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Clinical Study

COVID-19 pandemic and elective spinal surgery cancellations – what happens to the patients?

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ABSTRACT

BACKGROUND CONTEXT: The COVID-19 pandemic caused nationwide suspensions of elective surgeries due to reallocation of resources to the care of COVID-19 patients. Following resumption of elective cases, a significant proportion of patients continued to delay surgery, with many yet to reschedule, potentially prolonging their pain and impairment of function and causing detrimental long-term effects.

PURPOSE: The aim of this study was to examine differences between patients who have and have not rescheduled their spine surgery procedures originally cancelled due to the COVID-19 pandemic, and to evaluate the reasons for continued deferment of spine surgeries even after the lifting of the mandated suspension of elective surgeries.

STUDY DESIGN/SETTING: Retrospective case series at a single institution

PATIENT SAMPLE: Included were 133 patients seen at a single institution where spine surgery was canceled due to a state-mandated suspension of elective surgeries from March to June, 2020.

OUTCOME MEASURES: The measures assessed included preoperative diagnoses and neurological dysfunction, surgical characteristics, reasons for surgery deferment, and PROMIS scores of pain intensity, pain interference, and physical function.

METHODS: Patient electronic medical records were reviewed. Patients who had not rescheduled their canceled surgery as of January 31, 2021, and did not have a reason noted in their charts were called to determine the reason for continued surgery deferment. Patients were divided into three groups: early rescheduled (ER), late rescheduled (LR), and not rescheduled (NR). ER patients had a date of surgery (DOS) prior to the city’s Phase 4 reopening on July 20, 2020; LR patients had a DOS on or after that date. Statistical analysis of the group findings included analysis of variance with Tukey’s honestly significant difference (HSD) post-hoc test, independent samples T-test, and chi-square analysis with significance set at $p \leq .05$.

RESULTS: Out of 133 patients, 47.4% (63) were in the ER, 15.8% (21) in the LR, and 36.8% (49) in the NR groups. Demographics and baseline PROMIS scores were similar between groups. LR had more levels fused (3.6) than ER (1.6), $p = .018$ on Tukey HSD. NR (2.1) did not have different mean levels fused than LR or ER, both $p = >.05$ on Tukey HSD. LR had more three column osteotomies (14.3%) than ER and (1.6%) and NR (2.0%) $p = .022$, and fewer lumbar microdissectomies (0%) compared to ER (20.6%) and NR (10.2%), $p = .039$. Other surgical characteristics were similar

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between groups. LR had a longer length of stay than ER (4.2 vs 2.4, $p=.036$). No patients in ER or LR had a nosocomial COVID-19 infection. Of NR, 2.0% have a future surgery date scheduled and 8.2% (4) are acquiring updated exams before rescheduling. 40.8% (20; 15.0% total cohort) continue to defer surgery over concern for COVID-19 exposure and 16.3% (8) for medical comorbidities. 6.1% (3) permanently canceled for symptom improvement. 8.2% (4) had follow-up recommendations for non-surgical management. 4.1% (2) are since deceased.

CONCLUSION: Over 1/3 of elective spine surgeries canceled due to COVID-19 have not been performed in the 8 months from when elective surgeries resumed in our institution to the end of the study. ER patients had less complex surgeries planned than LR. NR patients continue to defer surgery primarily over concern for COVID-19 exposure. The toll on the health of these patients as a result of the delay in treatment and on their lives due to their inability to return to normal function remains to be seen. © 2021 Elsevier Inc. All rights reserved.

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Introduction

In December 2019, the first case of a novel coronavirus, named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was reported in Wuhan, China [1]. The disease caused by SARS-CoV-2 was later named coronavirus disease 2019 (COVID-19), and on March 11, 2020, WHO declared COVID-19 a pandemic [2]. The first US cases were reported in Seattle, Washington in February, 2020, followed shortly by cases in New York, which quickly became the primary epicenter of the outbreak in the United States [3,4]. Mandated suspension of elective surgeries followed in several cities across the nation as part of the reallocation of medical treatment resources to the care of patients with COVID-19 [5-7]. In New York City, elective cases were suspended on March 20, 2020 and resumed with Phase 1 reopening on June 8, 2020 [6,8].

