Burns and COVID-19 - Initial Experience and Challenges

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AM, SS, PKA were involved in the data collection, analysing the data and drafting the manuscript. SK and RK were involved in the conceptualizing the study and establishing department protocols for the management of burns in COVID-19.

Abstract

The COVID-19 pandemic has brought with it many challenges in the field of healthcare around the world. Managing burn patients has its own challenges as they require a long duration of care and are more susceptible to infection. We conducted a retrospective observational study from 30th January to 15th July 2020 at our centre to study the epidemiology of burns treated & patients and healthcare workers affected by COVID-19 during this period. The number of burn admissions showed a 42.6% reduction as compared to last year. A total of 17 patients (3.67%) and 29 health care workers (8.68%) tested positive for COVID-19 in the burns department. Our strategy underwent changes based on the changing dynamics of COVID-19 and changes in government and institutional policies. We have described the various challenges we faced in managing burns during this time. We found that effective screening of patients and healthcare workers, proper segregation of negative and positive/ suspect population and a low threshold for COVID-19 testing were essential to mitigate transmission of infection.

Keywords

Burns centre, COVID-19, challenges, strategy

Introduction

The COVID-19 pandemic has swept the entire world in a matter of months and has posed multiple challenges of controlling its spread while not letting it hamper patient care. India saw its first COVID-19 case on 30th January 2020 and announced a nationwide lockdown on 24th March 2020 when the case toll reached 536 in the country and 30 in Delhi [1, 2]. An entire block in our hospital was converted to a COVID-19 dedicated block, routine surgeries were cancelled, outpatient services restricted and only emergency services continued. Burn care was centralised to a few hospitals including ours as other hospitals were converted to exclusive COVID-19 centres. We run an independent burns casualty, outpatient department, burns ICU, ward and operation theatres in a separate building. As we receive burn patients directly in our department, we were responsible for the initial triaging as well as management of all COVID-19 negative, suspect and positive patients with mild to moderate symptoms. Only patients with severe symptoms were managed in COVID-19 intensive care unit.

We followed hospital directives and guidelines from the Ministry of Health and Family Welfare (MOHFW), Government of India and Indian Council of Medical Research (ICMR) as well as referred guidelines by World Health Organisation (WHO), national and international literature and adapted it to our set up. We had to periodically modify our protocols with the changing situation, government and institutional policies in order to maintain care and safety of patients as well as health care workers. Phased strategic unlocking had begun on June 8, 2020 but the number of COVID-19 positive cases had continued to rise in the country with 331,505 active cases in India and 17,800 in Delhi as of 15th July 2020 [1, 3]. Several cities in the country had reinstated lockdown. Delhi continues to remain in the unlock phase and has gradually resumed activity across several sectors. India is among the worst hit countries in terms of numbers, with total number of cases till August 17, 2020 being 2,701,604 in India and 153,367 in Delhi [1, 4]. At our hospital, more than 1,760 COVID-19 positive cases have been treated so far. This paper gives a brief account of our initial experience in managing burns during the times of COVID-19 and the challenges we faced.

Materials and method

A retrospective study was conducted at the Department of Burns, Plastic and Maxillofacial surgery at Safdarjung Hospital, Delhi from 30th January 2020 to 15th July 2020. The following data were collected and analysed:-

- Epidemiological data of all burn patients treated during this time
- COVID-19 positive burns patients treated
- Healthcare workers (HCWs) affected in the department of burns

Admission criteria

As per hospital protocol in the pre COVID-19 time, admission criteria for burns remained the same:-

- Burn surface area more than 20% in adults and 10% in children
- Associated inhalational burns, severe facial/ hand/ perineal burns
- Electric contact burns, chemical burns
- Patients with associated injuries/ comorbidities
- Those not having the necessary social support for home management

Risk of exposure to COVID-19 in hospital was explained to all patients and when feasible patients were encouraged to be treated on outpatient basis and at home and advised minimum follow up visits.

Change in the Burn centre layout

Only one entry and one exit to the building were used, manned by a guard. He was responsible for ensuring social distancing, mask worn by all patients and visitors, hand sanitisation and thermal screening. Burns casualty and outpatient department was divided into non COVID-19 and COVID-19 areas for non-suspect and suspect/ known cases respectively. Our Burns Intensive Care Unit (BICU) consists of 15 isolation beds. The burns general ward consists of 25 single occupancy rooms and 12 double occupancy rooms (Total 49 beds). Patients were placed in individual rooms till rooms were available. Ward and BICU layout was rearranged to shift the nursing station to a separate room from the ward or at one end of the ward. Donning and doffing areas were designated in each of the mentioned wards.

