Original Article

Postoperative, But Not Preoperative Coronavirus Disease 2019 (COVID-19), Is Associated With an Increased Rate of Medical Adverse Events Following Arthroscopic Procedures

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Purpose: To characterize how severe acute respiratory syndrome coronavirus 2 infection in the perioperative period affects the medical adverse event (MAE) rates in arthroscopic sports medicine procedures. **Methods:** The Mariner coronavirus disease 2019 (COVID-19) database was queried for all shoulder, hip, or knee arthroscopies, 2010 to 2020. Patients with COVID-19 in the 3 months before to 3 months after their surgery were matched by age, sex, and Charlson Comorbidity Index to patients with an arthroscopy but no perioperative COVID-19 infection, or a COVID-19 infection but no arthroscopic procedure. MAEs in the 3 months after surgery or illness were compared between groups. **Results:** The final cohort consisted of 1,299 matched patients in 3 groups: COVID-19 alone, arthroscopy and perioperative COVID-19, and arthroscopy alone. There were 265 MAEs if a patient had COVID-19 alone (20.4%), 200 MAEs if a patient had arthroscopy with COVID-19 (15.4%), and 71 (5.5%) MAEs if a patient had arthroscopy alone ($P < .01$). If a patient had an arthroscopy, having COVID-19 was associated with 3.1-fold elevated odds (95% confidence interval [CI] 2.9-3.4, $P < .01$) of MAE. Among patients with an arthroscopy, MAEs were more common if a patient acquired COVID-19 in the 3 months after their surgery (pooled odds ratio 7.39, 95% CI 5.49-9.95, $P < .01$) but not if a patient had preoperative COVID-19 (pooled odds ratio 0.66, 95% CI 0.42-1.03, $P = .07$). **Conclusions:** Having COVID-19 during the postoperative period appears to confer a 7-fold elevated risk of MAEs after shoulder, hip, and knee arthroscopy compared with matched patients with arthroscopy and no perioperative COVID-19 but equivalent to that of patients with COVID-19 and no arthroscopy. However, there was no increase in postoperative MAEs if a patient had COVID-19 during the 3 months preceding surgery. Therefore, it appears safe to conduct an arthroscopic procedure shortly after recovery from COVID-19 without an increase in acute medical complication rates. **Level of evidence:** Level III, retrospective cohort study.

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic (coronavirus disease 2019 [COVID-19]) dramatically affected health care delivery in the United States, placing a substantial strain on hospital resources with a resultant decline in the number of elective procedures performed at the outset

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of the pandemic.[1,2] Based on early projections, COVID-19 Surge Collaborative estimated more than 6 million orthopaedic operations would be canceled in the initial 12-week period of the pandemic, which was the greatest number of all specialties forecasted.[3] This was coupled with a decrease in demand for certain orthopaedic procedures, as one study found that patient volumes for 22 of 22 nonurgent conditions surveyed were significantly decreased.[4] With the introduction of COVID-19 vaccines, sports have resumed, and injury rates have returned to prepandemic levels.[4] While surgical volumes have increased, COVID-19 remains an active health concern that may affect orthopaedic patients as they interface with the health system.[5,6]

With a coinciding increase in surgical volume and ongoing concerns about new viral variants,[7] many surgeons may be faced with questions regarding the safety of undergoing an operation after a recent SARS-CoV-2 infection. In endemic areas, patients may be at risk of contracting SARS-CoV-2 postoperatively and have concerns about how it may affect their overall recovery. However, little is known about the impact of COVID-19 on the safety of elective procedures. The acute phase of SARS-CoV-2 infection has been linked with a hypercoagulable state,[8] which may impact the rate of postoperative venous thromboembolism (VTE).

Understanding the development of perioperative medical adverse events (MAEs) is important in providing an accurate risk assessment for patient–provider decision-making. The purpose of this study was to characterize how SARS-CoV-2 infection in the perioperative period affects the MAE rates in arthroscopic sports medicine procedures. We hypothesized that a recent SARS-CoV-2 infection would affect the likelihood of having a postoperative MAE.

