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COVID-19

A new role for orthopaedic surgeons: ongoing changes, lessons learned, and perspectives from a level I trauma center during the COVID-19 pandemic

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The COVID-19 pandemic has redefined global health care. With almost 13 million confirmed cases worldwide, medical professionals have been forced to modify their practice to take care of an expanded, critically ill population. Institutions have been challenged to implement innovative ways to maximize the utility and the safety of residents and personnel. Guided by lessons learned from prior mass causalities, wars, and previous pandemics, adjustments have been made in order to provide optimal care for all patients while still protecting limited resources and the lives of health care workers. Specialists who are trained in the management of lethal aspects of this disease continue to have a high demand and obvious role. Orthopedic surgeons, with ill-defined roles, have been redeployed to manage complex medical problems. Still, the need to manage trauma, fractures, infections, tumors, and dislocations remains a necessity. Various innovative measures have been taken to maximize the utility and safety of residents in the inpatient and outpatient setting. Commonalities to most measures and distinct changes in practice philosophy can be identified and applied to both current and future pandemic responses.

Level of evidence: Narrative Review

Keywords: COVID-19; pandemic; orthopaedic surgeons; education; residency; academic

The SARS-CoV-2 pandemic has redefined global health care. As of July 13, 2020, there have been almost 13 million confirmed cases and 570,434 COVID-19-attributed deaths worldwide.[13] Health care workers continue to play a well-recognized, chief role in the fight against this disease and have been challenged to redefine their roles to take care of an expanded, critically ill population. Specialists who are trained in managing the lethal aspects of COVID-19, primarily those in the emergency department (ED), pulmonology, cardiology, critical care, and hematology specialties, have an obvious role. The role of the orthopedic surgeon in this pandemic, however, is less intuitive.

Implicit in the lack of international preparedness for the current pandemic is the need for clear guidelines for noninfectious disease specialists. Our goal is to provide a comprehensive narrative using published literature, reputable news reports, anecdotes, and personal experiences in order to provide a framework for the role of orthopedic surgeons in pandemic response and highlight changes in practice philosophy.

Institutional review board approval was not required for this narrative review.

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The need for well-defined roles

Typically, orthopedic surgeons have protocols to coordinate with specialists as needed regarding critically ill patients. During surgery, residents, nurses, anesthesiologists, and technicians work together in a large team to provide optimal care for patients. When obtaining imaging, sufficient personal protective equipment (PPE) and sterilization guidelines allow for safe transfer into computed tomography scans and magnetic resonance imaging machines. There is often an abundance of resources, which hospital personnel can use to safely care for patients, teach, and account for less efficient practices.

Lessons learned from mass casualty events, wars, and previous pandemics, however, teach us that standard health care practices must be modified in times of crisis. When major disasters occur, a transition is made from administering optimal care for all patients to providing the greatest good for the greatest number of people. The path from the initial event to definitive management involves the contribution of countless individuals, from bystanders to law enforcement and those involved in transport, facilities management, triage, and medical care. The surgeon's role is, unsurprisingly, at the triage and management end of this journey. From the surgeon's perspective in such a setting, the skills implemented in the operating room are extensions of the skills used in everyday practice.[27]

Responding to a pandemic differs from military or mass casualty events in many ways, however. Changes in surgical procedures have included the judicious use of negative pressure rooms, extended periods of room turnover, the use of electrocautery at lower than usual settings to limit surgical smoke, and the involvement of minimum necessary personnel during aerosolizing procedures.[4,24] Proper use of PPE is of paramount importance. A recent study demonstrated that 90% of PPE use was incorrect, particularly regarding the doffing sequence, technique, or use of appropriate equipment.[22] The need for training is evident in order to maximally benefit patient care and minimize risk to care providers.

In addition to training, a chain of command must be defined. Decision making during times of crisis becomes more complex, and, consequently, suboptimal outcomes may result. Inexperience and chaos can lead to undertriage, but more commonly, overtriage is seen. When critical decisions are made in the setting of limited resources and time constraints, health care professionals err on the side of caution for fear of complications of delaying care. The decision-making process is accelerated, particularly when time available for triage and evaluation is limited. This overcautious approach, however, is not without consequences. On September 11, 2001, for example, an unprecedented 95% overtriage at New York University Downtown Hospital contributed to 44% critical mortality, demonstrating the devastating—and potentially avoidable—effects of a lack of preparedness.[23] It is currently impossible to determine the magnitude of effect current policy changes have on COVID-19. However, preparedness in the future through working in predefined teams may mitigate the effects of future pandemics.

