



Covid-19 Pandemic: Resumption of Orthopedic Care and Medical Education

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Abstract

Covid-19 is a respiratory disease caused by coronavirus 2 (SARS-CoV-2) first identified in Wuhan, China (December 2019). The disease rapidly crossed the barrier of countries, continents and spread globally. Non-pharmaceutical measures such as social distancing, face mask, frequent hand washing and use of sanitizer remained the best available option to prevent the spread of disease. OPD, IPD admissions, elective O. Ts were curtailed. Orthopedic care was only limited to emergency and semi-urgent procedures like necrotizing fasciitis, open fracture, and compartment syndrome. These measures were taken to preserve infrastructure and manpower to manage covid-19 pandemic. The children were thought to have a low susceptibility to covid-19 as compared to an adult. Deferring the patient during pandemic has led to high orthopedic disease burden, morbidity and disease-related sequelae, hence elective care must be resumed with modified hospital infrastructure. Resumption of elective/emergent orthopedic care should be slow, phasic and strategic, much similar to unlocking. Cases must be stratified depending on covid status and severity. Dedicated O.Ts with neutral/negative pressure and HEPA filter for covid positive and suspected patients are to be used. All symptomatic and suspected patients should be investigated for covid-19 by RT-PCR, blood counts and CT scan. Regional anaesthesia should be preferred to General anaesthesia. Power drill/saw/burr/pulse lavage should be minimized to avoid aerosol generation. Postoperatively continuous surveillance and monitoring to be done for covid related symptoms. Medical institutes rapidly shifted to the online mode of education. Blended learning (virtual & physical) and imparting skills have to be continued in post covid phase with equitable distribution of teaching hours to students of different years.

Keywords COVID-19 · Pandemic · Orthopedic care · Medical education

Introduction

The COVID-19 pandemic is a serious respiratory disease outbreak caused by novel coronavirus 2 (SARS-CoV-2) first identified in Wuhan, China (December 2019). The WHO declared it as an International public health emergency on 30th January 2020 and pandemic on 11th March 2020 [1, 2]. Very rapidly it crossed the barrier of continents, countries and spread globally [3] (see Table 1). Non availability of vaccine and lack of definitive treatment guidelines resulted in increased ICU admissions. Prevention remained the best available option with frequent hand washing, social distancing, use of sanitizer and face mask. Table 2 illustrates epidemiological definitions along with disease recovery profile and factsheet comparing Indian vs global statistics [4–9]. Best mechanism to manage infectious disease outbreak is to decrease and delay the epidemic peak, described as

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Table 1 COVID-19 Factsheet of world and top 6 countries on January 22, 2021

Country	Cases	Deaths	Transmission classification
WORLD	96,012,792	2,075,870	
United States	24,225,155	402,803	Community transmission
India	10,625,428	153,032	Cluster of cases
Brazil	8,638,249	212,831	Community transmission
Russia	3,655,839	67,832	Cluster of cases
UK	3,505,758	93,290	Community transmission
France	2,916,577	71,261	Community transmission

“flattening of the epidemic curve”. This mainly aims at gaining time for expanding the health services and developing medicine/vaccination [10].

First index case in India was reported on 30th January 2020 and soon reached 10 million mark in a little over 10 months. Figure 1 demonstrates the timeline of COVID 19 events in India till January 16, 2021. India witnessed approximately 3 months of complete lockdown [11, 12]. India being a developing country, and affordability remains the primary concern hence guidelines were issued to provide affordable, effective public health care. These guidelines mainly focused on effective disease prevention and averting oversaturation of services by high patient load [13]. The patients were stratified into three categories based on clinical characteristics and disease severity. Mild, asymptomatic cases were advised home isolation, after being informed appropriately about monitoring and complications. Moderate and severe COVID-19 patients were hospitalized for monitoring, oxygen therapy and ICU care where indicated [14]. The admitted patients were generally discharged after 10 days of onset of symptom with a persistent absence of fever for 3 days.

