



No Patients Having Elective Outpatient Orthopaedic Surgery Performed in an Ambulatory Surgery Center Using Preoperative Screening Protocols During the Coronavirus Pandemic Developed COVID-19

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Purpose: The purpose of this study is to determine the safety of elective, outpatient orthopaedic sports procedures during the Coronavirus (COVID-19) pandemic at a high-volume orthopaedic practice. **Methods:** All patients who were scheduled for elective, outpatient orthopaedic sports medicine procedures at 1 of 2 of outpatient surgical centers between July 1, 2020, and December 31, 2020, were asked to complete a custom survey during a postoperative clinic visit or phone call at a minimum of 2 weeks or were subject to a routine screening questionnaire and temperature screening at the time of the first postoperative follow-up visit. The survey questionnaire assessed for any COVID-19-related symptoms. Surgical case logs were retrieved to review for any cancelled surgeries due to a positive preoperative COVID-19 test. **Results:** In total, 3.5% of patients (n = 39/1119) scheduled for surgery were diagnosed with COVID-19 during preoperative testing, resulting in surgical cancellation. Patients with a positive preoperative COVID-19 test result were found to be significantly younger (46 ± 20 years) when compared to all other patients with a negative test (51 ± 21 years; $P = .002$). No patient was diagnosed with COVID-19, reported symptoms concerning for COVID infection, underwent additional testing, or reported close contact with another individual with a positive test or possessed symptoms concerning for COVID-19 at a minimum of 2 weeks after surgery. **Conclusion:** This study found that 3.5% of patients tested positive for COVID-19 and were significantly younger when compared with patients testing negative. No patient investigated for potential infection after surgery reported the development of any symptoms related to COVID-19 or reported a positive test result after surgery. Using current protocols for preoperative screening, elective outpatient orthopaedic surgery performed in an Ambulatory Surgical Center is safe with no documented cases of COVID-19 transmission in this cohort. **Level of Evidence:** Level IV, prognostic case series.

The safety of elective, outpatient surgery to patients and providers has become a topic of substantial interest in the setting of the Coronavirus (COVID-19) pandemic due to concerns of potential viral exposure and transmission. Recent investigations analyzing COVID-19 positivity rates in patients undergoing

outpatient procedures have largely reported a low risk for transmission.^{1,2} When investigating patients undergoing elective oncology procedures with minimum 2-week follow-up, Ji et al.¹ reported no patients (n = 621) were found to be COVID-19 positive after surgery. Meanwhile, the COVID-19 positivity rate for patients

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undergoing elective plastic surgery procedures has been estimated to be approximately 0.13%.² When evaluating a total of 74 patients at a single institution undergoing orthopaedic procedures, Oussedik et al.³ reported a total of 5 COVID-19 related-deaths (0.67% of all patients) in 2020 compared to 2 patients (0.05%) in 2019 during the same 8-week period.³ However, knowledge regarding the risk of viral transmission during elective, orthopaedic sports procedures during the pandemic remains largely unknown.

During the COVID-19 pandemic, there has been a substantial impact on orthopaedic services, with significant reduction in surgical case volume and revenue.⁴ Patient fear of contracting the COVID-19 virus has been cited as the primary factor behind the decrease in operative volume.⁵ A preliminary study reported that patients (n = 34) contracting the COVID-19 virus after elective orthopaedic surgery demonstrated a 20% mortality rate.³ Delay or avoidance of elective procedure can have substantial impact on patients including loss of recreational capacity, negative emotional impact and potential inability to work with resulting financial implications. As such, developing a better understanding of patient safety after elective orthopaedic procedures is warranted to better inform patients and providers regarding the risk of exposure and contracting the COVID-19 virus.

The purpose of this study is to determine the safety of elective, outpatient orthopaedic sports procedures during the COVID-19 pandemic at a high-volume orthopaedic practice. The authors hypothesize a low rate of positive COVID-19 test results and exposures after elective, outpatient orthopaedic sports procedures.

Methods

Approval was obtained before study initiation by the Institutional Review Board at Rush University Medical Center. Patient consent for study enrollment was not required because all patients were assigned a study identification number, and all data were deidentified. All patients who were scheduled for elective, outpatient orthopaedic sports medicine procedures at 1 of 2 outpatient surgical centers between July 1, 2020, and December 31, 2020, were identified using an electronic medical record system. Both surgery centers instituted standard COVID-19 precautions, including the need for a negative preoperative COVID-19 polymerase chain reaction (PCR) test result, symptom screening and temperature check of all employees and patients on entry to the facility, restricted visitor policy, mask wearing of all staff at all times and patients when possible, strict handwashing, and social distancing protocols where possible. Additionally, all patients were screened with temperature and questions before being seen by the provider at a postoperative clinic appointment (Table 1). Inclusion criteria consisted of patients

Table 1. COVID-19 Screening Questions Used By Clinics at Our Institution

1. Have you received a positive COVID-19 diagnosis in the last 3 weeks?
2. Have you been in close contact with someone who has received a positive COVID-19 test in the last 4 weeks?
3. Do you or someone you have been in close contact with presently have any of the following symptoms: fever/chills, cough, headache, diarrhea, shortness of breath, difficulty breathing, sore throat, loss of taste/smell, muscle or body aches, nausea or vomiting, runny nose, or congestion?

