Article published online: 2022-06-10

Original Article

The Impact of COVID-19 on the Timing of Rotator Cuff Repair and Method of Postoperative Follow-up

Impacto da COVID-19 no momento de reparo do manguito rotador e método de acompanhamento pós-operatório

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Abstract

Objective Rotator cuff repair (RCR) is one of the most common arthroscopic procedures. Our investigation aims to quantify the impact that the COVID-19 pandemic had on RCR, specifically on patients with acute, traumatic injuries.

Methods Institutional records were queried to identify patients who underwent arthroscopic RCR between March 1st to October 31st of both 2019 and 2020. Patient demographic, preoperative, perioperative, and postoperative data were collected from electronic medical records. Inferential statistics were used to analyze data.

Results Totals of 72 and of 60 patients were identified in 2019 and in 2020, respectively. Patients in 2019 experienced shorter lengths of time from MRI to surgery (62.7 ± 70.5 days versus 115.7 ± 151.0 days; $p = 0.01$). Magnetic resonance imaging (MRI) scans showed a smaller average degree of retraction in 2019 (2.1 ± 1.3 cm versus 2.6 ± 1.2 cm; $p = 0.05$) but no difference in anterior to posterior tear size between years (1.6 ± 1.0 cm versus 1.8 ± 1.0 cm; $p = 0.17$). Less patients in 2019 had a telehealth postoperative consultation with their operating surgeon compared with 2020 (0.0% versus 10.0%; $p = 0.009$). No significant changes in complications (0.0% versus 0.0%; $p > 0.999$), readmission (0.0% versus 0.0%; $p > 0.999$), or revision rates (5.6% versus 0.0%; $p = 0.13$) were observed.

Conclusion From 2019 to 2020, there were no significant differences in patient demographics or major comorbidities. Our data suggests that even though the time from MRI to surgery was delayed in 2020 and telemedicine appointments were

Keywords
- COVID-19
- operative time
- perioperative period
- rotator cuff
- shoulder

Work developed at the Department of Orthopaedic Surgery, Icahn School of Medicine at Mount Sinai, New York City, NY.

received
October 26, 2021
accepted
March 28, 2022

DOI https://doi.org/10.1055/s-0042-1749205.
ISSN 0102-3616.

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necessary, RCR was still performed in a timely manner and with no significant changes in early complications.
Level of Evidence III.

Resumo

Objetivo O reparo do manguito rotador (RMR) é um dos procedimentos artroscópicos mais comuns. Nossa pesquisa visa quantificar o impacto da pandemia de COVID-19 sobre o RMR, especificamente em pacientes com lesões agudas e traumáticas.
Métodos Os prontuários institucionais foram consultados para identificação de pacientes submetidos ao RMR artroscópico entre 1° de março e 31 de outubro de 2019 e de 2020. Dados demográficos, pré-operatórios, perioperatórios e pós-operatórios dos pacientes foram coletados de prontuários eletrônicos. Os dados foram analisados por estatística inferencial.
Resultados Totais de 72 e de 60 pacientes foram identificados em 2019 e 2020, respectivamente. Os pacientes de 2019 apresentaram menor intervalo entre a ressonância magnética (RM) e a cirurgia (62,7 ± 70,5 dias *versus* 115,7 ± 151,0 dias; $p = 0,01$). Os exames de RM mostraram menor grau médio de retração em 2019 (2,1 ± 1,3 cm *versus* 2,6 ± 1,2 cm; $p = 0,05$), mas nenhuma diferença foi observada na extensão anteroposterior da laceração entre os anos (1,6 ± 1,0 cm *versus* 1,8 ± 1,0 cm; $p = 0,17$). Em 2019, o número de pacientes atendidos por seus cirurgiões em consultas pós-operatórias por telemedicina foi menor em comparação com 2020 (0,0% *versus* 10,0%; $p = 0,009$). Não foram observadas alterações significativas nas taxas de complicação (0,0% *versus* 0,0%; $p > 0,999$), de readmissão (0,0% *versus* 0,0%; $p > 0,999$) ou de revisão (5,6% *versus* 0,0%; $p = 0,13$).
Conclusão Não houve diferenças significativas nos dados demográficos dos pacientes ou nas principais comorbidades entre 2019 e 2020. Nossos dados sugerem que, embora o intervalo entre a RM e a cirurgia tenha sido maior em 2020 e tenha havido necessidade de consultas por telemedicina, o RMR ainda foi realizado em tempo hábil e sem alterações significativas nas complicações precoces.
Nível de Evidência III.