Table 2 Epidemiological definitions and COVID-19 factsheet comparing India vs global on January, 22 2021

	Definition	India	Global
1 Total confirmed cases	Laboratory confirmed COVID-19 infection, irrespective of clinical signs and symptoms	10,655,435 ^a	99,338,137 ^a
2 Total Deaths	Death resulting from a clinically compatible illness in a probable or confirmed COVID-19 case, unless there is a clear alternative cause of death that cannot be related to COVID-19 disease	153,376 ^a	2,130,626 ^a
3 Recovered cases	No clearcut definition for naming the COVID -19 case as recovered	10,316,786 ^a	71,390,635 ^a
4 Active cases	Active cases = total cases – (total deaths + Recovered cases)	185,273 [*]	25,816,876 ^a
5 Confirmed cases per million population	Total number of cases or deaths divided by the total population of the country or cumulative total of confirmed cases per million of all country for world	7679 ^a	12,744 ^a
6 Deaths per million population	Total number of deaths Total population of the country/world	111 [*]	273.3 [*]
7 Case Fatality Rate	It is a ratio of total deaths and confirmed cases at one point of time	1.4% [^]	NA
8 Recovery Rate	Total number of recovered cases X 100 Total confirmed cases	96.78% ^b	NA
9 Total tests done	Cumulative total samples tested (which includes both RTPCR and RAT) up to January 23,2021	19,17,66,871 ^a	NA
10 Tests done per million population	Total tests done Total population of the country	138,196 ^a	NA
11 Positivity rate	Total number of tests positive Total number of tests done at a particular time	5.59% ^b	NA
12 Infection Fatality Ratio (IFR)	Proportion of deaths among all infected individuals	0.27% ^c	NA
13 Secondary Attack Rate (SAR)	Probability that an infected individual will transmit the disease to a susceptible individual	17.1% ^d	NA

NA not available

^aWorldometer. COVID-19 Coronavirus Pandemic. Available from: <https://www.worldometers.info/coronavirus/>

^bPIB Delhi, MohFW. [Jan 22, 2021] Available from: <https://pib.gov.in/PressReleasePage.aspx?PRID=1691127>

^c<https://www.aninews.in/news/national/general-news/india-adds-16311-new-cases-to-its-covid-19-tally20210111095156/>

^dIoannidis J. The infection fatality rate of COVID-19 inferred from seroprevalence data. MedRxiv. 2020 Jan 1

^eFung HF, Martinez L, Alarid-Escudero F, Salomon JA, Studdert DM, Andrews JR, Goldhaber JD. The household secondary attack rate of SARS 2020 Oct 12

