

Operational Effect of COVID-19 on Surgical Care at a Tertiary Pediatric Hospital

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ABSTRACT

The detrimental effects of the coronavirus disease 2019 (COVID-19) pandemic have profoundly disrupted surgical care at health care facilities worldwide. At our tertiary pediatric hospital, we made substantial adjustments to surgical suite utilization and staff member scheduling to account for reductions in surgical volume, increased demand for staff members in other sectors of the hospital, and the highly infectious properties of the virus. Perioperative leaders took advantage of the pandemic's disruption to clinical activities to design and implement a new procedure-scheduling process to rectify the inefficiencies that had accumulated as the previous system evolved. The implementation of said directives was largely facilitated by establishing communication with all involved parties for their input and feedback throughout the process. Although COVID-19 has had varying effects on procedural operations across pediatric health care facilities, we believe our institutional response to the disruptive forces of COVID-19 is of benefit to pediatric hospitals worldwide.

Key words: *coronavirus disease 2019 (COVID-19), surgical volume, staffing, nonurgent procedures, block scheduling.*

Surgical procedures are a substantial source of revenue for health care facilities, with elective surgeries generating approximately 23% of the total inpatient hospital revenue at high-performing institutions.^{1,2} Fastidious management and strategic decision making are key to an institution's success because of the considerable amount of overhead associated with running surgical suites.³⁻⁵ The coronavirus disease 2019 (COVID-19) pandemic has profoundly disrupted the operations of health care facilities worldwide since its emergence from Wuhan, China, in December 2019.⁶⁻⁸ Perioperative leaders have been forced to reimagine their institutions' procedural operations to address substantial reductions in surgical volume and to ensure health care is provided in a manner that keeps patients, health care workers, and their families safe.⁹⁻¹¹

Pediatric hospitals were not immune to the detrimental effects of COVID-19 despite caring for a patient population that much less frequently experiences clinically significant symptoms of this disease.¹²⁻¹⁴ Surgical volume at our institution dropped sharply after the governor of Texas issued a state-wide executive order in March 2020 that halted the performance of nonurgent surgical procedures.¹⁵ Unfortunately, surgical volume did not recover to prepandemic levels upon the lifting of the governor's order in April 2020. One reason our surgical volume remained low was that many families feared contracting the virus while in a hospital.¹⁶ Additionally, families were less inclined to have their child undergo a procedure because of supplementary preoperative tasks, such as symptom screening and patient testing for the virus, as well as restrictive visitor policies that only allowed one caregiver to be present

during the time of the procedure. We describe the effect that the COVID-19 pandemic had on our institution's procedural operations and detail the strategies and innovations we employed to abate the virus' detrimental effects.

SETTING

Our institution, an affiliate of Baylor College of Medicine, is the largest pediatric health care facility in North America and consists of three campuses located throughout the greater Houston metropolitan area. Personnel provide general and specialized pediatric care at all campuses; however, our flagship campus, situated in the Texas Medical Center, also offers women's health services. Our flagship and community hospitals, equipped with 971 patient beds in total, are licensed and accredited as trauma centers by the American College of Surgeons, and the main campus and two community campuses are designated as Level I and Level IV trauma centers, respectively.

Our institution houses a multitude of distinct perioperative units within our main hospital and across our two community campuses. The Texas Medical Center campus houses five different groups of ORs, including six ORs for high-acuity patients; four specialized cardiovascular ORs designed for treating patients with congenital heart conditions; eight all-purpose, 24-hour ORs; seven ORs used for elective day-surgery procedures; and three nonsterile procedure rooms for patients requiring general anesthesia or sedation for a minor procedure. Our community campuses have five and six ORs, respectively, which are used to perform standard procedures or, in the instance that a patient with severe trauma arrives, to stabilize critically injured patients before transfer to our main campus. In addition to their use for surgical care, some ORs also serve as procedure rooms for several medical subspecialties, including gastroenterology, dermatology, and cardiology. Each year, personnel perform approximately 36,000 pediatric surgical procedures across our three campuses, with an average procedure length of 90 minutes.

