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Review Article

Surgical management during three phases of covid-19 pandemic with changing role of thoracic computerized tomography imaging in orthopaedic patient management: Lessons learned by orthopaedic surgeon

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ABSTRACT

The coronavirus (Covid-19) pandemic has ravaged the whole world. It had affected the allied surgical branches that had to reinvent the protocols for patient management. Trauma being inevitable, needed urgent attention. The changing perspectives had a defining role in the direction of arthroplasty too.
The pandemic has been considered into three different phases: 1. The acute phase of the lockdown; 2. The intermediate phase of surgical prioritization; 3. The late phase of surgical management post-vaccination.
We deliberate on the impact of the pandemic on orthopaedic surgery and the role of Thoracic computerized tomography (Th-CT) imaging during Covid-19 on the surgical practice of orthopaedic surgeons.
Th-CT had been useful imaging during the acute phase of lockdown in the pandemic to identify the asymptomatic Covid-19 infection and to gauge the severity of viral infection. We reviewed the guidelines formulated during each step and identified the lessons learned by the practicing orthopaedic surgeon. We further elaborate on the changes in the usage of Th-CT in the subsequent intermediate and late phases of the pandemic for orthopaedic surgeons.
The critical consideration remained to achieve an uneventful recovery during the orthopaedic surgical management, to avoid the transmissibility of infection to the surgeon, and to protect the patient from the high morbidity and mortality of Covid-19 related illness. The Covid-19 pandemic has instigated orthopaedists to develop a holistic approach to deal with the new challenges during this pandemic era.

1. Introduction

Wuhan city in China has been embedded in history as the initiation site for the modern-era pandemic.[1] The SARS-COV2 infection transcended the world to epic proportions with alarming reactions.[2] The pandemic was initiated after a world health organisation (WHO) notification.[1] They further identified that the Covid-19 virus infection was highly contagious. Covid-19 was considered lethal as it caused severe respiratory distress syndrome with eventual high mortality.[3–6] In general, the measures to protect humanity and the population triggered unprecedented policy changes.[7,8] The survival of humankind has been given a new meaning and new dimensions.

The emergence of the Covid-19 pandemic raised concerns amongst orthopaedic surgeons regarding their professional and social responsibilities.[9] The surgeons were in the dark during the acute phase of the pandemic.[2] They needed to be made aware of how to respond to the needs of their specialty during this phase of lockdown. The orthopaedic surgeon, in general, were ill-prepared to deal with the developing scenario of the pandemic.[10–12] The viral video meme clip on various social media platforms featuring Hitler rebuking his comrades regarding their inaptness and

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incompetence in dealing with Covid-19 related illnesses had been widely circulated. Though a piece of black humour, it aptly suggested the general impression of the orthopaedic surgeon about his competence in judging the Covid-19 pandemic responsibilities and the changing perspective.[13] The situation was alien to almost all orthopaedic surgeons of varied ages, presenting a unique problem with multiple challenges.[14] The consensus was to integrate the services of orthopaedic surgeons with the physician as a team member for support and crisis management.[15]

The surgical management of orthopaedic affections, that is, trauma, arthroplasty, or spinal disorders, took a hard hit during the pandemic.[15–18] We identified and categorized the pandemic era into the three phases of Covid-19. We elaborate on the guidelines during each step with an assessment of the utility of Th-CT for an orthopaedic surgeon. We discuss the lessons learned and implore the present need for Th-CT for the surgical management of orthopaedic trauma and arthroplasty.

2. Materials and Methods

The search for the articles was made in August 2022 in PubMed for articles from April 2020 to July 2022. All the articles with the keywords "thoracic CT," "computerized tomography," "imaging," "orthopedic procedure," "orthopedics," "orthopaedics," "orthopaedic surgeon," "Covid 19," "Covid-19," "Corona," "Coronavirus," "Covid-19 vaccine," were identified. All possible combinations were taken into consideration, and the articles were retrieved. A scoping review was done for the articles identified initially based on abstract. The exclusion of articles was based on non-English text articles, articles based on other surgical specialties, and case studies. The manual search from September to mid December 2022 was done to include articles relevant to Covid-19 vaccination and its effect on orthopaedic practice. The narrative review was done for academic interest of medical professionals especially orthopaedic surgeons. The narrative review aimed to include relevant articles to identify the changing paradigm of surgical management for orthopaedic surgeons.

