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Elective operations delay and emergency department visits and inpatient admissions during COVID-19

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ABSTRACT

Introduction: At the beginning of the COVID-19 pandemic, many hospitals postponed elective operations for a 12-week period in early 2020. During this time, there was concern that the delay would lead to worse health outcomes. The objective of this study is to analyze the effect of delaying operations during this period on ED (Emergency Department) visits and/or urgent IP (Inpatient) admissions.

Methods: Electronic Health Record (EHR) data on canceled elective operations between 3/17/20 to 6/8/20 was extracted and a descriptive analysis was performed looking at patient demographics, delay time (days), procedure type, and procedure on rescheduled, completed elective operations with and without a related ED visit and/or IP admission during the delay period.

Results: Only 4 out of 197 (2.0%) operations among 4 patients out of 186 patients (2.0%) had an ED visit or IP admission diagnosis related to the postponed operation. When comparing the two groups, the 4 patients were older and had a longer median delay time compared to the 186 patients without an ED visit or IP admission.

Conclusion: Postponement of certain elective operations may be done with minimal risk to the patient during times of crisis. However, this minimal risk may be due to the study site's selection of elective operations to postpone. For example, none of the elective operations canceled or postponed were cardiovascular operations, which have worse health outcomes when delayed.

Introduction

At the start of the COVID-19 pandemic, many hospitals canceled or delayed elective procedures to reduce infection and transmission, as well as to reallocate healthcare resources. The cancellation rate was 72.3% across the globe with an estimated 28.4 million operations canceled or postponed [1].

On March 13, 2020, the American College of Surgeons (ACS) offered recommendations and guidelines for managing elective operations during the COVID-19 pandemic, which included "...a plan to minimize, postpone, or cancel electively scheduled operations, endoscopies, and other invasive procedures...". This was later reiterated by the Centers of Medicare and Medicaid Services (CMS) on March 18, 2020 [2,3]. At the

University of Arkansas for Medical Sciences (UAMS), which is the only tertiary academic medical center in the state, elective operations were halted from March 17, 2020, to June 8, 2020.

During this time, there was concern about the impact of delaying elective operations on patient morbidity and mortality. The objective of this study is to evaluate the effect of delaying elective operations on the number of ED (Emergency Department) visits and urgent IP (Inpatient) admissions related to the delayed operation.

Methods

The study took place at a tertiary healthcare system in a rural, southern US state and the study population consisted of patients who

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had elective, non-cardiovascular operations scheduled between 3/17/20 and 6/8/20 that were rescheduled or canceled. Patients with an initial operation date that was rescheduled and eventually completed were further analyzed for delay time in days and ED visits or IP admissions associated with the delayed operation. Operations for cardiovascular conditions were not halted.

Electronic Health Record (EHR) data extracted from the healthcare system's EHR system (Epic Systems, Verona, WI) using the services from a research data warehouse. During this time, an ad hoc placeholder date was used for all the canceled and postponed operations. Utilizing this date, EDIT trail records were used to identify the correct delayed operations. Operations completed on the placeholder date were excluded due to the emergent/urgent nature of the operation and diagnosis.

Unfortunately, while frequency was recorded, completed procedures without an initial scheduled date had to be excluded due to inability to determine if ED visits or Inpatient admissions prior to the completion date were due to operation delay. A descriptive analysis was performed, analyzing the distribution of the patients' demographics, the frequency of procedure types and procedures, and the delay time from initially scheduled date to completed date in days. The primary diagnosis of the ED visits and inpatient admissions between the canceled procedure date and the completed procedure date were then reviewed and compared to the primary procedure name. Data analysis was performed using JMP 16.1.0, a SAS Institute Inc. software.

Results

From March 17, 2020, to June 8th, 2020, a total of 966 operations among 920 patients were canceled/postponed. Of the 966 operations, 407 remained canceled and 545 were eventually completed at the study site. Three-hundred and forty-eight operations among 338 patients were completed, but did not have an initial, canceled operation date. The remaining 197 procedures among 189 patients had an initial operation date that was rescheduled and eventually completed. Fig. 1 visually depicts these categories.

Among the 197 operations, the most common operation types were orthopedics (35.3%), general (19.8%), and Ophthalmology (12.2%). The most common operations were total knee arthroplasty (11.2%), cataract with IOL (intraocular lens) insertion (9.1%), and posterior approach spinal fusion (7.6%). The median delay time was 73 days (IQR

(Interquartile Range): 56.0–94.0). Table 1 shows more detail on the operation types for the 197 postponed, completed operations with an initial operation date.