What practicing surgeons are doing now

Inpatient care

In the inpatient setting, emergency care of fractures, infections, tumors, and dislocations cannot be discontinued. Trauma specialists support a large proportion of these patients. Nontrauma specialists, however, are being utilized to staff clinics during the week and ensure adequate access to trauma patients and postoperative patients.[16] Those specialized in more elective-based surgery are shifting their practices to managing emergency conditions they can effectively treat or assisting in those they cannot. The University of Pennsylvania put forth recommendations to aid in this triaging process,[21]and both the American College of Surgeons and American Society of Anesthesiologists suggest the creation of a Surgical Review Committee to help make decisions, which may be useful for patients without clear indications for surgery.[2] As the operative population decreases because of fewer elective cases, it has also been suggested that the overall number of functional operating rooms should be reduced. This consolidation process protects staff, equipment, and resources from contamination and removes key elements in the pathogen transfer chain.[16]

Orthopedic surgeons have advocated for routine COVID-19 screening before surgery, use of low-power settings on powered instruments, use of particulate air filters, use of negative pressure rooms, and use of dedicated patient elevators and hallways.[8] Masks that are capable of reducing particulate transmission and comfortable to wear for extended periods of time should be used, including during procedures where surgical hoods are utilized. Although standard surgical helmets and hoods help to maintain sterility and protect the surgical team from bodily fluids, they should not be utilized solely as a means of PPE, as these helmets can actually pull and condense particles within the hood system.[9] Proper use of PPE, as well as routine cleaning of frequently touched surfaces in the operating room, such as door handles, helmets, lead aprons, X-ray machines, and keyboards, should be encouraged. It may be the surgeon's responsibility to add this element to the routine preoperative checklists and ''time-outs'' performed before patients enter the room.[8]

Outpatient care

Guidelines suggest that services should be geared toward trauma care with maximal use of telehealth

technologies.[16] Telehealth is a tool for providers that has gained increased utility with current social distancing requirements. Although available previously, concerns about billing, insurance resistance, and patient privacy limited its widespread use.[18] In the current pandemic, however, the use of video conferencing allows for inspection of the incision and provides a great deal of information on possible postoperative complications.[4,11] This requires special considerations in surgical planning, as the surgeon may opt for sutures and dressings that can be easily cared for by the patients themselves. Telehealth use in orthopedic patients is undoubtedly limited without a physical examination component. It is unlikely that when current restrictions are removed, it will supplant a standard visit in the office. However, guidelines for documentation and reimbursements may help aid the more widespread use for populations who cannot make it to the office (eg, elderly, critically ill patients).

Remote physical therapy is also gaining popularity through video uploads and virtual coaching.[18] It offers an effective alternative to traditional therapy and may have the added benefit of increasing compliance and optimizing cost and outcomes.[18] Indeed, digital care programs and virtual care technologies have been shown to be effective in reducing symptoms of musculoskeletal pathology and are increasingly used. These modalities will undoubtedly continue to increase in popularity because of demand and current restrictions on elective in-person visits.[5,7,20,26,32]

Our perspective

Despite the strain on the health care system and its providers, the COVID-19 pandemic has highlighted the exceptional individuals and teams who care for patients daily. As the sole level I trauma center in the densely populated region of northern New Jersey, one of the hardest-hit areas due to COVID-19, attending and resident physicians alike have suspended their routine practices and education, asking to work on teams caring for patients with COVID-19 under the supervision of colleagues trained in critical care. Nursing staff and technicians from the office setting have volunteered to work shifts in the hospital ward, the intensive care unit (ICU), and the ED, to relieve their colleagues already working more shifts than usual. In addition, coordinated redeployment of residents to teams aligned with their skill sets, such as to critical care teams, has allowed ICU-trained residents to be made readily available to assist in the care of patients with COVID-19 and fill the void. This strategy was coordinated by hospital staff with experience in mass casualty events. In a modern health care system burdened with bureaucracy, physicians have engaged in leadership roles with renewed vigor, working with fellow physician colleagues to lead rapid changes necessary to care for an evolving ill population and maintain the protection of health care providers.