TIMELINE OF EVENTS

In the latter part of March 2020, hospital and perioperative leaders discontinued nonurgent surgical procedures at our facilities in accordance with recommendations provided by the American College of Surgeons and the executive order issued by Texas Governor Greg Abbott (Figure 1).^{15,17} This measure, taken to conserve personal protective equipment and to protect patients, providers,

and staff members should the outbreak in the Houston metropolitan area worsen, was not without its associated challenges.¹⁸ Upon the cancellation of nonurgent surgical procedures at our institution, many surgeons voiced concerns for potential worsening of patient outcomes because of delays in surgical care. As a result, surgical leaders at our institution implemented a tier-based system to serve as a guide for identifying patients whose condition was at risk of deteriorating should they fail to undergo their scheduled procedure in a timely fashion. Patients who were deemed "at risk" were evaluated by their providers to establish whether immediate surgical intervention was necessary. Should the patient's family and the provider determine that the patient was best served undergoing surgery without delay, the surgeon presented the patient's procedure to our institution's perioperative leadership panel for additional review. This panel, comprising representatives from nursing, surgery, and anesthesia, was responsible for approving the procedure before the patient could undergo surgery. In the instance that a patient's surgery was not time-sensitive, the surgeon canceled the patient's procedure until the governor's executive order was revoked in April 2020.

At the time of canceling nonurgent surgical procedures, perioperative leaders replaced dedicated block times in favor of open block times that were used on a first-come, first-served basis. This measure was taken to increase operational efficiency, support decreased staffing, and to facilitate prompt scheduling of urgent procedures. Many of the operational changes made during the initial de-escalation of surgical care remained in place throughout the statewide halt of nonurgent surgical procedures. This period, marked by a 30% reduction in surgical volume, saw substantial reductions in OR utilization.

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Upon retraction of the governor's executive order in April 2020, perioperative leaders at our institution did not hesitate to initiate a phased escalation of elective surgical activity given the low census of patients who tested positive for

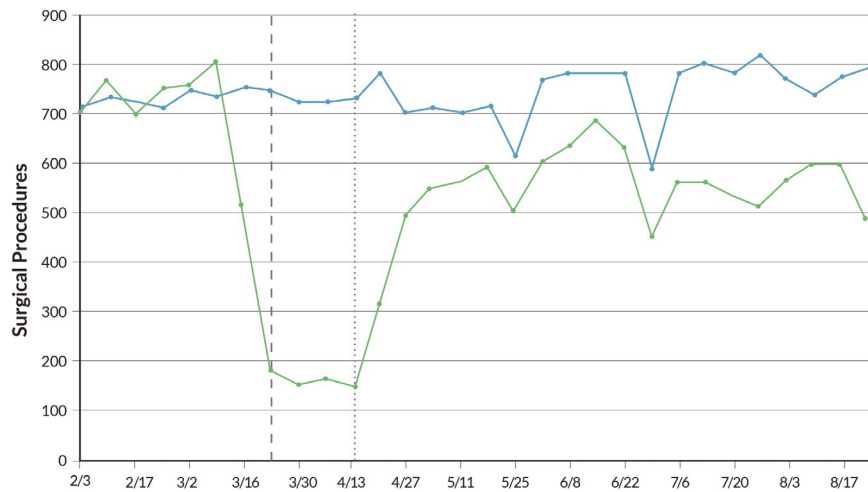


Figure 1. Comparison of surgical procedure volume between 2019 and 2020 at Texas Children’s Hospital, Houston. Note the substantial decrease in procedure volume upon the issuing of the executive order that barred health care facilities from performing nonurgent surgical procedures.

COVID-19. Perioperative leaders decided to redesign our institution’s procedure-scheduling process to correct inefficiencies that had accumulated over time with our institution’s growth before the pandemic. In the following weeks, perioperative leaders reintroduced dedicated block times to provide a predictable scheduling structure for each surgical service. As our institution increased surgical activity, the ratio of dedicated block times to open block times grew larger, culminating in early July 2020 with the formal transition to our novel procedure-scheduling process.

PROCEDURE SCHEDULING

There were several limitations associated with our prepandemic procedure-scheduling process that inspired perioperative leaders to design a new scheduling process. Disproportionate allocation of dedicated surgical block times in relation to each service’s budgeted and actual surgical procedure volume resulted in substantial underutilization of dedicated block times among multiple services. This underutilization, coupled with substantial variability in a service’s ability to release dedicated block times, resulted in many last-minute block releases, thereby limiting surgeons’ and schedulers’ ability to fill the newly released block times with another surgical procedure.