Methods

Database

The PearlDiver Mariner Patient Record Database (PearlDiver Technologies, Colorado Springs, CO), which houses deidentified patient information that reflects data for patients insured by commercial, Medicare, Medicaid, government, and cash payers, was used. The subset MCOVID-19, which contains all patients with COVID-19 and a random sampling of patients without COVID-19 from the Mariner database from 2007 to 2020, was queried for patients undergoing arthroscopic surgery of the shoulder, hip, and knee. Comorbidities, procedure types, and MAEs *were identified via International Classification of Diseases, Ninth Revision* (ICD-9); *International Classification of Diseases, Tenth Revision* (ICD-10) codes; and Current Procedural Terminology codes. Since PearlDiver is a deidentified, Health Insurance Portability and Accountability Act of 1996–compliant database, this study was considered exempt from institutional review board review.

Patient Selection

This was a retrospective, matched cohort analysis of patients with an arthroscopic shoulder, hip, or knee procedure from 2010 to 2020 (see supplement for Current Procedural Terminology codes), with or without perioperative COVID-19, and patients with COVID-19 but no recent arthroscopic procedure. Patients were excluded if they did not have at least 3 months of pre-enrollment and 3 months of follow-up. Patients with arthroscopy and COVID-19 infection, identified by the presence of ICD-10 code U071, in the 3 months preceding and following the index procedure, were matched in a 1:1 ratio with patients with arthroscopy and no COVID-19 infection and patients with a COVID-19 infection but no arthroscopy by age, sex, and Charlson Comorbidity Index (CCI). Patients with arthroscopy and a COVID infection ("Scope + COVID group") were further grouped based on the timing of the COVID infection in relation to their surgery (i.e., 3 months before, 2 months before, 1 month before, 1 month after, 2 months after, 3 months after).

Data Collection

Patient demographics for the COVID-Alone, Scope + COVID, and Scope-Alone groups were collected including age, sex, and CCI. Prevalence of comorbid conditions known to confer an altered risk of COVID-19 and MAEs were queried via ICD-9 or ICD-10 codes, including hypertension, chronic obstructive pulmonary disease (COPD), congestive heart failure (CHF), smoking, chronic kidney disease (CKD), diabetes, obesity, hypothyroidism, peripheral vascular disease, coagulopathy, iron-deficiency anemia, hepatic dysfunction, and alcohol use disorder.

Rates of MAEs in the 90 days after surgery or illness also were identified via ICD-9 and ICD-10 codes. MAEs included medical issues such as: deep venous thrombosis, pulmonary embolism, acute kidney injury (AKI), cardiac arrest, pneumonia, and urinary tract infection, as well as surgery-related issues such as surgical-site infections (SSIs), wound disruption, hematoma, nerve injury, and transfusion requirement. The primary outcomes were the composite rate of the aforementioned MAEs and the composite rate of all MAEs minus pneumonia (which may capture the COVID-19 infection used to stratify COVID-19 groups).

Statistical Analysis

Baseline demographics were reported as counts and percentages or median and interquartile range. Rates of MAEs were reported as counts and percentages and

compared between arms using the χ^2 test. Association between timing of infection and complication rates was analyzed via multivariable logistic regression predicting MAEs rates, with infection timing (via month relative to the index surgery) or timing of the arthroscopic procedure (via month relative to the COVID-19 infection). Significance was set at alpha = 0.05, and our sample size of 3,897 patients provided 80% power to detect a 1% difference in MAEs. The subanalysis assessing time dependence was adequately powered to detect a 3-fold increased rate of MAEs between month of infection. Analyses were conducted using the open-source R tool housed in the PearlDiver Bellwether platform (R Project for Statistical Computing, Vienna, Austria).

Results

Demographics of the Study Population

A total of 1,299 patients in the dataset had an ICD-10 code for COVID-19 during the 3 months before and after their arthroscopic procedure. Of the 1,299 arthroscopy patients with COVID-19, 899 underwent shoulder arthroscopy (69.2%), 44 underwent hip arthroscopy (3.4%), and 357 underwent knee arthroscopy (27.5%). Matching in a 1:1 ratio on age, sex, and CCI yielded 1,299 patients with arthroscopy but without a COVID-19 infection in the perioperative period and 1,299 patients with COVID-19 but no arthroscopic procedures in the 3 months before or after the symptomatic infection. Of patients with arthroscopy and perioperative COVID-19, 751 (58%) were affected in the preoperative period and 589 (45%) were affected in the postoperative period, with 41 patients who had an infection both before and after surgery (either reinfection or infection spanning the surgery).

