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REVIEW

COVID-19 Era - Adapting treatment and education in the Orthopedics and Traumatology Department - review

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Abstract

Coronavirus disease (COVID-19) is a pandemic-level health disaster with more than 220 million verified cases and more than 4.6 million confirmed fatalities globally as of September 2021. Since its initial detection in 2019, the virus has spread rapidly around the world. In many parts of the world, the present status of health systems has resulted in a decline in elective procedures.

Physician shortages have been clearly reported in nations that have previously been infected with the virus. Experienced and young physicians were similarly recruited to work on the front lines in medical wards and intensive care units outside of their specializations. As a result, hospitals have made significant modifications to their care systems, such as updating general wards to include ICU capabilities, postponing, and canceling elective procedures, and rethinking the duties of healthcare personnel.

Residents and fellows in training in orthopedic surgery have not been immune to these developments. As a result of many hospitals discontinuing elective procedures, orthopedic case volume has decreased significantly. Numerous educational activities must be implemented to provide workers with the knowledge and skills essential to protect themselves and their families from infection and to care for COVID-19 patients.

Keywords: Covid-19, shortages, infrastructure, education

Introduction

On November 17, 2019, the SARS-CoV-2 (COVID-19) virus surfaced in Wuhan, China. COVID-19, like MERS-CoV and SARS-CoV, has been connected to bats and many of the early patient cases have been related to seafood

and live animal markets [1]. On January 21, 2020, Washington state reported the first verified case of COVID-19 in the United States [2]. Coronavirus disease (COVID-19) is a pandemic-level health disaster. Since the virus's initial detection in 2019, the virus has spread rapidly around the world [1,3].

There were more than 220 million verified cases and more than 4.6 million confirmed fatalities globally as of September 2021 [3]. As a result, global health services have been changed to address difficulties brought about by the epidemic. The problem is intricate. The lack of hospital beds as a result of the establishment of special treatment departments, a scarcity of personal protective equipment (PPE), screening kits and a personnel shortfall were only a few of the challenges experienced. In many parts of the world, the status of health systems resulted in a decline in elective and semi-elective procedures. Urgent and emergency situations were addressed with appropriate safety precautions [4].

As the COVID-19 epidemic spread throughout Europe, officials began reorganizing hospital inpatient care to guarantee that the healthcare system could manage the predicted massive number of COVID-19 victims. While research into medical therapy for COVID-19 continued and the discovery of a vaccine changed the evolution of the pandemic, the demand on healthcare workers continued to grow in certain regions of the world. In spring 2020, the possibly overwhelming weight of diseases placed a strain on the capacity of the Danish health system and healthcare workers [5].

On March 1, 2020, New York City reported its first case of COVID-19, which was contracted by a 39-year-old woman who just returned from Iran. By April 23, this figure has risen to 142,432 confirmed cases and 10,977 fatalities in New York City alone due to COVID-19 [6]. These results are in comparison to the 849,094 cases and 47,684 fatalities reported for the whole United States on the same day [7]. The dense population of 8.34 million inhabitants in New York City, many of whom were immigrants with multigenerational homes, worked in "essential jobs", and relied on public transit for

transportation, made the viral containment a challenging task.

As a result, the broad use of prescribed personal protective equipment (PPE) in the management of all patients with respiratory symptoms was given precedence. In the orthopedic domain, Liang et al. emphasized three key principles for performing surgeries during a pandemic [8-10]: (1) determining the urgency of the surgery and the possibility of postponing it; (2) protecting professionals and patients' health through the provision of PPE and rapid testing; (3) being mindful of healthcare resource conservation. Hirschmann et al. [11] emphasized the significance of being aware of how aerosol-generating operations are handled, which was particularly important during orthopedic surgery. Additionally, it was suggested that interdisciplinarity is necessary for assuring the flow of high-quality information.