In our set up, it is usual for a family member to accompany the patient during the hospital stay as a care giver. No family members were allowed in the BICU. In the wards, only one family member was allowed with each patient. They were confined to the ward and not allowed free movement in and out of the ward. A separate burns ward was allocated in the COVID-19 block for all positive/ suspect COVID-19 patients.

Screening protocol

Screening was performed at the entry point using a questionnaire for all patients and their accompanying persons by a healthcare worker. As per guidelines by the ICMR, initially only symptomatic cases with known history of international travel or contact with a laboratory confirmed case could be tested but later the testing criteria were extended and the guidelines revised on 18 May, 2020 [5, 6]. Our initial protocol was to test suspects identified on screening questionnaire and any admitted patients showing influenza like symptoms and/or X-ray suggestive of COVID-19 pneumonia. As we saw a rise in the number of cases in the department, we modified our protocol

(Figure 1) and oro/ nasopharyngeal swabs were sent for Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) antigen test for the following:-

- All new admissions
- All hospitalized burns patients with influenza like illness or severe acute respiratory illness
- Within 5 days prior to planned surgery (No emergency surgeries were delayed for lack of test)
- All burn patients and healthcare workers with direct or high risk contact with laboratory confirmed positive cases between day 5 and 10 of coming into contact irrespective of symptoms

Management of burns

COVID 19 positive/ suspect patients with mild to moderate symptoms were managed in the allocated burns ward in COVID-19 block by a designated team from the burns department. They were treated symptomatically and monitored. In case of deterioration, they were transferred to COVID-19 ICU where they were managed by intensivists.

All cases were managed conservatively with specialised silver based dressings that warranted less frequent dressing changes. Surgeries in burn patients were limited to emergency procedures that were life or limb saving like tracheostomy, fasciotomy, escharotomy and semi emergency procedures like amputations for post electric burn gangrene, coverage of post burn raw areas that if not operated soon would risk functional impairment and/ or morbidity. Tangential excisions and early grafting of burn wounds were deferred. Preoperative COVID-19 testing was done for semi emergency cases but emergency cases were not delayed for want of report.

Strategy for Healthcare workers

All personnel working in the department underwent training regarding managing COVID-19 patients, use of personal protection equipment (PPE), hand hygiene and respiratory etiquettes. All healthcare workers were screened with a questionnaire regularly and suspects were tested/ home isolated as advised. Working personnel were divided in two to three cohorts, each cohort with 1-2 week long shifts followed by home/ hotel quarantine for 14 days. A separate team of doctors and nursing staff was designated for 15 Days rotatory duty in the COVID-19 block. They were allowed to resume work in the department only after confirmed negative on testing 5 to 10 days after completion of duty period and/ or completion of quarantine period of 2 weeks.

Personal Protective Equipment (PPE)

All healthcare workers coming in contact with patients or involved in patients' waste disposal, used gown, gloves, caps, eye protection and medical masks. For aerosol generating procedures in the burns ICU, burn dressing and all burn surgeries irrespective of COVID-19 status, coverall PPE suits along with respirators or well fitted N 95 masks and face shields were used [7]. All patients and their family members were provided medical masks and educated on hand hygiene and respiratory etiquettes.

Discharge criteria

As per hospital guidelines asymptomatic and mildly symptomatic patients could be discharged if they remained asymptomatic for 10 days isolation with advice for home isolation for 7 days without need for re testing [8]. However, many of our patients required frequent outpatient visits for dressings or surgery. Hence they were discharged or shifted to burns ward only after a confirmed negative report on RT- PCR test. Repeat testing was done seven to twelve days after the first positive report. In case the patient was still positive the test was repeated after 5- 7 days.

Results

The total number of burn patients that attended the burn casualty from 30 January to 15 July 2020 was 1624, of which 463 were admitted. The number of burn admissions compared to those in the same period last year showed a 42.6% reduction. The numbers steadily increased after lockdown was lifted (Figure 2).