COVID-19, Coronavirus.

scheduled for an elective orthopaedic sports medicine procedure from 1 of 7 board-certified, fellowship-trained orthopaedic sports medicine specialists with a minimum of 1 postoperative follow-up visit or survey completion. Exclusion criteria consisted of patients who underwent any urgent/emergency surgical procedure not classified as a "sports-related" procedure (i.e., spinal surgery, joint replacement, or hand surgery) or patients undergoing surgery at an inpatient (hospital) facility.

All patients meeting inclusion criteria who underwent scheduled surgery were asked to complete a customary survey (Table 2) during a postoperative clinic visit or phone call at a minimum of 2 weeks or were subject to a routine screening questionnaire and temperature screen at the time of the first postoperative follow-up visit. The survey questionnaire assessed for any COVID-19-related symptoms as defined on the Centers for Disease Control and Prevention's Website.⁶ All survey answers were recorded as either "yes" or "no." Patients were asked if they had contact with anyone who had concerning symptoms or had tested positive for COVID-19.

Surgical case logs were retrieved to review for any cancelled surgeries because of a positive preoperative COVID-19 PCR test or concern for potential COVID-19 exposure. This list was cross-referenced with a cancelled case log from each ambulatory surgical center. Chart review was performed in these patients to obtain basic demographic data, including age and procedure type. Furthermore, information regarding the incidence of COVID-19 in the state of Illinois for each month during the study period was retrieved from the website of the Illinois Department of Public Health to evaluate for any correlation between statewide rates and the incidence of COVID-19 tests in patients.

Statistical Analysis

The primary outcomes of interest were the number of surgical cancellations because of concern for positive COVID-19 tests, as well as the incidence of positive COVID-19 symptoms and tests in patients during the interval from surgery to minimum 2 weeks after surgery as assessed via the patient survey. The secondary

Table 2. Survey Questions

1. Did you have any of the below symptoms within 14 days after your surgery? Symptoms include fever, chills, chest pain, fatigue, cough, dyspnea, inability to smell, inability to taste, muscle aches, headache, sore throat, congestion or runny nose, nausea or vomiting, diarrhea? *
2. Were you told by a physician that you may have symptoms or need to be tested for COVID-19 within 14 days after your surgery? *
3. Did you test positive for COVID-19 within 14 days after days after your surgery?
4. Did you have close contact with anyone who was sick or was diagnosed with COVID-19 before or after surgery?

COVID-19, Coronavirus.

*Patients answering yes to these questions were later asked to obtain a COVID-19 test.

outcome of interest was the degree of correlation with the incidence of COVID-19 in Illinois. All statistical analyses were performed with Stata version 16.1 (StataCorp, College Station, TX). A Spearman's rank correlation analysis was performed to determine the association between total number of cases per month in the state of Illinois and number of cancelled cases because of a positive preoperative COVID-19 test. With a significance level of $\alpha = 0.05$ and $n = 6$ pairs of values associated to the number of cases in each month between July 2020 and December 2020, a Spearman correlation coefficient (ρ) was calculated. A P value was calculated from this result, and statistical significance was defined as $P < .05$. An independent t -test was performed to assess for statistical difference between mean age in patients with a positive preoperative COVID-19 test and patients with a negative preoperative COVID-19 test, with $P < .05$ indicating a statistically significant difference between groups.

Results

During the study period, 1119 patients were scheduled for an elective, outpatient sports medicine procedure. In total, 621 and 498 males and females were scheduled for surgery, respectively, with an average age of 49 ± 23 years. In total, 3.5% of patients ($n = 39/1119$) scheduled for surgery were diagnosed with COVID-19 during routine preoperative PCR testing, resulting in surgical cancellation. Of the patients with positive preoperative COVID tests, 43.6% (17/39) were scheduled for a procedure of the knee joint, 38.5% (15/39) were scheduled for a procedure of the shoulder joint, 15.4% (6/39) were scheduled for a procedure of the hip joint, and 2.6% (1/39) were scheduled for a procedure of the elbow joint. Patients with a positive preoperative COVID-19 test result were found to be significantly younger (46 ± 20 years) when compared to all other patients with a negative test result (51 ± 21 years; $P = .002$).