Similar to other institutions, our hospital personnel struggled to rectify these inefficiencies because of the process’ interlacing relationship with providers’ clinical, administrative, and academic activities.^{19,20} Perioperative leaders saw

the disruptive forces of COVID-19 as a rare opportunity to overhaul our procedure-scheduling process with minimal effect on extraoperative activities. The utilization of both open and dedicated block times provided time for perioperative leaders to critically evaluate the shortcomings of the previous procedure-scheduling process and to remedy these deficiencies more effectively during the development of our new scheduling process. The open block times were particularly useful for rescheduling surgical procedures during this period given the expansive backlog of canceled procedures that formed after the issuance of the executive order in March 2020.

Under the new scheduling process, perioperative leaders allocated dedicated block times based on both a service’s prepandemic surgical volume and prospective surgical volume given the substantial shift in procedure composition observed during the pandemic.^{21,22} This strategic reallocation of dedicated block times under the new scheduling process corrected many of the inefficiencies observed under the previous scheduling process, resulting in fewer dedicated block times being released. In addition, all services, with the exception of neurosurgery, were given a block time release deadline of two weeks. Purposeful reallocation of dedicated block times in conjunction with the establishment of a block time release deadline allowed surgeons and schedulers to post another surgical procedure during the released block time.

Most surgical services remained largely unaffected by the implementation of the new surgical scheduling process. This

was primarily because of the progressive escalation in surgical activity observed upon removal of the statewide ban on nonurgent surgical procedures in April 2020. Progressive increases in surgical procedure volume gave perioperative leaders time to collect feedback from each surgical service and to adjust surgical block allocation so that each service could effectively schedule procedures. As a result, many of our service lines (eg, plastic surgery, otolaryngology) were able to ensure that care was provided in a timely manner despite the disruptive forces of the pandemic.⁷

Surgical Suite Utilization

The substantial decrease in surgical activity after the cessation of nonurgent surgical procedures in March 2020 prompted perioperative leaders to reduce or stop surgical activity in many of our surgical suites to minimize overhead costs associated with running underutilized ORs. During the time of the mandate, most surgical procedures, except for those that required highly specialized suites, were performed in our 24-hour ORs. Upon resuming nonurgent surgical procedures, we initiated our institution’s ramp-up process that entailed the phased reopening of surgical suites based on several

operational metrics (Figure 2). Room utilization, defined as procedure time divided by the total time available for each room, was the primary metric used to guide our progression throughout each phase. Perioperative leaders targeted a sustained room utilization of 80% to 90% before moving on to the next phase of the ramp-up process to avoid the inefficiencies associated with increasing room use prematurely. Using this methodology, our surgical suites now operate at a higher efficiency than they did before the pandemic despite a substantial number of procedure cancellations. Additionally, this cautious approach to reopening surgical suites proved effective when the Houston metropolitan area experienced a profound surge in COVID-19 cases in the latter part of June 2020.²³

Staffing

Nursing managers made substantial changes to surgical staff member scheduling in response to the sharp reduction in surgical volume and increased demand for staff members in other sectors of the hospital. Staffing decisions, both in the pre-pandemic and COVID-19 eras, were based on the relationship between the number of hours