It was thought that there would be a surge of backlog surgeries once the mandates were lifted, but in many practices the volume of surgeries has remained lower than prior to the pandemic. A study of Medicare patients found that June 2020 surgical volume for spine surgeries was less than half the expected volume following resumption of elective cases, despite a 3-month backlog of canceled cases in addition to new cases [9]. It is important to determine the magnitude of surgical deferment and the reasons for its persistence despite the lifting of the mandate and the institution of strict safety measures in hospitals.

In this study we examined a large cohort of patients at a single institution who had to cancel their spine surgeries due to the initial mandate against elective surgeries. We noted the length of the delays in rescheduling surgeries and used statistical analysis to investigate the characteristics of patients who deferred longer. We also noted their stated reasons for deferment.

Materials and methods

Study design and inclusion criteria

All patients were included if they had their spine surgery canceled at our institution due to a mandated suspension of

elective surgeries for 3 months, from March 20 to June 8, 2020, and had outpatient documentation in our electronic medical record system (EMR). The list of included patients was created by pulling a list from our institution's EMR of spine surgeries scheduled and then canceled due to the pandemic. Our surgical coordinators compiled separate lists of spine patients booked but not yet scheduled in our EMR, which we then added to the list pulled from the EMR.

Data collection

Patient demographics, clinical characteristics, Health-Related Quality of Life (HRQL) scores, preoperative diagnoses, preoperative neurological dysfunction, length of preoperative symptoms, surgical characteristics, and COVID-19 test results were collected from the EMR. Demographics and clinical characteristics included age, sex, BMI, Charlson Comorbidity Index (CCI), and current smoking status. HRQL scores included baseline PROMIS scores of pain intensity, pain interference, and physical function. The PROMIS scores at the preoperative exam closest to the originally scheduled surgery date were chosen for analysis. Planned surgical characteristics were based on the booking sheet, and included levels fused, levels decompressed, microdiscectomy, 2 or 3 column osteotomy, and revision vs. index surgery. Length of preoperative symptoms was calculated based on patient reported start of symptoms to their originally scheduled surgery date. Length of stay in the hospital was noted for patients with rescheduled surgery. For patients who had not yet had surgery, their chart was reviewed for a documented reason for deferring surgery. If no reason was documented, patients were called to inquire their reason for surgery deferment.

Statistical analysis

Patients were divided into three groups for comparison: those who had their surgeries rescheduled early (ER), those who had their surgeries rescheduled late (LR), and those who had not had rescheduled surgery yet (NR). We defined the ER group as those with a rescheduled date of surgery prior to the city's Phase Four reopening on July 20, 2020

[10]. The LR group was defined as patients with a rescheduled surgery on or after July 20, 2020. The not rescheduled group (NR) was defined as patients who had not had surgery as of January 31, 2021.

One-way Analysis of variance (ANOVA) followed by Tukey's honestly significant difference (HSD) was used to test for differences in continuous variables among the 3 groups. Independent samples t-test was used when comparing continuous variables between ER and LR. Categorical variables were analyzed using the chi square test. Statistical analysis was performed using SPSS 25.0 (SPSS Inc., Chicago, IL). Statistical significance was set at $p \leq .05$.

