

# Evaluating the Strategies for Orthopedic and Spine Surgeries during COVID-19 Pandemic in India- a Retrospective Analysis of 24 Patients in a Multispecialty Hospital- Are We Heading to a New Normal?

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# Abstract

**Study Design:** Retrospective study.

**Purpose:** To present precautionary measures for the orthopedic and spine surgery patients, operating them as per the protocol and analyze findings that can be implemented in non-urgent surgeries during Covid-19 pandemic. Other aim was to analyze the role of multidisciplinary approach, average hospital stay, additional cost behind investigations and hospital bill to guide the patients.

**Overview of Literature:** The literature mentioned to postpone or delay all non-urgent surgeries related to orthopedic and spine conditions till Covid-19 pandemic continues. However, it is not predicted when will this end. No study focusing to conduct essential but non-urgent orthopedic and spine surgeries during this pandemic.

**Methods:** Between March 11, 2020 and May 8, 2020, information on 24 operated orthopedic and spine surgeries were prospectively collected at our institution. Patients were examined in either designated Flu Clinic or out patient department (OPD) after completing screening protocol for Covid-19. Flu clinic team examined all patients and blood investigations, x-ray chest and additional high resolution CT scan were ordered before admission. Patients with symptoms were investigated with RT-PCR for Covid-19. Standardized protocols using multidisciplinary approach were followed for outpatient clinic, admission, surgery and hospital stay regarding Covid-19. Analysis of patients' hospital stay, hospital bill, admission time and their results of surgeries were performed.

**Results:** 24 patients were operated for orthopedic and spine surgeries with triage as urgent surgeries. 8 and 16 patients were admitted through flu clinic and OPD, respectively; which caused average admission time  $179.4 \pm 138.5$  minutes from presentation to admission. All patients managed orthopedic and spine surgeries with improved VAS from average  $8.5 \pm 0.6$  preoperatively to  $2.7 \pm 1.0$  postoperatively. There was average increase of  $5.4 \pm 2.4\%$  in the overall cost compared to final bill pertaining to Covid-19 precautionary measures. There was no patient or healthcare worker who developed symptoms related to Covid-19.

**Conclusions:** Surgeries should be conducted during Covid-19 pandemics according to their need either to save lives or to provide improved quality of life. Multidisciplinary approach following strict precautionary measures can make it a new-normal norm for the healthcare providers.

## Introduction

During the time of Covid-19 pandemic, when the population is being instructed to stay at home, the healthcare workers are being expected to do exactly the opposite [1]. According to the number of patients as well as their deaths, it affected more economically developed countries than the economically developing countries as per the list [2].

The effect of Covid-19 on healthcare system is the most dreadful. As of on 11<sup>th</sup> February 2020, more than 1700 healthcare workers have been infected in China [3]. Two thousand and twenty six healthcare workers (approximately 9% of total patients) have been infected with the Covid-19 in Italy till March 15, 2020 [4]. It is draining the workforce of healthcare providers in the management of its acute effects; and on the other hand, it has made the treatment of non-Covid patients difficult because of possibility of nosocomial transmission of infection to the patient or healthcare workers. In anticipation of such situation, hospitals in many countries have quickly stopped all non-urgent visits, procedures, and surgeries, freeing up beds, equipments, and workforce [5-7]. However, if it is an emergency surgery to save life or functionality of a patient, question remains shall it be performed with precautions [8].

If we consider some of the orthopedic or spine procedures, they can be postponed or delayed till the pandemic settles down. However, we do not know when will it settle and normal work can be reinstated [7, 9-11]. Procedures for acute fractures in extremities or spine, spinal conditions causing neurological complications, malignancies in spine or bones, and infections are the conditions that need an urgent attention to avoid future complications [12]. Although orthopedic or spine surgeons are not the frontline workers in the time of Covid-19 pandemic, healthcare workers including orthopedic or spine surgeons can be infected in the course of delivery of their outpatient or surgical services to the patient [13-15]. As orthopedic or spine surgeons are in the deciding role, appropriate and timely decision can protect all of the involving health personals from unwanted health hazards from Covid-19. As a preliminary estimate of median incubation period of covid-19 are 5-6 days (rang, 0-14 days), some of the patients who come to seek surgical options related to orthopedic or spine surgeries are in the window period or they are asymptomatic carriers [16, 17]. The question arises here is how can we predict this phase and successfully perform the surgical procedures in these two specialties during this pandemic, and thereby, avoiding complications if left untreated or not operated.

