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Review Article

The Challenges During the COVID-19 Waves in India – from an Intensivists Experience

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Abstract

The unprecedented rise in cases during the second wave of COVID-19 in India unembellished life-threatening consequences as demand-supply gaps were increased many folds. It led to a significant constraint on the existing medical supplies. Additionally, an unprecedented rise in mortality was observed in the unvaccinated young and middle-aged population. An evidence-based observation and experience including the challenges faced by intensivists as to why the second wave was more dangerous than the first one, could help in identifying the potential areas to target with future control strategies.

Keywords: COVID-19; SARS-CoV-2; Pandemic Challenges; Intensivists; ICU; Pandemic Wave; Delhi

Introduction

In 2009 the World Health Organisation described that an influenza pandemic has 6 phases (Table 1) with a post-peak phase [1].

Phases of pandemic	Spread in population
1-3	Predominantly Animal infections with fewer human infections
4	Sustained human to human transmission
5-6	Widespread human infection
Post peak	Possibility of recurrent events
Post Pandemic	Disease activity at seasonal levels

Table 1

Phase 1-3 depicts minimal human spread where the virus is mostly restricted to an animal population, phase 4 is sustained human spread and phase 5-6 is wide spread human infection. It has been over a hundred years since the last pandemic of Spanish Flu engulfed the world. It lasted for about 3 years, but the times have changed significantly. The SARS-CoV-2 virus has the advantage of mutation and spread to a much wider and more vulnerable population due to continued transmission of newer strains with international air travel. At present, a prolonged phase 5-6 with widespread human infections is still happening around the world. It is now a race between the numbers of people getting vaccinated against the possibility of an infected population that can further result in the spread of infection. A large segment of the world's

vulnerable unvaccinated population can still be exposed to the infected population and a newer epicentre of virus spread may be created.

As per the PEW research data 2017, half of the world's population lives in 7 countries; China, India, Pakistan, Nigeria, the United States, Brazil, and Indonesia. In order to prevent the disastrous spread through these populous countries, nationwide lockdowns were initiated till the COVID-19 vaccine arrived on the scene. India is a country with the second-largest population with a + 0.99% yearly rate of population change. With a global share of 17.71%; and a current population of 1,380,004,385 with a population density of 460 people/Km^2 India faced challenges related to the demand and supply-chain logistics during the lockdown [2].

Lok Nayak Hospital has declared Delhi's largest dedicated COVID hospital during the first wave and the life of the anaesthesiologist changed dramatically. Most of us became COVID intensivists overnight as more and more COVID-ICUs were set up. Our pandemic journey was fraught with many challenges, but we moved forward by assimilating evidence, collecting data, and recording our experiences from the first wave.

Biochemists and pathologists played a significant role in research and subsequently prognostication and effective management of ICU patients through their services. The dynamic chain of events in the progress of this disease had to be appropriately assessed through inflammatory markers and thereby timely interventions depended on efficient lab services.

HCWs in diagnostic laboratories handling COVID positive samples were at risk and needed to take protective measures. Adequate protective materials were not available when the pandemic reached India forcing laboratory managers to take innovative measures to protect the laboratory staff. We made face shields from OHP sheets and substituted biosafety cabinets from cardboard boxes fitted with hypochlorite spraying devices initially during the 1st wave of COVID-19 [3].

The first wave had prepared us in terms of overcoming our own apprehensions while managing a fatal illness with new treatment protocols. Being a dedicated COVID hospital we needed to understand this pandemic better, so we gathered evidence in other diagnostic aspects as well.

Significant Role of the biochemistry department

The presence of SARS-CoV-2 virus in atmospheric air and contact surfaces in a COVID-19 dedicated hospital [4] was reported and the appearance of certain specific biochemical indicators such as the M-band(s), β- γ bridging, and pre albumin band signified that a rise in positive acute phase reactants occurred in COVID-19 [5] patients admitted to our hospital. Additionally, the detection of IgM against the receptor-binding domain (RBD) of S protein by the rapid test kit was found to be less effective, but IgG detection was reported as an effective diagnostic tool for SARS-CoV-2 infection [6]. Furthermore, research conducted by the biochemistry department, MAMC also came up with a conclusion that the exposed population in an endemic area of tuberculosis and typhoid is likely to withstand COVID -19 better with a reduced mortality [7].

