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A retrospective evaluation of characterization, clinical course and anaesthesia management of emergency trauma surgical patients during first wave of COVID-19 pandemic at a tertiary care center in India

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ABSTRACT

Background: The COVID-19 pandemic resulted in nationwide lockdown followed by phased unlock to break the chain of transmission of the SARS-CoV-2 virus in India. Management of emergency trauma patients has been particularly challenging for anaesthesiologists in order to treat these high risk group of patients and preventing cross infection to healthy patients as well as health care personnel.
Materials and Methods: It is a single centre retrospective observational cohort study conducted at tertiary care hospital in North India in the patients who underwent emergency trauma surgeries during 31^{st} March 2020-31^{st} May 2020(Lockdown) and compared with data from 1^{st} June 2020-31^{st} July 2020(Unlock).
Primary Objective: To compare the effect of lockdown and unlock during first wave of Covid-19 pandemic on the volume of emergency trauma surgical patients operated within 24 hours of admission.
Secondary Objective: To evaluate the difference between the two periods of lockdown and unlock a) in the mortality rates b) covid status c) the length of hospital stay d) the mechanism of injury e)severity of injury f)proportion of aerosol generating procedures (AGP) utilized and g)demographics of the patients.
Our anaesthesia experience of managing the patients differently in the pandemic, identify areas for improvement, particularly in terms of minimising exposure and optimising resource usage in the management of such emergency patients in the event of a future healthcare crisis is also discussed.
Results: Over the 2 periods of lockdown and unlock there was no statistical difference in number, age or sex distribution of the patients presenting for emergency trauma surgery. Number of covid positive patients were slightly higher during unlock but it was statistically insignificant (p=0.07) and the number of patients died during unlock was also higher during unlock as compared to lockdown but statistically insignificant(p=0.3). The median injury severity score and length of stay was also not statistically significant between two periods. Road traffic accidents were most common type of injury in both the groups, self-inflicted injury occurred in 5 patients during lockdown and zero during unlock, none of these showed a significant difference ($p > 0.06$). General anaesthesia was the most common anaesthesia technique used in both the periods.
Conclusion: Emergency trauma surgeries will continue to occur even in different phases of pandemics, anaesthesiologists should plan and prepare appropriately to provide anaesthesia and emergency care to these patients and prevent cross infection in healthy patients and health care workers.

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1. Introduction

As millions of people around the globe got infected from novel coronavirus (COVID-19), World Health Organization(WHO) declared COVID-19 as global pandemic on 11 March, 2020.[1]

Honourable Prime Minister of India requested Janta Curfew on 22nd March 2020. After which nationwide lockdown declared in India from 24^{th} March which gradually extended till 31^{st} May. Following this unlock was planned in phased manner 1^{st} June to 31^{st} June was unlock 1 and then 1^{st} July to 31^{st} July was unlock 2.[2]

To conserve the resources and prevent cross infection in patients elective surgeries were deferred globally[3] but emergency surgeries could not be postponed including trauma surgery. Emergency trauma surgeries are inherently very challenging as severe trauma is associated with life threatening injuries and during the pandemic these patients may be affected with COVID-19 and its multiorgan effects.[4] Various worldwide studies show a drastic decrease in trauma surgery cases during the lockdown period of 2020 when compared with the same period in 2019.[5,6]

But literature is very sparse on anaesthetic management of this high risk group of patients who underwent emergency trauma surgeries performed during two periods of lockdown and unlock in the pandemic.

The aim of this study is to compare the effect of lockdown and unlock during first wave of COVID-19 pandemic on the volume of emergency trauma surgical patients operated within 24 hours of admission, their covid status and outcomes at a tertiary care centre of North India.

We also intend to share our experience as anaesthesiologists in the management and planning of these patients differently in the pandemic, especially in terms of decreasing exposure and detect areas for improvement.

2. Materials and Methods

2.1. Study population

Emergency trauma surgical patients operated within 24 hours of admission from 31^{st} March 2020-31^{st} May 2020 (Lockdown) and compared with data from 1st June 2020-31^{st} July 2020(Unlock).

2.2. Study design

It is a single centre retrospective observational cohort study conducted at tertiary care hospital in North India after institutional ethical committee approval (IEC - 579/06.08.2021reference number).