Therefore, the purpose of this research was to present prospectively taken precautionary measures from entry to exit for the patients from orthopedic and spine specialties, operating them successfully, and retrospectively analyze the findings that can be possibly implemented in all essential non-urgent surgeries during Covid-19 pandemic. Other aim was to analyze additional findings such as, role of multidisciplinary approach, average hospital stay, additional cost behind investigations and hospital bill to guide the patients to recommend for future surgeries.

## **Material And Methods**

This study was conducted in 24 patients from the Department of Orthopedic and Spine surgery at Zydus hospitals and healthcare research center, Ahmedabad, India during the period of 11<sup>th</sup> March-8<sup>th</sup> May, 2020 over a period of two months. Study was implemented with protocol set by the hospital management as soon as World Health Organization (WHO) announced Covid-19 a pandemic. Selection of patient for admission and surgeries were done prospectively as per guidelines and analysis was carried out retrospectively. There were 14 male and 10 female patients with an average age of 56.2+/-19.4 years (range, 6-83 years) in the study. All patients related to the orthopedic and spine

surgeries were included in this study. There were 8 and 16 patients who were admitted through outpatient and flu clinic (Emergency), respectively. At both locations the criteria for the examination and admission were followed up with multidisciplinary approach as below (Fig. 1):

**Management for Outpatient Clinic.** All patients who wanted to consult specialists were given appointment at least a day prior to visit for the preparation by the hospital. Any patient presented without prior appointment was directed to emergency room (ER) for further procedure. All patients were given consultation time with an interval of at least 20 minutes between two consultations. They were instructed to present at entrance of the hospital premise at least 30 minutes prior to their consultation time where all patients and their relatives screened using thermal screening. Each person (patient and relative both) has to fill and sign self declaration form regarding any symptoms such as fever, cough, sore throat, body ache, head ache, history of close contact to Covid patient, history of travel or returning from international destination. Any patient or relative having positive history from the form or raised temperature on thermal screening was directed to the special Flu clinic which was created before ER [18]. Rest of the screened patients with one relative was allowed to attend outpatient department (OPD) where social distancing were strictly monitored during entire patient cycle. All patients and relatives were given disposable surgical masks to wear all the time till leave the hospital premise. Consultant would attend patient in OPD with precautions wearing N-95 mask, hospital gowns and gloves, with maintaining limited presence of patient and one relative in the chamber.

**Management for ER patients.** All patients without prior appointment or in emergency has to pass through special flu clinic for Triage [19]. This is created just before entrance of ER for the screening purpose of suspected Covid-19 patients. A team of internal medicine specialist, pulmonologist, emergency medicine experts and critical care specialist using multidisciplinary approach handled flu clinic, and team decides who will attend patient. All doctors and paramedical staff attending the flu clinic wear personal protective equipment (PPE). Any suspected patient was directed to the Covid-19 special center from the flu clinic itself for further management. Other patients were attended for general examination, routine blood work-up (complete blood count, erythrocyte sedimentation rate, c-reactive protein, and x-ray chest). After obtaining clearance from flu clinic team, consultant from orthopedic or spine team would attend patient in flu clinic for consultation.

**Investigations.** If patient requires further investigations such as blood investigation, x-rays, MRI, CT scan or ultrasound examination in OPD or in ER, doctor would inform the front desk immediately so that the communication to the laboratory or radiology department reach immediately and further process go smoothly without delay. A turn around time of the process was within 2 hours (for primary screening) or within 4 hours (for post consultation investigations) and re-consultation of patient with the primary consultant was followed. In any case patient should move out of the hospital after completion of treatment within 4 hours maximally if admission is not required. To ensure that this process was strictly adhered to, zonal managers from Medical services and Operations were positioned at essential touch points like emergency area, entry points of the hospital, Radiology, sample collection centers and Flu clinic.