Physician shortages have been clearly reported in nations that have previously been infected with the virus. On January 31, 2020, COVID-19 landed in Italy. By March 30, 11,591 fatalities in the country had been traced to the COVID-19, with physicians accounting for 61 of these deaths [12]. Italy authorized 10,000 senior medical students to bypass their final exams and enter the profession early in the hardest-hit regions, citing a need for extra physicians. Experienced physicians were similarly recruited to work on the front lines in medical wards and intensive care units outside of their specializations [13,14].

Established in 1891, Jamaica Hospital Medical Center (JHMC) is a 408-bed nonprofit teaching hospital situated in Jamaica, Queens [15]. The hospital is a Level One Trauma Center designated by New York State for New York City. COVID-19 is a rapidly spreading epidemic, with forecasts of a tenfold increase in inpatient demand that may overwhelm general ward and intensive care unit (ICU) capacity [16]. Throughout the first wave of the

COVID-19 pandemic in the United States of America (March and April 2020), various organizations, including the American Academy of Orthopaedic Surgeons, issued guidance on deferring or canceling elective and non-urgent surgeries in order to conserve healthcare resources. However, because these recommendations delegated interpretation of "elective" and "non-urgent" orthopedic procedures to local healthcare delivery systems, it is uncertain how elective orthopedic surgeries and outcomes were influenced [2,7].

Although Italy was cited early in the epidemic as a model for the projected infection trends in New York State, New York State overtook Italy on April 7 with 138,836 cases to Italy's 135,586 cases. However, many of Italy's staffing shortages have been replicated in New York State. While attendings, residents, nurses, and other hospital workers cared for patients, they were infected and were forced to quarantine, resulting in a health care provider shortage [17,18].

As a result, hospitals have made significant modifications to their care systems, such as updating general wards to include ICU capabilities, postponing, and canceling elective procedures, and rethinking the duties of healthcare personnel. Residents and fellows in training in orthopaedic surgery have not been immune to these developments. As a result of many hospitals discontinuing elective procedures, orthopaedic case volume has decreased significantly [19,20].

Additionally, there has been a rising emphasis on the health of frontline caregivers, both residents and coworkers. As a result of these considerations, orthopaedic surgery departments have developed a list of administrative and organizational goals to guide their administrative and organizational actions during this period. While the pandemic poses several obstacles, preparedness and

planning will provide continuing learning and unique chances for students, residents and fellows growth and development [8,13].

COVID-19 is caused by the SARS-CoV-2 virus, a single-stranded RNA virus belonging to the b-coronavirus 2b family. Aerosols, droplets produced by sneezing or coughing, contribute to transmission. COVID-19 has a modest reproduction rate of about two; consequently, each carrier transmits the illness to two other individuals and can be transmitted by asymptomatic patients [21]. On average, symptoms begin five days after exposure, and the time from symptoms to death is between six and forty-one days, although this time is shorter in patients over the age of 70 and those with impaired immunity, diabetes, or cardiovascular disease [22]. Fever, tiredness, and cough are the most common symptoms, but they may also include lethargy, sore throat, headache, stomach discomfort, and diarrhea. Acute respiratory distress syndrome (ARDS) with characteristic ground glass opacities on chest X-ray, pneumonia, and acute heart damage are the most common complications that result in mortality [23-25]. Mortality rates vary from 4% to 5% [25]. Healthcare workers are at risk of contracting this infection. While some subspecialties such as otorhinolaryngology and anesthesia are more frequently exposed to upper airway secretions, orthopedic physicians are also at risk. Guo et al. discovered that up to 20% of orthopedic physicians in Wuhan were COVID-19 positive [26].