Palavras-chave
- COVID-19
- duração da cirurgia
- período perioperatório
- manguito rotador
- ombro

Introduction

Rotator cuff tears are one of the most common causes of shoulder pain in adults and can contribute to significant dysfunction and shoulder pain. The degree of dysfunction noted – specifically with acute, traumatic tears – generally leads patients to present for orthopedic evaluation in a short time frame.[1] However, during the 2019 novel coronavirus disease (COVID-19) pandemic, health systems were forced to allocate medical resources and personnel to combat the rapidly spreading illness. The first case of COVID-19 was reported in the state of New York, USA, on March 1, 2020. To curb spread and preserve resources, the surgeon general issued a statement advising hospitals throughout the nation to halt elective procedures on March 14, 2020. This moratorium on elective procedures was lifted in New York City on June 8, 2020, but it took an additional period of months before elective procedures began to return to numbers resembling their prepandemic levels.

Even after elective surgical procedures resumed, patients remained hesitant to present for evaluation or treatment of shoulder injuries. There was a significant decline in public interest for rotator cuff surgery during the period of the pandemic, with a 53.32% decline in Google search volume during this period.[2] Previous investigations have identified that only between 27 and 56.8% of patients would be willing to undergo an elective procedure at the earliest available time.[3,4]

With patient hesitancy to obtain elective surgery, there was a potential for delayed care for rotator cuff pathology, a risk factor that has been linked to worse outcomes.[5,6] There is a risk for increased tear size, progression of muscle atrophy, and increased risk of revision surgery with delayed treatment of rotator cuff tears.[7–10] Given this risk for worsening outcome with delay, it has been recommended that rotator cuff repair (RCR) – specifically for acute tears – be given consideration to be prioritized over other, potentially less time-sensitive, elective procedures.[11,12]

The goals of our investigation are to evaluate for any differences in demographics in patients undergoing rotator cuff surgery immediately following the COVID-19 outbreak

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in 2020 compared with the same period from 2019 and to evaluate the extent to which rotator cuff surgeries were delayed (from onset of symptoms or time of magnetic resonance imaging [MRI] to time of surgery). We hypothesize that patients undergoing rotator cuff surgery in 2020 will be younger, more likely to have an acute injury, and have a larger delay in treatment for an acute injury compared with the previous nonpandemic year.

Materials and Methods

Patient Cohort

Our institutional review board approved the present study. Institutional records were queried to identify patients who underwent arthroscopic RCR based on Current Procedural Terminology (CPT) code 29827 between March 1 and October 31 of both 2019 and 2020. These procedures were performed at a single institution by two attending surgeons.

Data Collection

Electronic medical records for identified patients were queried for demographic data, MRI findings, and physical exam data. These data include preoperative, perioperative, and postoperative characteristics of patients undergoing RCR. Range of motion for forward elevation and external rotation were collected from the initial physical exam of the patients with their respective operating surgeon. Patient operative reports were reviewed to identify the type of rotator cuff repair and the number of anchors used during repair. Patients who were miscoded and did not undergo RCR upon review of operative reports were excluded from the analysis. For each patient, MRI imaging was reviewed to determine the Goutallier score, the degree of tear retraction, and the anterior-to-posterior extent of tear. Subanalyses were also performed by comparing the subset of patients who sustained traumatic injuries in 2019 versus the same group in 2020.

Statistical Analysis

Data were compared between the 2019 and 2020 cohorts. Descriptive and comparative statistics for patient demographics, as well as preoperative, perioperative, and postoperative data, were analyzed for all patients. Univariate analysis of categorical data was performed using the chi-squared test or the Fisher exact test when appropriate. Continuous data were analyzed using the 2-sample *t*-test or the Mann-Whitney U test depending on the normality of the sample. Normality was determined using the Kolmogorov-Smirnov test. To compare variance between the two groups, the F-test for equality of variance was used. Statistical significance was set to a p-value < 0.05.