***Patient requiring admission:*** Any patient from either specialty requiring admission must get approval from the internal medicine, pulmonology or critical care specialist team as a protocol. All patients seeking admission either from OPD or flu clinic were directed to the physician where x-ray chest were re-examined with patient. In any doubt, high-resolution CT (HRCT) of thorax was advised before getting clearance for the admission [18]. One relative policy was implemented for all patients. The patient shall be attended by the same relative from admission to discharge, and the relative shall be wearing a mask at all times. The patients who were suspected for Covid-19 was advised to get RT-PCR for Covid-19 report at special testing centers before admission. This procedure was explained to patients and their relatives in detail prior to following the process. Entire exercise would increase admission time, and therefore, any emergency medical treatment were initiated in flu clinic to alleviate the pain for orthopedic or spine patients.

***Management of patient in wards:*** Upon admission of a patient in ward, immediate medical treatment started for every patient before preoperative investigations. All patients were explained that they would be kept only in single occupancy rooms instead of keeping in sharing room for their safety purpose [18, 20]. Payment of the additional cost for the single room from the less-affording patients was not asked by the hospital. All routine preoperative investigations, cardiac work-up, preoperative physician and anesthetist clearance and additional investigations related to surgeries, such as MRI or CT scans were carried out from the wards with help of residents [20]. If any patient having complains of sore throat, fever, cough or breathlessness found, we shifted that patient to isolation ward immediately, and investigated for Covid-19 RT-PCR [18]. If any patient reported positive, immediately shifted to Covid-19 special care facility. If report comes negative, patient would be shifted to the ward again.

***Surgical procedure- Transfer, Operation room, Induction, Operation, Extubation and transfer back to ward*** [5]: Transfer of patient (patient with surgical mask) to OR was done by trained staff members wearing N-95 masks and disposable gowns. Patients were shifted directly to OR without waiting in holding area to reduce exposure time in OR. The entire process was preplanned before sending call from OR. Meanwhile OR scrub nurse would prepare all necessary arrangements and preparation of operating trolley and leave operation room before patient enters in. Once patient enters in OR, minimum number of staff, anesthesiologist, technician, nursing staff and runner remain present wearing N-95 masks. Anesthesiologist would be ready wearing PPE kit (Fig. 2). After the timeout procedure is completed, anesthesiologist proceeds for induction of patient. Regional or general anesthesia was given according to patient and surgical requirement under strict protocol and air-conditioning system was switched off 10 minutes prior to induction. Each general anesthesia was guided with video laryngoscopy to avoid direct blow on the face (Fig. 3). Once induction is done, operating surgeon would enter and give position and necessary preparation for surgery. Surgeon, assistant surgeon and scrub nurse would wear kit and perform surgery [5]. The senior surgeon would perform all surgeries and teaching would be avoided to complete the procedure as fast as possible. Additionally, surgeon would avoid using high-speed burr, electro-cautery, suction machine, drilling tools to minimize aerosol particles formation inside OR (Or use with transparent plastic sheet as a barrier) (Fig. 4), thus preventing cross-infection. Operation room and its preparations would follow a standard set protocol published in literature [1, 21, 22]. Air-conditioning

system is again switched off at least 10 minutes prior to the completion of surgery. Once surgery is over, patient would be extubated in OR and depending upon his condition and establishing his normal airway and saturation in isolation recovery ward, patient would be shifted to ICU or ward with preplanning.

***Postoperative care in wards and discharge.*** Postoperatively all orthopedic and spine patients were monitored in wards, except those requiring ICU care, till the discharge. Consultant, physiotherapist, resident doctor and nurse separately, followed up all patients. Communication of each postoperative event and update were done immediately to avoid any lapse. Washing hands with soap-water immediately before and after visit were strictly followed. Additionally hospital has set up an announcement call for all the staff members to wash their hands with soap-water every hourly as a rule to avoid any possible transmission of contagious disease. Physiotherapist followed mobilization, chest and limb physiotherapy twice a day regularly for all patients to enhance recovery. Senior consultant took ward rounds with presence of only one staff member to maintain social distancing and implementing the actions on time. A day prior to the discharge, summaries of all patients were preliminarily prepared by residents and checked by attending consultant. On the day of discharge, final discharge summary were checked and signed by consultant, discharge were marked and billing was completed within two hours to avoid any delay in the discharge. All patients were explained about discharge medications and further follow-up with home-care instructions by the consultant to avoid any communication error. All patients and their relative were given discharge along with the surgical masks that was mandatory during their entire stay in the hospital.