Demographics were largely similar between groups, except for differences in select comorbidities (Table 1). The mean age was 50 years (standard deviation 15), and 45.5% of patients were female ($P = .99$ and $>.99$, respectively). Patients with a COVID-19 infection, regardless of whether an arthroscopy was conducted, were more likely to have obesity (COVID Alone = 20.7%, Scope + COVID = 25.6%, Scope Alone = 18.5%, $P < .01$) and CKD (COVID Alone = 8.2%, Scope + COVID = 5.4%, Scope Alone = 5.0%, $P < .01$). Patients with an arthroscopic procedure alone were more likely to have CHF (COVID Alone = 0.7%, Scope + COVID = 0.2%, Scope Alone = 1.9%, $P < .01$) and COPD (COVID Alone = 7.2%, Scope + COVID = 6.9%, Scope Alone = 16.5%, $P < .01$). Patients with an arthroscopy and COVID were more likely to be active tobacco users (COVID Alone = 13.6%, Scope + COVID = 19.5%, Scope Alone = 14.7%, $P < .01$).

Rates of MAEs in the 3 Months After Arthroscopy or Infection

Overall, 200 patients with arthroscopy and perioperative COVID-19 developed an MAE during the subsequent 3 months (15.4%), compared with 265 patients with COVID-19 and no arthroscopy (20.4%) and 71 patients with arthroscopy and no COVID-19 (5.5%, $P < .01$, Table 2). Specifically, arthroscopy patients with perioperative COVID-19 developed medical complications at the following rates compared with patients with arthroscopy and no COVID-19: AKI (44 patients [3.4%] vs 7 patients [0.5%], $P < .01$), cardiac arrest (5 patients [0.4%] vs 0 patients [0%], $P < .01$), and pneumonia (161 patients [12.4%] vs 13 patients [1.0%], $P < .01$) at greater rates than patients who had an arthroscopy without perioperative COVID-19. In comparison, the matched cohort with COVID-19 but no arthroscopy had 72 patients with AKI (5.5%, $P < .01$ in pairwise comparison with Scope + COVID), 5 patients with cardiac arrest (0.5%, $P = .56$), and 199 patients with pneumonia (15.3%, $P = .03$).

There were no differences between groups for rates of VTE ($P = .09$); however, patients with arthroscopy without COVID-19 were more likely to have a pulmonary embolism (7 patients [0.5%] vs 0 in both COVID groups, $P < .01$). Regarding surgical complications, while 0 patients with arthroscopy and perioperative COVID-19 had an SSI, 5 patients with arthroscopy alone developed SSI (0.4%, $P < .01$).

Timing of COVID-19 Infection on Likelihood of MAEs

The likelihood of developing MAE was greater in patients who contracted COVID-19 during the 3 months after surgery (Table 3, Fig 1 pooled OR for COVID during the 3 months after surgery vs controls = 7.39, 95% CI 5.49-9.95, $P < .01$). On the contrary, having COVID-19 in the 3 months before surgery did not confer an elevated likelihood of developing MAEs pooled OR for COVID-19 during the 3 months before surgery versus controls (0.66, 95% CI 0.42-1.03, $P = .07$). Similarly, if a patient had COVID-19, having an arthroscopy before the infection was associated with an increased likelihood of MAE but having an arthroscopic procedure after the infection was not (Table 4, Fig 2).

Discussion

The present study found (1) patients with a perioperative COVID-19 infection in the 3 months before and after shoulder, hip, or knee arthroscopy had over twice the likelihood of a MAE as patients without COVID-19 undergoing an arthroscopic procedure; (2) rates of AKI, cardiac arrest, and pneumonia in patients with an arthroscopic procedure and COVID-19 were similar to those with COVID-19 but no arthroscopy, but significantly greater than those with arthroscopy and no COVID-19; (3) there was no difference in rates of