Clinical evidence-based approach

Lok Nayak Hospital, has had more than thirteen thousand COVID admissions with more than two thousand ICU admissions. 8-10% of the hospital admissions were in the severe category of illness requiring ICU stay. The first wave outcomes at our hospital were analysed on 10314 COVID patients who were admitted to our hospital between April 2020 and November 2020 [8]. Age was found to be the most important factor affecting mortality, the highest being the elderly females. Initially, patients had apprehensions about hospitalization and presented late in the course of illness, and were difficult to treat, but we observed a higher recovery rate of approximately 93% in the younger population. The majority of the younger population had asymptomatic to mild illnesses during the first wave which was successfully managed by home quarantine. Hence hospitals were not overwhelmed with admissions during the first wave. As a dedicated COVID-19 hospital one of the major concerns during the first wave was whether virus particles could remain airborne or on contact surfaces for long, especially in high viral load areas such as the ICU, medical, and the emergency wards. Air samples were collected from different areas of the hospital on membranes and were analysed by RT-PCR methodology to assess for viral load presence. It was reported that the virus was located in air samples beyond a distance of 1 meter from the patient bedside end. This warranted the use of precautions for the public as well, to prevent the airborne spread of the virus once the lockdown restrictions were removed [4]. The report was published in April 2021 and this was also the month that the Delta variant surfaced in the Indian population.

But in spite of all this preparation, the first wave did not prepare us for the unexpected magnitude of the second wave. What India witnessed during the second wave was an explosion of cases that overwhelmed our existing healthcare infrastructure. The second wave of COVID-19 hit India at a time when we least expected it. Healthcare workers did not apprehend that at this time, it would be a stormy clinical presentation with an overflow of in-hospital admissions. The time was fraught with many challenges and it is important to elaborate on them through the lens of an intensivist who was there in the eye of this storm.

The second wave was unpredictable, aggressive, highly infectious, virulent, and causing breakthrough infections in the vaccinated population [9]. And now, the daily caseload had risen from approximately 10000 COVID cases per day during the first wave to 30000 COVID cases per day in the second wave. This also led to a proportionate rise in the number of severely ill patients. India was reporting a massive caseload of approximately 4 lakh cases per day.

The multitude of Challenges during the second wave

- Trained manpower crunch
- Lack of ICU beds
- Medical Oxygen crisis
- COVID-19 associated Mucormycosis.

With increasing hospital admissions, HCWs faced a multitude of personal and professional challenges such as a trained manpower crunch as many of them started getting affected themselves. The surge in hospital admissions also meant that these patients needed oxygen support which resulted in the second wave becoming synonymous with an oxygen crisis. And lastly, the onset of an unexpected additional burden of COVID-19 associated rhino-orbital mucormycosis (ROM).

There was an enormous strain on the ICU resources. The intensivists bore the heavy emotional burden of having to break the bad news to relatives of patients who were not able to be with their loved ones during their last moments. The HCWs of COVID ICUs were also facing the brunt of being isolated from their families for a second time, as this virus presented its ugly face yet again in a more detrimental form. With the scarcity of resources such as ICU beds, trained manpower, and inadequate PPE kits at times, the intensivist also shouldered the burden of feeling responsible for the safety of their own colleagues. Every physician, intensivist, and anaesthesiologist became a part of multiple telemedicine groups – but this time they were treating families and friends, tele-supervising the care of extended family members and close friends while recuperating themselves. Every house was affected by COVID-19 in one way or another. Civilians created groups to help patients find verified links for ICU beds, oxygen refilling for domiciliary use, and availability of oxygen concentrators.

The delta wave was turning out to be much more dangerous than the first wave. The outcomes of the first wave had revealed higher mortality in the older age group, but this time, the severity of illness and hospitalizations were happening even in the young, unvaccinated population. And this time, the HCWs and patients were all sailings in the same boat. 60% of our department including residents and consultants got affected during the second wave creating a trained manpower crunch to manage the COVID ICUs. India lost 513 doctors during the second wave.