2.1. Categorization of pandemic phases

2.1.1. Acute phase of the lockdown

The phase of the pandemic when in India, the national government identified the pandemic and imposed a lockdown. The period from April 2020 to September 2020 was a strict lockdown policy.

2.1.2. Intermediate phase of surgical prioritization

The phase of the pandemic when the relaxation of lockdown allowed the patient and surgeons to adapt to the new normal of adaptive protocols.[16,19] This phase also saw the vaccination initiation for the healthcare workers. The period from October 2020 to June 2021 was the waxing, and waning phases of the pandemic, with significant affection of the population inflicted during the second wave of Covid-19.

2.1.3. Late phase of post-vaccination surgical management

The phase of the pandemic when the government of India had expanded the vaccination program to include elderlies and persons with associated medical comorbidities along with health care workers. The patients of varied age groups who had either been vaccinated or had recovered from Covid-19 infection presented with an orthopaedic concern for surgical management. The period from July 2021 to June 2022 was considered for this phase.

2.2. Surgical management of Orthopaedic cases and the role of Th-CT imaging

2.2.1. Acute phase of the lockdown

The different strategies devised and developed to allow the orthopaedic surgeon to manage trauma or arthroplasty patients presented a new chapter in the life of the orthopaedic surgeon.[10] The uniqueness of the situation was that people needed to figure out what strategy to follow and what plan to fall back on in this acute phase.[12,18]

2.2.1.1. Apprehensions of surgeons. How to protect the orthopaedic surgeon and the paramedical personnel from ensuring their safety while managing the Covid-19 pandemic?.[10] There was a phase during Covid-19 when trauma with suspected patients of Covid-19 came to emergency and posed a management dilemma for the surgeon.[20] It was also essential to address patient safety in this period of crisis.[11,21] The opinion from across the world was that since we are fighting a war-like situation with an unknown enemy, we need to protect the population from contacting the infection and protect our Covid-19 warrior healthcare professionals from the ongoing disease.[9,22,23] Successive cases occurred during Covid-19 with a serial interval close to the median incubation period of approximately five days.[24] This made the pandemic situation unpredictable, reduced the daily practice of surgeons, and posed various dilemmas in surgical management.[12]

The patient was required to undergo a thorough preliminary check of medical records and history to ascertain any contact with a Covid-19-infected or exposed patient or any symptoms suggested for Covid-19, including cough, fever, breathlessness, or signs of hypoxia or investigations indicating leucopoenia, high marker levels.[16,25] Here the management was guided by the hospital policies, and patients were kept in isolation till their Covid-19 infectivity status was confirmed.[20] Universal testing of the patient with reverse transcriptase test (RT-

PCR) test or rapid antigen testing before a prescribed procedure was followed.[26,27] A Th-CT was also undertaken to evaluate a suspect patient with a negative Covid-19 report to exclude the infection possibility and to know the stratification of risk involved in any surgery.[17,28] Once the Covid-19 status was confirmed, then one planned for the procedure. When the patient was diagnosed or reported to be Covid-19 negative, then shifting to a desired non-Covid-19 standard hospital bed was done. If Covid-19 is positive, one needs to take the desired precautions and use PPE, PAPR, gowns, and disposables with the need for protocols to protect the associated healthcare workers.[2,27]

The varied unexplained scenarios possibly presented and posed apprehensions for surgeons in the management during this acute phase of the pandemic.[10,29] Can one operate on a Covid-19 patient for an emergency or elective surgery, and what may be the rationale for using thoracic CT? How to interpret the CT findings in the context of elective surgery? It may be a healed or active lesion, and one needs to know if any transmissibility was present and if any extra precautions were suggested.[26]