What residents are doing now

Redeployment

Under the direction of attending physicians, orthopedic residents are charged with the evaluation and treatment planning of virtually all orthopedic patients who enter the hospital. Unsurprisingly, the changing health care landscape has forced residents to adapt new skills and duties. Of all orthopedic surgical procedures performed before the current pandemic, about 25% have been considered nonelective or emergent.[6] Thus, the suspension of elective surgeries represents a significant decline in invaluable training for residents. At the cost of their specialized training opportunities, many residents have either volunteered for or have been redeployed to teams caring for patients in a role unfamiliar to their training to provide support to colleagues caring for a large census of patients with COVID-19.[14]

Many institutions have unique plans for redeployment. Some involve the creation of 2 teams: one managing inpatients across all services and the other conducting research and independent study, with the goal of mitigating exposure while delivering needed orthopedic care.[14] Emory University School of Medicine instituted a plan involving the creation of 2 distinct teams (active duty and remotely working), participation in continuity of care with in-person encounters and telehealth, establishing a 2-team system with team-based redundancy, and protection of departmental leaders and decision makers.[29] Institutions in New York City have deployed residents and attending surgeons in an ad hoc basis to the ED, medicine, ICU, and proning teams, with frequent cooperation among all ranks of training and a myriad of specialties.[12]

Completing shifts in the ED and ICU, resident tasks include drawing arterial blood gases, placing and removing central lines and nasogastric tubes, obtaining chest radiographs, and transporting patients.[28] Surgical residents have been challenged to become efficient in the management of complex medical problems unfamiliar since intern year or medical school. At our institution, both surgical and medical residents alike have displayed the utmost professionalism and enthusiasm for patient care as colleagues—perhaps even more so than before COVID-19—despite these challenges. Recently published accounts echo these sentiments and highlight a united front among health care workers.[16,28]

Research

Many residents have used the restructuring of their departments to make advances in their research and stay productive when not on duty. Although studies involving prospective data collection may have to be delayed, progress can be made regarding retrospective studies, book

chapters, technique papers, meta-analyses/systematic reviews,[16] and institutional review board applications. Particularly among departments that have restructured their schedules so that residents have time to work remotely, research productivity is expected to increase over this period.

Education

Resident education has changed in tandem with the rest of health care. Virtual learning is not a new concept and has been developed with the intention of maximizing resident time away from the hospital.[19] Online surgical databases, such as Orthopedic Video Theater and Orthopedic Video Theater plus, provided through the American Academy of Orthopaedic Surgeons (AAOS) may enhance the remote education experience.[31] Now, using this technology is not a matter of convenience, but of necessity. As in-person gatherings are actively discouraged, departments are organizing remote curricula to maintain fracture conferences, mortality and morbidity meetings, and research presentations. Suggestions for structuring these events include gathering minimal in-person attendees, such as 1 chief resident, 1 junior resident, and the night-float resident plus 1 faculty from the orthopedic trauma team and relevant subspecialty teams, using video conferencing, and inviting guest speakers.[16] Similar formats have been adopted and modified accordingly to the events' needs. Indeed, some have found this an ideal opportunity to enhance their resident curricula with guest speakers from both inside and outside the United States using free-to-use applications.[14]

Our perspective

At our institution, residents and faculty have led numerous efforts to maintain and even increase educational opportunities during these times. Our daily fracture conference has been changed from an in-person conference to a video conference, now attended by more faculty and residents than before, as they have the capability to login and learn, even if they are at a remote site such as another hospital or home after a shift. In-person lectures on various orthopedic topics for residents have been replaced by the use of web-hosted video conferencing to deliver information. Interestingly, it has challenged educators within our program to create novel ways to increase engagement, including the use of live polls and multimedia. In addition, an increasing number of online journal clubs have been utilized, facilitating greater review of the current literature. Similarly, in light of severely limited roles of medical students, residents at our program have developed an orthopedic lecture series to help students interested in orthopedic surgery increase their knowledge. As concerns exist over the return of medical students to the hospital, this education may be increasingly important if students are not able to complete orthopedic rotations before applying to orthopedic residency.