Results

Demographics

The present study identified 132 patients, 72 in 2019 and 60 and 2020, who underwent RCR. There was no difference in gender (48.6 male versus 58.3% male; $p = 0.27$), mean age at surgery (61.0 ± 9.4 years versus 60.5 ± 10.2 years; $p = 0.78$), or body mass index (BMI) (28.1 ± 5.3 versus 29.9 ± 7.0; $p = 0.27$). American Society of Anesthesiologists (ASA) scores ($p = 0.31$), smoking status ($p = 0.68$), and history of diabetes (6.9 versus 15.0%, $p = 0.12$) and hypertension (48.6 versus 56.7%; $p = 0.29$) were also similar between years. The distribution of insurance providers for these patients was also consistent ($p = 0.63$) (►**Table 1**). After the end of the moratorium on elective procedures on June 8, 2020, 38 patients in the 2019 cohort underwent RCR, compared with 46 patients in the 2020 cohort.

Preoperative Characteristics

More subjects in the 2019 cohort had a history of surgery on the same shoulder than in 2020 (11.1 versus 1.7%; $p = 0.04$). There was also a trend toward more subjects in the 2019 cohort being treated for acute injuries (38.9 versus 25.0%; $p = 0.09$) but this was not significant in our sample. No significant difference was found for the number of traumatic injuries treated between years (68.1 versus 75.0%; $p = 0.35$). Additionally, no difference was found between years for the length of time from pain or injury onset to surgery for traumatic injury patients (360.6 ± 938.5 days versus 259.4 ± 304.0 days; $p = 0.47$) or atraumatic injury patients (436.3 ± 388.1 days versus 478.7 ± 426.7 days; $p = 0.66$). For preoperative therapy, a similar number of patients attempted physical therapy (63.2% versus 55.0%; $p = 0.35$) and received a corticosteroid injection in the office prior to attempting operative management (25.0 versus 28.3%; $p = 0.67$). For patients who did receive corticosteroid injections, there was a trend toward 2019 patients experiencing longer times from injection to surgery (342.9 ± 376.4 days versus 157.8 ± 89.2 days; $p = 0.10$). For the preoperative physical exam, there was no difference in range of motion for both forward elevation ($158.0° \pm 38.6°$ versus $158.3° \pm 29.3°$; $p = 0.47$) and external rotation ($51.6° \pm 13.1°$ versus $50.5° \pm 14.7°$; $p = 0.63$) (►**Table 2**).

Radiographic Findings and Intraoperative Characteristics

Patients in 2019 experienced significantly shorter lengths of time from MRI to surgery (62.7 ± 70.5 days versus 115.7 ± 151.0 days; $p = 0.01$). There was no difference between 2019 and 2020 in the amount of rotator cuff tears that progressed from partial tear as read on MRI to full tear as determined by intraoperative evaluation (12.5 versus 15.0%; $p = 0.68$) or the amount of full rotator cuff tears at surgery (84.7 versus 81.7%; $p = 0.64$). There was no difference in Goutallier scores for supraspinatus (0.5 ± 0.7 versus 0.8 ± 1.0; $p = 0.17$) or infraspinatus (0.5 ± 0.8 versus 0.6 ± 0.8; $p = 0.25$). The 2019 cohort demonstrated smaller degrees of retraction for their rotator cuff tears (2.1 ± 1.3 cm versus 2.6 ± 1.2 cm; $p = 0.05$) but there was no significant difference in size on the anterior-to-posterior measurement (1.6 ± 1.0 cm versus 1.8 ± 1.0 cm; $p = 0.17$). There was no difference in the number of massive (> 4 cm) rotator cuff tears between the 2 years (7.0 versus 7.5%; $p = 0.91$). Reviewing the operative reports, there was a trend toward a greater proportion of single-row repairs being performed in 2019 (72.7 versus 56.0%; $p = 0.06$) but there

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Table 1 Patient demographics (2019: $n = 72$; 2020: $n = 60$)

Characteristic	2019	2020	*p-value*
Age at surgery (years old)	61.0 ± 9.4	60.5 ± 10.2	0.78
Gender			
Male	35 (48.6%)	35 (58.3%)	0.27
Female	37 (51.4%)	25 (41.7%)	
BMI	28.1 ± 5.3	29.9 ± 7.0	0.27
ASA Score			0.31
1–2	56 (77.8%)	42 (70.0%)	
3–4	16 (22.2%)	18 (30.0%)	
Insurance Provider			0.63
Medicare	16 (22.2%)	18 (30.0%)	
Medicaid	7 (9.7%)	3 (5.0%)	
Private	37 (51.4%)	26 (43.3%)	
Workers compensation	11 (15.3%)	12 (20.0%)	
Self-paid	1 (1.4%)	1 (1.7%)	
Diabetes			0.12
Yes	5 (6.9%)	9 (15.0%)	
No	67 (93.1%)	51 (85.0%)	
Hypertension			0.29
Yes	35 (48.6%)	34 (56.7%)	
No	37 (51.4%)	26 (43.3%)	
Smoking history			0.68
Responses (*n*)	70	60	
Never	44 (62.9%)	42 (70.0%)	
Former	18 (25.7%)	13 (21.7%)	
Current	8 (11.4%)	5 (8.3%)	