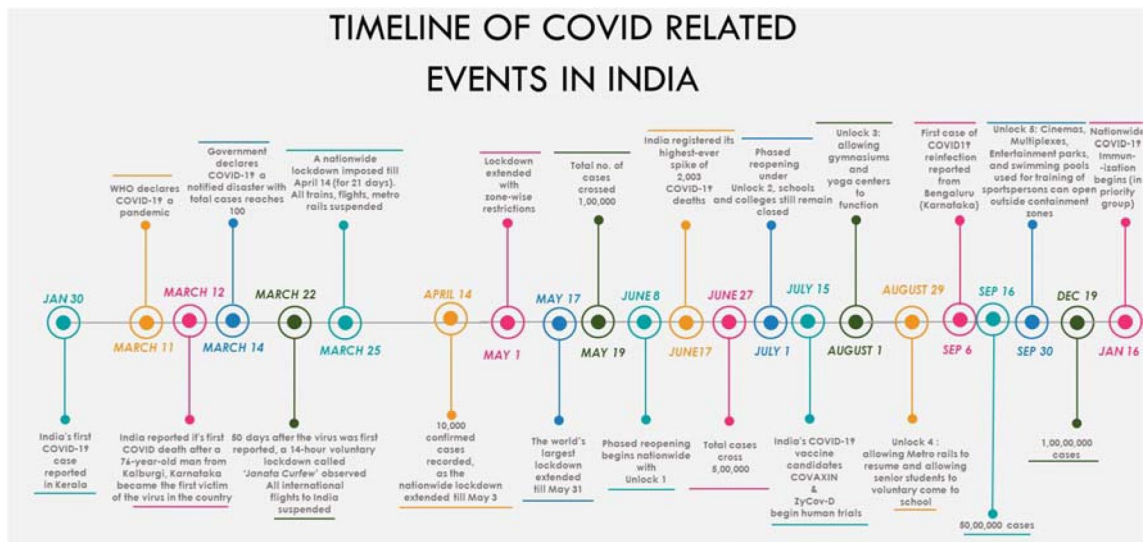


Fig. 1 Timeline of COVID related events in India

Impact on Orthopaedics

Rapid increase in COVID-19 resulted in saturation of health infrastructure. COVID-19 patient care was prioritized over non-COVID-19 patient care due to limited availability of hospital beds, PPE kits, ventilators and trained HCW to provide intensive care. There was a decrease in OPD, IPD admissions, emergency visits, surgical volume and elective surgical intervention. Orthopaedic care was limited to emergency and semi-urgent procedures namely proximal femur fractures, necrotizing fasciitis, open fracture and compartment syndrome. The detailed clinical and travel history, universal screening of COVID-19 by RT PCR prior to surgery become mandatory. These measures were taken to preserve infrastructure and manpower to manage ongoing pandemic [15–17].

The reduction in orthopaedic interventions was observed in India and globally. Wong et al. reported quantified impact of COVID-19 on orthopaedic surgical volume, hospital admission and elective/emergency attendance in a multicentric study. Almost 44% reduction in orthopaedics related operations ($p < 0.001$) and increased emergency/elective operation ratio (1.27:1–3.78:1) was documented. Elective operative intervention for upper limb, lower limb fractures and elective joint replacement reduced significantly ($p < 0.001$) [18].

Rannuccio et al. evaluated (cross-sectional survey) devastating effect of COVID-19 on European orthopaedic practice. Almost 90% public/private institutes stopped elective non-urgent orthopaedic procedures while urgent surgical care was given in 68% private hospitals. Surgical team was reduced in more than 70% (75/102) institutions. Almost 98% orthopaedic participants (surgeons) limited their operative

care to only emergency cases. Only 14.3% institutes had COVID dedicated orthopaedic surgical team while 30% (25/84) institutes had at least one surgical procedure on COVID-19 patient hence a need to train surgical team about covid-19 pandemic was felt for the safety of health care provider, patients and their families [19]. Scenario in India was no different. Kumar et al. in a survey reported that 64% orthopaedic surgeons stopped elective surgeries during the COVID pandemic [20]. Mi et al. reported the clinical impact and outcome of 10 Chinese fracture patients with COVID-19. 70% (7/10) contracted the disease nosocomially and mortality or severe pneumonia was the outcome among patients undergoing arthroplasty or other surgery for degenerative diseases. These patients for elective surgery for degenerative conditions are usually elderly (> 60), with one or more co-morbidities, may be asymptomatic or in the incubation period which goes undetected preoperatively and can become infectious to other patients or health care provider (surgeon/anesthetist/OT staff), hence, nonoperative management of trauma and chronic cases like backache, knee pain should be preferred [21]. The Royal Australian College of Medicine suggested that non-operative treatments will give advantage over operative treatments if similar/slightly poor outcomes are expected, than providing no treatment at all [22]. There are a number of common orthopaedic conditions that would be managed surgically, but would not be deemed as urgent procedures during the pandemic like fracture tibia, which is managed surgically to decrease morbidity and improving the quality of life of patients. Sports medicine specialists, arthroplasty surgeons and spine surgeons may need to consider the use of physical therapy, bracing, NSAIDs, or local injectables to help manage patient symptoms [23–26].