***Analysis.*** Twenty-four patients operated for orthopedic and spine surgeries were included in the study after triage for urgent surgeries [7, 12, 19, 22, 23]. Their postoperative improvements and clinical score for pain (visual analogue scale- VAS) were recorded. For all patients, time from OPD/ER to admission in wards, additional investigations, duration from admission to operation, number of days of hospital stay and additional amount of hospital bill in percentage to final bill were analyzed. Analysis was done to replicate similar situation if patient presented without emergency, however, needs surgical procedure to improve quality of life.

## Results

There were 24 patients operated for orthopedic and spine surgeries after admission process during Covid-19 in two months. There were 18 orthopedic and 6 spine surgeries performed due to various pathologies shown in table 1. All patients were admitted following the protocol by the hospital (material and methods). There were 8 who were admitted through OPD consultation; rest 16 were admitted thorough ER at the time of presentation. There were 5 patients who underwent through screening, CBC, ESR, CRP and x-ray chest before the admission; rest 19 patients had additional HRCT thorax and 4 out of these 19 patients had additional RT-PCR test for Covid due to suspicion by flu clinic team (Table 1). There was no patient who became Covid-19 positive later till the date. Average duration of admission from presentation was 179.4+/-138.5 minutes (range, 62-590 minutes). Average hospital stay for patients were 6.5+/-2.4 days (range, 3-24 days). Preoperative VAS score was improved from 8.5+/-0.6 to 2.7+/-1.0

postoperatively ( $p < 0.001$ ). Comparing their hospital bill at the time of discharge, there was an additional 5.4 $\pm$ 2.4% (range, 2.1%-10.1%) cost marked up if they had not followed the covid-19 protocol (Table 2).

## Discussion

A series of patients with pneumonia caused by the novel coronavirus (Covid-19) emerged in Wuhan, China and were reported to the World Health Organization's (WHO) office in China on December 31, 2019 [24, 25]. Despite the aggressive containment measures taken by the local government, the infection was transmitted rapidly around the globe affecting almost all countries. India is also witnessing increasing numbers of Covid-19 cases with more number of cases in Maharashtra, Gujarat and Delhi states. As of now it has already crossed more than 55,000 cases in India in spite of strict lockdown across the nation since March 25, 2020 (Fig 5). In consultation with professional associations, government of India announced advisory for all health institutions to avoid non-urgent hospitalization and minimize elective surgeries. However, most of the healthcare professionals and hospitals have been witnessing significantly reduced numbers of OPD patients and planned surgeries since the beginning of March as Covid-19 cases started increasing during that period. We believe this period might further extend if number of cases do not start declining in coming future. Therefore query arises how long can patient wait or postpone surgery that is essential for improving the quality of life. This study was conducted in Ahmedabad, Gujarat that is badly affected by Covid-19; and therefore, we believe this study would set up an example focusing this issue to continuing healthcare services.

In a multicenter retrospective study by Lei et al. found out clinical characteristics and outcomes of patients who were unintentionally scheduled for elective surgeries during the incubation period of Covid-19 pandemic [26, 27]. They concluded that surgery could accelerate and exacerbate the progression of disease. The median time of appearance of symptoms was 2.6 days after the surgery. The median time of onset of Covid-19 (defined as duration from onset of the first symptom to onset of dyspnea) in this study was 3.5 days with a mortality rate of 20.5%. In our study, all of our patients stayed at least 3 days (average, 6.5 days) in the hospital before the discharge. None of the patient developed any sign or symptoms regarding Covid-19. Additionally there were 4 patients who had flu-like symptoms such as sore throat or coughing were kept in isolation ward and investigated for RT-PCR for Covid-19. All of them had negative report and they were shifted to the wards before surgery. We believe our protocol prior to admission was crucial negating such an unexpected complications to occur in our initial experience.