Recommendations for Safety

Denmark's social distancing measures and lockdowns were put in place after seeing the awful images of military vehicles bringing COVID-19 corpses to a cremation in Northern Italy. In order to prepare for COVID-19 testing, triaging, resuscitation, and treatment, Aarhus University Hospital halted all elective surgeries

and outpatient visits. A stepwise technique was employed [7,27] to equip inpatient departments to care for admitted COVID-19 patients in five newly formed COVID-19 clusters. As soon as the Department of Infectious Diseases formed the first COVID-19 cluster, patients with the virus were admitted while the rest of the hospital underwent a major reorganization. COVID-19 patients had to be accepted into the next cluster after 50% of the previous cluster's capacity was used up. Both the chief of nursing and an infectious disease or respiratory medicine physician led COVID-19 clusters.

Jamaica Hospital Medical Center was hindered in its response to COVID-19 by the infection of its own health care workers. For health care workers who had confirmed or suspected COVID-19 infection, the New York State Department of Health mandated that they stayed in isolation for seven days and be fever-free for at least 72 hours before returning to work. Health care workers who were asymptomatic but tested positive, had to be isolated for at least seven days. For at least 14 days following the onset of symptoms, these people were compelled to wear a facemask at work. Even if a hospital only lost one or two resident doctors to home quarantine because of these strict guidelines to limit the spread of COVID-19, it would have been a hardship for the department. The absence of more than 10 resident physicians would have been disastrous. In fact, on March 24, 17 of the 72 Internal Medicine residents at JHMC had been placed on home quarantine because of COVID-19. For this reason, hospitals began seeking for help in other departments to deal with the increasing number of COVID-19-infected patients [20,28].

Screening was essential. At the facility's entrance, the temperature of all patients had to be recorded. It was possible to reduce the risk of harmful exposure by asking about

common symptoms such as rhinorrhea and fever. Patients who were admitted to the hospital had to be tested for COVID-19, if possible. Two successive tests were required on rare occasions [29]. Patients and visitors alike were encouraged to take simple precautions to prevent the spread of the disease in the hospital. Maintaining a social distance of at least two meters, housing fewer patients per room, and limiting the number of visitors were all precautions taken. As a result of quarantine or an increase in patient numbers, staff shortages emerged. Several institutions divided their staff into organic shifts to thwart the spread of the disease. Visitors and workers were exposed to virus-designated locations if notification signs were not properly erected. It was demonstrated that simple architectural solutions like ensuring proper airflow in open spaces and wards and cleaning infected surfaces minimized viral propagation dramatically [30].

Management Solutions

Clinicians from the emergency department were assigned to staff COVID-19 testing, triage, and clustering. This choice was made to optimize the usage of the orthopedic team's core clinical expertise and ED physicians, who were more experienced in handling respiratory compromised patients with multiple comorbidities. As a result of this change, orthopedic surgeons encountered minimal discomfort and hardship. Consultations for infectious illnesses were handled by the same personnel that routinely cared for orthopedic patients with infectious diseases. Numerous critical principles contributed to the departments of Internal Medicine and Orthopedic Surgery collaborating well [3,17,27].

The orthopedic surgery personnel had to be kept to ease the care of patients requiring orthopedic surgery, as well as internal

medicine. Additionally, keeping the team together created camaraderie and reduced disruptions to the established culture that occurred with the addition of new team members or the transfer of orthopedic surgery residents to other fields. Fractures, vascular dysfunction, compartment syndrome, and infection all required prompt attention during triage [29]. The bulk of elective orthopedic treatments were rescheduled during the first wave in the United States to save medical resources, including PPE, and to make way for corona departments [31].

By keeping the orthopedic surgical team structure, a well-defined hierarchical chain of command was maintained, maximizing efficiency and safety. The team maintained safety and avoided infection among its members by implementing a team-based strategy that included monitoring the donning and doffing of personal protective equipment (PPE), as well as its correct use (disposable gown and gloves, N95 mask and face shield) [32].

Regrettably, delaying certain elective orthopedic operations had undesirable repercussions, such as an increased risk. There was no universally accepted standard for which processes should not have been postponed. The American College of Surgeons recommended for deferring all elective treatments during the initial wave and published a guide for orthopedic surgery triage under the COVID-19 restriction [26,32].