The trauma management being obligatory, the required safety guidelines were formulated in the immediate lockdown period with direct implications.[2] The surgeons had to initially take an individual call regarding the surgical management in an emergency based on the presentation with little knowledge or understanding of the consequences, and subsequent survey realized the enormity of course correction.[30] If the emergency orthopaedic case was required, does a CT scan permit a better evaluation of Covid-19 status or not? If an elective issue was being planned, does CT help to know if there are any additional complications for the surgeon or the patient?.[31] If healed Covid-19 patient is presented, then what findings on the CT scan should one look for? There were apprehensions about the conduction of major tumour surgery, total joint replacement, and spine surgery with the need for general anaesthesia and aerosol-generating procedures.[32] Negative pressure rooms and strict sanitization after each patient were recommended,[14] Teleconferencing or teleconsultation was accepted as a standard and legal way of patient assessment and followed up advise.[9,10,25]

2.2.1.2. Risks in management . The evaluation of risk factors for rescheduling the elective cases and risk of doing surgery in an emergency, along with the risk of contracting a Covid-19 infection in trying times of the pandemic, was weighed when dealing with a patient.[33] The risk and benefit ratio needed to be monitored.

And the routine protocol was to test for additional Covid-19 tests before admission. The hospital policies said that a patient needing admission must undergo a preadmission test to confirm Covid-19 infection status. This entailed rapid antigen testing or an RT-PCR test.[34,35] The test remained valid for 72 hours, and the patient was instructed to avoid further contact and stay in isolation until admitted to prevent contracting the infection in the incubation period. The RT-PCR test was more reliable than a rapid antigen test.[36] However, there was a need for evaluation by Th-CT for any further confirmation of the asymptomatic patients.[17]

If a patient was received in an emergency and there were pulmonary symptoms or symptoms of fever, cough, breathlessness, history of travel, or contact with a Covid-19 infected patient, then the patient was managed with Covid-19 guidelines even if not confirmed.[27,34] The suspect patient was handled in a ward dedicated to suspect patients, and the tests were repeated as per protocols.[21] Emergency surgery was done with full precautions and in a Covid-19 dedicated operation theatre.[10] The specific guidelines for using PPE, protection of health care workers, and the need for general or regional anaesthesia were taken care of accordingly.[19] Reorganization of the infrastructure and operating room protocol was done to facilitate and treat the suspected and confirmed Covid-19 patients with streamlined pathways for surgery and training of the health care professionals.[20]

The risk-benefit ratio needed to be addressed by the surgeon.[35] There were high apprehension rates among patients and their relatives who came to the hospital because of the unpredictable rise in the Covid-19 pandemic cases.[37] There was a solid need to allay their fears. Thus, the judgment was based on the need for surgical correction, and the type of surgery required.[14] A trauma case that needed stabilization and could not be managed with conservative methods was planned for the procedure according to the local government guidelines or hospital-based Covid-19 protocols.[17] Though, there was an expected delay in initiating the final treatment.

2.2.1.3. Line of management. Guidelines were given for the reallocation of the hospital resources and to avoid the burdening of the hospital medical personnel during the phase of lockdown and restrictions.[29] Respective national orthopaedic associations formulated guidelines for surgical orthopaedic trauma and arthroplasty cases[8]. The surgeons were advised to postpone non-emergency cases and suggested to operate on emergency cases and day care procedures with established protection kits and negative Covid-19 RT-PCR report.[22,38] A person with co-morbidities was considered a very high-risk candidate for Covid-19 infection susceptibility, and any planned surgical management was linked and associated with high mortality.[39–41] The cessation of medical activities, mainly surgical-oriented procedures, increased the wait list for the elected practices.[2]

The procedure planned was more in line with avoiding aerosol-generating procedures since the transmissibility of Covid-19 from person to person was being linked to droplets or aerosols.[34,42,43] In orthopaedic surgery, generally, one uses high-speed drills and electrocautery. Hence initial guidelines suggested the avoidance or contraindication

of procedures that generated aerosol during orthopaedic surgery, and those procedures were either abandoned or utilized a different approach to manage the patient.[14,22,37] This was to reduce the risk of infection to healthcare workers and paramedical staff working in the operation theatres.[11]

There was a changing profile of fracture patients initially. During the lockdown, outdoor activity and vehicular movement restrictions were markedly reduced.[31] Hence, the mode of injury changed from high-energy trauma to low-energy trauma.[2,44,45] Often low energy trauma occurs due to falls and involves the elderly with pre-existing osteoporosis.[10,40] The elderly, compromised with medical comorbidity, became a high-risk patient. If they required surgery for fracture management, it overburdened the reallocated resources and compromised the fragile infrastructure further.[34,41,44] This also led to a surgeon's dilemma as an orthopaedic surgeon to decide the best line of management.[10] This required a modified guideline from national associations for their help initially. The surgery, which was short, quick, and less time consuming, was preferred, and there were guidelines given for the same by respective associations.[37] There was reorganization and reorientation of resources in the trauma departments for the management of severely injured trauma cases.[31]

