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The impact of elective surgery restrictions during the COVID-19 (coronavirus disease 2019) pandemic on shoulder and elbow surgery: patient perceptions

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\textbf{Background:} In late 2019 and early 2020, a novel coronavirus, COVID-19 (coronavirus disease 2019), spread across the world, creating a global pandemic. In the state of Pennsylvania, non-emergent, elective operations were temporarily delayed from proceeding with the normal standard of care. The primary purpose of this study was to determine the proportion of patients who required prescription pain medication during the surgical delay. Secondarily, we sought to determine the proportion of patients who perceived their surgical procedure as non-elective and to evaluate how symptoms were managed during the delay.

\textbf{Materials and methods:} A single institutional database was used to retrospectively identify all shoulder and elbow surgical procedures scheduled between March 13 and May 6, 2020. Charts were manually reviewed. Patients who underwent non–shoulder and elbow–related procedures and patients treated by surgeons outside of Pennsylvania were excluded. Patients whose surgical procedures were postponed or canceled were administered a survey evaluating how symptoms were managed and perceptions regarding the delay. Preoperative functional scores were collected. Statistical analysis was performed to determine associations between procedure status, preoperative functional scores, perception of surgery, and requirement for prescription pain medication.

\textbf{Results:} A total of 338 patients were scheduled to undergo shoulder and elbow surgery in our practice in Pennsylvania. Surgery was performed as initially scheduled in 89 of these patients (26.3%), whereas surgery was postponed in 179 (71.9%) and canceled in 70 (28.1%). The average delay in surgery was 86.7 days (range, 13–299 days). Responses to the survey were received from 176 patients (70.7%) in whom surgery was postponed or canceled. During the delay, 39 patients (22.2%) required prescription pain medication. The surgical procedure was considered elective in nature by 73 patients (41%). One hundred thirty-seven patients (78%) would have moved forward with surgery if performed safely under appropriate medical guidelines. Lower preoperative American Shoulder and Elbow Surgeons scores ($r = -0.36, P < .001$) and Single Assessment Numeric Evaluation scores ($r = -0.26, P = .016$) and higher preoperative visual analog scale scores ($r = 0.28, P = .009$) were correlated with requiring prescription pain medication. Higher preoperative American Shoulder and Elbow Surgeons scores were positively correlated with perception of surgery as elective ($r = 0.4, P < .001$).

This study was approved through Thomas Jefferson University’s Institutional Review Board (control no. 20E.1055).

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In late 2019 and early 2020, a novel coronavirus, COVID-19 (coronavirus disease 2019), spread across the world, creating a global health crisis. On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a pandemic and global health emergency. As infections across the United States rapidly increased, health care organizations made efforts to prepare by conserving resources. On March 13, 2020, US Surgeon General Jerome Adams urged health care systems to consider postponing elective surgical procedures, and 5 days later, the Centers for Medicare & Medicaid Services recommended delaying all elective surgical procedures, as well as non-essential medical, surgical, and dental procedures, to preserve personal protective equipment, hospital beds, and ventilators. Many surgical staff members were reassigned to medical floors and intensive care units, and elective procedures were indefinitely put on hold. In the state of Pennsylvania, non-emergent, elective operations were temporarily delayed from proceeding with the normal standard of care. Any operation that would have been considered elective in nature was not allowed to proceed unless certified time-sensitive by the treating surgeon. Any operations that moved forward during this period at our facility were reviewed by the state health department. This elective operation “ban” was in effect in Pennsylvania from March 13 until May 6, 2020.

Although their conditions were not life- or limb-threatening, many patients who experienced a delay in surgery had musculoskeletal disorders that significantly impacted their quality of life. Few studies have evaluated how the delay in surgery and disruption in care are perceived by orthopedic patients. According to recent literature, older patients, women, and non-native English-language speakers were more hesitant to proceed with elective orthopedic surgery during the pandemic. However, in a recent study by Ho et al., 40% of elective orthopedic surgery patients perceived their surgical procedures as urgent. To our knowledge, no previous studies have evaluated the impact of elective surgery restrictions on patients undergoing shoulder and elbow surgery. Gaining a better understanding of patient perceptions regarding the surgical delay could have implications for patient education, counseling, and management of expectations to improve patient satisfaction.