Data collected retrospectively from anaesthesia register database, electronic patient management system and in few instances from patient's proper clinical notes.

Patient characteristics (age, sex, Injury severity score, mode of injury, glasgow coma scale (GCS), Covid status positive or negative, type of anesthesia -general anesthesia (GA), regional, combined regional and GA, blood transfusion, use of vasopressors, death or discharge days after trauma, all observed retrospectively.

Primary objective was to evaluate a) the difference in number of emergency trauma surgeries during lockdown and unlock.

Secondary objectives were to compare between the two periods a) the difference in the mortality rates b) covid status c) the length of hospital stay d)the mechanism of injury e)severity of injury f) type of anaesthesia used g)demographics of the patients.

COVID-19 status of the patient undergoing emergency surgery was reported as positive, suspect or negative based on the result of nasal /pharyngeal swab by rapid antigen test RAT/ reverse transcription- polymerase chain reaction (RTPCR)/ geneXpert (CBNATT).

The mechanisms of injury were divided into five categories 1) fall from height 2) road traffic accident 3) stabbing 4) shooting 5) self-inflicted injury

2.3. Inclusion criteria

1. All patients admitted to emergency trauma surgery during 31^{st} March 2020-31^{st} May 2020 of national lockdown and operated within twenty-four hours of admission.
2. All patients admitted to emergency trauma surgery during 1^{st} June -30^{th} July 2020 national unlock operated within twenty-four hours of admission.

2.4. Exclusion criteria

1. In hospital emergency surgical patients
2. Procedures for postoperative complications
3. Admitted trauma patients undergoing repeat surgeries
4. Neurotrauma patient
5. Orthopaedic trauma patients

2.5. Management of trauma patient during first wave of Covid-19 pandemic at our set up

Ours is a largest tertiary care centre in north India with a dedicated trauma centre and a main hospital at a distance of 1 km. In a makeover arrangement we converted our trauma centre into a dedicated COVID-19 centre as soon as the lockdown was declared. And all trauma related surgeries planned in main hospital from 31^{st} March 2020.

2.6. Triage

There was a specific triage for trauma victims with defined hot, warm and cold zones. "Hot zone" was made for "high

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risk" patient and was considered possibily contaminated "warm zone" was the area used for placing and transporting supplies and was also used for donning and doffing of the hot zone staff, area outside the warm zone was the "cold zone" where staff and supplies not involved in resuscitation were available.

2.7. Emergency department management

All trauma victims were considered covid positive on arrival in the emergency department (ED), and the teams who were involved in the first contact with a trauma victim, donned Level 3 personal protective equipment (PPE) at all times and were responsible for the immediate management of the incoming patient, irrespective of their COVID-19 status.

Primary assessment and management was done as per the Advanced Trauma Life Support (ATLS) protocol. Patients with minor trauma went through covid screening before initial assessment and management, whereas major trauma victims were admitted and stabilized before testing for Covid-19 infection. Samples from nasopharyngeal swab or lower respiratory tract secretions were sent for laboratory investigation of SARS-CoV-2 virus by, RT-PCR, CB-NAAT or RAT testing. Test reports were available either during or by the end of the procedure in case of emergency surgeries.

The algorithm for the work flow in trauma ED is shown in Figure 1, it was unidirectional flow and was planned to minimise the risk of exposure among healthcare professionals as well as cross infections among patients.

Other measures taken by the anaesthesia team to decrease exposure while providing general anaesthesia was the use of videolaryngoscope for intubation. Before intubating the patient sufficient neuromuscular relaxant was given to abolish cough reflex; aerosol-producing procedures like suctioning was avoided as far as possible. Propofol and rocuronium were used for rapid sequence induction. Etomidate was avoided as its immunosuppressive effects are a relative contraindication to use in COVID-19. After induction of anaesthesia bag mask ventilation was avoided, but in cases of severe hypoxemia ventilation was done with low tidal volume and high frequency. For patients with suspected or confirrmed COVID-19, appropriate positioning of the endotracheal tube was confirmed by chest movement and end-tidal carbon dioxide (Etco2), waveform instead by auscultation. High efficiency particulate air filters were placed between the mask and the breathing circuit and at the expiratory end of the breathing circuit to decrease viral contamination to the anesthesia machine and conserve heat and moisture within the breathing circuit. Disposable anaesthetic equipment in contact with the respiratory tract, such as video laryngoscope lenses, anaesthesia circuits, filters, reservoir bags, suction tubes, were discarded after single used to prevent cross infection among patients.

