the non-COVID-19 era but household injuries and DIY injuries appear to have increased.
- Decreased outdoor activities, particularly increased trauma around elbow and wrist amongst paediatric age group. Parents should be better equip with tools to deal with same scenarios in future pandemic.
- In pandemic period, due to fear of covid infection, haphazard situation created, most doctors were given unnecessary tasks to complete during covid first pandemic year so most got infected.
- Repeated new guidelines to follow, difficulty in collecting and maintain data, major staff getting infected, converting buildings into dedicated covid centres and unable to give proper treatment due to lack of proper facilities are some problems faced during covid pandemic which were only tip of iceberg.
- The increasing availability of RTPCR might reduced the risks of resumption of elective orthopaedics surgery during the pandemic by facilitating the pre-operative screening of

patients. The use of the screening policy has become successful. The current plans will incorporate all patients attending the hospital for either surgery or outpatient clinics undergoing screening and appropriate subsequent testing for all patients undergoing surgery.

- The COVID-19 pandemic has also changed the pathway for treating patients with greater utilisation of telemedicine in the form of virtual fracture clinics, allowing for safer ongoing follow-up without risking contamination, by reducing face-to-face consultation.
- All clinical needs should be met within an acceptable timeframe and there should not be consideration for delayed surgery to prevent possible malunions.
- The main lessons learned for the next pandemic are that orthopaedics departments need to remain flexible to infrastructural re-organization to increase critical care capacity, facilitate outpatient management by taking proper precautions and proper patient exposure for under graduates and precise clinical drill training may also improve the clinical skills of fore coming doctors which will enable them to face any pandemic like covid with basic clinical skills.
- We believe that this study would provide a basis for further studies to evaluate the impact of COVID-19 on the field of orthopaedics and traumatology. This is a unique study that has compiled the full pandemic years (2020-2021) and compared it with the preceding year. The presented data is large enough to come to a reasonable conclusions. This study should also help in resource and manpower allocation in such a human tragedy in the future

Limitations of Study

These are some limitations of our study:

1. Lack of follow-up.
2. Lack of appropriate date due to haphazard situation during covid period.
3. No records of patients absconded due to fear of COVID-19 infection.
4. Lack of facilities in tertiary care for trauma patients (dedicated covid centres).
5. Lack of visits and referrals from nearby Bhopal and cities/villages due to fear of COVID-19.

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