Only 7 of the 197 operations had an inpatient admission or ED visit between the first, canceled operation date and actual operation date with only 4 of the 7 having primary diagnoses associated with the postponed procedure. The 4 cases were among 4 patients had a median age of 65.5 (IQR: 59.8–66), cases were postponed by a median of 91 days (IQR: 42.5–136.5), majority were married (3 (75%)), and evenly split between White and Black patients and by sex. 50% were orthopedic procedures. The primary diagnoses of the ED visits and IP admissions for the 4 cases were osteoarthritis in the left knee with delayed total knee arthroplasty, left hip pain with delayed spinal fusion, shortness of breath with delayed laryngoscopy with CO2 laser, and cystostomy breakdown with delayed suprapubic catheter insertion. The 193 operations among 186 patients that did not have an ED visit or urgent IP admission related to the delayed operation, had a median age of 60 (IQR: 47.8–68.3), majority were female (56.6%) and white (75.8%). The most common operations and operation types among the 193 operations were the same as the total 197 operations used for the analysis, but the IQR for delay time was slightly smaller (73 days (IQR:56.0–93.0)). Table 2 provides greater detail on patient demographics and operations.

Discussion

Only 4 out of 197 (2.0%) postponed procedures resulted in an ED visit or inpatient stay associated with the deferred procedure. When comparing the patient demographics and delay time between the 4 procedures with an associated ED visit or IP admission and the 193 procedures without an associated ED visit or IP admission between the first cancellation date and completion date, the 4 patients were older, and the associated operations had a longer median delay time (days). However, the sample size is too small to assess for statistical significance.

While reviewing current literature on the risk of increased mortality and morbidity due to postponed operations, studies that looked at surgical delays prior to the 12-week operation hiatus in 2020 found that delay led to worse patient outcomes. Two systematic reviews assessed the morbidity and mortality of patients with delayed operations for various cancers and found that overall survival was worse [4,5]. Another study found associations between adverse patient outcomes, including longer lengths of stay and higher risk of 6-month readmission, and delays in surgical procedures for cancer and cardiovascular conditions, such as coronary artery bypasses [6].

Journal articles that focused on outcomes during and after the 2020 12-week cancellation period were more mixed and dependent on the reason for operation and operation type. Ro et al. found that 27 of 77 patients with severe aortic stenosis suffered a cardiac event during the 12-week postponement period [7]. A small clinical study looked at delay in rotator cuff repair operation and found no difference in pain scores (Simple shoulder test, American shoulder and elbow surgeons score, and

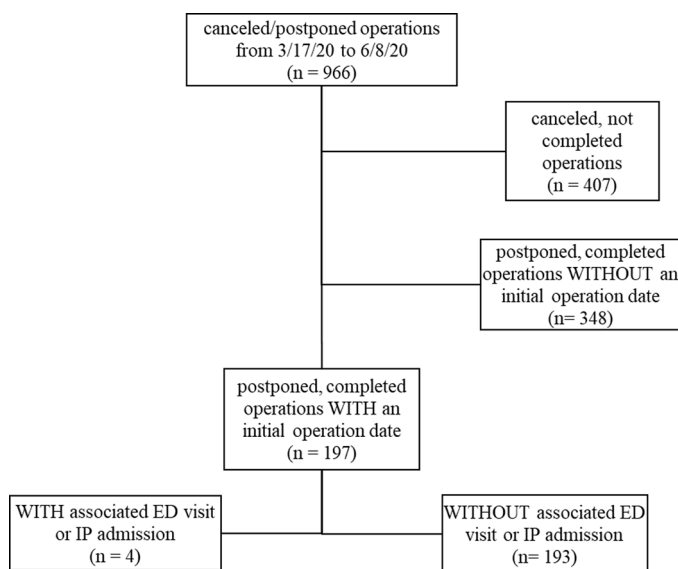


Fig. 1. A figure depicting the categorization of the canceled/postponed operations between 3/17/20 to 6/8/20 based on completions status, the existence of an initial operation date, and the operation's association with an ED visit or IP admission within the delay period.

Table 1
All completed, rescheduled operations with an initial operation date.

Operation type	n (%)
Orthopedics	70 (35.5%)
General	39 (19.8%)
Ophthalmology	24(12.2%)
ENT	23 (11.7%)
Neurosurgery	17 (8.6%)
Plastics	10 (5.1%)
Urology	9 (4.6%)
Gynecology	5 (2.5%)
All	197 (100%)

Abbreviations: ENT = Otolaryngology.

Table 2

Patient demographics and operations within the postponed, completed operations with initial operation dates split by presence of related ED visit or urgent IP admission.

Characteristic	Completed, rescheduled operations without ED visit/IP admission		Completed, rescheduled operations with ED visit/IP admission	
No. of patients	186		4	
Age (years), Median (IQR)	60 (47.8–68.3)		65.5 (59.8–66)	
Gender, n (%)	Male	81 (43.5%)	2 (50%)	
	Female	105 (56.5%)	2 (50%)	
Race, n (%)	White	141 (75.8%)	2 (50%)	
	Black	39 (21.0%)	2 (50%)	
	Other	6 (2.2%)	0 (0%)	
No. of surgeries	193		4	
Top 3 operation types, n (%)	Orthopedics	69 (35.2%)	Orthopedics	2 (50%)
	General	39 (20.2%)	Urology	1 (25%)
	Ophthalmology	24 (12.4%)	ENT	1 (25%)
Top 3 operations, n (%)	Total knee arthroplasty	21 (10.9%)	Total knee arthroplasty	1 (25%)
	Cataract w IOL insertion	18 (9.3%)	Spine fusion	1 (25%)
	Spine fusion	14 (7.3%)	Suprapubic catheter insertion	1 (25%)
Delay time (days), Median (IQR)	73 (56–93)		91 (42.5–136.5)	
ED visit, n (%)	–		2 (50%)	
IP stay, n (%)	–		2 (50%)	