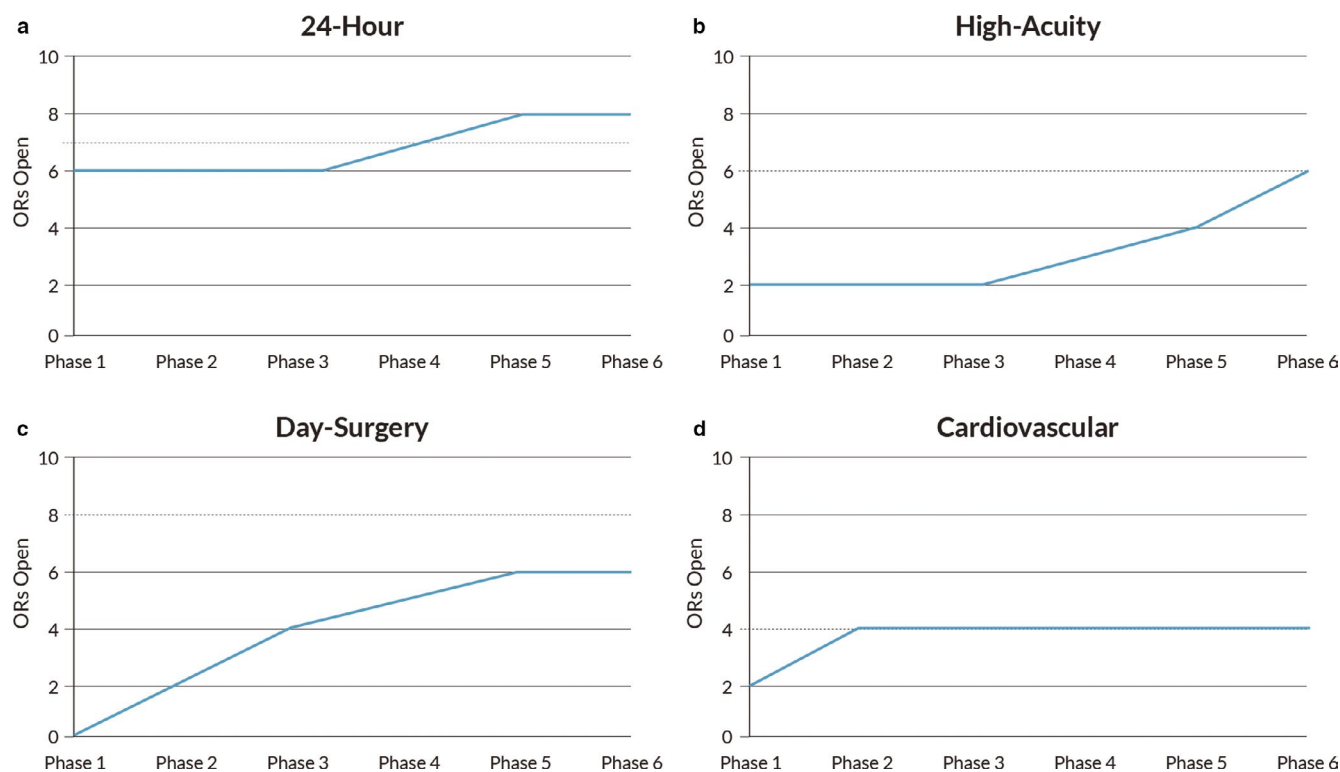


Figure 2. Number of active ORs at Texas Children’s Hospital, Houston, during each phase of the ramp-up process: 24-hour ORs (a), high-acuity ORs (b), day-surgery ORs (c), and cardiovascular ORs (d).

staff members worked and the number of procedures performed in a surgical suite. As a result, the number of surgical staff members scheduled per shift was directly related to surgical volume.

Several challenges accompanied decreases in the number of staff members scheduled throughout the pandemic. One challenge was ensuring that all surgical procedures were staffed by individuals who were sufficiently experienced to assist with the wide variety of procedures performed during their shift. Before the COVID-19 pandemic, many nurses and surgical technologists were scheduled to staff procedures exclusive to individual services, thereby allowing them to become highly proficient in caring for a specific subset of patients. After the sharp reduction in surgical procedure volume in March 2020, however, both nurses and surgical technologists were suddenly tasked with staffing a wide variety of procedures with which they lacked familiarity. To ensure patients were receiving quality surgical care under safe conditions, perioperative leaders and nursing managers worked together to develop work schedules to ensure that all procedures were staffed by individuals of sufficient competency. Initially, several surgical staff members were apprehensive about the transition from their pre-pandemic routine given the highly specialized nature of pediatric surgical care.^{24,25}

In an effort to decrease staff member anxiety, nursing managers and perioperative leaders established open communication channels between surgical staff members and nursing managers so that surgical staff members would have access to support in the instance that they required assistance. Despite the circumstances, most of the surgical staff members were able to adapt successfully to each clinical situation using their baseline knowledge and surgeons' preference cards in conjunction with the support provided by nurse managers and perioperative leaders. When queried about their experiences during this period, both nurses and surgical technologists expressed that the previously described measures greatly aided in their transition to staffing unfamiliar procedures. Additionally, surgical staff members reported that said procedures provided them unique opportunities to accrue competencies that they normally would not have acquired before the pandemic.