2.2.1.4. Initial role of Th-CT. RT-PCR was considered a standard gold test for confirming Covid-19 during this initial phase of the pandemic[46]. However, it had certain limitations, namely, it being time-consuming. Therefore, there was a delay in isolation and recognition of the Covid-19 positive cases, and secondly, the specificity was high, but sensitivity was low[46]. Some patients reported when the person presented in an incubation period and the initial RT-PCR test was negative[24,44,46] They needed Th-CT evaluation to identify the tell-tale signs of Covid-19 infection being a candidate for elective surgery[35,36]

The chest radiography was performed as an initial investigation[42]. The invariable presentations of specific standard chest radiographic abnormalities if Covid-19 infection affected the lungs were identified. The findings include bilateral opacities, multiple ground glass shadows, infiltration and consolidation in the lungs, and thickening of the pulmonary texture.[23] However, direct chest radiographs may be normal in the early or mild disease.[33]

Due to the wide availability and brief examination time for a Th-CT, the supplemental role of chest CT to RT-PCR grew for the early detection of patients with Covid-19 pneumonia in the acute phase.[40] The guidelines by the Fleischner Society gave directions for conducting the imaging in various scenarios of Covid-19 affections.[47] Th-CT imaging, the overall specificity, and sensitivity were mainly depending on the incidence of disease and ranged between 61 and 97%, with a reported false-negative rate of up to 20% in symptomatic patients.[21,32,48–51] The most frequent Th-CT abnormalities reported were ground-glass opacities, septal thickening, and parenchymal consolidation.[23,46,51,52] CT abnormalities were more likely to be bilateral, had a peripheral distribution, and involved the lower lobes with a slight right lower lobe predilection.[51,53–56] The intensification of a crazy-paving pattern, an increase in the number of involved lobes, and the appearance of consolidative opacities occurred in most patients over time.[57]

The Th-CT findings were generally based on the time of illness with an early stage identified between days 0 to 4 with subpleural unilateral or bilateral ground glass opacities, the progressive stage between days 5 to 8 with diffuse/multilobe distribution of opacities, crazy-paving pattern of opacities with superimposed inter- and intralobular septal thickening accompanied by consolidations without mediastinal lymphadenopathy, and peak stage between days nine to 13 with worsening opacity diffusion and crazy-paving with residual

parenchymal bands associated with ARDS.[52,58,59] On average, CT findings were most prominent on day 10 of the disease. After day 14, the absorption stage with improvement in imaging findings was reported in 75% of the patients, including decreased number of involved lobes and resolution of crazy paving pattern and consolidative opacities.[52,60] The differential diagnosis included atypical viral pneumonia as H1N1 influenza, cytomegalovirus pneumonia etc.[53] Th-CT had been advised to evaluate a postoperative pulmonary complication too.[61]

The need was justified as the susceptibility and potential for the spread of infection when dealing with an emergency presentation of an asymptomatic carrier for an orthopaedic patient had been quite worrisome.[37,40] However, the dilemmas faced in the radiology department included constrained resources, the need for equipment decontamination, the lining up of CTs for sequential scans for the suspected patient, and the protection of personnel involved.[57] Th-CT has been identified as a primary imaging method that can identify the patient-specific susceptibility and grade the infection's severity.[36,46] It allowed the surgeons to devise strategies for a safe environment for potential surgical patients and surgeons. The resolution and follow-up of Covid-19 infection can also be gauged with a repeat Th-CT[34]. However, the Th-CT findings were advised for clinical correlation as the results may be non-specific and may be reported normal in an asymptomatic and early Covid-19 affection.[51] The orthopaedic surgeon had to learn and know about the peculiarities of Covid-19 related Th-CT findings for managing their trauma patients.