Beside this, at the end of each day or immediately after surgery of patients with confirmed or suspected COVID-19 cases, fumigation of the operating room was conducted with 15% solution of Gramicid-11 (11% hydrogen peroxide w/v & silver nitrate 0.01%) and mopping with one percent sodium hypochlorite solution. Routine disinfection of the anesthesia machine and external surface of other medical equipments were done with 70% isopropyl alcohol.

It was routinely inspected by the infection control team for proper reinforcement of disinfection services.

2.8. Statistical analysis

Data were recorded in a predesigned proforma and managed on an excel spreadsheet. Categorical variables were summarized as frequency (percentage) and analysed using $\chi 2$ or Fisher's exact test. Continuous variables were summarized as mean and standard deviation (SD) or median and range (when SD was >50% of mean) and analysed using parametric (one-way analysis of variance) or nonparametric tests (Kruskal-Wallis test), as appropriate. Statistical analysis was performed using Stata 12 software (StataCorp [2011], College Station, TX). A P value of 0.05 or below was considered statistically significant.

3. Results

Between 31^{st} March 2020 to 31^{st} June 2020, total fifty-nine patients operated within twenty-four hours for emergency trauma surgery, twenty-nine during lockdown period and thirty during unlock. During lockdown period 25 (86.21%) were male and 4 (13.79%) of the patients were female, during unlock 29 (96.67%) patients were male and only 1 of the patients (3.3%) was female (p=0.66).

The mean age of the patients was 30.65517± 13.17in the lockdown and 34.8±13.30 in unlock (p=0.23).

Of the total cases only 4(13.8%) in the lockdown period and 11 (36.7%) patients in unlock period tested positive for Covid-19. Although covid positive cases were slightly higher during unlock but it was statistically not significant (p=0.07). The median of ISS in lockdown and unlock period are 11 and 15 respectively, (p= 0.1) which shows there is no significant difference of ISS between both the periods. The median length of hospital stay in days is 15 during lockdown and 12.5 during unlock (p=0.88) indicating there is no significant difference in length of hospital stay between both periods. Out of 29 patients, 25(86.21%) were discharged and 4 (13.79%) died in the lockdown period and during unlock 22(73.33%) patients were discharged and 8 (16.67%) succumbed to death (p= 0.3). (Table 1)

Mechanism of injury is shown in Table 2. The most common modes of injury were road traffic accidents, followed by stabbing, falls at home, self-inflicted injury and shooting in that order. Self inflicted injury which occurred in 5 patients during lockdown and zero during unlock, none of these showed a significant difference (p > 0.06).