The first two cases to test positive in the department were two asymptomatic healthcare workers from the burns casualty and ward traced from two different laboratory confirmed cases outside the hospital with no reported contact to one another on 14th May and 16th May 2020 respectively. Both were put under home isolation and contact tracing done. None of the contacts tested positive at that time. On 23rd May an asymptomatic patient, tested positive on preoperative screening. Again contact tracing, isolation and testing was performed and subsequently protocol was modified to the existing protocol. (Figure 1)

A total of 149 burn patients (32.18% of total admissions) were tested for COVID-19 and 30.87% (n=46) of these patients underwent repeat testing (either due to developing symptoms, contact with a positive case or prior to surgery). A total of 17 (3.67%) burn patients tested positive. Age ranged from 18 months to 60 years (median 24 years); 8 were males and 9 females. On observing the age, gender and burn characteristics, distribution of COVID-19 positive group appeared to be similar to other burn patients admitted during this time. 15/17 cases were acute burns (10 flame burns, 3 scalds and 2 electric contact burns) and 2 cases were admitted surgery for post burn raw areas. Among these, 8 (47.05%) patients were found to be positive on admission, 3 (17.64%) were found positive on contact

tracing from positive patients in the ward, 3 (17.64%) were detected on preoperative screening and 3 (17.64%) cases were detected once they developed symptoms during their course of hospitalization. For the latter 5 cases, no contact could be traced to other positive patients or health care workers. Nine patients were asymptomatic, six had mild symptoms and two had severe symptoms that later died. None of the suspects who tested negative initially developed symptoms or tested positive later.

The first patient was a 58 year old woman with 35% flame burns with inhalational burns, had no comorbidities and no prior symptoms or known history of contact with a positive case prior to admission. She tested positive on admission, developed low grade fever 24 hours later followed by high grade fever from day 5. On day 10 of admission she rapidly developed respiratory distress and sudden fall of saturation levels and died on day 11. The second case was 28 year old male with 55% flame burns with inhalational burns. He was a known smoker, alcoholic and drug abuser and sustained burns under suspicious circumstances and was found and brought to the hospital by a neighbour in a semi-conscious state. He had no known comorbidities and history of contact or prior symptoms was unavailable. He tested positive on admission, developed high grade fever after 48 hours of admission followed by respiratory distress and fall in oxygen saturation on day 12 and died on day 14 of admission. They were managed with antibiotics as per wound culture, symptomatic treatment and other supportive care. They did not receive antivirals and anticoagulants. Early chest X-rays revealed no specific findings although later films showed features of ARDS.

4 cases were discharged after an asymptomatic period of 10 days with advice for home isolation of 7 days as per the discharge protocol [8]. One patient left against medical advice after 5 days as the parents became anxious with his worsening clinical condition. 10 of the 17 positive cases underwent repeat testing, of which 6 tested negative for antigen within 12 days and other 4 by day 21. One of the patients underwent debridement and skin grafting after becoming antigen negative on RT-PCR of oro/ nasopharyngeal swab. Perioperative period was uneventful.

Ninety seven (29.04%) healthcare workers (n=334) underwent RT-PCR testing and 29 (8.68%) tested positive. Of these (n=29) 16 were nursing staff, 6 were cleaners, 4 orderlies and 3 doctors. All were asymptomatic or mildly symptomatic except one nursing staff that required ICU admission. No deaths occurred. On contact tracing, 13 were traced to positive patients (44.82%), 6 to positive HCWs (20.68%), 5 cases were community acquired (13.79%) and in another 5 (13.79%) no known positive or suspect contact could be traced.

Cases among healthcare workers as well as patients were clustered around last week of May and month of June and its peak roughly coincided with incidence of new cases in Delhi (Figure3).

Discussion

Burn centre protocols have varied across different centres in the world. Protocols depended on stage of the pandemic the country was experiencing. Few centres had strict admission criteria and only allowed COVID-19 negative burn patients while others managed both positive and negative patients [9]. Ours being a government run institute and COVID-19 treating centre, all patients presenting were accepted irrespective of their COVID-19 status.

The WHO recommendation for testing suspected patients is by RT/ PCR from oro/ nasopharyngeal swabs [10]. Additionally, some centres screened all patients by performing chest CTs [9]. We did not use CT/ X ray chest for routine screening due to limitations in resources and used imaging only in those who presented with any respiratory symptoms and performed RT-PCR test if the findings were suspicious.

In our study 52.94 % cases (n=9) were asymptomatic. As per literature, nearly half the patients infected with COVID-19 are asymptomatic, nonetheless can spread infection [11]. It is likely that we missed a number of asymptomatic cases in the early study period prior to the revision in testing guidelines. In a few centres, repeated weekly testing of both patients and health care workers in confined spaces like skilled nursing facilities have been done until no new cases are identified. This has shown to help in breaking the chain of transmission by timely identification of asymptomatic cases. However, people with repeated negative RT-PCR have also shown to develop COVID-19 specific antibodies highlighting the pitfalls of the RT-PCR test done for COVID-19 [12]. At our centre, at least 41 out of 132 (31.06%) patients who initially tested negative were tested at a later date for various reasons and none of them tested positive. COVID-19 antibody testing was not done in any of our patients.