We started training non-anesthesia residents for creating more ICUs in the hospital. Residents from plastic surgery, ENT, paediatrics surgery, and orthopaedics were trained in the basics of oxygen supplementation and ICU care. Core groups were created on digital media platforms to circulate treatment protocols and help in the assessment of the severity of COVID-19 illness. Anesthesia residents became an integral part of each ICU for optimal airway and ventilatory management. An ICU tier (Table 2) system was created in the hospital to ensure the appropriate allocation of this newly trained manpower. The ICU tier system also helped in maintaining the logistics and inventory of other available resources (Table 2).

Tier level	Patient category	Oxygen Requirement
Tier 1	Moderate COVID disease with no pre-existing co morbidities	Venturi face mask Non rebreathing face mask (NRBM) High Flow Nasal Cannula (HFNC)
Tier 2	Moderate COVID disease with pre-existing diseases	NRBM HFNC Intermittent BIPAP
Tier 3	Severe Disease	Continuous BIPAP
Tier 4	Severe Disease	Invasive ventilation

Table 2: The organization of the ICU tier system to care and manage the patients during Wave-II.

BIPAP (Bilevel positive airway pressure).

Specific Medical recommendations for Management of COVID-19 in adults

The pharmacological treatment of the mild, moderate, and severe categories of COVID-19 comprised of antivirals, dexamethasone, inhaled steroids, anticoagulants,and interleukin-6 inhibitors like tocilizumab. The treatment protocol depended on the diagnostic and prognostic markers. During the second wave, the rate of the rise in cases was high leading to an increase in the demand-supply gaps resulting in logistic challenges. In April 2021, AIIMS/ICMR-COVID-19 National Task Force/Joint Monitoring Groups (Dte. GHS) Ministry of Health and Family Welfare, Government of India has issued new clinical guidelines for the management of COVID-19 among adults. The guidelines had specific recommendations based on the severity of a case i.e. mild, moderate, or severe[10]. Guidelinesrecommended asymptomatic and mild cases should go for home isolation &moderate to severe cases, should be admitted to the ward and ICU respectively.

ICU Management of Moderate to severe category COVID-19 patients

It was important to become experiential learners from the first wave and use the most beneficial mode of oxygen support at the appropriate time during the course of the illness. We designed and used an evidence-guided, experience-based, and patient compatible 3 step protocol to manage moderate to severe category COVID-19 patients [11].

This protocol was applied to conscious patients with refractory hypoxia maintaining saturation of 92-94% on Non-Rebreathing Mask (NRM) with flows of 10-15l/min, respiratory rate <28/min on admission to the ICU, and in patients who had X-Ray findings of >50% involvement of lung fields with no evidence of a pneumothorax.

- Step 1 – early alveolar recruitment was attempted by applying BIPAP support for 48 hours with Pressures and FiO2 titrated to maintain SpO2> 94%.
- Step 2– wean off the BIPAP support over 48 hours by attempting Bipap free intervals with High Flow Nasal Oxygenation (HFNO) and replacing it with HFNO support for the next 3-5 days. HFNO was initiated at a flow rate of 60-70 L/min corresponding with a PEEP of 6-7cm of H_2O and gradually stepped down to 30-20 L/min. In case the patients continued to worsen on BIPAP support, then elective intubation was planned.
- Step 3– after stabilization, oxygen supplementation was continued with NRM and intermittent trials of face mask to allow early shifting out from the ICU.

The aim of the 3-step protocol was to ensure that maximum benefit of alveolar recruitment was provided in the first few days of ICU admission. The turning point for the successful expansion of NIV is its ability to achieve the same physiological effects as invasive mechanical ventilation with the avoidance of the life-threatening risks correlated with the use of an artificial airway [11]. Keeping this in mind, the bi-level pressure support was started with an aspiratory pressure of 12-16 cm of H_2O (maintained depending on the tidal volume generated) and expiratory pressure of 5-10 cm of H_2O, to prevent alveolar collapse. The BIPAP mask was removed only during meals with a staff standing close by, and HFNO or nasal prongs were applied for this duration. The evidence of this technique enabled us to start using the BIPAP as an early treatment modality.