Paediatric and Spine Care

The children were thought to have a low susceptibility to the novel Covid-19 virus however, a few recent studies have shown increased susceptibility with the emergence of a new strain [27]. A retrospective study by Dong et al. on epidemiology of Covid-19 in children has shown that the infants were more susceptible compared to the older children with an incidence of 10.6% for severe disease in those aged less than a year [28].

The American Academy of Orthopaedic Sciences (AAOS) and other international societies have laid down guidelines for judicious deferment of routine elective procedures during uncertain Covid-19 pandemic. The risk-benefit analysis of deferment vs intervention should be weighed against all conditions to make a final call. The recommendations for common paediatric and spine conditions is presented below [28–31].

- The conditions like limb deficiencies/defects or routine surgical cases like cerebral palsy (CP) can be safely deferred for 3–6 months keeping them on virtual follow-up. Surgery in CP should be reserved for intractable pain/complications of earlier surgery, as rehabilitation/therapy will be much more difficult to carry out in the present times since CP patients are usually accompanied by more than three care takers and almost as much healthcare workers are also exposed.
- Adolescent Idiopathic and Neuromuscular scoliosis can be deferred for 3–6 months and follow-up visits should be planned accordingly or as soon as the pandemic is controlled.
- In hip disorders such as DDH, the initial screening can be deferred as the bracing protocol has good results and can be started at 6–8 weeks as well. Most of the infants requiring reduction under anaesthesia can be made to wait for 2–4 months, however, the decision should be made on an individual basis keeping all the factors in mind as the potential for late presentation, associated risk and outcome of late/ delayed intervention can be high. In acute cases of SCFE, pinning is recommended following all practices of safety, however, routine prophylactic pinning of the contralateral hip should be avoided.
- Open fractures should be treated as per the fracture type and recommended guidelines. The un-displaced fractures should be treated in a removable cast/splint and the parents can remove the same after intended period and follow-up on virtual platform.
- Paediatric sports and ligament injuries like ACL tear can be safely postponed for 2–4 months, however, locked knee, meniscal tear (bucket handle) should be managed early.

The recommendations for each and every condition is beyond the scope of this article and standard guidelines should be followed in this regard.

Outpatient Care

We lack clear guidelines for outpatient services. In view of the constrained staff, limited resources and lack of proper isolation space the normal outpatient services were either delayed or shut completely for varying periods. These services have to be resumed ensuring the safety of patients/HCWs. The guidelines can be changed/modified according to the region, type of setup, local needs and the resources available. Tips for the resumption of OPD have been mentioned in Table 3.

The door handles, tables and other material in OPD should be cleaned with hypochlorite solution at least three–four times in a day. A triage system can be set in which the patients can be first contacted on phone/email and only the patients that essentially requires a physical examination, an investigation or an intervention should be called.

OPDs in government hospitals are generally unregulated and patients attend without appointments and end in the unregulated crowd. This practice will need to be stopped and patients should be decided on clinical priority and the availability of number of doctors. The number of visits by the patient to make a provisional diagnosis/investigation and initiation of treatment should be minimised.

The telemedicine may be used for routine/minor complaints such as low back pain (without red flags), cervical spondylosis, common foot and ankle conditions and for follow-up visits to review investigation results. Telemedicine, however, has some data privacy threat which should be communicated to patients in advance. In spite of being an extremely useful platform at present, it cannot substitute the normal physical consultations [32–36], it may, however, reduce the number of a visit by patients during follow-up in private hospitals. Its feasibility in government set-ups remains questionable.

Table 3 OPD practice tips

Hospital visit with prior appointments
One patient one attendant
Posters in native language about covid-19 in OPD areas
Maintaining social distancing at all time
History regarding symptoms, travel and any contact with a COVID positive patient to be dictated
Rapid antigen testing for covid-19 in out patient
Separate assessment and procedure rooms
Give one stop treatment and minimum follow-up visits
Online videos for rehabilitation

The hospital infrastructure needs to be modified before resuming normal services in the COVID-19 pandemic which is listed in Table 4.