The median duration of viral shedding in our patients (n=14) was 12 days (Range 10-21 days). The reported median duration of viral shedding in COVID-19 patients has varied from 10.5 days to 31 days [13, 14]. The longest virus shedding reported was 48 days by Fu et al [15]. Risk factors associated with prolonged viral shedding include low albumin, coronary artery disease, delay in time of initiation of antiviral therapy, disease severity, corticosteroid therapy and fever [16]. Burn specific data on viral shedding has not been reported in literature, although many of the above mentioned risk factors like low albumin, fever are commonly associated in burn patients.

22,073 cases of COVID-19 among HCWs from 52 countries had been reported to WHO by 22nd April 2020 [17]. Wuhan, reported an infection rate of 1.1% among their HCWs [18]. In our study 8.68% of HCWs tested positive for COVID-19, which is comparable to the study by Sikkema et al where the infection rates were 2-8 % [19]. None of these numbers are specific to burn care setting where higher infectivity rates could be expected as burn care requires multiple aerosol generating procedures,

prolonged close contact with patient during wound treatment and surgeries [20]. At our centre, only two among the COVID-19 positive HCWs were working in the COVID-19 dedicated ward (6.89%), rest all were from the non COVID-19 area in the burns department. Higher infectivity rates were expected in the Burns Casualty, ICU and OTs, where most aerosol generating procedures were performed but most of the infected healthcare workers were from the ward. Even in areas with heavy footfall like the outpatient and burns casualty infection rates were low. This could be attributed to better preparedness, adherence to screening protocol, effective segregation of COVID-19 suspect cases and better compliance to PPE by HCWs in known high risk areas. These findings are similar to other published literature [18, 21].

The predominant mode of transmission in HCWs was found to be from patients. These findings have been echoed in the study by Xiaoquan et al [18]. Also, infection rates were found to be higher in the nursing assistants and nursing staff in the initial stages than the doctors similar to reports by Sikkema et al [19]. This could be attributed to the relatively higher numbers of nursing and support staff as compared to doctors and also prolonged duration of contact with patients among them as compared to doctors.

Transmission rates among HCWs were expected to be high in view of close contact with each other during their duty hours, common changing rooms, duty rooms, work desk, eating spaces and space constraints making effective social distancing among HCWs difficult. Despite these factors we found that our rates of HCW to HCW transmission were low (20.68%) compared to those (30%) reported in the literature [19]. 13.79 % of HCW infections were from contacts outside the hospital which highlights the importance of taking equally stringent precautions outside the hospital as inside.

Challenges

We are a high volume centre which was further burdened with burns cases during the pandemic as many other burn centres were made exclusively COVID centres. Our infrastructure has been built on gradually over the last 40 years and was not designed keeping a pandemic in mind. We do not have negative pressure rooms and spare rooms that could be allocated for isolation and social distancing among patients or HCWs.

Most of the patients who turned out to be positive were asymptomatic and hence were never suspects. On the contrary many who were suspects turned out to be negative. Since features of fever and respiratory distress are seen in burn sepsis and inhalational burns as well, it is difficult to differentiate these symptoms from those of COVID-19.

Managing the family members of the patients was another challenge as they were not made to undergo mandatory testing. Due to the stigma associated with COVID-19 and the partly subjective nature of the questionnaire, it could not be completely relied on. Additionally family members accompanying the patient would periodically change adding to the problem.

At the time when the cluster of cases emerged in our department, dedicated beds to COVID-19 burn patients in the COVID-19 block were limited and one of the burn wards in the department building had to be converted to COVID-19 positive isolation ward till necessary arrangements for isolation could be made. This reduced the available bed capacity and placed the entire department under high risk of exposure. During the lockdown discharging the patients also became a concern since travelling was prohibited as all borders were sealed. We had multiple instances where the family members abandoned their patients in the hospital due to fear of acquiring COVID-19.