2.2.2. Intermediate phase of surgical prioritization

The different strategies devised and developed allowed the orthopaedic surgeon to manage the trauma or arthroplasty patients based on risk-benefit analysis.[62] The geographical

location and evolving Covid-19 infection guided the strategy to follow and adopt in this intermediate phase.[62–64]

2.2.2.1. Challenges for surgical prioritization of orthopaedic cases. The acute phase had reached a standstill, and finding ways to make life sustainable had been difficult.[65] The Covid-19 infection had created havoc and panic of indeterminate magnitude, with little respite from initial lockdowns and restricted travel advisories. The elderly with comorbidities had suffered the most, and the challenges in managing arthritis and osteoporosis increased with the subsequent unlock of the Covid-19 situation. The elective surgeries had been postponed with prolongation of the wait time for surgical intervention.[66] The ongoing viral spread posed challenges in return to elective surgery due to its asymptomatic spread and long incubation period of the Covid-19 illness.[53] Hence, the need was greater to understand the magnitude of the problem and keep things within the safety net for the surgeons and the patients alike. The innovative strategies took leaps and bound in the surgical management of orthopaedic cases during the Covid-19 pandemic.[66] The reorganization of the resources and personnel involved in surgical management became the gateway for other protocols.[67] The call of the hour was to adjust, co-exist and plan surgeries with Covid-19 protocols.[68] The orthopaedic trauma injuries needed careful risk-benefit analysis and identification of systemic inflammation before proceeding with a planned procedure.[69]

2.2.2.2. Line of management. Lockdown had been eased, and activities had been allowed. With the resumption of travel activities, the trauma profile changed.[40] Road traffic accidents and high-energy trauma saw a surge. The other profile of injuries or trauma that were either neglected or overlooked during the initial pandemic started to come to the outpatient department. This included primarily soft tissue injuries, back injuries, and injuries that went undiagnosed. They had been managed either by self-support and self-medication or had received teleconsultation to avoid any physical contact during the pandemic initially. The persistence of discomfort, maybe deformity and restriction of movements along a joint, brought them to the departments for a check-up and diagnosis.

This phase was initiated with rapidly evolving parameters for the management protocols to effectively deliver standard protocols for various surgical procedures.[62,70] A rapid antigen test, RT-PCR test, or a Th-CT was investigations conducted within 72 hours before surgery or after admission, as close to the planned procedure as possible, to identify the positive cases.[63,64,66,71] In cases undergoing hip arthroplasty for elective and urgent issues, researchers found no high risk of contracting the Covid-19 virus during the peri-surgery period.[72]

The pre-vaccination or post-early and acute Covid-19 era was the phase where orthopaedic surgeons needed to maintain a high vigil. They were advised not to let their guard down to avoid contracting any untoward Covid-19 infection.[66] Since new mutant virus strains were being identified. Recent lockdowns being implemented and new clinical manifestations being reported posed additional challenges. There was a heightened fear amongst the healthcare personnel and the general population about the efficacy of the possible vaccination and the eventual protection by the generated antibodies from the vaccination or the post Covid-19 infection.[73]

Designated separate areas planned the mitigation of risk factors for Covid-19 and non-Covid-19 patients across healthcare facilities.[67,74] The contamination risk would be lessened with education, awareness, and protocol establishment for health care personnel along with administrative and infrastructural up-dation.[64,67] The surgical listing was based on urgent, elective, and day-care procedures.[16] The way ahead was by assessing the available hospital resources, preoperative anaesthetist evaluation for patient fitness, and sensitivity of technique planned as judged by the surgeon in their capacity.[73,74] Preferential day-care procedures were allowed.[43] The surgeons were advised to spacing by sequential rather than concomitant surgeries.[66] The indoor facilities were encouraged for early discharge, reducing exposure and limiting the utilization of hospital resources. The healthcare workers needed to be cared for and protected from infection with early detection and management initiatives at the earliest[21,64]