Another challenge we all faced was a sudden increase in oxygen requirement. Our hospital's oxygen consumption went up by 10 times in a day during the peak demand days. The liquid oxygen tank (LMO) which needed re-fuelling once a week on regular days, was now requiring re-fuelling twice a day. The vaporizer which supported the production of medical oxygen from the LMO tank was no longer sufficient to meet this exponential increase in demand as the majority of the patients needed high oxygen support. Immediate steps were taken to install a higher output vaporizer, but since the logistics of liquid medical oxygen delivery were also strained, on-site oxygen generating Pressure Swing Adsorption (PSA) plants were installed to augment this existing supply. In order to maintain the medical gas pipeline oxygen pressure across all wards, additional strengthening of our cylinder manifold backup system was done. Full oxygen cylinders were delivered multiple times during the day to ensure the supply remained adequate. Hyper-vigilant monitoring with alarm systems in place was ensured at all times to circumvent any fall in oxygen pressures. Technicians were trained through drills, closed-loop communication, and emergency manifold kits were made available on each ICU floor.

Soon after the second wave receded, the syndemic disease burden [12,13] of opportunistic fungal infections, rhino orbital mucormycosis (ROM) presented its ugly head leading to visual loss, facial deformity, and intracranial involvement in these patients. Our hospital was then declared a dedicated center for managing COVID-19 associated mucormycosis, and a multidisciplinary team comprising various specialties, ENT, Ophthalmology, Anesthesia, Intensive Care, Radiology, and Pathology was created. A preliminary study [7,8,11] was reported from our hospital that showcased the clinical profile and common associations of this novel subset of patients. This study reported three major causes of increased prevalence of mucormycosis which were; uncontrolled diabetes mellitus in 77% of patients, injudicious use of corticosteroids in 60%, and a dysfunctional immune system due to SARS-COV-2 infection. A multidisciplinary team approach along with hyper-vigilant monitoring enabled us to manage 131 Mucormycosis patients with 124 recoveries in a condition that is associated with 50% mortality if it is left untreated.

The Department of anesthesia also reported the multifactorial challenges that we encountered while managing this novel subset of patients. We highlighted the important role of preoperative assessment that helped in risk stratification and vigilant perioperative monitoring while managing such patients [14]. Perioperative anesthetic guidelines [15] were formulated based on the evidence of our experience and the management of these patients. In the sequential studies in management of pandemic, our team is working in multiple dimensions with objectives of to invigorate a scientific debate on how pathogenic potential of the new pandemic viral strains contributes toward development in the field of virology in general and COVID-19 disease in particular and role of Curcumin in the therapeutic management of SARS-CoV-2 infection [16,17].

Light at the end of the tunnel

As intensivists, we attempted to navigate through the storm of these second-wave challenges with tools of communication, collaboration, cooperation, and innovation in addition to the routine medical protocols. Through collaboration between various departments, and cooperation amongst all medical and paramedical hospital teams, effective closed-loop communication was established. Additionally using innovative steps with judicious handling of available resources, we were able to successfully treat and discharge over 13000 COVID-19 patients.

Conflict of Interests

The authors declare that there is no conflict of interest.

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Bibliography

1. Pandemic Influenza Preparedness and Response: A WHO Guidance Document. Geneva: World Health Organization; (2009).

2. Worldometer population data India (2022).

3. Dubey A, Bansal A, Sonkar SC, Goswami B, Makwane N, Manchanda V, Koner BC. "In-house assembled protective devices in laboratory safety against SARS-nCoV-2 in the clinical biochemistry laboratory of a COVID dedicated hospital". *medRxiv* (2008).

4. Dubey A, Kotnala G, Mandal TK, Sonkar SC, Singh VK, Guru SA, Bansal A, Irungbam M, Husain F, Goswami B, Kotnala RK, Saxena S, Sharma SK, Saxena KN, Sharma C, Kumar S, Aswal DK, Manchanda V, Koner BC. "Evidence of the presence of SARS-CoV-2 virus in atmospheric air and surfaces of a dedicated COVID hospital". *Journal of Medical Virology* 93.9 (2021): 5339-5349.