Certain emergency conditions like fracture in extremities, spinal cord injuries, infection in joint or spine, malignancies in bone and spine, severe spinal cord compression causing neurological deficits or severe pain make the surgery unavoidable [20, 28]. In such situations, strict preventive measures should be taken to protect healthcare personnel by inhibition of cross-transmission of Covid-19 among healthcare workers and thereby, balancing personal risk and professional duty [14]. In this situation, all the healthcare personnel related in the management of patient including surgeons, anesthesiologists, and nurses should have special training to use PPE kit [12]. We followed the same in our cases mentioned in methods

section. Maintaining strict criteria none of the OR staff, surgeons or anesthetists reported symptoms related to Covid-19 over two months experience.

When surgery is required, HRCT of chest should be done in all patients because 17.9 % of infected individuals are asymptomatic [29]. In a series of 51 patients with chest CT and RT-PCR assay performed within 3 days, the sensitivity of HRCT for Covid-19 infection was 98% compared to RT-PCR sensitivity of 71% ( $p < 0.001$ ) [30]. In the cases with high suspicion after HRCT and RT-PCR test should be considered before surgery if the condition is not life threatening. However, negative RT-PCR does not exclude the possibility of Covid-19 [30]. Some authors have recommended repeating of RT-PCR test to minimize the errors [31]. In our study as we learnt this quickly, we started doing HRCT for patients being admitted for the surgery. Whatever the result of RT-PCR, patient with high clinical suspicion of Covid-19 should be considered as a positive case and necessary precautions should be taken during the hospital stay and surgery. For all the patients who are clinically suspected or not, whether they are tested positive or not, precautions must be taken to minimize the risk of cross infection to the healthcare workers. We have followed these principles and treated all patients with precautionary measures.

OR is an area that is considered as a source of cross infection if precautionary measures are not taken. The number of OT staffs should be minimized. The number of assistant surgeons should be limited to as less as possible. Similar strategies can be applied from anesthesia and nursing side. All of this will collectively help in managing the problem of overcrowding in OR during surgery. The instruments like power drill, burr, pulsatile lavage and electric cautery should be minimized to decrease the possibility of cross-transmission of infection containing aerosol generation [32, 33]. Another additional thing to remember that all precautionary measures would definitely increase the cost for surgery especially if patient has to pay without insurance. We have calculated this part as well in our case series and we found that it had increased the cost by  $5.4 \pm 2.4\%$  (range, 2.1%-10.1%) regarding the Covid-19 measures. Patient who stayed for longer duration had over all less increase in bill when compared to final bill. However, we agree that the cost might go up if patient is Covid-19 positive. Meyer et al. also recommended in their patients for spine surgery in France to admit the patients in single room instead of sharing room as a precaution [34]. Additionally we kept all patients in single room instead of sharing room that may further increase the cost to some extent for the less-affording patients who wanted to stay in sharing room. We similarly believe our preliminary experience helped us explaining our patients about the hospital bill. Additionally admission time (average, 179.4 minutes) for the patients requiring surgeries has gone up due to investigations pertaining to Covid-19 infection. However, it is still justified regarding the safety issue of patients and healthcare workers by inhibiting cross-infection.

Despite of taking all actions such as social distancing, nation-wide lockdown, closure of all shops except essential services, closure of schools and colleges, tracking and testing all suspects along with their contacts and strict quarantine measures, numbers of Covid-19 cases are slowly increasing [35]. It is difficult to predict about its reversal pattern. Therefore question how long a patient requiring non-urgent but essential surgery will wait that may affect the quality of life raised by Meyer et al. their observational study in France [34]. They pointed out that surgeries must be evaluated according to need of a patient in

three categories urgent, semi-urgent and non-urgent. They emphasized that surgeries must be conducted after discussing with patients and their family members. We agree that the study population in our study was small; however, it included patients from only one specialty to understand. Further study with larger group is recommended to accept it better. We believe our study and its outcome have presented a guideline and recommendation while conducting such surgeries in a hospital with multidisciplinary approach. This might make a new-normal norm of working and performing our professional duties with Covid-19 pandemic and providing services to the society.