There were studies to evaluate, assess and guide the outcomes of surgically managed cases affected by Covid-19 infection.[45,70] The orthopaedic surgeries in this phase presented reports of increased mortality and ICU admission even with a higher threshold for surgery than in non-Covid-19 operated patients.[66,70] The hypercoagulability and hyperinflammatory responses during the Covid-19 pandemic contributed to poor outcomes.[69] The review studies, including those from China, suggested poor results of occult Covid-19 positive patients undergoing surgery; 44% of patients required admission to the intensive care unit (ICU), and 25% died.[75] The surgeons needed to do a risk calculation for the patient and provider. The transmissibility in asymptomatic patients was likely low except with AGPs or prolonged exposure to Covid-19 positive patients. The surgeons accepted to operate as first-line patients on those who were asymptomatic 24-48 hours before admission, had a negative RT-PCR test report, and were kept in isolation for surgery after that.[69] The surgeons adopted PPE and CDC guidelines for the operation room safety guidelines and postoperatively advised symptoms check for a minimum of 7-10 days for an occult Covid-19 infection. The pragmatic advice was to avoid surgery for at least a month for the post-Covid-19 patient and only after two negative RT-PCR tests

had been recorded.[62] The use of chest imaging to rule out infection was case-based.[45,75]

The risk stratification was done for a case to consider for surgical management.[16,76] The pulmonary complications may compromise the outcomes of surgical management of Covid-19 patients.[45] However, the patients with low anaesthesia risk grading reported having similar clinical outcomes as the nonsurgical Covid-19 group.[76] The trial-and-error method for allocating hospital beds and allotting surgical time was streamlined based on the changes in the hospital protocols.

2.2.2.3. Revised role of Th-CT. The guidelines were reset to allow phased surgical management.[75] The RT-PCR was done to identify the infectivity and a normal chest radiograph dictated the need for a further Th-CT evaluation.[16] The chest radiograph had its limitation of poor delineation of interstitial lung affection for Covid-19 infection.[77] The meta-analysis on Th-CT imaging in Covid-19 identified that the disease severity, comorbidities, and the proportion of asymptomatic patients affect the diagnostic sensitivity of CT.[50] The Th-CT was not beneficial in a low prevalence region of Covid-19 for the primary screening or diagnosis because of false-positive findings at a substantial rate.[50] The Th-CT presented with pulmonary fibrosis, air bronchogram, and pulmonary dilatation in severe Covid-19 affection in the subsequent CT evaluation on recovery.[58,77] The surgeons had to learn to prioritize the Th-CT for evaluation. Th-CT was planned to identify any asymptomatic patients of Covid-19 before a surgical procedure.[66,67] The emergency procedures required Covid-19 protocol precautions for management, and if elective, it was deferred until infection resolution occurred. They also identified the day-care procedures and procedures with short hospital stays and expanded the domain of surgical management to all aspects with recommended safety guidelines.[16] The waiting period and the posting of surgical cases was a significant challenge.[65,67] The identification of extensive fibrosis necessitated a physiotherapeutic intervention for optimization and pulmonary rehabilitation in perioperative conditions.[58]

The need for introspection was immense as the second wave hit the world hard. A changing mutant variant posed additional challenges in this intermediate phase of prioritization of surgical interventions during the pandemic.[73]

2.2.3. Late phase of post-vaccination surgical management

Evolving Covid-19 pandemic had a new phase that started with vaccine development and availability. The vaccination was initiated in January 2021, with governments providing a framework to initially include the population at risk for the first dose.[78,79] The phase presented additionally with Covid-19 recovered patients for orthopaedic surgical management with many concerns. What should be the guidelines for them? What may be the time frame to resume the surgery for them? What are the precautions one needs to take in their management? It was observed that there was marked heterogenicity in the clinical presentation for Covid-19 related illnesses in orthopaedic patients making it difficult to follow a fixed standard protocol.[68]

2.2.3.1. Vaccine development, acceptance, and hesitancy for Covid-19. Historically any development of vaccination had always been a long-drawn process. The introduction of a vaccine in this later phase of the pandemic was unexpected early, fast-tracked, and unheralded in the history of vaccine development.[80] The vaccination trials confirmed that vaccines provided a protective shield to reduce the infection's severity and intensity.[81] The vaccination worldwide was granted an emergency use authorization by authorities[82]. The healthcare workers and geriatric population, especially the elderly affected with comorbidities and physical illnesses, were primary recipients of the vaccine dosages.[82]

The vaccine acceptance was low initially, and its safety or adverse side effects were issues even with healthcare workers and the population in general due to vaccine breakthrough infections.[79] However, the educated class and orthopaedic surgeons in particular, had high acceptance.[82] Vaccine hesitancy was encountered when vaccination trials were in the early development phase, and gradually, it facilitated the inpatient flow for surgical management.[80,83]