In total, 1080 patients with negative preoperative test results who underwent surgery successfully completed the survey at a postoperative clinic appointment or via a phone call at a minimum of 2 weeks or were screened with a routine questionnaire at the first postoperative clinic visit. Average follow-up length for patients screened with the routine questionnaire during the first postoperative clinic visit was 7.8 ± 1 days. No patient reported symptoms concerning for COVID infection, underwent additional testing, or reported close contact with another individual with a positive test result or possessed symptoms concerning for COVID-19.

The distribution of the cases in the state of Illinois and the cases cancelled due to the diagnosis of COVID-19 at our surgical centers are provided in Table 3. A significant correlation ($P = .007$) was observed between the monthly number of COVID-19 cases reported in Illinois and the monthly number of elective cases cancelled because of a positive COVID-19 diagnosis. A combined plot of the number of COVID-19 cases and number of cancelled elective cases over time is shown in Figure 1.

Discussion

The primary results from this investigation were that from July 2020 to December 2020, 1119 patients were scheduled for elective, outpatient orthopaedic sports procedures, of which 3.5% ($n = 39/1119$) were found to be positive for COVID-19 before surgery. Patients testing positive were significantly younger when compared to patients who tested negative. We identified no cases of disease transmission within 14 days of the surgical episode. High correlation was appreciated between the number of cases cancelled because of a positive COVID-19 test result before surgery and the number of statewide COVID-19 cases. This study demonstrates that using current elective surgery screening protocols, elective sports medicine orthopaedic surgery is safe with minimal risk of COVID-19 infection transmission.

As the COVID-19 pandemic continues through 2021, the number of patients undergoing elective orthopaedic procedures will continue to increase, posing increased concern for risks to healthcare providers and the patients treated. As such, elective surgical protocols have been developed in an attempt to limit the risk of any COVID-19 transmission during the surgical episode. Although these protocols were designed using intuitive protocols, the effectiveness of the protocols is largely undetermined. As such, patients continue to inquire about the risk of undergoing elective surgery during an ongoing pandemic. In addition, delaying orthopaedic care does have negative ramifications on quality of life and ability to perform activities of daily living, work activities or engage in recreational or competitive sports.⁷

Table 3. The Distribution of the Cases Reported in the State of Illinois and the Cases Cancelled Because of the Diagnosis of COVID-19 According to Time Periods

Reported Unit	Time Period					
	July	August	September	October	November	December
No. of cases in Illinois	35,652	56,186	58,251	117,026	316,004	237,085
No. of cancelled cases because of (+) PCR	4	3	5	5	12	10

COVID-19, Coronavirus; No., number; PCR, polymerase chain reaction.

It is essential to mitigate the spread of infection by identifying patients with symptoms concerning for potential COVID-19 before any elective surgery. Although patients may be asymptomatic at the time of testing or during the course of the infection,⁸ it has been reported that asymptomatic patients can possess viral loads comparable to symptomatic patients.^{9,10} Furthermore, patients with positive COVID-19 PCR tests are at an increased risk for perioperative respiratory compromise,¹¹ warranting proper identification of potential symptoms or exposure before any surgical procedure.

Of the 1119 patients scheduled for surgery, patients with positive preoperative COVID-19 tests were significantly younger when compared to patients with a negative COVID-19 test. When evaluating 1295 patients scheduled for orthopaedic surgery procedures, Gutman et al.¹² similarly reported that patients with positive test results were significantly younger than patients with a negative test result (39 ± 12 years vs 56 ± 16 years; $P = .01$). Prior investigations have reported younger patients to be more likely to develop asymptomatic COVID-19 infections.¹³⁻¹⁵ Preoperative testing can be an effective method to identify these patients and prevent further transmission of infection among staff and other patients. In a set of guidelines established by the International Consensus Group,¹⁶ it was recommended that preoperative testing of all patients be performed in high-prevalence areas given the risk of disease transmission by asymptomatic patients. As such, continued preoperative testing, especially among younger, asymptomatic patients remains critical to ensure effective mitigation of viral spread.

No patient investigated for potential infection after surgery reported the development of any symptoms related to COVID-19 or reported a positive test after surgery. Gutman et al.¹² similarly investigated the safety of both urgent and elective orthopaedic procedures in a large metropolitan area in Philadelphia. After reviewing patient electronic medical records for postoperative visits because of a COVID-19 infection, the authors reported a 0% infection rate.¹² However, as stated in their limitations, patients with positive test results may have been missed if they received treatment outside of their healthcare facility.¹² As such, despite the negative reporting of symptoms or positive

test results among patients, a high degree of caution must be exercised in the postoperative period to avoid the potential for exposure within clinical areas.