Orthopedic surgery occurred in phases [21,31]: Phase 1 was when there were few COVID-19 cases and hospital resources such as intensive care units (ICUs), ventilators, and nurses were not depleted. Stahel pioneered the stratification of elective surgery [4]. Elective surgery was categorized by him as either required (reconstructive surgery) or discretionary (arthroplasty and sports surgery). Due to the system's purpose of relieving medical teams of the burden of

COVID-19, patients were triaged according to their severity. In phase 2, numerous COVID-19 patients were treated with limited financial resources. Phase 3 installed when COVID-19 patients received all hospital resources [4,27].

When patients were admitted from the emergency department, the medical staff assessed their severity. Most patients who could be sent to the Ortho-COVID-19 management team had to present moderate severity. While most patients were stable, a significant number could require oxygen wearing prior to being safely released. Internal medicine teams had to be allowed to focus only on unstable and critical patients by including orthopedic surgery into this function. Additionally, if a patient was diagnosed as being at high risk for COVID-19 and had a higher American Society of Anesthesiologists classification, or was likely to require blood products or critical care therapy, the operation had to be postponed [27,33].

Increased oxygen therapy had to be mandated by hospital-wide policies. While oxygen requirements continued to develop, the fundamental progression increased from nasal cannula to venturi mask, nonrebreather mask, high-flow nasal cannula, BiPAP, and finally intubation. Patients' oxygen saturations were monitored continuously and if they went below 92 percent at the device's maximum setting, they had to be advanced to the next level of oxygen supplementation. Any pharmacologic escalation had to be carried out with the advice of infectious disease specialists. Clinical talents of orthopedic nursing personnel had to be refreshed and strengthened in order to provide therapy to medical patients. COVID-19 patients with a variety of co-morbid conditions could substitute normal orthopedic inpatients. Numerous educational activities had to be implemented to provide workers with the knowledge and skills essential to protect

themselves and their families from infection and to care for COVID-19 patients [23,32].

Preoperative evaluation and surgical room configuration

Exposure could be minimized when examining the patients. Data extraction from electronic logs and previous medical records had to take place in a separate area. Physical examinations had to be conducted in a corona-designated room and while wearing complete protective equipment [29,33].

Anamnesis was challenging since patients were alone and it was difficult to interpret conversation while wearing a mask. Cast removal with an oscillating saw resulted in an increase in aerosols. All orthopedic equipment used in the removal of casts or bandages had to be sterilized. In a retrospective research conducted in Wuhan by Zhou et al. [34], 54 of 191 patients with COVID-19 died in the hospital. Risk factors for poor prognosis were identified as advanced age, a high sequential organ failure assessment (SOFA) score, lymphopenia, diabetes, and D-dimer more than 1 g/ ml. Orthopedic surgery had to be avoided in these high-risk patients. Proximal femoral fragility fractures were an exception [32].

Catellani and colleagues [35] showed that the COVID-19 positive patients' respiratory parameters stabilized with reduction and fixation. Corona mode had to be used for operating rooms (OR). Ideally, a whole OR complex was dedicated to COVID-19 patients. Unnecessary equipment, such as a tourniquet used in upper or lower limb fracture reduction and internal fixation, had to be removed from the room. Ideally, the same crew of less than 60 years old had to work on the parameter. COVID-19 flooded the affected areas in the United States with the largest concentration of orthopedic physicians over the age of 60 during the first wave [36].

Maximum ventilation using high-efficiency particulate air (HEPA) filters had to be installed and operated in a negative pressure environment, in contrast to normal operating rooms, which used positive pressure to decrease pathogen infiltration [37]. The OR's entry and exit were restricted to one-way doors and separated by anterooms for dressing and undressing, with appropriate warnings and signs displayed to minimize staff mobility and exposure. Anesthesia had to be administered outside the room, as intubation could result in the production of aerosols [38].