When scheduling surgical staff members for the OR, nursing managers and perioperative leaders had to develop contingency measures should a scenario arise in which a

staff member tested positive for COVID-19. These measures were designed under the assumption that all individuals in close contact with the infected staff member also could be infected because of the highly infectious properties of the virus and the high proportion of individuals diagnosed with COVID-19 who are asymptomatic carriers.^{26,27} Under the modified staff member scheduling process, nursing managers placed staff members into two groups with members of each group having their shifts scheduled together exclusively (Figure 3). Should a staff member in one group test positive, all surgical staff members belonging to the same group were tested and quarantined and had their shift rescheduled to a later date, while members belonging to the nonexposed group were promptly scheduled to fill the newly opened shift in seamless fashion.

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Lastly, nursing managers implemented minor staffing changes in surgical suites if a patient with COVID-19 required urgent or emergent surgical care. Under normal circumstances, surgical suites are staffed by an RN circulator, a surgical technologist, surgeon(s), an anesthesiologist, and trainees. When managing patients with COVID-19, additional surgical nurses were scheduled to ensure that donning and doffing of personal protective equipment were performed according to our institutional protocols and to serve as runners to minimize OR traffic should more supplies be needed.

Of note, the implementation of employee screening and contact tracing services in March 2020 generated demand for additional workers to enter the labor pool. Positions were offered to hospital employees who had experienced reduced work hours because of the pandemic (eg, perioperative staff members) rather than individuals outside of our institution. Hospital leadership's decision to employ the services of surgical staff members, allowed our institution to secure income for our employees despite the reduction in surgical volume experienced at our institution. Shifts scheduled for employee screening and contact

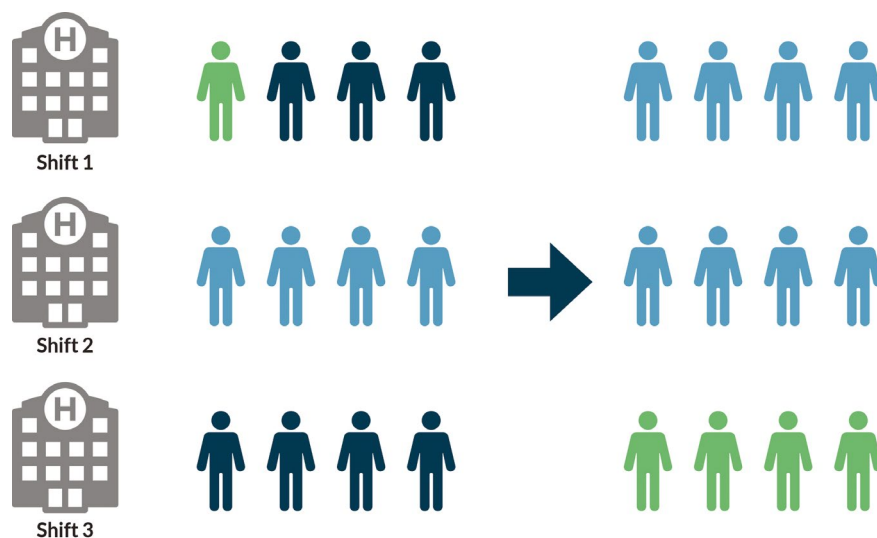


Figure 3. Staff member scheduling protocol at Texas Children's Hospital, Houston. Staff members belonging to groups A (green) and B (light blue) are exclusively scheduled with each other. In the instance that an individual belonging to group A tests positive for coronavirus disease 2019 (dark blue), all members belonging to group A are tested for the virus and quarantined while the newly vacated shift is assigned to group B.

tracing positions were distributed so as to not interfere with employee's normal clinical activities.

COMMUNICATION

Effective and purposeful communication was highly important for the development and implementation of our new procedure-scheduling process given the time-sensitive nature of these tasks. Discussions regarding our new procedure-scheduling process between all involved parties began after the director of Perioperative Services designed a preliminary model that would serve as the backbone for the new scheduling process that was implemented later in July 2020. Upon completion, the director scheduled meetings between herself and the division chief, practice administrators, and schedulers of each surgical service to present the new scheduling process and to collect feedback regarding its design. In addition, the director wanted to provide a platform for personnel from each service to express their needs and provide details regarding their clinical and academic responsibilities to ensure that the new system did not interfere. Each service's input was considered when modifying the novel scheduling process to minimize scheduling errors upon its implementation.