Table 1. Patient Demographics

Variable (N, % unless otherwise specified)	COVID-19, No Scope (N = 1,299)	%	Scope, COVID-19 (N = 1,299)	%	Scope, No COVID-19 (N = 1,299)	%	*P* Value
Age, y, mean (SD)*	51 (15)		50 (15)		50 (15)		.99
Female sex*	708	54.5	708	54.5	708	54.5	>.99
Comorbidities							
Cancer	109	8.4	105	8.1	100	7.7	.81
CHF	9	0.7	3	0.2	25	1.9	**<.01**
CKD	107	8.2	70	5.4	65	5.0	**<.01**
Coagulopathy	56	4.3	42	3.2	35	2.7	.07
COPD	94	7.2	89	6.9	214	16.5	**<.01**
Depression	232	17.9	245	18.9	209	16.1	.17
Diabetes	351	27.0	311	23.9	362	27.9	.06
EtOH use disorder	38	2.9	32	2.5	27	2.1	.38
Hypertension	564	43.4	569	43.8	586	45.1	.66
Hypothyroidism	131	10.1	167	12.9	157	12.1	.08
Iron deficiency anemia	84	6.5	75	5.8	71	5.5	.54
Liver disease	77	5.9	84	6.5	90	6.9	.58
Obesity	269	20.7	332	25.6	240	18.5	**<.01**
Peripheral vascular disease	77	5.9	58	4.5	83	6.4	.08
Smoking	177	13.6	253	19.5	191	14.7	**<.01**
Arthroscopy joint							.35
Shoulder	—	—	899	69.2	903	69.5	
Hip	—	—	44	3.4	32	2.5	
Knee	—	—	357	27.5	369	28.4	

COVID-19, coronavirus disease 2019; SD, standard deviation; CHF, congestive heart failure; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; EtOH, ethanol alcohol.

NOTE: Bolded P-values refer to statistical significance at $P < .05$.

*Indicates matching criteria.

venous thromboembolism, irrespective of COVID-19 status, albeit patients having arthroscopy without perioperative COVID-19 were more likely to have a pulmonary embolism; and (4) patients had a 3-fold increased odds of developing MAEs if COVID-19 was acquired in the 3 months after but not before surgery. Overall, these findings suggest that a patient who has COVID-19 before an arthroscopic procedure is not at an increased risk of MAEs, relative to arthroscopy patients without COVID-19. However, acquiring COVID-19 in the postoperative period harbors medical risks similar to the infection itself, irrespective of the surgical procedure (i.e., there was no additive effect for these variables).

In the present investigation, patients with perioperative COVID-19 infection were more likely to have certain comorbidities. The authors posit that many of

Table 2. Adverse Events In the 90 Days After Surgery

Variable	COVID-19, No Scope (N = 1,299)	%	Scope, COVID-19 (N = 1,299)	%	Scope, No COVID-19 (N = 1,299)	%	*P* Value
Surgical complications							
SSI	0	0.0	0	0.0	5	0.4	**<.01**
Wound disruption	4	0.3	4	0.3	4	0.3	>.99
Hematoma	0	0.0	0	0.0	0	0.0	>.99
Nerve injury	0	0.0	0	0.0	0	0.0	>.99
Transfusion	7	0.5	12	0.9	3	0.2	.06
Medical complications							
AKI	72	5.5	44	3.4	7	0.5	**<.01**
Cardiac arrest	7	0.5	5	0.4	0	0.0	**.04**
Pneumonia	199	15.3	161	12.4	13	1.0	**<.01**
UTI	44	3.4	28	2.2	32	2.5	.13
VTE	14	1.1	18	1.4	7	0.5	.09
DVT	14	1.1	18	1.4	7	0.5	.09
PE	0	0.0	0	0.0	7	0.5	**<.01**
Any complication	265	20.4	200	15.4	71	5.5	**<.01**
Any complication excluding pneumonia	127	9.8	87	6.7	61	4.7	**<.01**
Mortality	0	0	0	0	0	0	>.99

COVID-19, coronavirus disease 2019; AKI, acute kidney injury, UTI, urinary tract infection; VTE, venous thromboembolism; DVT, deep venous thrombosis; PE, pulmonary embolism.

NOTE: Bolded P-values refer to statistical significance at $P < .05$.