Equipment for personal safety

The availability and proper use of personal protective equipment (PPE) was critical in preventing team members from getting COVID-19. Maintaining a steady stock of PPE required a team effort to accomplish. When treating a COVID-19 positive or suspected patient, complete PPE had to be worn. Hair coverings, eye protection, side shields or goggles, and breathing protection were all advised [21].

When treating COVID-19 patients, the US National Institute for Occupational Safety and Health recommended the use of properly sealed N95 respirators. The epidemic resulted in an upsurge in the demand and a significant scarcity of personal protective equipment (PPE), particularly respirators [39]. Members of the team doubled glove and replaced the outer glove between each patient interaction. Prior to applying the second layer glove, the inside glove had to be sanitized with hand sanitizer. Before returning to the workroom, gowns, outer surgical masks, face shields, gloves, and head gear were removed.

The Centers for Disease Control and Prevention in the United States granted specific exclusions for the N95 series mask and permitted the use of out-of-date respirators during surgeries. Expired respirators provided

superior protection over conventional surgical or makeshift masks. This was a measure that had to be taken only in times of crisis when there were no options and not as a normal practice [40].

Powered air purifying respirators with HEPA filters offered superior protection and could assist orthopedic surgeons by improving visibility with less goggle condensation and decreasing the likelihood of dislodgement and seal loss while performing aggressive manipulations such as dislocated hip reduction or caring for a polytrauma or agitated patient. Additional protective clothing included a complete face shield, a fluid-resistant gown worn over scrubs, long-sleeved gloves with taped wrists, and impermeable surgery room shoes with a single-use cover. Orthopedic helmets, which are frequently used in arthroplasties, did not provide enough protection against microscopic viruses, and were not utilized in place of N95 ventilators. The sequence in which sterile PPE was donned and scrubbed was subject to alter at the discretion of state and medical establishments [41].

Anesthesia and orthopedic surgery technical precautions

During general anesthesia, aerosols could be dispersed with tracheal intubation. After intubation, some doctors advocated a 15-minute delay before entering the room [38,41]. Orthopedic surgeons in collaboration with colleagues in the anesthesia and intensive care unit, could abandon the indication of general anesthetic in favor of spinal or block anesthesia. Not only did this lessen the risk of infectious aerosols spreading, but it also alleviated the overall pressure on anesthesiologists, freeing them up to help in other areas, such as the intensive care unit. When intubation was necessary, powered air-purifying respirators were warranted [37,41].

Intubation had to take place in a separate room, and the surgeon had to enter the operating room once the patient was intubated and draped correctly. This citation could not be overstated in the COVID-19 pandemic period. Impractical equipment and standby surgical kits added to the risk and logistical strain of the OR. Predicting the appropriate measured nail or screw and using the appropriate method all contributed to a reduction in the operating time and danger of exposure. Finally, electrocautery was shown to produce aerosols and thus, had to be used cautiously in conjunction with air suction [23]. All wounds were closed with absorbable sutures to eliminate the need for another outpatient operation and to minimize the risk of infection [42].

Hospitalization and rehabilitation in the orthopedics department

Trauma, such as hip fractures and infections of various kinds, were likely to constitute the basis of many of the orthopedic procedures performed during the pandemic period. These circumstances needed a stay in the postoperative department as well as therapy. On the Ortho-COVID-19 service, most COVID-19 patients were in a stable clinical state. The COVID-19 patients were addressed with the attending family medicine or internal medicine physician after the morning rounds to identify those who needed careful monitoring [27,32].

To ensure the highest level of care, patients on more complicated drugs had to be re-evaluated in the morning by the chief medical attendant. Daily physiotherapy or occupational therapy activities, for example, could be carried out through video chat or with a good explanation. Patients could change their own bandages, thereby minimizing the need for direct interaction. As for follow-up appointments, many were done by telehealth

or video chat. The effective handling of privacy concerns was given particular attention, as not all apps were secure [18,32].