Another issue we faced was in the management of COVID-19 positive paediatric burns cases. We had 5 COVID-19 positive burn patients who were less than 12 years old (29.41%) and 3 among them were less than 5 years old. For the latter three children, parents were allowed to stay with them. The older children (8 years and 12 years old) were isolated without a parent but could speak with them telephonically. Additionally frequent visits by healthcare workers were made to ensure the children were comfortable.

Initially the recommended protocol for managing healthcare workers with exposure was home isolation for 14 days and testing only on development of symptoms [22]. This placed a strain on the working number of staff as they were already divided in cohorts. Although the education regarding COVID-19 and training for PPE use was provided by the hospital, this was a one-time event and many healthcare workers failed to understand the disease transmission completely in the beginning. PPE availability was not an issue in our set up but compliance was an issue due to the hot and humid weather conditions making use of PPE extremely uncomfortable and physically exhausting. We suspect the increased transmission from patient to HCW was due to breach in technique of donning/ doffing and inability to maintain air tight barrier during patient contact. Even use of face masks and shield had to be reinforced repeatedly to ensure compliance among patients and HCWs. Although, there was no confirmed incidence of infection transmission from HCW to patient, this cannot be ruled out entirely.

Since the routine OTs shut down, surgical management of burns suffered. The OPD and Burn Casualty also face high numbers of unscreened burn patients as tele-consultations could not be initiated for lack of infrastructural support and poor socioeconomic and education level of our patients.

Sero-surveillance can help in identifying level of transmission in the community. This can further help in planning exit strategies as countries prepare to resume normal functioning. Testing for COVID-19 antibodies (Sero-surveillance) has already been initiated in health care workers at our hospital. This pandemic has taught us that preparedness and caution are paramount and the future is likely to see a continuation of the practices we follow now in some or the other form.

Limitations of the study

The numbers of positive cases were too few to identify the risk factors of contracting infection and the ensuing severity of disease. Due to change in strategy of testing in the later part of the study period and low rates of re-testing in negative patients (31.06%), many asymptomatic cases were likely missed. In the initial stages of the pandemic, patients who died without a COVID-19 test were not assessed. As age is a known risk factor for severity of symptoms and poor outcome in COVID-19 infection and the burn population treated at our centre is relatively young, our experience may be different from other centres. A comparative study of a matched cohort population from the pre COVID-19 times may be indicated to fully assess the impact of COVID-19 infection in the outcome of burns patients.

Conclusion

Strategy for burn centres during the COVID-19 pandemic largely depends on the stage of pandemic the country is facing and has significantly varied across different centres. There is a need to continuously evolve and modify strategies as the pandemic progresses. Effective screening of patients and healthcare workers, proper segregation of negative and positive/ suspect population and a low threshold for COVID-19 testing are essential to mitigate transmission of infection.

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Declaration of Interests

None

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Le**gends**

Figure 1: Department protocol for management of burn patients (*GDR- General Dressing room; **CDR- COVID-19 designated dressing room)

Figure 2: Distribution of patients attending the Burns Casualty in the study period

Figure 3: New COVID-19 positive cases emerging in the department among patients and healthcare workers and incidence of new cases in Delhi-NCR region during the study period. (Ministry of Health and Family welfare.(n.d.).*Health Bulletin Updates*. Delhi.Gov.In.http://health.delhigovt.nic.in/wps/wcm/connect/doit_health/Health/Home/Covid19/Bulletin+March+2020)