Resumption of Elective Surgery

India has a high disease burden (huge population) and due to lack of universal delivery of optimum health care and limited resources, we see the natural history of the disease. It is imperative that we resume normal health services and surgical care as soon as possible, knowing fully well that covid-19 is going to linger on for long and we will have to learn to live with it.

Resumption of elective/emergent orthopedic care should be slow, phasic and strategic, much similar to the unlocking. Initially, the resumption could include geographical areas with a sustained decrease in the rate of new COVID-19 cases for at least 14 days [37]. At the same time, care of critical trauma/malignancy-associated orthopedic cases must not be delayed any further due to COVID-19.

The limited resources and high disease burden always remain to limit factor to provide optimum health care in India. Deferring the patient during pandemic has lead to high orthopaedic disease burden, morbidity and disease-related sequelae. More goal oriented and stratified approach from the beginning will lead to lesser morbidity, and lesser saturation of health services while imparting efficient orthopedic care.

Cases may be stratified depending on COVID status and severity. (a) Stable COVID positive patient requiring non-urgent surgery can be treated conservatively or surgery may be deferred till the patient becomes COVID negative. (b) Unstable patient with moderate/severe COVID-19 infection requiring non-emergent surgery first should be treated for COVID and surgery can be taken thereafter. The COVID-19 positive patient presenting in emergency needs to be operated in negatively pressurized operation theatre. The area

should be easily accessible from the corridor and adjacent spaces. The post-operative monitoring should be performed in the negative pressure post anaesthesia care unit (PACU) [38].

The number of Operation Theatres (OTs) should be recruited in phased manner since large number of HCWs of all categories have already been deployed to manage pandemic and will be required to manage an unforeseen surge in covid cases, if it occurs. The balance of opening O.Ts and available staff of all categories need to be organized. The resumption of operation theatre will simultaneously add to supporting area(wards, HDU, follow-up areas, outpatients, laboratory services, blood banks and preanaesthetic clinics). The constraints of depleted staff already on covid duties, arranging safe corridors in hospitals, modification in the airconditioning and other facilities, ensuring the availability of personal protective equipment (PPE) will need to be organized. It is of utmost importance to prioritize/reschedule the orthopedic cases from the pending list. The cancelled/postponed cases or those with malignancy may be given first preference. It was estimated that clearing a surgical backlog of 12 weeks may require up to 45 weeks, assuming pending surgeries would still be required [39]. This may be a bigger issue in public hospitals than in private.

Health Care Workers (HCWs)

The staff deployed in the designated non-COVID center should be tested prior to the resumption of services, to avoid their becoming a “super spreader” [40]. Their protection from possible infection is thus of utmost importance. This would require their repeated periodic training in infection control practices including appropriate use of PPE.

The shortage of anaesthetists/other doctors due to attrition/burnout by the time pandemic subsides, and the additional demand on operating capacity due to backlog of surgeries will have to be addressed. In India, the problem is likely to be compounded due to lower ratio of trained

Table 4 Hospital modification, Patient&Surgeon safety in post covid era

Thermal screening or RAT for patients and relatives
Surgeon and HCWs should wear PPE kit and N-95 mask all the time
Face shield/safety goggles should be used to prevent accidental soiling
Use of disposable medical supplies/gowns/sheets to be encouraged
Separate ward for covid positive/suspected and non covid patients
Separate O.Ts for covid positive/suspected patients with separate entry and exit with dedicated corridor for transfer
Negative pressure O.T's with HEPA filters installed
Central suction units to be replaced with electric suction unit
Distance of 6 feet should be maintained between two adjacent beds in the ICU and perioperative patient care areas
Adequate nutrition and hydration of operated cases
Telemedicine for physiotherapy and preanaesthetic check-up to minimize hospital visits

doctor: population ratio than advocated (roughly 1:10,000 as opposed to 1:1000) [41].