## Declarations

**Declaration Statement:** All authors declare that none of the authors or their family members have received funding or support for this work from any industry or organization.

Manuscript was checked by the hospital authority and they have told that approval from Ethics Committee was not required as it is a retrospective study. However, there is 'No Objection' from the hospital authority was taken to submit this manuscript. Therefore need for consent was waived by the approving ethics committee.

**Competing interests:** The authors declare no competing interests.

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## Tables

Due to technical limitations, Tables 1 and 2 are only available as a download in the supplemental files section

## Figures

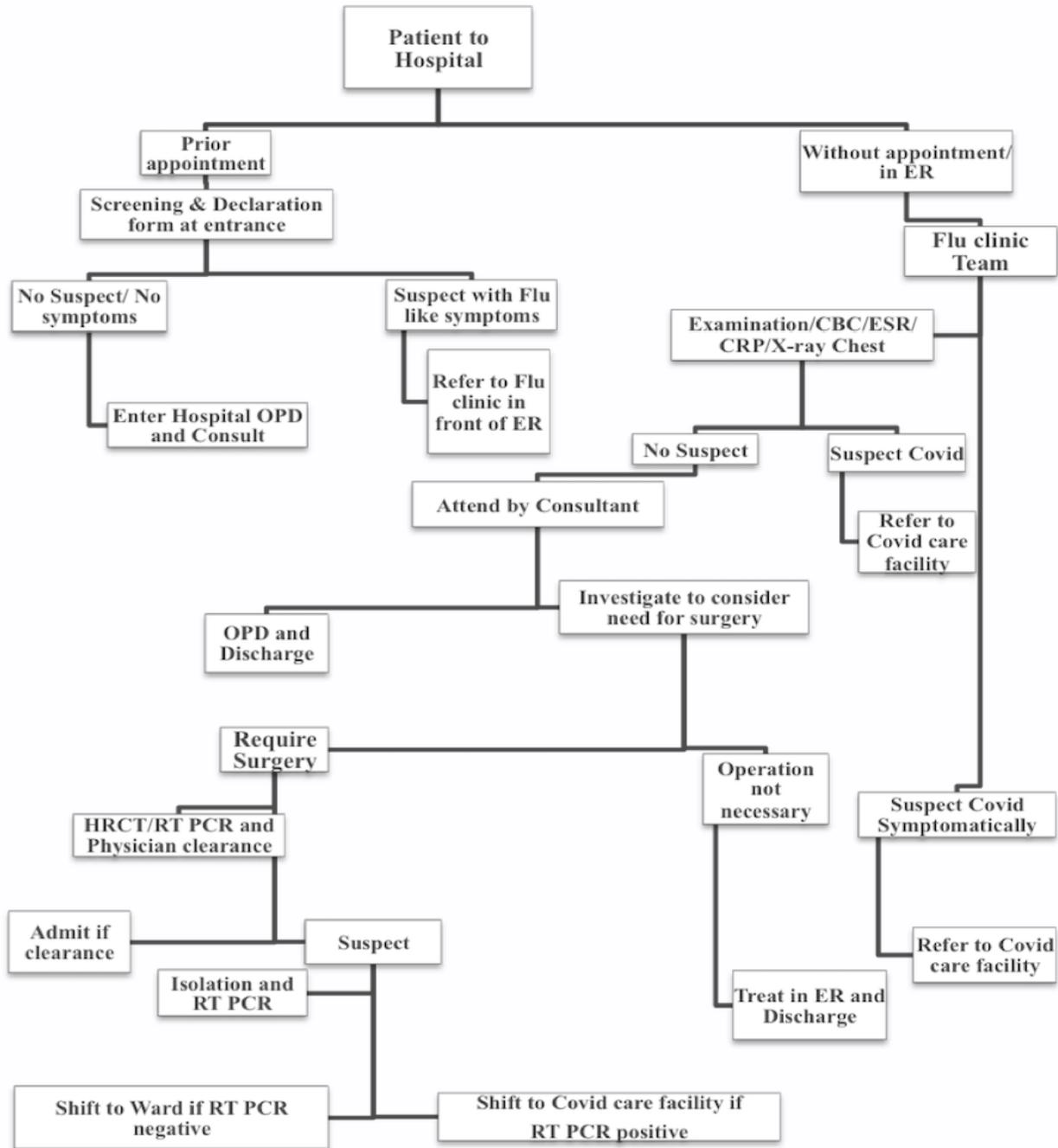


Figure 1

explains flow chart protocol by the institution for patient's entry in the hospital to the admission process.



**Figure 2**

shows anesthesiologist preparation before the induction of patient during Covid-19 pandemic for each case.

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Figure 3

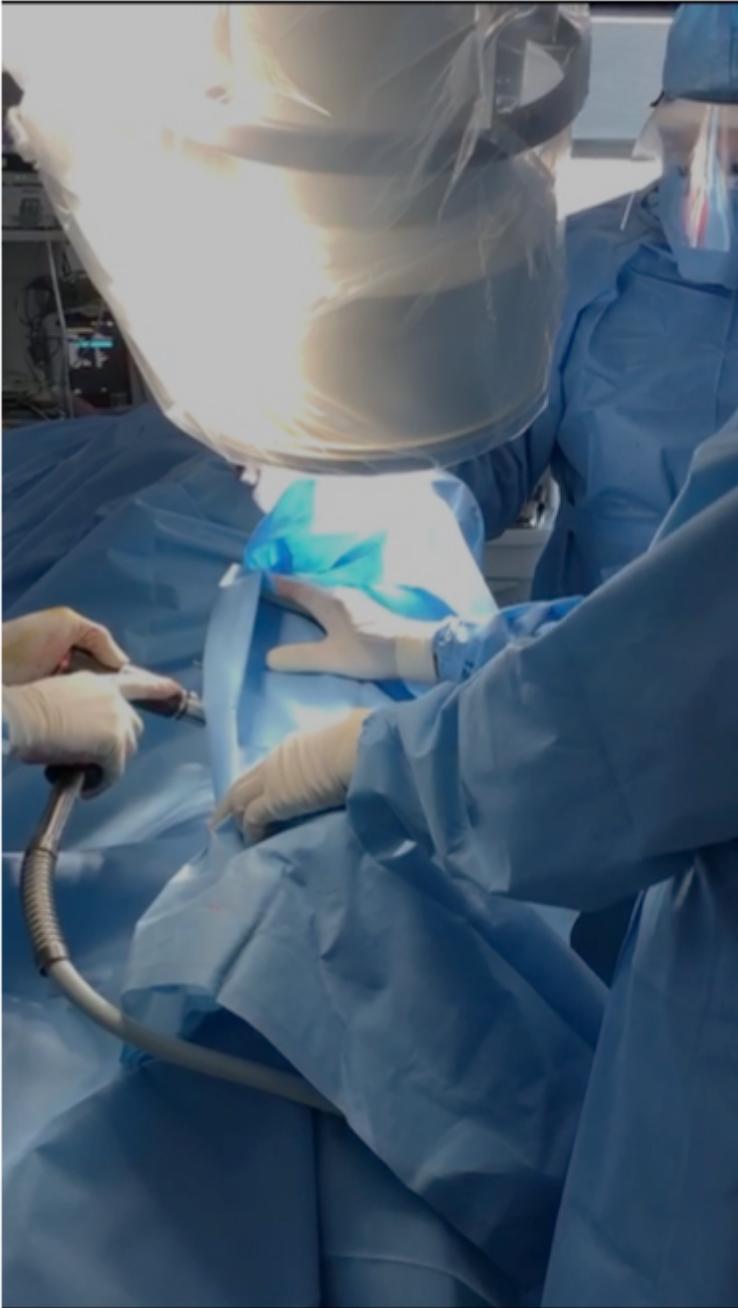


Figure 4

shows how to protect aerosol transmission from the bone while using drilling instrument or high-speed burr.

