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The impact of confirmed coronavirus disease 2019 (COVID-19) infection on ambulatory procedures and associated delays in care for asymptomatic patients

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ABSTRACT

Background: Since the reopening of ambulatory centers, minimal data has been reported regarding positive tests among patients undergoing ambulatory procedures, associated delays in care, and outcomes of patients previously positive for coronavirus disease 2019.

Methods: A retrospective observational case series of ambulatory procedures was performed. Records since the reopening of ambulatory centers in New York were searched for patients with positive coronavirus disease 2019 nasal swab results who underwent ambulatory procedures. Chart reviews were conducted to determine coronavirus disease history and hospitalizations, demographic information, procedure details, and 30-day admissions.

Results: A total of 3,762 patients underwent ambulatory procedures. Of those, 53 were previously diagnosed with coronavirus disease 2019 but recovered and tested negative at preprocedural testing. Of the 3,709 asymptomatic patients, 37 (1.00%) tested positive during preprocedural testing; 21 patients had their procedures delayed on average 28.6 days until testing negative, while 16 had their procedures performed before testing negative owing to the time sensitivity of the procedure. There were no major complications or 30-day admissions in any of these asymptomatic patients. Three patients tested positive for coronavirus disease after having an ambulatory procedure.

Conclusion: Positive tests in asymptomatic patients led to procedure delays of 28.6 days. No patients who underwent ambulatory procedures after a positive coronavirus disease 2019 test had any coronavirus disease-related complications, regardless of whether or not the procedure was delayed until testing negative. Three patients tested positive for coronavirus disease 2019 after having an ambulatory procedure; however, at an average of 19.7 days after, these cases were likely community acquired making the rate of nosocomial infection negligible.

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Introduction

When the first case of coronavirus disease 2019 (COVID-19) was reported in the United States on January 20, 2020, the profound impacts that it would have on health care, economics, and everyday life were unforeseeable.¹ New York State quickly became the epicenter of the COVID-19 pandemic. The first COVID-19 case was detected in New York City (NYC) on March 1, and by the end of the

month, areas of NYC and surrounding counties had some of the highest per capita infection rates in the world.^{2,3} Northwell Health, a large integrated health care system that serves the greater NYC area, reported their first positive COVID-19 test on a sample collected from March 4 and went on to diagnose 26,735 cases (14.8% of all positive cases in New York) over the next 5 weeks.⁴

The United States declared a state of emergency on March 13, and the Centers for Medicare and Medicaid Services recommended that all elective procedures be postponed to limit viral exposure and conserve hospital resources.^{1,5,6} Only time-sensitive procedures, defined as “those that cannot reasonably be delayed for more than 8 weeks without significant harm to the patient,” were allowed to proceed with extra precautions to curtail virus transmission.^{6–8} Although necessary, it is estimated that the pause in

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elective surgical procedures resulted in monthly losses of \$4 to \$5.4 billion of income and \$16.3 to \$17.8 billion of revenue for the US health care sector.⁵ Because of this, there was pressure for hospitals to reopen ambulatory surgical centers and resume elective procedures as soon as possible.

Based on national and state recommendations, many health care systems in New York began to resume elective ambulatory procedures in May 2020, with universal screening for COVID-19.^{9,10} Since then, minimal data has been reported regarding asymptomatic patients testing positive for COVID-19 as a result of universal screening, resulting delays in care, outcomes of patients undergoing procedures after having COVID-19, or the number of patients who test positive for COVID-19 after a procedure. The purpose of this study was to determine the impact of COVID-19 on ambulatory procedures since the reopening of ambulatory care centers.

Methods

This study was institutional review board approved. Medical records for patients who underwent an outpatient ambulatory procedure across a large health care system were retrospectively reviewed. The study period spanned May 15, 2020 through July 17, 2020. Electronic medical records were searched for patients with a positive COVID-19 nasal swab polymerase chain reaction (PCR) result. This included patients who had a history of a positive test in the past, patients who tested positive during routine preprocedural testing, and patients who had a positive test after their ambulatory procedure.

For patients with positive tests, chart reviews were conducted of their COVID-19 infection courses, including COVID test history, symptomatology, and related hospitalizations. Charts were reviewed for delays in care that resulted from a positive test. Procedure details, including procedure type, anesthesia type, and preoperative American Society of Anesthesiologists (ASA) score, were evaluated. Patient demographics were also collected including patient age, county of residence, comorbidities, and insurance type. Charlton comorbidity indices (CCI) were calculated for all patients. We reviewed complications and 30-day admissions.

Most of the data points identified in this study were epidemiological and lacked true comparison groups; therefore, it was not possible to run statistical analyses for many of the numbers we report. To determine if there were any factors that may have influenced the decision to postpone a procedure on asymptomatic COVID-positive patients, we compared factors of age, ASA score, and CCI for asymptomatic patients who had their procedures delayed to patients who had their procedure before retesting negative using 2-tailed heteroscedastic *t* tests. Type of anesthesia chosen was compared for these 2 groups using χ^2 tests to determine if there were differences in how anesthesiologists chose to manage COVID-positive patients. We also used a *t* test to compare the time between the first positive test and the first negative test between the group of patients who were known to have been COVID-positive before preprocedural testing and patients who had their procedures delayed as the result of a positive test.