Abbreviations: ENT = Otolaryngology, IOL = Intraocular lens, CO₂ = carbon dioxide.

visual analog scale). However, 27% of patients in the delay group did have a re-tear, but it was not statistically significant [8]. A population-based study in Canada looking at elective cholecystectomies and hernia repairs delayed during the first wave of the COVID-19 pandemic found an increase of urgent cholecystectomies following the delay period, but no increase of open surgery, use of cholecystectomy tubes, length of stay, or mortality [9]. A VA study by Tran et al. during and after the COVID-19 pandemic operation postponement period, which was not focused on a particular condition or operation, showed no increased risk of 30-day or 90-day mortality after the elective operation was delayed [10].

This study found that the risk of adverse outcomes, specifically ED visits or inpatient admission, after postponement of elective operations is minimal. This is likely due to the study site using an operation triaging system. During this elective surgery pause, each specialty was asked to triage their patients into urgent and non-urgent, using a guideline for urgent that stated if an operation would not proceed within two weeks, the patient would be at risk for mortality or severe morbidity. It was up to each specialty to prioritize and rank their patients using specialty-specific criteria. The operative service line maintained the pre-pandemic operating room blocks, which meant that if a service had previously been allocated an operating room on a given day, they would be allowed to schedule one time-sensitive case for that day. Each service was sent the surgical block assignments two weeks in advance, and services were instructed to release any slots they did not have urgent cases for back to central scheduling – those slots were then reassigned to services with more urgent cases. There was room for negotiation on a case-by-case basis, and communication was open between specialties.

This may indicate that a healthcare system's ability to correctly triage surgery cases can minimize the risk of subsequent ED visits or IP admissions during the delay period. There is also a possibility that the reasons for delay for patients prior and during the COVID-19 12-week surgical hiatus are different.

Future steps will focus on the impact of patients' comorbidities on health outcomes among patients who experienced surgical delays and an investigation into the reasons for operations delay prior to and during the 2020 COVID-19 surgery postponement period as well as an investigation into COVID-19 related delay periods after the first surge in 2020.

Limitations

Limitations for this study include issues with generalizability, small

sample size, and narrow focus on ED visits and IP admissions for patient outcomes. The study took place in one single tertiary hospital in a rural, southern US state, and results might not be generalizable outside of that setting. The sample that was examined, delayed operations with a first, canceled operations date, and the number that were associated with a subsequent ED visit or IP admission were too small to perform a statistical analysis for significance and only represented a small proportion of the canceled/postponed operations. Data on ED visits or IP admissions as well as canceled operations completed at other health institutions could not be captured because the data was limited to a single healthcare system. This study does not capture the psychological, economic, or functional toll of delaying elective operations. A strength is the use of log data, which decreases recall bias as well as the ability to track the delay time between the initial schedule date and the eventual completion date and sequence of events.

Conclusion

During the 12-week pause in elective operations, only 2% of patients had to seek urgent care either by visiting the emergency room or being admitted to our flagship academic center in a rural state. These data indicate that for most patients, the wait during the halting of elective procedures did not generate emergencies, and, with an operations triaging system, periods of elective surgery pause may be well justified in times of healthcare emergencies such as a worldwide pandemic. Future research is needed to explore delayed procedure outcomes and a potential increased burden in primary care due to canceled elective operations.

Disclosure

KS has received grants from NIH, HRSA, and Economic Development Association, received royalties from Vanderbilt University, has been supported as an invited speaker for the Eastern Association for the Surgery of Trauma, has participated on the board for Decisio Health, LLC and Little Rock Tech Park Board, has stock in Decisio, LLC, and is a managing member of Datafy, LLC. JS has received grants from PCORI, HRSA, and FCC, received royalties from the University of Arkansas for Medical Sciences, is on the board of Horizon Health Solutions, has a leadership position in Datafy, LLC, has stock or stock options in SJ Medconnect, Microsoft

AMD, NVIDIA, Apple, and other holdings through index funds, and is a managing member of Datafy, LLC. KS and JS have patents for a PIVA

monitor, PIVA/NIVA, Clip Beat, and markerless motion capture

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CRediT authorship contribution statement

Lori Wong: Investigation, Methodology, Validation, Visualization, Writing – original draft. **Moriah Hollaway:** Conceptualization, Data curation, Investigation, Writing – review & editing. **Joseph Sanford:** Methodology, Project administration, Resources, Supervision, Validation, Writing – review & editing. **Kevin Sexton:** Methodology, Project administration, Resources, Supervision, Validation, Writing – review & editing. **Feliciano Yu:** Supervision, Writing – review & editing. **Hanna Jensen:** Conceptualization, Investigation, Project administration, Supervision, Writing – review & editing.

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