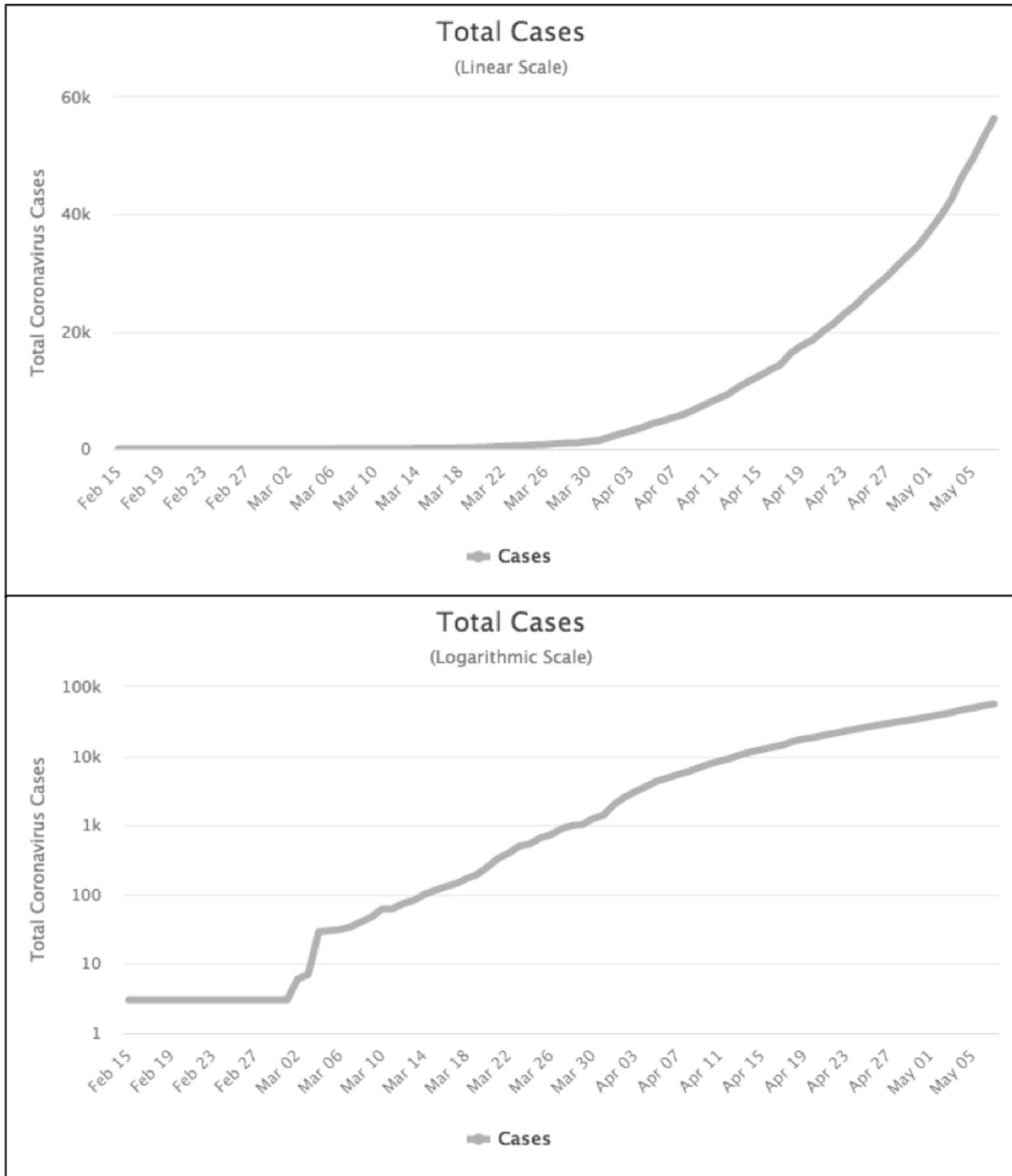


Figure 5

shows demographics of Covid-19 confirmed cases in India till May 7, 2020.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [ExcelSpreadsheetdata.xlsx](#)