The primary purpose of this study was to determine the proportion of patients who required prescription pain medication during the surgical delay. Secondarily, we sought to determine the proportion of patients who perceived their surgical procedures as non-elective and to evaluate how symptoms were managed during the delay.

Methods

This was a retrospective survey study. A single institutional database was used to retrospectively identify all shoulder and elbow surgical procedures scheduled between March 13 and May 6, 2020. Patient charts were manually reviewed. Patients who underwent non–shoulder and elbow–related procedures and patients treated by surgeons outside of Pennsylvania were excluded because surgical postponement regulations were different in each state. Surgical procedures were categorized as scheduled, postponed, or canceled. Cancellation was recommended by the surgeon based on an institutional mandate in accordance with state regulations. Date of scheduled surgery, date of actual surgery, and procedure were collected via manual chart review. Preoperative American Shoulder and Elbow Surgeons (ASES) scores, visual analog scale (VAS) pain scores, and Single Assessment Numeric Evaluation (SANE) scores were collected from questionnaires completed at the final preoperative visit. Patients whose surgical procedures were postponed or canceled were administered a survey evaluating how symptoms were managed and perceptions regarding the delay. Surveys were administered via email. Surveys were re-sent 2 weeks after administration of the initial survey if patients did not respond. Patients who did not respond to the email survey were contacted via phone; 3 phone call attempts were made.

Statistical analysis was performed using the t test for analysis of parametric continuous data. Nonparametric data were analyzed using the Mann-Whitney test. The χ² or Fisher exact test was used to calculate P values for categorical data. P < .05 was deemed significant. Correlations were analyzed using the Spearman correlation coefficient. Logistic regression analysis was performed. All statistical analyses were performed using RStudio (version 3.6.3; R Foundation for Statistical Computing, Vienna, Austria).

Results

During the study period, 338 patients were scheduled to undergo shoulder or elbow surgery in our practice in
Pennsylvania. Of these patients, 89 (26.3%) underwent surgery as initially scheduled. Surgical procedures in the remaining 249 patients (73.7%) were postponed or canceled because of the COVID-19 elective surgery restrictions. The average delay in surgery was 86.7 days (range, 13-299 days). Surgery was performed in a delayed fashion in 179 patients (71.9%), whereas surgery was canceled altogether in 70 patients (28.1%) (Fig. 1). The breakdown of delayed and canceled procedure types is as follows: primary arthroplasty, 99 (39.8%); revision arthroplasty, 11 (4.42%); fracture fixation, 8 (3.21%); rotator cuff repair, 84 (33.7%); labral repair, 10 (4.02%); other arthroscopic procedure, 22 (8.84%); other open procedure, 14 (5.62%); and total elbow arthroplasty, 1 (0.40%) (Fig. 2).

Preoperative ASES scores, SANE scores, and VAS pain scores were documented in 128 patients (51.4%), 156 patients (62.7%), and 118 patients (47.4%), respectively. The mean preoperative ASES, SANE, and VAS scores were 43.1, 30.4, and 7.34, respectively.

Responses to the survey were received from 176 patients (70.7%) in whom surgery was postponed or canceled. During the delay, 39 patients (22.2%) required prescription pain medication. In 55 patients (31.2%), additional nonoperative measures were required to manage pain, such as increased over-the-counter medication (39 patients, 22.2%), physical therapy (31 patients, 17.6%), or injections (15 patients, 8.5%). Of the survey respondents, 42 (23.9%) indicated their pain had improved, 44 (25%) indicated their pain had worsened, and 90 (51.1%) indicated their pain had stayed the same during the delay. Of the 42 patients who reported an improvement in pain, 13 (31%) reported using additional nonoperative measures to manage pain. Of the 44 patients who reported their pain had worsened, 20 (45%) reported using additional nonoperative measures to manage pain. Of the 90 patients who reported unchanged pain, 22 (24.4%) reported using additional nonoperative measures to manage pain. Among the patients who reported pain improvement, the breakdown of procedures they were scheduled to undergo is as follows: primary arthroplasty, 17; revision arthroplasty, 3; fracture open reduction–internal fixation, 3; rotator cuff repair, 13; labral repair, 1; other arthroscopic procedure, 2; and other open procedure, 3. Seventy-three patients (41%) considered their procedure to be elective in nature. However, 137 patients (77.8%) would have moved forward with surgery if performed safely under appropriate medical guidelines, whereas 39 patients (22.2%) would have waited until the COVID-19 numbers decreased or a vaccine was developed (Fig. 3).