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index.

was no difference in the number of anchors used between 2019 and 2020 for either single-row repair (1.4 ± 0.8 versus 2.2 ± 1.5; $p = 0.61$) or double-row repair (2.6 ± 1.5 versus 2.5 ± 1.7; $p = 0.53$) (►**Table 3**).

Perioperative Characteristics

There was no significant difference in the duration of the surgical procedure between 2019 and 2020 (80.0 ± 28.2 minutes versus 86.7 ± 34.1 minutes; $p = 0.32$) or length of stay in the recovery unit on the day of their procedure (8.1 ± 3.0 hours versus 7.4 ± 1.9 hours; $p = 0.12$). Additionally, no patient in either group experienced any intraoperative complication (►**Table 4**).

Postoperative Characteristics

Significantly more subjects in 2020 had a virtual/telehealth postoperative visit with their operating surgeon compared with 2019 (0.0 versus 10.0%; $p = 0.009$). There was also a trend toward 2020 patients experiencing longer lengths of time and more variability in the time between their surgery date and postoperative visit (12.0 ± 4.7 days versus 16.7 ± 17.5 days; $p = 0.19$). There was no significant difference in participation in physical therapy between the two cohorts (2019: 98.5 versus 2020: 90.4%; $p = 0.08$). There was no difference in readmission rates (0.0 versus 0.0%; $p > 0.999$) or in patients needing revision surgery on the same shoulder (5.6 versus 0.0%; $p = 0.13$) (►**Table 5**).

Subanalysis of Patients with Traumatic Injury

Subjects in the 2019 and 2020 cohorts who sustained an identifiable traumatic injury to their rotator cuff were further analyzed. In the 2019 cohort, 57.1% of the traumatic injuries occurred in males compared with 60% in the 2020 cohort ($p = 0.836$). There was still no significant difference in the length of time from injury to surgery in 2019 and 2020 (360.6 ± 938.5 days versus 259.4 ± 304.0 days; $p = 0.47$). Additionally, patients in 2019 still experienced shorter lengths of time from MRI to surgery (56.7 ± 47.3 days versus 80.9 ± 75.8 days; $p = 0.04$). When comparing the variance in time from the onset of symptoms between cohorts, there was a significantly greater variance in the 2019 cohort compared with the 2020 cohort ($p < 0.001$).

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Table 2 Patient preoperative characteristics (2019: $n = 72$; 2020: $n = 60$)

Characteristic	2019	2020	*p-value*
Prior shoulder surgery			0.04
Yes	8 (11.1%)	1 (1.7%)	
No	64 (88.9%)	59 (98.3%)	
Chronic versus acute injury			0.09
Chronic (> 3 months from injury to surgery)	44 (61.1%)	45 (75.0%)	
Acute (< 3 months from injury to surgery)	28 (38.9%)	15 (25.0%)	
Traumatic versus atraumatic injury			0.35
Traumatic	49 (68.1%)	45 (75.0%)	
Atraumatic	23 (31.9%)	15 (25.0%)	
Average time from injury to surgery (days)			
Traumatic	360.6 ± 938.5	259.4 ± 304.0	0.47
Atraumatic	436.3 ± 388.1	478.7 ± 426.7	0.66
Attempted physical therapy prior to surgery			0.35
Responses (*n*)	68	60	
Yes	43 (63.2%)	33 (55.0%)	
No	25 (36.8%)	27 (45.0%)	
Received corticosteroid injection			0.67
Yes	18 (25.0%)	17 (28.3%)	
No	54 (75.0%)	43 (71.7%)	
Average time from injection to surgery (days)	342.9 ± 376.4	157.8 ± 89.2	0.10
Preoperative forward elevation	158.0° ± 38.6°	158.3° ± 29.3°	0.47
Preoperative external rotation	51.6° ± 13.1°	50.5° ± 14.7°	0.63