Results

Baseline characteristics

There were 133 patients who met inclusion criteria. Ninety-nine of these patients were pulled from the list of canceled surgeries in the EMR, and the remaining 34 patients were pulled from surgical coordinators' booking logs. There were 63 patients (47.4%) in the early rescheduled group, 21 patients (15.8%) in the late rescheduled group, and 49 patients (36.8%) who had not had surgery as of January 31, 2021 (Table 1). While this did not reach statistical significance, there was a trend towards younger patients rescheduling surgery earlier, with an average age of 54.59 years in ER, 62.81 years in LR, and 61.18 years in NR ($p=.057$). Gender was similar in all three groups, with 44.3% ($n=28$), 38.1% ($n=8$), and 46.9% ($n=23$) females in the ER, LR and NR groups respectively; $p=.792$. BMI was similar across the groups, with an average of 28.27, 29.53 and 29.02 respectively; $p=.670$. Baseline health was statistically similar, with an average Charleston Comorbidity Index (CCI) of 2.76, 3.86, and 3.33, respectively; $p=.129$. The percentage of current smokers was similar with 11.1% ($n=7$), 4.8% ($n=1$), and 10.2% ($n=5$), respectively; $p=.692$.

Preoperative diagnoses and neurologic dysfunction

The rates of preoperative spinal diagnoses were fairly similar between groups for most diagnoses, as shown in Table 2. The rate of spondylolisthesis was highest in NR (53.1%; $n=26$) versus LR (33.3%; $n=7$) and ER (28.6%; $n=18$); $p=.027$. Degenerative disc disease occurred more

frequently in NR (55.1%; $n=27$) than ER (41.3%; $n=26$) than LR (23.8%; $n=5$); $p=.047$. There was a trend towards more kyphotic deformity in LR (19.0%; $n=4$) compared to NR (8.2%; $n=4$) and ER (3.2%; $n=2$), although this did not quite reach statistical significance ($p=.056$). Similarly, there was a trend towards more flat-back deformity in LR (9.5%; $n=2$) than NR (6.1%; $n=3$) than ER (0%; $n=0$); $p=.076$. Proximal Junctional Kyphosis (PJK) was also a more frequent indication for surgery in LR (4.8%; $n=1$) compared to ER and NR (both 0%; $n=0$), although this this not quite reach statistical significance ($p=.068$). All other diagnoses were similar between groups. The rates of preoperative neurologic dysfunction were similar between groups, with the exception of preoperative weakness. There was a higher incidence of preoperative weakness in ER (28.6%; $n=18$) and NR (30.6%; $n=15$) compared to LR (0%; $n=0$), $p=.016$. When weakness was further broken down by severity, there were no statistically significant differences between groups at each deficit level, but the only patients with 0/5 or 1/5 strength were in the ER group. Furthermore, the ER group had a higher raw percentage of patients with 2/5 and 3/5 strength, while most of NR had 4/5 strength. There were no differences in rates of other neurologic dysfunction, including sensory deficits, hyper- and hypo-reflexia, Lhermitte's sign, Spurling test Hoffman sign, and Babinski reflex between groups. The duration of symptomatology from initial onset to originally scheduled surgery date was not statistically different between groups with an average of 484.25 ± 642.98 days for ER, 456.67 ± 803.14 days for LR, and 695.61 ± 955.88 days for NR ($p=.313$).

Surgical characteristics

The average number of levels fused was higher for LR compared to ER (3.57 vs 1.63; $p=.018$ on Tukey HSD). NR had a mean levels fused in-between the other groups and was not found to be significantly different from them (2.10 levels; $p > .05$ on Tukey HSD). The number of levels decompressed was similar among the groups, with an average of 0.65, 1.05, and 0.57 in the ER, LR and NR groups respectively; $p=.251$. The rate of 3-column osteotomies was higher for LR: 14.3% ($n=3$) compared to 1.6% ($n=1$) and 2.0% ($n=1$) in the ER and NR groups respectively; $p=.022$. There was no statistically significant difference in 2-column

Table 1

Comparison of demographics between patients with spine surgeries rescheduled prior to New York City's Phase 4 reopening, after reopening, and those not rescheduled

Demographics and Clinical Characteristics	Early Rescheduled (n=63)	Late Rescheduled (n= 21)	Not Rescheduled (n=49)	p-value
Age	54.59±19.01	62.81±17.46	61.18±13.86	.057
Gender (%F)	28 (44.3%)	8 (38.1%)	23 (46.9%)	.792
BMI	28.27±6.84	29.53±4.81	29.02±5.81	.670
Charlson Comorbidity Index (CCI)	2.76±2.30	3.86±2.46	3.33±2.15	.129
Current Smoker	7 (11.1%)	1 (4.8%)	5 (10.2%)	.692