A significant correlation between the number of surgical cancellations and the number of cases of COVID-19 reported statewide was appreciated. Over the course of this study period, more than 800,000 COVID-19 cases were detected in the state. There were approximately 300,000 new cases during the month of November alone, representing the greatest spike in terms of new cases since May 2020 and instigating another stay-at-home order from city officials. Similarly, the number of canceled cases because of a positive preoperative COVID-19 test result at our surgical centers reached a peak during November ($n = 12$). Given the increase in incidence of COVID-19 cases in the state during November, the spike in surgical cancellations during this time is likely reflective of the higher viral load present in the state.

Limitations

This study is not without limitations. The risk for postoperative COVID-19 infection was assessed using a custom questionnaire, because such patients may have not understood the intent of specific questions and because of misinterpretation bias, not provided accurate responses. Furthermore, the survey questions have not previously been validated. The survey was also retrospective in nature, leading to the potential for recall bias among patients. The authors could not verify the incidence of patients who developed symptoms or tested positive for the COVID-19 infection and were treated at an outside medical institution at a date after survey completion. Additionally, the patients who were surveyed for symptoms during routine postoperative evaluation had an average follow-up length of less than 14 days. However, a prior study reported average onset of symptoms after COVID-19 exposure to be close to 5 days.¹⁷ Finally, patients did not receive postoperative testing, and therefore cases that occurred but were asymptomatic may have been missed. Finally, the study was performed in regard to cases performed in an outpatient ambulatory surgical center and therefore cannot be extrapolated to hospital-based surgery.

Conclusion

This study found that 3.5% of patients tested positive for COVID-19 and were significantly younger when

Number of COVID Cases over Time

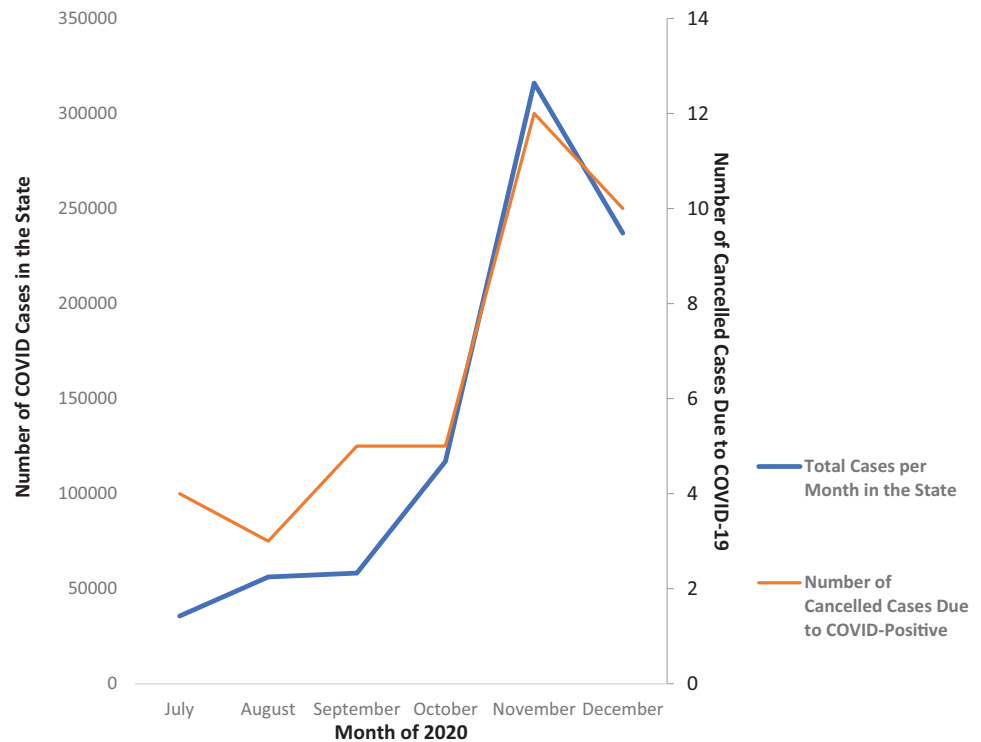


Fig 1. Combined graph of the monthly cases. Line graphs representative of the number of monthly COVID-19 cases reported in the state of Illinois and the number of monthly cases cancelled because of a positive COVID-19 diagnosis between July and December of 2020.

compared to patients testing negative. No patient investigated for potential infection after surgery reported the development of any symptoms related to COVID-19 or reported a positive test result after surgery. Using current protocols for preoperative screening, elective outpatient orthopaedic surgery performed in an ambulatory surgery center is safe with no documented cases of COVID-19 transmission in this cohort.

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