When we compared patients whose surgical procedures were delayed and patients whose surgical procedures were canceled, those with canceled procedures had a significantly higher preoperative ASES score (59.3 vs. 38.2, \(P < .001\)). There were no significant differences in SANE scores (31.7 vs. 26.9, \(P = .406\)) or VAS pain scores (7.20 vs. 7.80, \(P = .216\)) in patients in whom surgery was delayed vs. patients in whom surgery was canceled (Table II). There was no significant difference in the requirement for prescription pain medication or the use of additional nonoperative measures for treatment between patients in whom surgery was delayed and those in whom surgery was canceled. A greater number of patients with delayed surgery considered the surgical procedure non-elective (87 patients [65.9%]) compared with patients in whom surgery was canceled (16 patients [36.4%], \(P = .001\)). In addition, a greater number of patients with delayed surgery responded that they would have moved forward with surgery despite the pandemic (113 patients [85.6%]) compared with patients in whom surgery was canceled (24 patients [54.5%], \(P < .001\)).

Patients whose surgical procedures were delayed or canceled were categorized by diagnosis. Patients with cuff tear arthropathy were more likely to delay than to cancel surgery (\(P = .013\)), and patients with proximal humeral fractures were more likely to cancel than to delay surgery.
The remaining diagnoses were not predictors of cancellation status (Table III).

Correlations between several variables of interest (preoperative outcome scores, surgical delay, delayed vs. canceled status, requirement for pain prescription, improvement in pain, and perception of surgery as elective) were evaluated (Fig. 4). Weak correlations were observed between preoperative outcome scores and the requirement for prescription pain medication. A weakly negative correlation was found between preoperative ASES score and the requirement for prescription pain medication ($r = -0.36, P <.001$), as well as between SANE score and...
the requirement for prescription pain medication \((r = -0.26, P = .016)\). We observed a weakly positive correlation between preoperative VAS pain score and the requirement for prescription pain medication \((r = 0.28, P = .009)\). No correlation was found between the duration of surgical delay and the requirement for prescription pain medication \((r = 0, P = .962)\) (Table IV). Preoperative ASES score was positively correlated with perception of surgery as elective \((r = 0.4, P < .001)\). VAS pain score \((r = 0, P = .970)\) and SANE score \((r = 0.12, P = .207)\) were not correlated with perception of surgery as elective (Table V). Improvement in pain was positively correlated with canceled status \((r = 0.32, P < .001)\) (Table VI).

**Discussion**

At the beginning of the COVID-19 pandemic in early 2020, there was a large amount of concern in the medical community about inpatient hospital space, as well as the availability of personal protective equipment. In an effort to mitigate these perceived shortfalls, operations considered non-emergent or non–life-threatening were mandated to be postponed by state governments. This study evaluated a broad cohort of patients who had previously been scheduled to undergo shoulder and elbow surgery during the mandatory elective surgery shutdown period in Pennsylvania. Those operations that were mandated to be postponed were deemed elective operations. However, in this cohort of patients undergoing these operations, only 41% perceived surgery as being elective in nature. Most patients would have moved forward with surgery despite the pandemic. A significantly greater proportion of patients who altogether canceled surgery perceived their surgical procedure as elective compared with those who underwent surgery in a delayed fashion. Worse preoperative functional scores were correlated with perceiving surgery as non-elective.

Similarly, in a study evaluating perceptions of surgery during COVID-19 in elective orthopedic surgery patients, Ho et al\(^8\) found that approximately 40% of patients perceived their surgical procedure as urgent, and these patients were more likely to proceed with surgery during the pandemic. Ninety-three percent of patients surveyed in their study trusted the hospital to cancel surgery if there was an increased risk of contracting COVID-19. In a study performed in the United Kingdom, Chang et al\(^3\) found that only 57% of a single surgeon’s elective orthopedic surgery patients indicated that they preferred to move forward with their procedure upon resumption of elective surgery. This rate is somewhat lower than the 71.9% of patients who

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**Table II** Preoperative outcomes in patients in whom surgery was delayed vs. canceled

| Preoperative outcomes measure | Surgery delayed (n = 179) | Surgery canceled (n = 70) | \(P\) value |
|------------------------------|--------------------------|--------------------------|-------------|
| ASES score                   | 38.2                     | 59.3                     | <.001       |
| SANE score                   | 31.7                     | 26.9                     | .406        |
| VAS pain score               | 7.2                      | 7.8                      | .216        |

ASES, American Shoulder and Elbow Surgeons; SANE, Single Assessment Numeric Evaluation; VAS, visual analog scale.