Table 2

Comparison of preoperative diagnoses and neurologic dysfunction between patients with spine surgeries rescheduled prior to New York City's Phase 4 reopening (early rescheduled), after reopening (late rescheduled), and those not rescheduled

	Early Rescheduled (n=63)	Late Rescheduled (n= 21)	Not Rescheduled (n=49)	p-value
Preoperative Diagnosis				
AIS	5 (7.9%)	2 (9.5%)	1 (2.0%)	.327
Adult Scoliosis	6 (9.5%)	3 (14.3%)	2 (4.1%)	.322
Adult Kyphosis	2 (3.2%)	4 (19.0%)	4 (8.2%)	.056
Flatback deformity	0 (0.0%)	2 (9.5%)	3 (6.1%)	.076
Radiculopathy	37 (58.7%)	10 (47.6%)	28 (57.1%)	.667
Myelopathy	9 (14.3%)	5 (23.8%)	8 (16.3%)	.595
Degenerative Disc Disease	26 (41.3%)	5 (23.8%)	27 (55.1%)	.047
Herniated Nucleus Pulposus	24 (38.1%)	7 (33.3%)	13 (26.5%)	.435
Spondylolisthesis	18 (28.6%)	7 (33.3%)	26 (53.1%)	.027
Spinal Stenosis	37 (58.7%)	14 (66.7%)	35 (71.4%)	.370
Proximal Junctional Kyphosis	0 (0.0%)	1 (4.8%)	0 (0.0%)	.068
Adjacent Segment Disease	2 (3.2%)	2 (9.5%)	1 (2.0%)	.303
Pseudarthrosis	3 (4.8%)	2 (9.5%)	2 (4.1%)	.627
Preoperative Neurologic Dysfunction				
Motor Weakness	18 (28.6%)	0 (0.0%)	15 (30.6%)	.016
0/5 strength	1 (1.6%)	0 (0.0%)	0 (0.0%)	.571
1/5 strength	1 (1.6%)	0 (0.0%)	0 (0.0%)	.571
2/5 strength	2 (3.2%)	0 (0.0%)	1 (2.0%)	.692
3/5 strength	4 (6.3%)	0 (0.0%)	2 (4.1%)	.471
4/5 strength	10 (15.9%)	0 (0.0%)	10 (20.4%)	.088
Sensory deficit	5 (7.9%)	1 (4.8%)	2 (4.1%)	.672
Hyperreflexia	5 (7.9%)	2 (9.5%)	3 (6.1%)	.872
Hyporeflexia	5 (7.9%)	1 (4.8%)	3 (6.1%)	.860
Lhermitte's Sign	3 (4.8%)	0 (0.0%)	1 (2.0%)	.479
Spurling Test	3 (4.8%)	0 (0.0%)	3 (6.1%)	.523
Hoffman Sign	4 (6.3%)	1 (4.8%)	6 (12.2%)	.424
Babinski Reflex	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Symptom Duration (days)	484.25±642.98	456.67±803.14	695.61±955.88	.313

osteotomies among groups with 1.6% (n=1), 4.8% (n=1) and 0% (n=0) in ER, LR, and NR respectively; p=.324. The rate of lumbar microdiscectomy was highest among ER, with a rate of 20.6% (n=13), followed by NR with 10.2% (n=5), and LR with none (0%); p=.039. There was no statistically significant difference in rates of revision surgery in the 3 groups with 25.4% (n=16), 38.1% (n=8) and 28.6% (n=14) in ER, LR, and NR respectively; p=.537. Length of stay was longer for LR than ER, with stays of 4.20 compared to 2.43 days, respectively; p=.036 (Table 3).