After the formal implementation of the new scheduling process, the director met with practice administrators and

decentralized schedulers twice a week to identify and address problems with the new scheduling process should they exist. Despite the gravity of these changes, most surgeons were receptive to the implementation of the new scheduling process and were highly satisfied with the final result. Establishing a dialogue between perioperative leaders and representatives from each surgical service, presenting a comprehensive solution to a problem, and taking swift action upon receiving feedback from said dialogue was key to implementing our new procedure-scheduling process in just five weeks.

Communication between nursing leaders and nursing staff members also was central to our institution's ability to respond to the operational disruptions caused by the COVID-19 pandemic. There was substantial heterogeneity in nurses' comfort levels regarding working shifts during the early phases and the height of the pandemic. Some nurses were apprehensive to return to their clinical responsibilities because of fears about contracting the virus while interacting with patients, their families, and fellow staff members. On the other hand, other nurses desired to return to work full-time because of their family's dependence on their income or fear of losing their job if they were to take a leave of absence during the peak of the pandemic.²⁸

Because of the substantial variability in nurses' outlooks on working during the pandemic, nursing leaders hosted a

Key Takeaways

- ◆ Pediatric hospitals were not immune to the detrimental effects of coronavirus disease 2019 (COVID-19), despite caring for a patient population that much less frequently experiences clinically significant symptoms of this disease. Surgical volume at a tertiary pediatric hospital in Texas dropped sharply after the governor issued an executive order in March 2020 that halted the performance of nonurgent surgical procedures.
- ◆ Leaders saw the disruptive forces of COVID-19 as a rare opportunity to overhaul the procedure-scheduling process with minimal effect on extraoperative activities. Perioperative leadership replaced dedicated block times in favor of open block times that were used on a first-come, first-served basis to increase operational efficiency, support decreased staffing, and facilitate prompt scheduling of urgent procedures.
- ◆ Nursing managers also made substantial changes to surgical staff member scheduling in response to the reduction in surgical volume and increased demand for staff members in other areas of the hospital. They facilitated this process by establishing a dialogue between perioperative leaders and staff members from each surgical service, presenting a comprehensive solution to a problem, and taking action upon receiving feedback.
- ◆ Lessons learned included the importance of identifying and capitalizing on the opportunities presented during uncertain times, remaining vigilant during assessments of procedural operations, and making a purposeful effort to approach and establish communications with stakeholders for their input and feedback. This institution's response to the disruptive forces of COVID-19 may be beneficial to pediatric hospitals worldwide.

series of virtual town halls to provide a platform for nurses to engage with nursing leaders directly in a safe and non-judgmental environment. These virtual town halls allowed nurses to voice their concerns and ask difficult questions that they might normally feel uncomfortable discussing in a one-on-one meeting with a member of nursing leadership. The virtual town halls also were highly beneficial for nursing leaders because the events allowed leaders to prepare for potential challenging questions from their constituents in a controlled environment. Anecdotally, both nursing leaders and staff members felt that this open dialogue was highly beneficial and resulted in a substantial reduction in the anxiety felt by staff members at the start of the pandemic.

LESSONS LEARNED

Our experience with the COVID-19 pandemic at our institution has taught us many lessons. First and foremost, remaining level-headed and not losing sight of our mission allowed perioperative leadership to identify and capitalize on the opportunities presented to us during these uncertain times. By doing this, we successfully designed and implemented a novel procedure-scheduling process

in prompt fashion. Second, critically evaluating our procedural operations throughout the pandemic served as a catalyst for the adjustments perioperative leaders made to increase operational efficiency despite substantial disruption to surgical care. Lastly, making a purposeful effort to approach and establish communications with stakeholders for their input and feedback regarding institutional directives aided in the optimization of said directives and increased receptiveness to change among personnel from each service.

CONCLUSION

The far-reaching effects of COVID-19 have had a detrimental effect on health care facilities worldwide. The substantial overhead associated with providing surgical care forced hospitals to adjust for sharp reductions in surgical volume while implementing protocols to keep patients, providers, and their families safe. Should we face similar circumstances in the future, we would replicate our institution's response to the deleterious effect that the COVID-19 pandemic had on our procedural operations to innovate while providing high-quality care to our patients.

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