Discussion

These findings suggest that the COVID-19 pandemic caused a delay in time to surgery for patients following rotator cuff tear. Patients in 2019 were more likely to have had a previous surgery on their shoulder, but there were no other significant differences between the 2019 and 2020 cohorts. After the moratorium on elective procedures, more patients underwent RCR surgery in 2020 compared with 2019. This is despite previous literature that demonstrated a 53.32% decrease in Google search trends for "rotator cuff surgery" during and around the COVID-19 pandemic.[2]

Mall et al.[1] described that acute, traumatic rotator cuff tears are more likely to occur in generally young, male patients. Previously, Moverman et al.[4] found that male patients were more likely to feel comfortable pursuing elective surgery during the early stages of the COVID-19 pandemic. However, we found no significant difference in the gender distribution in traumatic rotator cuff tears or time from injury to surgery between the 2019 and 2020 cohorts. Additionally, it is likely that the mean difference in time from MRI to surgery between the 2 groups (53 days) can be partially explained by the duration of the moratorium on elective surgery (86 days).

The current literature on the increased risk for retear or worse outcomes in patients who undergo delayed repair of their rotator cuff tear is controversial. Kwong et al.[13] reported in a systematic review that approximately one-third of symptomatic, full-thickness rotator cuff tears progress by ≥ 5 mm by 37.8 months, at a rate of ∼ 1% per month. Fu et al.[8] demonstrated an increased rate of retear in the delayed reconstruction group (> 12 months) compared with both the early (< 6 weeks) and routine (6 weeks to 12 months) groups. However, these data were obtained from a large national database and only evaluated the time from the date of the initial diagnosis – nontraumatic event – to the date of surgery. Another report on a series of 20 patients undergoing surgery within 6 months of injury demonstrated improved patient-reported outcomes scores compared with an age- and gender-matched cohort who underwent surgery at between 6 and 18 months after injury.[7] In contrast, Petersen et al.[10] reported no significant influence on the outcome for any size rotator cuff tear in a series of 36 patients if repaired within 4 months of the injury; however, massive tears repaired after 4 months had inferior outcomes. Patel et al.[9] demonstrated a shorter time to recovery and less need for allograft augmentation in large tears for subjects in an early repair group, but there was no significant difference in outcomes at the mid-term follow-up (a median of 30 months postoperatively). In their systematic review, Mall et al.[1] did not demonstrate any consensus in the literature on improved outcomes with early repair of rotator cuff tears. Our data did

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Table 3 Operative Report and Magnetic Resonance Imaging data (2019: $n = 72$; 2020: $n = 60$)

Characteristic	2019	2020	*p-value*
Time from MRI to surgery (days)	62.7 ± 70.5	115.7 ± 151.0	0.01
Partial tear at MRI to full tear at surgery			0.68
Yes	9 (12.5%)	9 (15.0%)	
No	63 (87.5%)	51 (85.0%)	
Type of rotator cuff tear at surgery			0.64
Full	61 (84.7%)	49 (81.7%)	
Partial	11 (15.3%)	11 (18.3%)	
Average supraspinatus Goutallier scores	0.5 ± 0.7	0.8 ± 1.0	0.17
Supraspinatus Goutallier scores			0.12
0–1	56 (90.3%)	45 (80.4%)	
2–3	6 (9.7%)	11 (19.6%)	
Average infraspinatus Goutallier scores	0.5 ± 0.8	0.6 ± 0.8	0.25
Infraspinatus Goutallier scores			0.35
0–1	53 (85.5%)	51 (91.1%)	
2–3	9 (14.5%)	5 (8.9%)	
Average degree of retraction (cm)	2.1 ± 1.3	2.6 ± 1.2	0.05
Average tear size (cm)	1.6 ± 1.0	1.8 ± 1.0	0.17
Massive rotator cuff tears at MRI			0.91
MRI read (*n*)	57	53	
Yes	4 (7.0%)	4 (7.5%)	
No	53 (93.0%)	49 (92.5%)	
Type of Rotator Cuff repair			0.06
Single Row	48 (72.7%)	28 (56.0%)	
Double	18 (27.3%)	22 (44.0%)	
Average Number of Anchors used			
Single-row repair	1.4 ± 0.8	2.2 ± 1.5	0.61
Double-row repair	2.6 ± 1.5	2.5 ± 1.7	0.53