Laboratory services

In-house testing facility for RT-PCR with accurate and reproducible results should be available to decrease the turn-around time and expedite delivery of health care. Procedure of an elective or elective but somewhat urgent nature should be carried out only after confirmation of negative COVID status of the patient [42]. However, an emergency life-saving surgery cannot be delayed for want of a pending COVID test result. In such a case, the patient should be assumed as COVID positive, all precautions taken and the surgery conducted.

Additional testing for blood investigations as D-dimer/C-Reactive Protein (CRP)/Procalcitonin/IL-6/serum ferritin and LDH may be required in COVID patients, hence should be available. Radiological imaging including Computerised Tomography (CT) chest and cardiac testing by echocardiography would be required as well.

Operation theatres

There should be a separate dedicated COVID operating room for positive or suspect cases. This room should be easily accessible with a separate entrance/exit. The pressure in OT should be maintained to either neutral or negative. If the negative pressure facility is not available, there should be a time gap of at least 30 min in between two procedures to allow complete air exchange. The door of OT area should remain closed at all times and safety precautions must be displayed.

Negative pressure maintenance equipment should be installed [43]. The device should be started 30 min prior to the scheduled case and the procedure can be initiated once the pressure is -5 KPa [44].

The exhaust air from the theatre should be treated by HEPA filters of H13 (EN1822-1) filter class or equivalent. It must conform to International standards such as the Institute of Environment Science and Technology (IEST), European standards (EN) or International organization of standardization (ISO) [45]. In the absence of HEPA filters, chemical disinfection by bubbling the exhaust air through a non-metallic “Diffused air aerator tank” with 1% sodium hypochlorite solution should be done [46–48]. All equipment likely to be unused must be removed to prevent contamination. The equipment in use must be covered with disposable plastic wraps wherever possible and wrap to be changed between two cases.

a. Pre-anaesthetic evaluation

A telemedicine/video-conferencing-based approach can be charted and face-to-face interaction reserved only for ASA 3/4 patients [49]. The detailed history of recent exposure/symptoms suggestive of covid must be enquired in asymptomatic or pre-symptomatic patients with a long latent period. The fever, tachypnoea, tachycardia of orthopedic ailments may mimic covid-19. Patient should be counselled about the risk of contracting covid during the course of their procedure/stay in the hospital despite rigorous infection control measures, and an informed consent for the same must be obtained. The patients with high-risk exposure history or from containment zones should be investigated even if asymptomatic. All symptomatic and suspected patients should be investigated for COVID-19. Investigations should include a CT scan, blood count, RT-PCR test for COVID [43]. Temperature monitoring should be done until the day of surgery. Elective procedures in patients who have recovered from COVID should be delayed until full recovery, and for a 4–12 week wait period depending on the severity of disease; lung CT-scan 48–72 h before surgery may also be helpful [42]. Preoperative investigations will need to include ready access to echocardiography and cardiac enzymes since cardiac manifestations of COVID are increasingly being recognized [50].

Low molecular weight heparin (LMWH) is used for COVID patients due to microthrombotic nature of the disease. Planning, timing and nature of neuraxial anaesthesia in relation to LMWH doses will be required. Postoperative re-initiation of LMWH will also need meticulous planning and adherence to existing guidelines [51].

b. Intra-operative care

i) Choice of Anaesthesia

The choice between regional or general anaesthesia will be dictated by patient profile/type of surgical procedure. General anaesthesia may be avoided, where ever possible, to eliminate endotracheal intubation and suctioning. The patients may have to be put on assisted mechanical ventilation or high flow nasal oxygen due to respiratory insufficiency of COVID.

The surgical and anaesthesia teams must discuss the extent and duration of surgery before giving regional anaesthesia to avoid unplanned conversion to GA. The blocks should be performed inside the OT with prescribed PPE with minimum equipment inside OT. The ultrasound machine may facilitate the placement of peripheral nerve blocks and may help to increase the block efficacy. Care should be taken to avoid peripheral nerve blocks with the potential of respiratory depression. Deep sedation should be minimized to avoid airway interventions.