A change in philosophy

Like many health care workers, orthopedic surgeons are driven by an incessant need to help others and be dedicated contributors to the team. This is the reason why we pursue medicine and seek to improve the lives of our patients. Despite this passion, it is known that many orthopedic surgeons have not had the training to manage acute respiratory distress syndrome and respiratory failure, nor the ICU-level magnitude of other COVID-19 symptoms such as persistent hypotension,[33] hepatic injury,[15] thromboembolic events,[33] and pneumonia.[10] The treatment of patients with COVID-19, therefore, is daunting for orthopedic residents, nurses, and attending surgeons alike.[30]

The predominant feeling among most health care workers seems to be that in times of crisis, we must defer to the specialist most closely tied to that field and take a peripheral role if needed. As in mass casualty events, it is often the trauma surgeons and ED physicians who assume the role of leadership. In the current pandemic, it may be ICU and respiratory specialists who designate roles, thus highlighting the need for leadership and the explicit assignment of duties. The orthopedic resident may be most useful in obtaining arterial blood gases (ABGs), ordering imaging, and performing bedside trauma procedures at the direction of others. In surgery rotations and acting internships during training, a common question is asked: ''What can I do to help?'' In the trying times of a pandemic, this once again becomes our mantra wherever we are needed.

Several principles may be extracted from the changes orthopedic surgeons have made and serve as a guideline for both current and future pandemic response plans (Table I). A transition is made to provide the greatest good for the greatest number of people—from an egalitarian to a utilitarian approach to patient care. A surplus of critically needed anesthesiologists, nursing staff, PPE, or medical equipment is no longer available. The surgeon must therefore use medical equipment sparingly and anticipate and plan for a worst-case scenario. Although the goal of care is never intentionally compromised, this balance of situational awareness and single-patient focus differs from the standard mantra focusing on 1 patient at a time.

Often, delaying treatment must be considered to minimize disease transmission and result in alternatives to the ''gold standard'' of care. To further minimize transmission, dedicated elevators and hallways for the transport of patients with COVID-19 should be utilized, where possible. However, as many hospitals do not have the infrastructure to make these changes, minimizing patient traffic—and by extension, surgery—may be a viable alternative and further limit the number of surgeries possible. Lastly, senior

Table I Changes in management principles from routine practice to pandemic response

Routine practice	Pandemic response
Leader in clinical decision making	Peripheral role in clinical decision making
Egalitarian approach	Utilitarian approach
Gold standard of care	Prioritize infection and exposure control
Large amounts of resources	Limited resources
Lead from front	Lead from rear

leadership has been advised to "lead from the rear," in order to minimize the risk of infection of experienced clinicians.[3]

Morale and well-being

As in previous outbreaks, prominent feelings among health care workers include fear, anxiety, stigma, anger, and frustration.[17] Resident and physician well-being is promoted, however, through education, transparency, and camaraderie. Frequent opportunities for feedback are encouraged among the administration. Having residents take part in the decision-making process ensures that their concerns are addressed and promotes leadership among the team.[14] Over lunch, residents and faculty have an opportunity to discuss life outside of the hospital and connect on a lighter level in this setting or remotely with video conferencing. Stress-relieving exercises and peer support, wherever possible, are integral to mental wellness. For some staff members, just the knowledge of support may suffice, but all should be encouraged to seek it out if needed.[17]

Coming home is also a source of stress for health care workers, with alternative housing offered in some programs.[25] The American College of Surgeons suggests practices such as removing clothes from home and keeping them in garment bags before changing into scrubs, cleaning phones after care activities, and keeping phones in plastic bags during work. Removing clothes and washing them on entering home, reducing physical contact with family members, using disinfectants with at least 60% alcohol content, and frequently washing hands are also recommended.[1]

Summary

Our role in the fight of the COVID-19 pandemic is ill-defined. Many institutions have instituted innovative ways to maximize the utility and safety of their personnel, and there is unlikely to be 1 "correct" answer. Nonetheless, commonalities to most approaches can be applied to current and future pandemic responses. Our role may be limited, but that is not to say we do not have a role. The willingness to move outside our area of expertise and help will remain for future times of crisis.

Disclaimer

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