**Table III** Association between diagnosis and cancellation status

| Diagnosis                              | Surgery delayed (n = 179), n (%) | Surgery canceled (n = 70), n (%) | \(P\) value |
|----------------------------------------|---------------------------------|---------------------------------|-------------|
| Partial-thickness rotator cuff tear    | 9 (5.03)                        | 8 (11.4)                        | .903        |
| Full-thickness rotator cuff tear       | 46 (25.7)                       | 15 (21.4)                       | .589        |
| Labral pathology                      | 12 (6.70)                       | 1 (1.43)                        | .118        |
| Shoulder osteoarthritis               | 39 (21.8)                       | 16 (22.9)                       | .990        |
| Cuff tear arthropathy                 | 31 (17.3)                       | 3 (4.29)                        | .013*       |
| Recurrent Instability                 | 6 (3.35)                        | 1 (1.43)                        | .677        |
| Proximal humeral fracture             | 3 (1.68)                        | 5 (7.14)                        | .042*       |
| Recurrent rotator cuff tear           | 6 (3.35)                        | 3 (4.29)                        | .714        |
| Failure of previous arthroplasty      | 7 (3.91)                        | 3 (4.29)                        | >.999       |
| AC pathology                          | 3 (1.68)                        | 3 (4.29)                        | .354        |
| Other upper-extremity fracture        | 1 (0.56)                        | 3 (4.29)                        | .669        |
| Adhesive capsulitis                   | 2 (1.12)                        | 1 (1.43)                        | >.999       |
| Medial or lateral epicondylitis       | 2 (1.12)                        | 1 (1.43)                        | >.999       |
| Other                                  | 12 (6.70)                       | 7 (10.0)                        | .538        |

AC, acromioclavicular.

* Statistically significant \((P < .05)\).
Table IV  Regression analysis of factors associated with requiring pain prescription

| Factor          | OR (95% CI)     | P value |
|-----------------|-----------------|---------|
| ASES score      | 0.95 (0.92-0.97)| <.001   |
| VAS pain score  | 1.54 (1.13-2.30)| .016    |
| SANE score      | 0.97 (0.95-0.99)| .009    |
| Delay, d        | 1.00 (0.99-1.01)| .962    |

OR, odds ratio; CI, confidence interval; ASES, American Shoulder and Elbow Surgeons; VAS, visual analog scale; SANE, Single Assessment Numeric Evaluation.

* Statistically significant (P < .05)

Figure 4  Correlations between variables of interest. The numbers are $r$ values, showing the strength of correlation (Corr). (VAS, visual analog scale pain score; SANE, Single Assessment Numeric Evaluation score; ASES, American Shoulder and Elbow Surgeons score.)
moved forward with surgery in a delayed fashion in our study. This may be because of differences in health care systems or geographical differences in the severity of the pandemic at various times. These findings represent an opportunity for improved patient counseling regarding factors that make surgery urgent vs. elective, as well as the risks of operating during the pandemic.

We found that lower preoperative ASES and SANE scores and higher preoperative VAS pain scores were correlated with the requirement for prescription pain medication. Previous studies have shown preoperative opioid use to be associated with worse outcomes after shoulder arthroplasty.\textsuperscript{1,6,9,14} Thompson et al\textsuperscript{14} demonstrated worse preoperative and postoperative outcome scores, in addition to smaller changes in preoperative to postoperative scores, in opioid users undergoing total shoulder arthroplasty compared with nonusers. Similarly, Baessler et al\textsuperscript{1} demonstrated inferior postoperative outcome scores, higher rates of periprosthetic radiolucency, and higher revision rates in opioid users undergoing reverse total shoulder arthroplasty than in nonusers. Previous studies have also shown inferior outcomes in preoperative opioid users after rotator cuff repair.\textsuperscript{5,7,12} These findings highlight the importance of prescribing preoperative opioids sparingly and managing patients’ expectations of postoperative outcomes in the setting of opioid use. It is interesting to note that we found no correlation between the duration of surgical delay and the requirement for prescription pain medication. This finding may be attributable to a high percentage of patients perceiving their surgical procedures as urgent and therefore rescheduling surgery as early as possible. Because of the lack of outcome reporting early during the pandemic, further study is necessary to compare outcomes between patients who required prescription pain medication and those who did not.