Table 3. Likelihood of Adverse Events by Timing of COVID-19 Infection in Relation to Arthroscopy

	OR	2.50%	97.50%	*P* Value
3 months before (N = 141)	0.19	0.06	0.45	.48
2 months before (N = 176)	0.21	0.08	0.45	.13
1 month before (N = 434)	0.26	0.15	0.40	.99
1 month after (N = 191)	4.24	3.07	5.83	**<.01**
2 months after (N = 190)	2.97	2.12	4.13	**<.01**
3 months after (N = 208)	2.65	1.90	3.66	**<.01**

COVID-19, coronavirus disease 2019; OR, odds ratio.
NOTE: Bolded P-values refer to statistical significance at $P < .05$.

Table 4. Likelihood of Adverse Events by Timing of Scope, if COVID-19 Infection

	OR	2.50%	97.50%	*P* Value
3 months before (N = 208)	3.57	2.57	4.94	**.02**
2 months before (N = 190)	2.63	1.87	3.64	**<.01**
1 month before (N = 191)	3.57	2.57	4.94	**<.01**
1 month after (N = 434)	0.64	0.24	1.56	.35
2 months after (N = 176)	0.52	0.15	1.53	.26
3 months after (N = 141)	0.49	0.11	1.71	.29

COVID-19, coronavirus disease 2019; OR, odds ratio.
NOTE: Bolded P-values refer to statistical significance at $P < .05$.

these comorbidities influence risk of infection, disease severity, and adverse events after arthroscopy. Numerous systematic reviews and meta-analyses have found male sex, increasing age, hypertension, obesity, diabetes mellitus, and atherosclerotic cardiovascular disease to be associated with both developing and progressing to severe COVID-19 infection.[9] Despite matching, our study found that individuals with perioperative SARS-CoV-2 were more likely to have obesity, which is in line with the current literature. A pooled analysis of 45,650 patients from 30 studies found obesity to confer 2-fold increased odds of developing severe COVID-19 infection,[10] suggesting it may be a strong modulator of adverse events and patient outcomes. Furthermore, in the current analysis, patients with perioperative COVID-19 were also more likely to have iron-deficiency anemia, which has also been independently associated with poorer outcomes after surgery.[11,12] Since both risk factors are modifiable, the authors propose that patients may trial iron supplementation and a weight-loss regimen before arthroscopic surgery to help mitigate the risk of COVID-19 and adverse events in the postoperative period. When planning elective arthroscopic surgery, a strong emphasis should be placed on the evaluation of medical comorbidities associated with severe SARS-CoV-2 such that the clinician identifies high-risk individuals and recommends risk-modifying behaviors before surgery.

Individuals with perioperative COVID-19 did not have greater rates of venous thromboembolic disease after arthroscopic procedures, although they had lower rates of pulmonary embolism than patients with arthroscopy and no COVID-19. The authors posit that the lower rate of pulmonary emboli despite a greater proportion of patients with VTE represents successful efforts by providers to increasingly monitor for VTE in the setting of the pandemic. As such, patients with a deep venous thrombosis may have been diagnosed earlier, before clot migration to the lungs, and promptly placed on prophylactic therapy. As COVID-19 is known to promote a hypercoagulable state, a large retrospective database analysis of 54,354 patients with confirmed COVID-19 has reported a 29-fold increased rate of VTE during the first week of infection.[13] Consequently, a systematic review and meta-analysis of surgical patients with COVID-19 has identified thromboembolic events as one of the most common perioperative adverse events.[12] However, this finding was not replicated in the current analysis of patients undergoing arthroscopy. One explanation for this disparity is that patients in the current study may have been adequately anticoagulated via postoperative aspirin prophylaxis, which