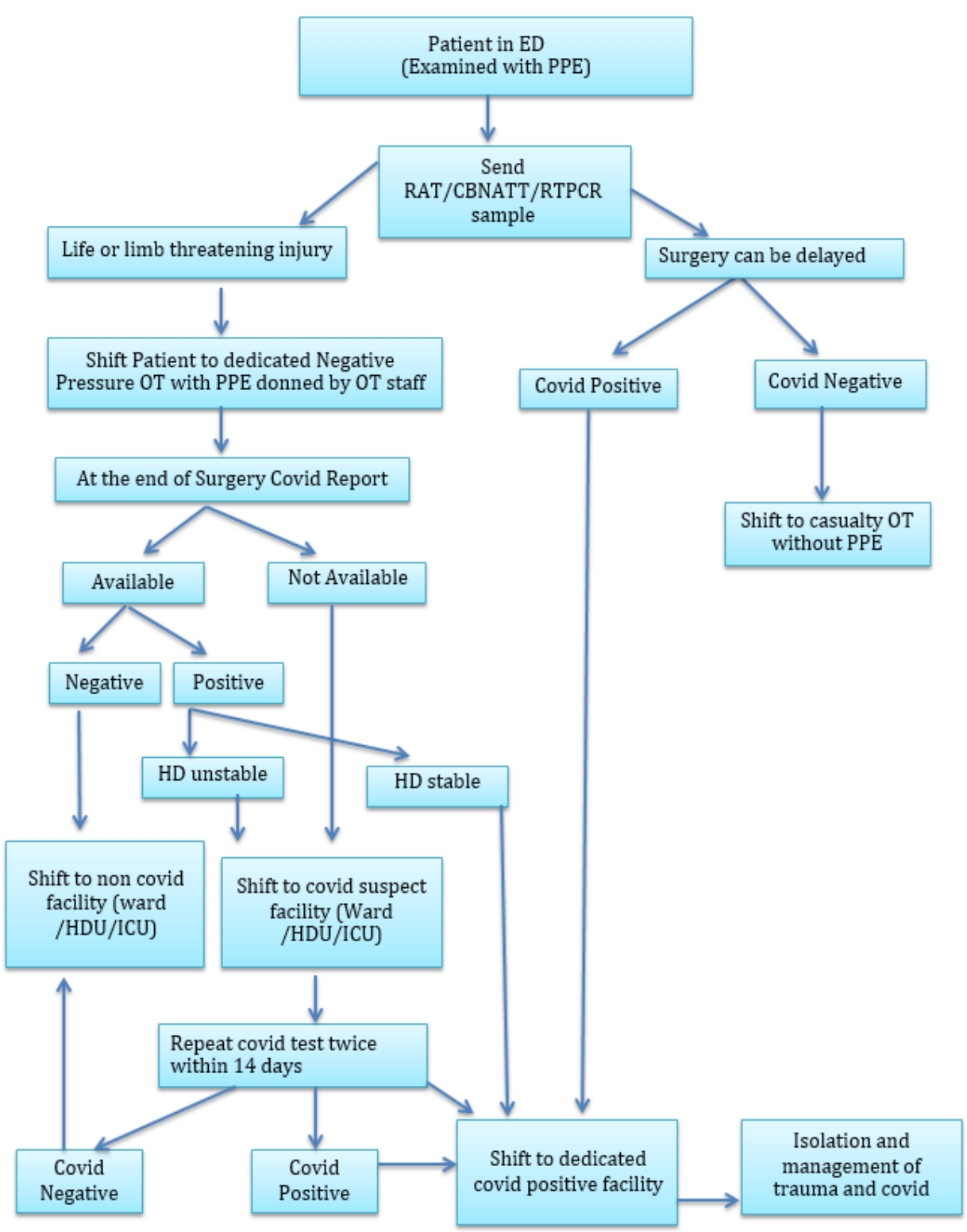

Fig. 1: The algorithm for the work flow in trauma emergency

Table 1: Comparison of demographics, covid status, injury severity, length of stay, disposition, and outcome of patients between Lockdown and Unlock

Parameter	During Lockdown	During Unlock	p Value
Gender (n%)			
Male	25(86.29%)	29(96.7%)	0.195
Female	4(13.79%)	1(3.3%)	
Age (years) Mean±SD	30.68±13.17	34.8±13.30	0.23
Covid Positive (n%)	4(13.8%)	11(36.7%)	0.07
Injury severity score Median (min, max)	11 (3, 33)	15 (4,50)	0.1
Length of stay (days) Median (min, max)	15 (3,90)	12.5 (1,49)	0.8
Patient Status Discharge (n%)	25(86.21%)	22(73.33%)	0.3
Death(n%)	4(13.79%)	8(16.67%)	

Table 2: Comparison of mechanism of injury between lockdown and unlock

Mechanism of Injury Parameter	Total	During Lockdown	During Unlock	p Value
Fall from height	6 (10.17%)	4 (13.79%)	2 (6.67%)	
Road traffic accident	33 (55.93%)	12 (41.38%)	21 (70.0%)	
Stabbing	12 (20.34%)	6 (20.69%)	6 (20.00%)	0.06
Shooting	3 (5.08%)	2 (6.90%)	1 (3.33%)	
Self inflicted Injury	5 (8.47%)	5 (17.24%)	0	

GA has been administered equally in both the periods i.e. 24(82.76%) patients in lockdown and 25(83.33%) patients in unlock period. Combined spinal epidural (CSE) and GA+ caudal has been administered only in lock down period for 3 (5.08%) and 1 cases (3.45%) respectively. A total of 5 patients (8.47%) have been given subarachnoid block (SAB) which consists of 1 in the lockdown period and 4 in the unlock period. Monitored anaesthesia care (MAC) was provided to only 1 patient (3.33%) in the unlock period (Table 3).