The Health Insurance Portability and Accountability Act approved Apple's Facetime and a modified version of Zoom (HIPAA). Using video chats to evaluate and assist patients while also providing emotional support and encouragement was a valuable tool for health care providers and patients alike. For example, a COVID-19 patient's mental condition could deteriorate over several days with a quick decline in hemoglobin levels and an increase in the amount of supplementary oxygen required that the family medicine attending doctor needed to have frequent and direct discussions so that he could help this type of patients [20,27,34].

Students and residents training in the covid era

Development, information technology, and research ensured that the comprehensive flow of new relevant information from the Central Denmark Region to the hospital was reviewed and communicated to the staff via guidelines, newsletters, and daily departmental morning meetings. All employee issues and concerns were addressed during staff meetings and on a question-and-answer poster. Numerous teaching sessions were prepared in response to staff concerns and demands, including proper PPE usage, care for medical COVID-19 patients, and so on. Thus, educational activities were developed in response to staff demands, enhancing their competences and addressing their concerns and ideas [7,12,27].

To guarantee the educational program's flexibility, participants could provide ad hoc assessments of the activities' learning and relevancy. The committee had to analyze these assessments on a constant basis,

discontinuing wasteful projects and adding new activities as requested. Participants in all events could be recorded, and activities had to continue until the full workforce had the opportunity to participate. To avoid the spread of COVID-19 among participants, instructional activities had to be delivered numerous times daily, in small groups of 2-5 participants, at areas with a minimum of 1-2 m between participants [24,27].

Educational activities were critical in preparing the orthopedic department's healthcare workers for COVID-19. According to the participants, the COVID-19 circumstance resulted in mixed experiences for healthcare providers. On the one hand, participants could see the organizational changes as beneficial (i.e., more multidisciplinary acts, less bureaucracy, and a stronger feeling of community), but on the other hand, could express doubt as a result of the disease's severity paired with an overwhelming amount of information [27,32].

By demystifying the disease and offering hands-on experiences with the patient group, simulation training was seen as critical in preparing oneself and the department for the COVID-19 disease, thereby enhancing a sense of self-efficacy. Residents had to be relieved of daily orthopedic chores associated with near-constant learning during time spent away from the hospital or with non-orthopedic care teams. As a result, residency and fellowship programs had to examine creative and unconventional modes of education [18,27,39].

Weekly meetings and conferences that were held in person could then be held virtually. In response to European working time laws, which were equivalent to the ACGME duty hour constraints, Palan et al. [43] described their experience building and conducting virtual learning platforms and virtual journal clubs to assist residents in optimizing their time away from the hospital.

The team discovered several distinct advantages over traditional in-person learning, including the ability to revisit a digitally recorded session for clarification or continued learning, ease of access to both clinical material (i.e., radiographs, advanced imaging, and key article) and the ability to connect individuals geographically dispersed throughout the world. Similar methods had to be followed considering the situation at that moment in time [44].

Today, tools such as WebEx [45], Google Classroom [46] and Zoom [47] provided collaborative platforms for teams that the department had to employ. Each program offered its own set of functions and the majority were completely free for basic use. These were distributed among the subspecialties (adult reconstruction, hand, and sport). Given the reduction in clinical responsibilities and the ease with which virtual meeting rooms were used, these conferences were accessible to any residents interested in attending. Interestingly, participation in these virtual conferences increased above typical levels, with teachers and participants alike expressing pleasant sentiments. Like team-based learning, the benefits of active independent study could be emphasized at that turbulent moment. Conveniently, reduced case volume and clinical responsibilities could provide more time for that emphasis. Individual study efforts were worthwhile since past research indicated that residents who engaged in normal conventional home study practices score higher on the Orthopedic In-Training Examination than those who did not [48].

To this goal, several orthopedic professional organizations developed high-quality educational resources geared for resident learning, including didactic text or questions. For those sites that included question banks, exams tailored to certain subspecialties (e.g., adult reconstruction, hand

surgery, and sports medicine) could be constructed. After these exams were administered, the results could be communicated to the program director or specialty attending doctors to determine the degree of proficiency. Additionally, the ABOS demanded that a certain amount of time was spent on each service in order to graduate [49].