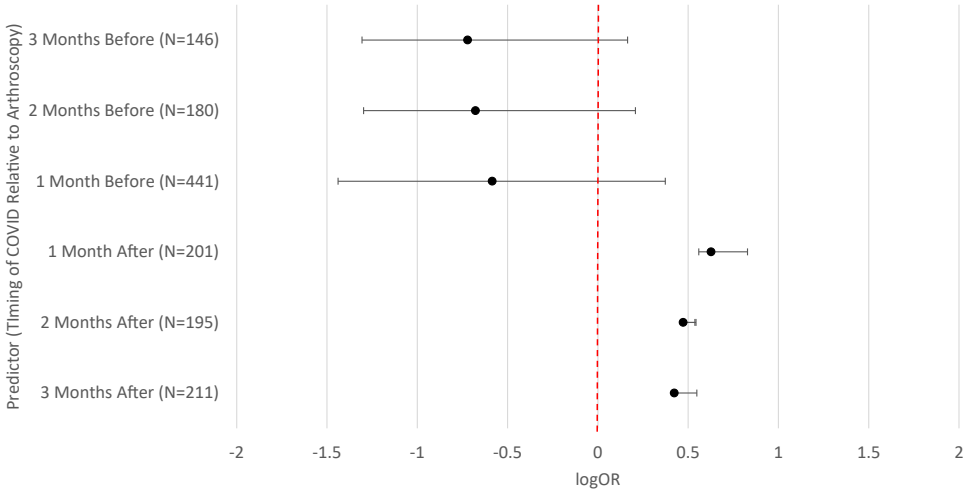

Fig 1. Forest plot for likelihood of medical adverse events depending on the timing of COVID-19 infection relative to arthroscopy. Dotted red line = odds ratio of 1. If the 95% confidence interval bars pass the dotted line, the predictor is not significantly associated with medical adverse events. (COVID-19, coronavirus disease 2019.)

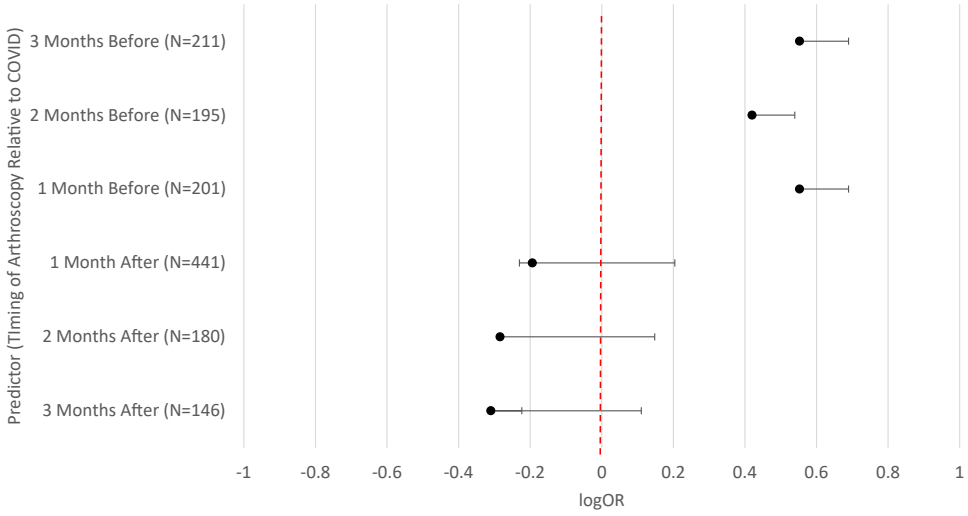

Fig 2. Forest plot for likelihood of medical adverse events depending on the timing of arthroscopy relative to a COVID-19 infection. Dotted red line = odds ratio of 1. If the 95% confidence interval bars pass the dotted line, the predictor is not significantly associated with medical adverse events. (COVID-19, coronavirus disease 2019.)

is routinely recommended by many orthopaedic practices despite conflicting evidence of its benefit.[14-16] Moreover, patients postarthroscopy may be more ambulatory and less comorbid than those included in these previous studies, and therefore less subject to venous stasis or hypercoagulable states such as having a current malignancy.[12]

Importantly, we found that COVID-19 infection in the 3-month period preceding surgery did not confer an elevated risk of MAEs. This stands in contrast to previous literature from the COVIDSurg Collaborative, which demonstrated increased adverse events and mortality in patients undergoing surgery up to 7 weeks following infection.[17] The differences between the current findings and those of the COVIDSurg Collaborative may be due to their inclusion of patients with both ambulatory and hospital-based operations of varying severity. A systematic review of 26 cohort studies examining surgical patients with perioperative COVID-19 found that emergency surgery, major surgery, and poorer preoperative condition were all risk factors for poorer safety outcomes.[18] In contrast, patients undergoing arthroscopy are often ambulatory and relatively active compared with surgical patients of other specialties. Since active patients are less likely to possess comorbidities (such as obesity, diabetes, and hypertension) known to confer an elevated risk of symptomatic and complicated SARS-CoV-2 infection,[19,20] it is not unexpected that arthroscopic sports medicine procedures would have fewer postoperative adverse events when compared with other surgeries. Therefore, in contrast to findings in other procedures, it appears safe to conduct an arthroscopic procedure shortly after a COVID-19 infection. To maximize patient safety and mitigate the risk of viral spread, the authors suggest surgeons wait until at least 14 days after a positive SARS-CoV2 test, as per the U.S. Centers for Disease Control and Prevention guidelines, to schedule an elective arthroscopy.