Baseline HRQL scores

Of the 133 patients, there were 47 patients (23 ER patients, 7 LR, and 17 NR) with documented baseline PROMIS scores for pain intensity, pain interference, and physical function impairment. The duration between the time these scores were collected and the originally scheduled date of surgery was similar between the groups with 77.61 days prior for ER, 82.71 days for LR, and 84.75 days for NR (p=.952). There were no significant differences in average PROMIS scores between groups for each category. The average pain intensity score was 54.19, 53.16, and 55.46, respectively; p=.739. The average pain interference was 63.42, 66.12, and 63.14, respectively; p=.851. The

average physical function was 35.79, 35.36, and 36.78, respectively; p=.886 (Table 4).

Reason for surgery deferment

There were 49 patients who had not had their surgeries by the end of the study (the NR group). Of this group, 40.8% (n=20) reported that they wanted to delay surgery until the COVID-19 pandemic was over because they were concerned about COVID-19 exposure in medical facilities. 16.3% (n=8) delayed surgery due to a new or worsening medical comorbidity. These comorbidities included acute coronary syndrome, cerebrovascular accident, hematologic conditions, new pregnancy, uncontrolled diabetes mellitus, other neurological conditions, and other orthopedic conditions. 4.1% (n=2) died before having surgery, one from COVID-19 infection and the other from an unknown to us cause. 8.2% (n=4) were recommended for conservative treatment on later follow-up with their surgeon or from a second opinion. 6.1% (n=3) had enough symptom improvement during the pandemic that they chose to permanently cancel their surgery. 2.0% (n=1) were on the OR schedule but had not yet had the rescheduled surgery. Another 8.2% (n=4) were in the process of rescheduling their surgery, and were acquiring updated imaging or exams needed prior to scheduling. We

Table 3

Comparison of surgical characteristics between patients with spine surgeries rescheduled prior to New York City's Phase 4 reopening (early rescheduled), after reopening (late rescheduled), and those not rescheduled

Surgical Characteristics		Early Rescheduled (n=63)	Late Rescheduled (n= 21)	Not Rescheduled (n=49)	p-value
Levels fused	<i>mean</i>	1.63±2.36	3.57±4.48	2.10±2.33	.025
	<i>post-hoc group</i>	a	b	ab	.018
Levels Decompressed		0.65±1.14	1.05±1.32	0.57±0.98	.251
2 column osteotomy		1 (1.6%)	1 (4.8%)	0 (0.0%)	.324
3 column osteotomy		1 (1.6%)	3 (14.3%)	1 (2.0%)	.022
Lumbar microdiscectomy		13 (20.6%)	0 (0.0%)	5 (10.2%)	.039
Revision		16 (25.4%)	8 (38.1%)	14 (28.6%)	.537
Length of Hospital Stay		2.43±2.97	4.20±3.97		.036

Table 4

Comparison of baseline HRQLs between patients with spine surgeries rescheduled prior to New York City's Phase 4 reopening, after reopening, and those not rescheduled

Health-Related Quality of Life Scores	Early Rescheduled (n=23)	Late Rescheduled (n= 7)	Not Rescheduled (n=17)	p-value
Baseline PROMIS Pain Intensity	54.19±9.67	53.16±5.82	55.46±9.82	.739
Baseline PROMIS Pain Interference	63.42±9.74	66.12±5.34	63.14±8.61	.851
Baseline PROMIS Physical Function	35.79±7.63	35.36±3.82	36.78±8.42	.886

were unable to contact the remaining 14.3% (n=7) of patients who had not rescheduled, so we do not know their reasons for continued surgery deferment (Table 5).

Covid-19 transmission

There were no patients in this study who tested positive for COVID-19 or were a person under investigation for COVID-19 infection following their surgery. There were 4 patients in the ER group who had contracted COVID-19 prior to surgery, but all of them had overcome their illness and developed antibodies prior to their date of surgery.