Patient vitals on arrival like heart rate and room air saturation (SpO2), glasgow coma scale, number of blood transfusions, use of inotropic support are depicted in Table 4.

4. Discussion

At the end of January, 2020 first case of COVID-19 was spotted in India.[7] By 25^{th} March 2020, the total numbers cases increased above 600 in Indian subcontinent. At that point government of India ordered a sequential country-wide lockdowns that lasted for 68 days (March 25—June 1, 2020).[8]

Over the 2 periods, lockdown and unlock we did not see any statistical difference in the numbers, age, or sex distribution of the patients presenting for emergency trauma surgery.

Reason for no significant difference in number of patients between these two periods may be because of strict lockdown which controlled the spread of the fast spreading pandemic and was then relaxed in multiple phases.[9]

It was planned as phase one and two of unlock with only few people involved in certain important activities were allowed to come out and rest of the population was either doing work from home or were allowed to go out only for a limited time of the day.

Number of covid positive patients were slightly higher during unlock but it was statistically insignificant (p=0.07) and the number of patients died during unlock was also higher during unlock as compared to lockdown but statistically insignificant(p=0.3).

Stringent preventive measures were implemented by the government across the country, such as wearing masks, using hand sanitizer, maintaining social distancing, and controlling mass gatherings, which slowed infections significantly during unlock phase.

Although it is a single centre study it suggests that phased unlock with appropriate preventive measures did not lead to rise in number of emergency trauma patients, covid positivity rates and deaths in these group of patients. The other reason may be the low infection fatality rate of 0.46% during first wave in India in comparison to other Western countries.[10]

Workflow designing at our centre may also have played an important role in preventing cross infection to other trauma patients.

A systematic review by Antonini et al in 35 studies involving 36,987 patients observed that number of major

Table 3: Comparison of type of anaesthesia given to emergency trauma patients between lockdown and unlock (GA-general anaesthesia, CSE-combined spinal epidural, SAB- Subarachnoid block, MAC-monitored anaesthesia care)

Parameter	Total	During Lockdown	During Unlock	p Value
GA	49(83.05%)	24(82.76%)	25(83.33%)	0.418
GA +Caudal	1 (1.69%)	1 (3.45%)	0	
CSE	3 (5.08%)	3 (10.34%)	0 (0%)	
SAB	5 (8.47%)	1 (3.45%)	4 (13.33%)	
MAC	1 (1.69%)	0	1 (3.33%)	

Table 4: Comparison of quantitative variables between lockdown and unlock (SD-standard deviation)

Parameter	During Lockdown	During Unlock	p Value
Initial Heart Rate (/min) Mean±SD	88.96 ±24.43	97.6 ±18.63	0.12
Initial SPO2 Mean±SD	99.1±2.2	98.7±1.06	0.41
GCS Mean±SD	11±3.6	11.5±3.5	0.6
Blood Transfusion (n%)	4(13.8%)	9(30%)	0.2
Inotropic Support (n%)	6(20.68%)	8(26.67%)	0.761

trauma admissions overall decreased during the first wave of COVID-19 due to movement restriction policies but the severity and mortality did not change in this period as compared to previous years.[11]

Surek A et al studied retrospectively the patients who underwent emergency surgery at Level I trauma center in Germany from March 14^{th} to May 15^{th} 2020 during pandemic and within the same period from the year 2019. They observed number of emergency surgeries conducted due to trauma, gastrointestinal system bleeding, perforation and mesenteric ischemia were not altered by the pandemic. The demographic profile of these patients was also similar in the two groups.[12]

In our study the mean age of the patients was 30.65 in the lockdown and 34.8 in unlock (p=0.23), it can be justified as our study was entirely on trauma patients in a country with 65% population under 35 years of age.

Road traffic accidents were most common during both the periods, this may be because of the empty roads which might have led to high speeds, self-inflicted injury was higher in lockdown but it was zero during unlock this may be because of increase in depression and anxiety in the population during lockdown.