One-third of the patients in our study reported using additional nonoperative measures to manage their symptoms during the surgical delay, including over-the-counter medication, physical therapy, and injections. One-quarter of patients considered their pain to have improved during the delay, and patients whose symptoms improved were more likely to cancel surgery. We found that one-third of patients who reported symptom improvement also reported using additional nonoperative treatment measures. This finding could indicate that some shoulder and elbow pathology may be self-limited and improve with a longer course of nonoperative management. Activity modification also may have played a role in this observation, as many patients were less active during the pandemic because of the closure of gyms and postponement of recreational sports. Although the small number of patients is a limitation, we found that the diagnosis of proximal humeral fracture was significantly associated with canceled surgery. This finding suggests that even when fractures are indicated for surgery, patients may achieve satisfactory results with nonoperative management. It is interesting to note that we found cuff tear arthropathy to be associated with delayed status, suggesting that these patients were less likely to cancel surgery. The reason for this is unclear, as a recent study comparing patients with cuff tear arthropathy and those with glenohumeral osteoarthritis found no difference in preoperative outcome scores.\textsuperscript{13}

Our study has several limitations. Prior to the pandemic, patients routinely answered outcome surveys on an electronic tablet during the check-in process. We believe the transition from in-person to virtual appointments greatly reduced the number of outcome surveys completed during that time, and therefore, we have limited outcome data to report. We did not provide patients with a definition of the term “elective,” and patients may have different opinions.

| Table V | Regression analysis of factors associated with perception of surgery as elective |
|---------|---------------------------------|
| OR (95% CI) | P value |
| ASES score | 1.05 (1.03-1.07) | <.001* |
| VAS pain score | 1.00 (0.84-1.20) | .970 |
| SANE score | 1.01 (0.99-1.03) | .207 |

* OR, odds ratio; CI, confidence interval; ASES, American Shoulder and Elbow Surgeons; VAS, visual analog scale; SANE, Single Assessment Numeric Evaluation.

| Table VI | Regression analysis for factors associated with cancellation status |
|----------|---------------------------------|
| OR (95% CI) | P value |
| Pain improved | 4.83 (2.28-10.36) | <.001* |

* OR, odds ratio; CI, confidence interval.

* Statistically significant (P < .05).
regarding what is considered elective surgery. Our study evaluated the use of prescription pain medication during the delay, which could have been prescribed by the surgeon or by another provider. We relied on patient reporting, which can be inaccurate. This was a survey study and therefore is at risk of being subject to recall bias and sampling error. The prescription drug monitoring program was not reviewed to confirm the accuracy of patient reporting, and it is unknown how many patients may have been taking prescription pain medication prior to the surgical delay. Additionally, patients may have reported non-narcotic classes of prescription pain medication. All types of shoulder and elbow surgery were included. Although we categorized patients by diagnosis, the numbers in several of the diagnosis groups were limited to <10 patients, and therefore, multivariate logistic regression was not performed. Finally, owing to the variations in COVID-19 restrictions geographically, we focused on patients in 1 state; therefore, our findings may not be generalizable to patients in all practices. However, the effects seen in this study could be applicable to a delay in surgery for other reasons as well.

Conclusion

Patients scheduled to undergo elective shoulder and elbow surgery during the beginning of the COVID-19 pandemic experienced a nearly 3-month delay on average. Fewer than half of patients in whom surgery was delayed perceived their surgical procedures as elective in nature. Additionally, most would have moved forward despite the pandemic. Nearly one-quarter of patients surveyed also reported requiring extra prescription medicine during the delay. This study elucidates the fact that although orthopedic shoulder and elbow surgery is generally considered “elective,” it is more important to a majority of patients.

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