Discussion

The patients who deferred their surgeries included the LR patients (15.8%) who delayed having surgery until after

the Phase 4 reopening on July 20, 2020, together with the NR patients (36.8%) who still had not had surgery by the end of the study on January 31, 2021. Thus, just over half of the patients scheduled prior to the pandemic deferred rescheduling well after the mandate was lifted, confirming that there was a reluctance to reschedule surgery that extended for 8 months or more. The primary concern voiced by the NR patients was for their safety from COVID-19 in the hospital environment as the pandemic continued to manifest (40.8% of the NR group). The remaining NR patients were in the process of rescheduling (10.2%), had since developed comorbidities that contraindicated spinal surgery (16.3%), had chosen nonsurgical treatment (14.3%) or had died (4.1%).

We did not find differences between groups in the prevalence of most preoperative diagnoses, finding similar rates of myelopathy, radiculopathy, adolescent idiopathic

Table 5

Reasons for continued surgical deferment for patients who have not yet had rescheduled surgery

Reasons For Continued Deferred Surgery	Not Rescheduled (n=49)
Rescheduled for a future date	1 (2.0%)
In process of acquiring updated imaging and medical clearance before rescheduling	4 (8.2%)
Patient expressed wish to delay until Pandemic is over	20 (40.8%)
Permanent cancelation due to interim symptom improvement	3 (6.1%)
Recommended conservative treatment on follow-up with surgeon or second opinion	4 (8.2%)
Patient's surgery delayed due to new or worsening medical comorbidity	8 (16.3%)
Patient died before rescheduling surgery	2 (4.1%)
Unknown reason for not-rescheduling	7 (14.3%)

scoliosis, adult scoliosis, herniated nucleus pulposus, spinal stenosis, adjacent segment disease, and pseudarthrosis. Patients in the late rescheduled group had higher rates of preoperative spondylolisthesis, kyphosis, flat-back deformity, and PJK, but lower rates of degenerative disc disease. These higher rates of many deformity diagnoses in LR patients is congruous with the finding that LR patients had more surgically invasive procedures planned.

Regarding preoperative neurological dysfunction, patients in the early rescheduled and not rescheduled groups had higher rates of weakness than late rescheduled. Additionally, patients in the early rescheduled group with weakness included patients with more severe weakness, while most of the patients with weakness in the late rescheduled group had minor weakness with 4/5 strength, and none had 0/5 or 1/5 strength. This difference in severity may partially explain why NR patients have not felt the need to reschedule surgery yet despite having the same rate of weakness as ER.

Although there were not many differences in preoperative diagnoses and neurological deficits between groups, we did find significant differences in surgical invasiveness. Patients undergoing more complex procedures, which necessitate a longer hospital and rehabilitation stay tended to delay surgery. The late rescheduled group had more levels fused, more three column osteotomies, and longer hospital stays than the early rescheduled group. In contrast, the early rescheduled group had more lumbar microdisectomies with short hospital stays. The patients who have not rescheduled surgery yet had surgical complexity in between the early and late rescheduled groups. This deferral of more invasive alignment correction procedures with longer hospital stays supports our hypothesis that patient concern for COVID-19 exposure is a major driving force for delaying surgery during the pandemic. Length of stay has been shown to be a risk factor for nosocomial COVID-19 infection with reported time from admission to diagnosis of greater than two weeks [11,12]. Despite concern for hospital-acquired COVID-19 in surgical patients, we did not have any patients test positive for COVID-19 following their procedure. This is consistent with the literature reporting an incidence of positive COVID-19 results ranging from 0-3.2% in elective orthopedic and neurosurgical patients [12-15]. In our cohort, patients likely to have longer medical stays due to the complex nature of their procedure chose to delay surgery until COVID-19 cases had decreased locally and the city moved into Phase 4 of reopening.