The ICON Trauma study in United Kingdom observed during the lockdown period in 2020 falls (both those greater or less than 2 m) increase in the proportion of presentations as compared to the year 2019. Elderly population those aged 65 years suffered from it mostly, may be due to decreased care and social support provided by family members not living in the same house were the attributable factors contributing towards this.[13]

Increase in suicidal tendency was observed in various parts of the world during pandemic and the reason may be social isolation and loss of employment.[13] Kreis et al observed a decrease in the total number of surgeries during the shutdown period at a Level I trauma centre of Germany, but an increase in emergency surgeries, severe open fractures, house hold related injuries and injuries related to psyschological disorders.[14]

Chiba et al in a retrospective study from California compared epidemiological and clinical characteristics and outcomes of trauma admissions during the lock- down period (March 20, 2020, to June 30, 2020) to a similar period in the previous year (March 20, 2019, to June 30, 2019) they observed increased trend of suicides by 38.5 percent.[15]

We observed higher ISS during unlock as compared to lockdown (p=0.1), Fojut R. from Italy also observed reduced major trauma admissions during first lockdown but more severe injury presentation measured by ISS.[16]

Nia et al in a retrospective study from a level I trauma center, identified patients admitted between 15 March 2020 and 30 April 2020 (lockdown) and compared them to those between 15 March 2019 and 30 April 2019 (baseline). It was observed that total number of trauma patients decreased during lockdown but injury severity score in major trauma patients was significantly high during lockdown.[17]

In our study general anaesthesia was the most common anaesthesia technique used in both the periods. Regional anaesthesia was provided in both the periods in the form of CSE, SAB, GA combined with caudal. MAC was also used in one patient during unlock.

Wade et al reviewed anaesthesia charts of patients who underwent emergency surgery at London, United Kingdom from March 23, 2020 to May 10, 2020 and compared it with same period of year 2019, it was observed that regional anaesthesia (RA) was increasingly used as the sole mode of anesthesia for patients during the COVID-19 pandemic.

This was especially distinct in the surgical specialties of gynecology, urology and general surgery where RA was not primary anesthetic of choice before the COVID-19 pandemic.[18]

Sugand K et al in a longitudinal, multicenter, retrospective, observational, cohort study conducted in United Kingdom during the peak 6 weeks of the first wave from 17 March 2020 compared with the same period in 2019 observed, that for the patients undergoing surgery for acute orthopaedic trauma during COVID-19, there was an increase in odds of aerosolising-generating anaesthesia by three-quarters.[19]

In summary, it is obvious that the emergency trauma surgeries will continue even during pandemics in periods of general lockdown as well as unlock. Anaesthesia teams working in centres with trauma care must consider this while developing strategies and reallocating resources during such health emergencies, epidemics or pandemics. This study highlighted that in India phased unlock helped in preventing rise of infection rate in general population which reflected in trauma cases and to improve patient outcomes during different phases of pandemic the work flow designing is crucial for minimizing the risk of cross infections among patients. This study also observed that unlike other western countries in India road traffic accident was the most common trauma with high injury severity score and general anaesthesia was used in most of the patients, so in future prepartions adequate logistics for general anaesthesia and resuscitation must be provided for these group of patients.

5. Conclusion

In the first wave of COVID-19 pandemic there was no significant difference in number of emergency trauma surgical patients between lockdown and unlock in our tertiary care centre of north India. Although the number of covid positive patients and deaths were higher during unlock but it was statistically insignificant. As the volume appeared same during both these periods we surmise that the general public was also adopting covid appropriate behavior independent of government orders. During unlock incidence of self-inflicted injury was zero which suggests improved psychological status of general public through unlock. General anaesthesia was the most commonly used anaesthesia technique which guides future preparedness for the drugs, equipments, infrastructure and planning of anaesthesia during emergency trauma surgery.

6. Limitation

Single centre retrospective study only analysed emergency trauma surgical patients operated within twenty-four hours of admission. There is also a need for assessing the data from other level one trauma centres in India to see the effect of the lockdown and unlock during pandemic on the emergency trauma facilities all encompassing the trauma care system.

7. Source of Funding

None.

8. Conflict of Interest

None.

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