These online assessment tools enabled program directors to document work completed while a resident was on duty in order to demonstrate that the resident/ fellow was progressing toward competency. Additionally, a variety of alternative educational modalities that were modified or made available in response to COVID-19 had to be investigated. The American Academy of Orthopedic Surgeons' (AAOS) 2020 Annual Meeting is currently accessible on the AAOS website. Additionally, to the typical research investigations and poster presentations, that offered Instructional Course Lectures and Ask an Expert! sessions. Likewise, the annual spring AAOS orthopedic board preparation and review course were conducted entirely online. Moreover, opportunities geared at a fellowship level of study were made available. For example, the American Association of Hip and Knee Surgeons launched the FOCAL Initiative: Fellows Online COVID-19 AAHS Learning, a series of online lectures by invited faculty designed to maintain fellow education during that time period [50].

In orthopedic surgery, many simulation modalities were examined, including surgical skill laboratories [51], cadaveric dissection and procedural training [52], computer-based virtual reality training [53] and arthroscopic surgery simulation [54]. Despite their potential to improve surgical teaching, the huge volume of "observational" surgery and time spent on direct patient care were significant impediments to wider use. Changes in hospital and residency policies in the aftermath of

COVID-19 freed up more time for those initiatives. Nonetheless, the rules of cleanliness and social separation were still observed when using those instruments. As disruptive as these developments might appear at first glance, they really created unprecedented potential for resident growth and resilience. Historically, resident education emphasized the development of “cognitive” abilities such as anatomic knowledge, surgical proficiency, and clinical intuition. However, there has been a change in the development and stimulation of “noncognitive” talents in recent years [55].

These characteristics, which included resilience, self-control, and conscientiousness, have been highlighted as indicators of future personal and professional success. Attaining and optimizing these principles has been related with increased resident well-being [56], decreased chance of burnout as an attending surgeon [57] and greater overall career satisfaction [58,59]. Uncertainty in the work environment as a result of COVID-19, including unique individual roles with new care teams, varied orthopedic case mix and volume, and schedule format adjustments, surely fostered development, and resilience, as well as refining of these important characteristics. Finally, given their invaluable viewpoint on the front lines, many residents were requested to assume leadership roles in order to organize and plan daily activities. A critical component of this was supporting fast communication between residents and program leadership in order to minimize e-mail overload and information gaps [32,56,57].

Discussion

The COVID-19 pandemic has made healthcare professionals nervous and stressed. Patients with COVID-19-related diseases are now being treated by physicians trained in surgical subspecialties. While healthcare

workers are aware of the increased risk of infection, they worry about transmission to family members, especially the elderly, immunocompromised or chronically unwell. Stress and a lack of dedication are known to impair the quality of work performed by healthcare workers. A recent study indicated that surgeons and nurses in the operating room and surgical department have good attitudes on improving teamwork and safety. They observed that nurses, surgeons, and trainees made more errors in stressful situations [60].

The success factors for an Ortho-COVID-19 team and a military unit are similar. The military has long acknowledged the importance of psychological resilience. In their review of 270 studies, Meredith et al. identified 20 individual, family, unit, and community-level characteristics that define resilience. It is no secret that a military unit’s performance depends on group cohesion. Group cohesion improves performance and survival chances. Changes in organizational structure and social relationships might cause safety and efficiency issues. Retaining the orthopedic surgery team for both orthopedic and COVID-19 care will help the team practice and maintain resiliency [61,62].