Table 4 Perioperative characteristics of the patients (2019: $n = 72$; 2020: $n = 60$)

Characteristic	2019	2020	*p-value*
Duration of surgery (minutes)	80.0 ± 28.2	86.7 ± 34.1	0.32
Length of stay (hours)	8.1 ± 3.0	7.4 ± 1.9	0.12
Blood transfusion			1.0
Yes	0 (0.0%)	0 (0.0%)	
No	72 (100.0%)	60 (100.0%)	
Surgical complications			1.0
Yes	0 (0.0%)	0 (0.0%)	
No	72 (100.0%)	60 (100.0%)	

demonstrate significantly more retracted tears in the 2020 cohort, but there was no difference in the number of anchors required for arthroscopic repair between the 2 cohorts.

Elective surgery during the COVID-19 pandemic was strongly influenced by several factors, including ethical considerations, resource limitations, and patient willingness to undergo surgery during a pandemic.[6,11,14] In a report on oncological orthopedic patients, the delays in surgical management caused by COVID-19 demonstrated major morbidity.[5] There have been no reports to date on the impact in delays in surgical management on orthopedic sports medicine patients. One evidence-based guideline suggested that

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Table 5 Postoperative characteristics of the patients (2019: $n = 72$; 2020: $n = 60$)

Characteristic	2019	2020	*p-value*
Postoperative visit method			0.009
Telehealth visit	0 (0.0%)	6 (10.0%)	
In-person office visit	69 (100%)	54 (90.0%)	
Time from surgery to postoperative visit (days)	12.0 ± 4.7	16.7 ± 17.5	0.19
Performed physical therapy			0.08
Responses (*n*)	67	52	
Yes	66 (98.5%)	47 (90.4%)	
No	1 (1.5%)	5 (9.6%)	
Readmission			1.0
Yes	0 (0.0%)	0 (0.0%)	
No	72 (100.0%)	60 (100.0%)	
Revision surgery			0.13
Yes	4 (5.6%)	0 (0.0%)	
No	68 (94.4%)	60 (100.0%)	

acute, traumatic rotator cuff injuries should be treated in a time-sensitive manner while chronic, degenerative injuries should be treated as not time-sensitive surgeries.[11] Specifically for massive tears, evidence suggests that repair in a timely fashion can improve outcomes and reduce morbidity.[10,12,15]

During the COVID-19 pandemic, a significant number of patients participated in telehealth consultations rather than in-person consultations for their immediate postoperative appointment. This was offered at several institutions worldwide, including our own.[14] The goal of these visits was to reduce the number of potential exposures and infections in our community while encouraging appropriate stewardship of healthcare resources. Early reports demonstrated no significant impact on patient-reported outcomes for shoulder surgery patients who underwent telemedicine follow-up postoperatively.[16] We found no immediate increase in postoperative complications in patients who underwent telemedicine follow-up postoperatively; however, only a relatively small proportion of patients (10%) selected this option. The potential for expanding the role of telemedicine without compromising the quality of patient care has been suggested as an area of impact and potential improvement in a postpandemic healthcare environment.[17]

Regarding the limitations of the present study, we only collected immediate and short-term data for patients in the 2020 cohort and cannot compare longer-term outcomes and complications between cohorts. Additionally, our institution represents a specific subset of the global pandemic experience; while our investigation represents a region of significant impact, we have a well-developed healthcare system with the benefits of significant resources and administrative support in aiding a return to normal after COVID-19. Our hope is that the lessons learned during the current pandemic can help guide future approaches to disasters that require rationing of healthcare resources. Future investigations should aim to quantify if the changes surrounding the pandemic led to any intermediate or long-term changes in patient outcomes.

Conclusion

There were no significant differences in patient demographics during the COVID-19 pandemic. Delays in surgical management of acute, traumatic tears from the time of diagnosis via MRI were noted, but the delay from time of injury was not significantly different between the 2019 and 2020 cohorts. Our data suggests that these injuries were still able to be treated in a timely fashion during the pandemic, and the utilization of postoperative telemedicine visits did not lead to any significant changes in early complications.

Financial Support
The present study received no financial support from any public, commercial, or not-for-profit sources.

Conflict of Interests
Cagle, P. J., – Stryker: Consultant
Johnson & Johnson: Consultant
Parsons B. O., MD – Arthrex: Consultant
The other authors have no conflict of interests to declare.

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