Although there is a theoretical risk of viral seeding into the nervous system with the use of neuraxial anaesthesia,

there is no clinical experience to support the hypothesis [52]. The presence of coagulopathy in COVID patients would be a contraindication to neuraxial blocks. There have been no recommendations to alter the dosages of local anaesthetics in spinal anaesthesia.

ii) Airway management

The elective procedure and its pre-procedure planning should be performed in a separate, preferably, negative pressure room with a strict door policy, with a minimum number of personnel in PPE. The procedure must be carried out by the most experienced team member with rapid sequence intubation. Videolaryngoscopy should be preferred over conventional direct laryngoscopy. Closed-loop suction system, HEPA filters and end tidal CO₂ monitoring should be available. Presence of cervical spine instability along with a full stomach may add to the difficulty in securing the airway. The flow of oxygen should be kept to a minimum to maintain saturation and to minimize aerosol generation. The patients should be made to wear a surgical mask over the oxygen therapy device. Most advanced anaesthesia workstation should be available in the COVID care location for employing and monitoring lung-protective mechanical ventilation consequent to the varying degree of pneumonitis or even ARDS.

The transportation of COVID-19 patient between ward, OT, recovery room and to ICU should be preplanned to avoid any form of airway management that increases the formation of aerosols such as open breathing circuits; using heat and moisture exchanger (HME) filter and surgical face masks for patient.

iii) Orthopedic consideration

The use of power drill/saw/burr/pulse lavage should be minimized to avoid aerosol generation [53]. Expert surgical skill will help in minimizing OT time, further improved by adopting the shortest efficacious operative procedure. Minimally invasive procedures should be preferred and lengthy surgeries should be avoided [54]. Bleeding should be minimized using tranexamic acid, tourniquet, and achieving good hemostasis. Unwarranted use of electrocautery should be limited. Absorbable sutures should be used for the closure of wound.

c) Postoperative

Post-operatively continuous surveillance and monitoring for COVID-related symptoms and complications will be needed [43]. Patients should be transferred to an isolation room with restricted access. Continuation of infection control practices to decrease transmission of the disease will be needed. Post-operative period should be minimized.

Resuming medical education

Medical education has been affected in myriad ways during public health emergencies such as the Spanish flu pandemic (1918–1919) and the more recent ones such as Ebola and Middle East Respiratory Syndrome. The medical institutions were closed along with all the other educational institutions to avoid gatherings to prevent community COVID spread. Closure of schools/universities is considered a non-pharmaceutical intervention to prevent the spread of influenza. Closing educational institutions has been expected to break the chain of transmission, leading to the reduction of cases, and limiting burden on the healthcare system and also peak absenteeism in the general population [55].

The medical students have been involved in conducting health education activities and management of the large number of patients. Involvement of medical students in the management of patients during such crises helps them to imbibe certain expected virtues of doctors as courage, empathy, and teamwork [56–58].

Medical education worldwide is broadly divided into classrooms lecture-based instructions, practical teaching in laboratories, and patient-centred teaching inwards/out-patient [59]. All these components came to a standstill during this pandemic. The medical UG students were forced to sit at home, hence the course duration is being prolonged. The postgraduate medical education was hampered as many teaching hospitals have been converted to COVID dedicated hospitals and are diverted to manage covid patients. Even without their course duration being extended, there is an opportunity cost associated with such diversion of learning opportunities.

The medical institutes rapidly shifted to online mode mostly theoretical and didactic of medical education. The psychomotor and affective domains of learning is being affected the most. The hands-on skill component among the medical students could not be provided. Virtual learning will not be sufficient to teach how to understand and manage the patients who are living human beings with social constructs, emotions, apart from the complex interplay of the various organs of the body. A personal and humane approach lies at the heart of medicine, which is marred by virtual exposure.