In COVID-19 orthopedic patients, deferring needless surgeries or employing temporary external fixation might help decrease the cytokine storm that is typical in both COVID-19 and polytrauma patients. If this is a struggle, PPE and laws are our best weapons [27,45]. In one of the quoted studies, participants expressed concern about the COVID-19 virus’s fast proliferation. They also said the training sessions, especially the in-situ simulation, helped them relax and understand the COVID-19 situation. Participants reported increased individual and transdisciplinary professional self-efficacy, less uncertainty, and less stress after simulated training sessions. In their methodology, employee expectations

were among the seven stresses. The workload, shortage of employees, and complexity of the task were all examples of demand. COVID-19 is predicted to complicate orthopedic work [63].

Sadly, a global lack of PPE has led to norm reductions like the use of outmoded ventilators in daily practice. This valuable treasure must be conserved. Elective operations have provoked a heated discussion. Saving hospital resources was crucial then, however Zhang et al. demonstrated that canceling or postponing more than 50% of all elective surgical procedures could cause significant harm to patients [42]. To reduce stress and skill loss in a pandemic like COVID-19, employee help and training were critical [64].

Infrastructure was crucial to enhancing patient care and well-being while also offering a favorable healthcare experience. A hospital infrastructure that could adapt to the possibly increased number of COVID-19 patients appeared to be crucial [27,65]. Residency balanced service with education. It was feared that adding additional internal medicine patients to an orthopedic surgery program might disrupt orthopedic surgery didactics. Orthopedic surgery residents continued to learn by seeing patients in clinic, triaging orthopedic surgery consultations, and preparing for urgent or emergency orthopedic surgery cases. They had to be supplemented by weekly video-assisted residency-wide lectures and team-based fracture conferences [32,44,48].

Various learning exercises could be used to teach participants about receiving and caring for COVID-19 patients. In-situ simulation was used to teach challenging situations, improve communication, and develop specific technical skills. The teacher also had to be regarded as a significant feature by being active in the scenario, ensuring realism, and debriefing the simulation. The impact and use of

interdisciplinary simulation training sessions could also be discussed. It underlined the role of each healthcare professional in dealing with these patients and in general. Time constraints between operating room and floor work was a secondary consideration, aside from the COVID-19 patients, the Orthopedic Surgery department was supposed to address patients with acute musculoskeletal problems [32,44].

Simulated events also enhanced interdisciplinary learning in terms of specialized processes and information exchange, leading to increased trust in the administration of COVID-19 [66]. Simulation was proved to help hospitals prepare for emergencies and train huge numbers of healthcare staff. Through experience learning, it could help workers develop. Job organization and process improvement could benefit from simulations [27,67]. Finding ways to incorporate patients from an internal medicine service into an orthopedic surgery team improved patient care, resident physician morale, and team structure while allowing for continuous orthopedic education and service. The economic costs were tremendous. The COVID-19 outbreak compromised the viability of some hospitals [16]. Also, 17% of all operating room procedures were orthopedic [33,35]. Due to lack of resources, incorporating COVID-19 patients into orthopedic surgery program was feasible.

Conclusions

The COVID-19 epidemic provided an unprecedented challenge for orthopedic education. Orthopedic departments had to construct a set of priorities based on their institutional requirements to assist decision-making during those times of uncertainty.

Orthopedic surgeons had to set specific recommendations in tandem with state or

country protocols per their institution or department, with comprehensive criteria showing which patients were candidates for urgent surgical therapy and which could be postponed. The exponential surge of patients requiring hospital-based treatment caused by the COVID-19 epidemic compelled surgical subspecialists to swiftly adjust to operating outside of their field of practice.

We should be prepared for a post-corona era in which neglected patients will present with complications related to insufficient treatment. In-situ simulation received favorable reviews and may be a useful method of training staff for COVID-19 and other disruptive occurrences that need fundamental clinical competence.

Many healthcare experts encountered confusion due to the fast growth of the COVID-19 condition. Amongst the uncertainty, there are unique chances for resident growth and development. Subjective assessment of the learning outcome of an educational intervention is not as reliable as an objective assessment. It is of the highest significance that for these programs to operate, the students and residents must feel secure, protected, and heard.

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The authors state no conflict of interest.

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