This does not fully explain why the not rescheduled group continues to delay surgery when they had less complex surgery scheduled than the late rescheduled group. This group (NR) may have higher perceived concern for COVID-19 exposure than the other groups, leading to continued surgery deferment, but we were unable to assess these differences in our study. Although we found no differences in preoperative pain or function between the groups as assessed through PROMIS scores, baseline scores were only available for 35% of patients. It is possible that the NR group had less preoperative pain and dysfunction, allowing

them to defer surgery longer, but we missed this difference due to our low PROMIS numbers. From our data, it appears that patients with more complex procedures planned, possibly representing more pre-operative dysfunction and a greater need for surgical intervention, decided to undergo spine surgery at a point during the pandemic where they felt safe due to lower COVID-19 transmission rates. Patients who have not rescheduled surgery had less invasive surgeries planned than the late rescheduled group, likely representing less pre-operative dysfunction, and therefore, felt able to wait out the pandemic before rescheduling surgery.

Our findings indicate the need for surgeons to discuss patients' individual risk of COVID-19 infection based on their planned surgery and length of stay in medical facilities. We found that many patients without a rescheduled surgery were delaying surgery due to fear of nosocomial COVID-19 infection, despite having no nosocomial COVID-19 infection in spine surgery patients at our institution and low nosocomial COVID-19 infection reported in the literature for orthopedic and neurosurgical patients. Patients may not have been aware of these low transmission rates, and were thus delaying surgery due to improbable fears. Surgeons can help assuage these fears by informing patients of the low COVID-19 transmission risk, and the institutional protocols in place to prevent nosocomial COVID-19 transmission, such as preoperative COVID-19 testing, personal protective equipment usage, and COVID-19 isolation units.

To our knowledge, this is the first study published which looks at factors affecting when patients reschedule spine surgery during the COVID-19 pandemic. In total joint arthroplasty literature, a national survey found that early in the pandemic, 87% of patients wanted to reschedule their elective cases as soon as possible, and only 6% wished to delay due to fear of COVID-19. However, this same study showed that patients in the Northeast US and older patients were more nervous about contracting COVID-19 [16], which more closely matches our patient population. These regional and age related differences in addition to the decreased length of stay for total joints cases may explain why more total joints patients reported willingness to proceed with surgery immediately compared to the spine patients in our study. In global literature for all elective orthopedic surgery cases early in the pandemic, 30% or more of patients wanted to cancel their surgeries, with the primary reason for cancellation concern for COVID-19 exposure [17,18]. This is consistent with findings in our study showing 40.8% of patients not rescheduled are deferring surgery due to concern for COVID-19 exposure in medical institutions. This concern for nosocomial COVID-19 infection was seen throughout the elective surgery literature with 53-61% of patients worried about contracting COVID-19 during their stay, and the finding that patients who thought hospital transmission of COVID-19 was likely were more prone to cancel their surgery [12,15,19].

We recognize certain limitations inherent to this study. Being retrospective, it suffers from the possibility of bias in selection and has no control subjects. Yet in this COVID-19 era, it is essential to learn what we can from the evidence at hand, and this fairly large cohort is considered a source of useful information. Furthermore, the study may not be generalizable to all areas of the US or to other countries because of the different patterns of approach to allocating medical resources. These practices may change over time as well. This study was conducted on patients who were scheduled at the onset of the pandemic. With time, people may experience “COVID fatigue,” with a more relaxed attitude towards safety considerations. This may be especially true as more people are vaccinated. Finally, we should note that baseline pain and functioning PROMIS scores were only available for about 35% of patients in the cohort, which hampered our ability to assess the influence of these factors on the decision for early versus late surgery.

Conclusions

Over one third of elective spine surgeries canceled due to the first wave of COVID-19 remain unscheduled 8 months after elective spine surgeries resumed in our institution. Of the patients who did have surgery, those who rescheduled earlier had less complex procedures with shorter hospital stays than those who rescheduled later. The primary reason for patients continuing to defer surgery is their concern over COVID-19 exposure in healthcare settings. Our findings highlight the importance of the patients’ perception of COVID-19 exposure risk in their decision to reschedule surgery, and it will be important for surgeons to help patients weigh those risks as the pandemic waxes and wanes over the coming months to years.

Declarations of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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