Patients had a greater risk of developing MAEs if they acquired SARS-CoV-2 in the 3 months after arthroscopy. Moreover, these patients developed MAEs similar to those observed in individuals with isolated COVID-19 infection. Our findings are in accordance with those reported in a systematic review by Zheng et al.,[18] which describes poorer safety outcomes for patients diagnosed with COVID after, rather than before, surgery. In our study, complication rates were greatest if a patient developed COVID-19 in the first month following a procedure, a finding similar to data from Price et al.[21] Given that infection with SARS-CoV-2 in the 3 months following an operation conferred an increased risk of developing an MAE, it will be important to counsel and collaborate with patients, particularly those at greater risk for severe disease,[22] on vaccination and decisions surrounding timing of surgery in order to create the best individualized treatment plan.

Adherence to standardized surgical protocols may underlie the finding that patients with preoperative COVID-19 infection were not found to have an elevated risk of MAEs. At many institutions, patients are required to have both an absence of symptoms and negative SARS-CoV-2 test before surgery. Rigorous testing of all patients, encouraging vaccination in the high-risk population, and regular screening of health care workers can help reduce the risk of viral transmission during the preoperative period.[23] Additional perioperative measures to continue practicing include personal protective equipment use, wearing of N95/KN-95 masks, using minimally crowded transportation routes to the operating room, adherence to sterile surgical technique, surgical decontamination, and cancellation of suspicious or confirmed COVID-19 cases.[23]

During the postoperative period, it is critical for patient's to engage in initial self-isolation at home, continue wearing masks in public places, following adequate hand hygiene, using telemedicine as needed, and maintaining a high index of suspicion for potential infection such that early care can be initiated.[24,25] Taken together, adherence to pre-, peri-, and postoperative guidelines can significantly mitigate the risk of contracting SARS-CoV-2. Because most surgical institutions in the United States follow similar standardized protocols, patients in the current study with a positive test in the 3 months before surgery would all have been asymptomatic with achievement of either immune clearance or control of the virus by the time of their surgery, thereby minimizing their complication risk. It is important to note, however, that postoperative surgical protocols are difficult to enforce, and adherence largely depends on patient discretion. Thus, this may partially explain the discrepancy in complication risk between the pre- and postoperative time periods found in the study.

Limitations

As with any retrospective study, we are unable to describe causative relationships between COVID-19 and MAEs after arthroscopic surgery. Despite matching on age, sex, and CCI, there were notable baseline differences in CHF, COPD, CKD, obesity, and smoking status. All of these comorbidities are known to be associated with an increased risk of COVID-19 infection and adverse events.[19,20,26,27] Although cohorts were matched on CCI, this score accounts for the presence of certain comorbidities, but not their severity.[28] Patients with more severe comorbidities may not undergo arthroscopic procedures, leading to a selection bias. More patients with comorbidities may have self-selected against undergoing surgery in the setting of recent COVID-19, and surgeons may be less inclined to recommend these patients for arthroscopy.

Since hip arthroscopies represented a low proportion of the 2 arthroscopy groups, the findings of this study may be underpowered to specifically comment on the likelihood of MAEs and their relationship to COVID-19 in hip arthroscopy. Importantly, this database did not include vaccination status, which may have affected the likelihood of COVID-19 and adverse events. Finally, database studies are reliant upon accurate coding. While the risk of miscoding is always possible, PearlDiver maintains a dedicated data manager who regularly conducts quality checks of the database.

Conclusions

Having COVID-19 during the postoperative period appears to confer a 7-fold elevated risk of MAEs after shoulder, hip, and knee arthroscopy compared with matched patients with arthroscopy and no perioperative COVID-19. However, there was no increase in postoperative MAEs if a patient had COVID-19 during the 3 months preceding surgery. Therefore, it appears safe to conduct an arthroscopic procedure shortly after recovery from COVID-19 without an increase in acute medical complication rates.

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