5. Garg S, Singh VK, Sonkar SC, Kelkar H, Singh S, Garg S, Arya M, Husain F, Chandra L, Chitkara A, Talukdar T, Goswami B, Koner BC. "Pattern of serum protein capillary electrophoretogram in SARS- CoV-2 infection". *Clinica Chimica Acta* 527 (2022): 11-16.

6. Irungbam M, Chitkara A, Singh VK, Sonkar SC, Dubey A, Bansal A, Shrivastava R, Goswami B, Manchanda V, Saxena S, Saxena R, Garg S, Husain F, Talukdar T, Kumar D, Koner BC. "Evaluation of Performance of Detection of Immunoglobulin G and Immunoglobulin M Antibody Against Spike Protein of SARS-CoV-2 by a Rapid Kit in a Real-Life Hospital Setting". *Frontiers in Microbiology* 13 (2022): 802292.

7. Gupta A, Sural S, Gupta A, Rousa S, Koner BC, Bhalotra A, Chawla R. "Positive QuantiFERON test and the severity of COVID-19 disease: A prospective study". *Indian Journal of Tuberculosis* 68.4 (2021): 474-480.

8. Malhotra V, Basu S, Sharma N, Kumar S, Garg S, Dushyant K, Borle A. "Outcomes among 10,314 hospitalized COVID-19 patients at a tertiary care government hospital in Delhi, India". *Journal of Medical Virology* 93.7 (2021): 4553-4558.

9. Arora G, Taneja J, Bhardwaj P, Goyal S, Naidu K, Yadav SK, Saluja D, Jetly S. "Adverse events and breakthrough infections associated with COVID-19 vaccination in the Indian population". *Journal of Medical Virology* (2022): 1-8.

10. A Joint guidelines release and recommendation for management of COVID-19 in adults.

11. Husain F., *et al*. "Evidence-guided, experience-based, patient compatible, a 3-step protocol for managing moderate to severe category COVID-19 infections". *IAR Journal of Anaesthesiology and Critical Care* 2.1 (2021): 12-14.

12. Scala R and Pisani L. "Noninvasive ventilation in acute respiratory failure: which recipe for success?" *European Respiratory Society* 27.149 (2018): 180029.

13. Yadav UN, Rayamajhee B, Mistry SK, Parsekar SS, Mishra SK. "A Syndemic Perspective on the Management of Non-communicable Diseases Amid the COVID-19 Pandemic in Low- and Middle-Income Countries". *Frontiers in Public Health* 8 (2020): 508.

14. Meher R, Meher R, Wadhwa V, Kumar V, Shisha Phanbuh D, Sharma R, Singh I, Rathore PK, Goel R, Arora R, Garg S, Kumar S, Kumar J, Agarwal M, Singh M, Khurana N, Sagar T, Manchanda V, Saxena S. "COVID associated mucormycosis: A preliminary study from a dedicated COVID Hospital in Delhi". *American Journal of Otolaryngology* 43.1 (2022): 103220.

15. Wadhawan S Husain F, Agarwal M. "The New Normal Anesthesiologist and the Challenging Post-COVID-19 Mucormycosis Patients – Our Experience". *MAMC Journal of Medical Sciences* 7 (2021): 126-135.

16. Soni VK, Mehta A, Ratre YK, Tiwari AK, Amit A, Singh RP, Sonkar SC, Chaturvedi N, Shukla D, Vishvakarma NK. "Curcumin, a traditional spice component, can hold the promise against COVID-19?" *European Journal of Pharmacology* 886 (2020): 173551.

17. Mahilkar S, Agrawal S, Chaudhary S, Parikh S, Sonkar SC, Verma DK, Chitalia V, Mehta D, Koner BC, Vijay N, Shastri J, Sunil S. "SARS-CoV-2 variants: Impact on biological and clinical outcome". *Frontiers in Medicine (Lausanne)* 9 (2022): 995960.