On the other hand, we need greater number of health personnel to join the fight against covid. There is an urgent need to resume medical education and begin the meaningful training of future doctors. The availability of clinical material is the first challenge with the resumption of clinical training. The number of patients coming to hospitals have decreased in number due to non availability of public transport or apprehensions of the patients to go

to hospitals for fear of contracting covid. The medical students will also be apprehensive about interacting with patients for fear of getting infected with covid. In certain states in India, e.g. Delhi, certain public teaching hospitals have been fully dedicated for covid care [60]. This further restricted the learning opportunity of the medical students regarding various health conditions. Resumption of clinical teaching in hospitals would require them to have dedicated blocks which admit all patients and these blocks can be involved in medical training.

Blended learning will have to be continued in post-COVID times. The lectures should continue to be delivered using online mode even when the medical colleges resume the activities. Various studies among medical students during COVID lockdowns have found that most students would prefer blended learning in the post-COVID phase [61]. Physical contact should be minimal, crowding should be avoided in the colleges. The clinical postings can be done by dividing the students into small groups and in multiple shifts. The teaching in the hospital posting will have to be closely followed by the faculty with well-developed lesson plans and learning objectives to be achieved by the students attending the postings. Maximum care must be taken to not waste any of the already limited opportunity, the medical students are getting towards learning in a real-world setting. Some colleges have made plans to reopen based on these considerations [62]. Even newer techniques such as flipped classroom and case-based learning may contribute to the delivery of medical education.

There should be an equitable distribution of the teaching hours to students of different admission years. Senior students should be given more time for clinical postings as compared to the students in the initial years. This is because they have less time to attain competencies in the clinical tasks. This will have an immediate bearing on their ability to manage patients once they complete their course. This can also impact their chances of getting employed in near future [63].

Flexible timings for teaching-learning activities will have to be implemented when medical education resumes in post-COVID times [63]. Asynchronous learning will also help students to learn at a time of their choice. This will contrast with the earlier teaching schedules which we had in India where mostly the morning 9 am–12 noon were dedicated for clinical postings. A report published recently in India notes that multiple shifts will be required by schools to limit the number of students. Even though it will put pressure on the schools with respect to resources, it might help in improving the quality of education by having lesser students per teaching session [64]. The teacher–student ratio need to be modified as it would require a mere number of resource persons.

Student support would also have to be streamlined in post-COVID resumption of medical education. Guidelines

need to be developed for hostels too which can include precautions to be taken by the medical students. Self-monitoring of temperature, frequent hand washing, wearing of masks, physical distancing must be practiced by the students. The dining areas/common rooms should be utilized taking full COVID precautions. A separate isolation block in the hostel would be required which can be used to isolate those students who have symptoms of COVID. The students should be provided with laptops, internet connection and data so that they can attend the online trainings.

Training of medical teachers/students in using online platforms for teaching must be organised in medical institutes. The choice of the digital platform will depend upon the familiarity among teachers/students, its cost, and the features it offers. The initial few weeks, after resuming medical education should be kept for such orientation trainings. This will increase the efficiency of the blended learning model which is going to continue in the post-COVID-19 phase.

There are even long-term lessons to be learned by the medical education system, from this crisis. The apprenticeship model being currently employed for postgraduate teaching need to shift to competency based. This will keep the spotlight on postgraduate medical teaching in the hospitals which are busy managing patients. Even hospital administrators and governments need to change their paradigm about the priorities of a teaching hospital. At present, the focus is only on patient management in most of the teaching hospitals. It is necessary that both patient management and medical education are given equal importance in the teaching hospitals.

Reopening of medical institutions gives us an opportunity to modify the medical education system to make it more futuristic, relevant, and resilient. Administrators, faculty, students, and all stakeholders should collectively decide the best strategy in their given circumstances.

Compliance with Ethical Standards

Conflict of Interest There is no conflict of interest.

Ethical Standard Statement This article does not contain any studies with human or animal subjects performed by any of the authors.

Informed Consent For this type of study informed consent is not required.

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