Figure 1

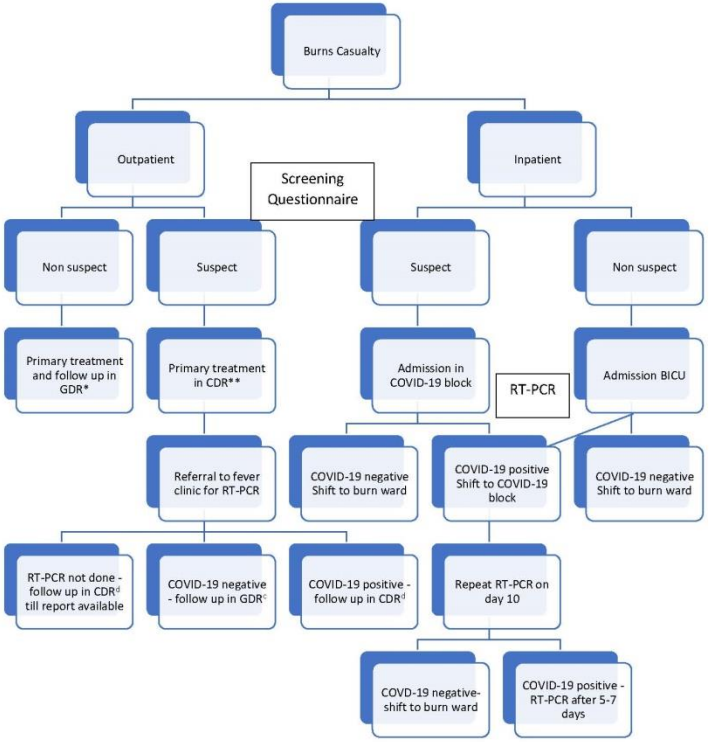

Burns Casualty
Outpatient
Inpatient
Screening Questionnaire
Non suspect
Suspect
Suspect
Non suspect
Primary treatment and follow up in GDR*
Primary treatment in CDR**
Admission in COVID-19 block
RT-PCR
Admission BICU
Referral to fever clinic for RT-PCR
COVID-19 negative Shift to burn ward
COVID-19 positive Shift to COVID-19 block
COVID-19 negative Shift to burn ward
RT-PCR not done - follow up in CDR[d] till report available
COVID-19 negative - follow up in GDR[c]
COVID-19 positive - follow up in CDR[d]
Repeat RT-PCR on day 10
COVD-19 negative- shift to burn ward
COVID-19 positive - RT-PCR after 5-7 days

Figure 2

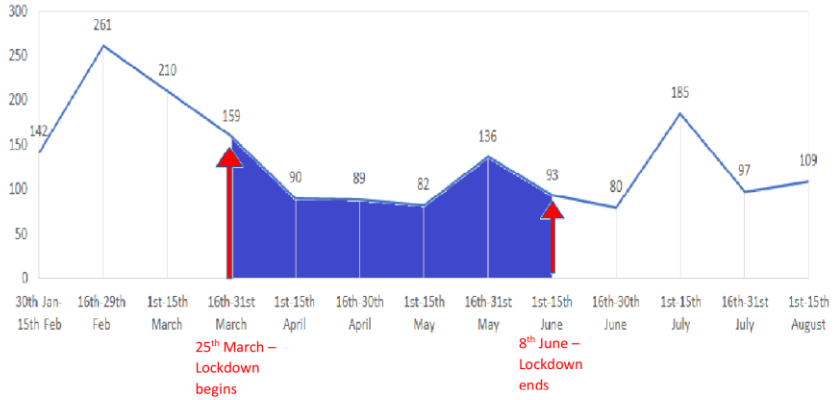
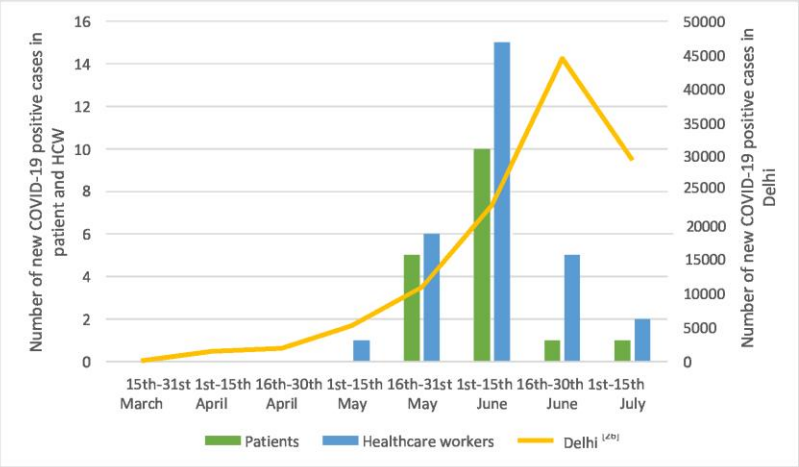

300
250
200
150
100
50
0
261
210
159
142
90
89
82
136
93
80
185
97
109
30th Jan-15th Feb
16th-29th Feb
1st-15th March
16th-31st March
1st-15th April
16th-30th April
1st-15th May
16th-31st May
1st-15th June
16th-30th June
1st-15th July
16th-31st July
1st-15th August
25th March – Lockdown begins
8th June – Lockdown ends

Figure 3


Number of new COVID-19 positive cases in patient and HCW
Number of new COVID-19 positive cases in Delhi
16
14
12
10
8
6
4
2
0
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
15th-31st March
1st-15th April
16th-30th April
1st-15th May
16th-31st May
1st-15th June
16th-30th June
1st-15th July
Patients
Healthcare workers
Delhi