2.2.3.2. Line of management. The wait-listed patients had significant physical and mental alterations from their pre-pandemic duration[68]. This impacted the outcomes of surgery with a heightened possibility of infection post-surgery due to lower immunity and delayed progression of recovery due to lower physical and mental strength. The task forces needed to be formed to take care of the surgical needs of the community with an emphasis on composing the protocols for the sub-specialty practice.[68]

The surgeons performed elective and emergency surgeries with a better understanding with thorough preparation, continuous monitoring of virulence for predominant variant, and maintaining Covid-19 appropriate safety guidelines.[81] The hospital's infection control policies allowed surgical management resumption.[83] The isolated pathways in hospitals needed to be established to manage Covid-19 patients.[84] Risk stratification was a standard tool for deciding the management.[85]

The type, date, and dosage schedule of vaccination had a bearing on the decision-making for the planned surgical intervention.[81,86] The fragility fractures of the hip accounted for the majority of trauma patients susceptible to Covid-19 poor outcomes with higher mortality. The rates of Covid-19 positivity in the patient after arthroplasty were similar to the general population,

even without vaccination.[85] And even after vaccination, the operated surgical patients needed reasonable perioperative precautions to achieve favourable outcomes and avoid Covid-19 infectivity.[86]

2.2.3.3. Insignificant role of Th-CT . The phase allowed the surgeons more liberty to undertake surgical management with more enthusiasm, in bulk, and with more freedom. The studies and close observation confirm that Th-CT findings are less severe in the vaccinated group than non or partially-vaccinated group.[77,78,87] Th-CT was, however, imaging for the assessment of the suspect patient for surgical management as the positivity rates had decreased with more common occurrences of asymptomatic affections.[53] The Th-CT imaging was done for routine polytrauma assessment and another region of CT imaging for trauma evaluation, especially for intraarticular fractures. The indications for the Th-CT assessment of surgical patients have become very limited. Though its role in assessing lung pathology, residual or sequelae of Covid-19 affection, and providing negative correlates for a safe surgical pathway stands its importance.[87]

3. Conclusions

As time went by and the pandemic progressed, our eyes got used to the darkness that surrounded us in the acute phase of lockdown, the research illuminated our path during the intermediate phase of surgical prioritization, and the uncertainties about this invisible enemy diminished in the late phase of post-vaccination surgical management.

The critical consideration remained to achieve an uneventful recovery during the orthopaedic surgical management, to avoid the transmissibility of infection to the surgeon, and to protect the patient from the high morbidity and mortality of Covid-19 related illness. The Covid-19 pandemic essentially taught orthopaedists to go beyond the perspective of managing bone and joint disorders alone and have a utilitarian holistic approach to disease.

Covid-19 had developed rapidly, and even more quickly, there were changing dynamics of the pandemic. Maintaining a lifestyle that ensured the safety of surgeons and patients was paramount and remains so even today. The orthopaedic surgeon should strive to fulfil and overcome the challenges to maintain the common desired orthopaedic motto of “Life is Movement and Movement is Life” even during this pandemic era.

This is a narrative review study done solely for academic interest of medical professionals especially orthopaedic surgeons.

4. Abbreviations

Th-CT: Thoracic Computerized Tomography, WHO: World Health Organization, RT-PCR: Reverse Transcriptase Test, AGP: Aerosol Generating Procedures, PPE: Personal Protection Equipment, PAPR: Powered Air Purifying Respirators, ARDS: Acute Respiratory Distress Syndrome, CDC: Centre for Disease Control and Prevention. ICU: Intensive Care Unit.

5. Authors Contribution and Declaration

GG contributed to the study conception and design.

GG performed the literature search and prepared the original draft of the manuscript and reviewed the subsequent version with editing of the manuscript.

LT and PD did review analysis.

All the authors commented on the previous versions of manuscript.

All authors read and approved the final version of manuscript.

6. Ethics Approval

Not applied for as the study was a narrative review with no personal data being presented or disclosed.

7. Consent for Publication

The data presented has no disclosure to identify with any human involvement in the study.

8. Conflict of Interest

None.

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