Results

During the study period, a total of 3,762 patients underwent ambulatory procedures. There were 93 patients who tested positive for COVID-19 at some point, representing 2.47% of patients who underwent an ambulatory procedure.

Prior COVID-19 positive patients who tested negative before procedure

Fifty-three patients were previously diagnosed with COVID-19 before testing for their ambulatory procedure. Twenty-two of the 53 patients required hospitalization for COVID-19 and spent an average of 13.3 days hospitalized (Table I). All 53 patients tested negative for COVID-19 at preprocedural testing. The average time from a patient's first positive test to their first negative test was 56.5 days among this group of patients. The average age for this patient group was 49.2 years old. Twenty-six patients resided in Queens County (49.1%), 15 in Nassau County (28.3%), and 12 in Suffolk County (22.6%). The breakdown of insurance types for these patients was as follows: 26 patients (49.1%) had private insurance, 11 (20.8%) had Medicare, and 16 (30.2%) had Medicaid (Table II). These patients had an average ASA score of 2.2 and an average CCI of 2.0. After their procedures, 4 of the 53 patients were admitted within 30 days of their procedure; however, all admissions were for non-COVID related reasons (Table III). Two of the 4 patients readmitted had major surgical complications requiring intervention. One patient's nephrostomy tube fell out, and they required reinsertion of the tube. Another was admitted with fever and found to have an intra-abdominal collection near the site of a prior splenectomy, which required drainage by interventional radiology (IR). The 2 other admissions were for uncontrolled hypertension and a urinary tract infection. Specialty breakdowns for the procedures these patients underwent was as follows: 18 gastroenterology, 15 general surgery, 6 urology, 4 orthopedic surgery, 3 vascular surgery, 2 neurosurgery, 2 obstetrics and gynecology (OB/GYN), 1 plastic surgery, and 1 IR (Table IV).

Asymptomatic patients who tested positive for COVID-19

Thirty-seven of the patients who tested positive for COVID-19 were asymptomatic and tested positive during preprocedural testing. Among patients who had not previously tested positive for COVID-19, this was equivalent to an asymptomatic positive test rate of 1.00% (37/3,709).

Of the asymptomatic positive tests, 21 had their procedures delayed for an average of 28.6 days. The average time from a patient's first positive test to their first negative test was significantly shorter than in the group that had recovered from COVID before their preprocedural testing (25.5 vs 56.5 days, $P < .001$) (Table I). Eleven patients resided in Queens County (47.8%), 8 in Nassau County (34.8%), 3 in Suffolk County (13%), and 1 in Brooklyn County (4.3%). The breakdown of insurance types for these patients was as follows: 14 patients (60.9%) had private insurance, 4 patients (17.4%) had Medicare, and 5 (21.7%) had Medicaid (Table II).

For patients who had their procedures delayed until testing negative, the average age was 42.2 years. ASA score was 2.0, and CCI was 1.2. Seventeen of these patients (73.9%) had general anesthesia, while 4 (17.4%) had regional anesthesia, 1 patient (4.3%) had local anesthesia, and 1 patient (4.3%) was unknown (Table III). Patients who had their procedure delayed by a positive test had the following specialty breakdown: 1 gastroenterology, 7 general surgery, 2 urology, 3 orthopedic surgery, 2 OB/GYN, 1 IR, 2 surgical oncology, and 2 ear, nose and throat (Table IV).

The other 16 asymptomatic COVID-positive patients had their procedures performed before converting to a negative test owing to the time-sensitive nature of their procedures and lack of symptomatology. This included 2 patients who had their procedures delayed by 6 and 35 days; however, after repeat PCR testing was positive, the decision was made to undergo the procedure without further delays (Table I). Four patients resided in Queens County (25.0%), 4 in Nassau County (25.0%), 7 in Suffolk County (43.8%), and

Table I
COVID history

	Prior COVID-19 positive converted to negative (n = 53)	Asymptomatic COVID-19 positive, procedure delayed (n = 21)	Asymptomatic COVID-19 positive, case performed before negative test (n = 16)
Average d hospitalized for COVID-19	13.3 (n = 22)	-	-
Delay in procedure (d)	-	28.6	20.5 (n = 2)
Time from first positive test to negative test (d)	56.5*	25.5*	-

COVID-19, coronavirus disease 2019.

* P < .001

Table II
Patient demographics

	Prior COVID-19 positive converted to negative (n = 53)	Asymptomatic COVID-19 positive, procedure delayed (n = 21)	Asymptomatic COVID-19 positive, procedure performed before negative test (n = 16)
Male/female sex (%)	49.1/50.9	42.9/57.1	42.9/57.1
Age (y)	49.2	42.2	44.6
Insurance type			
Private	26 (49.1%)	13 (61.9%)	11 (68.8%)
Medicare	11 (20.8%)	4 (19.0%)	1 (6.3%)
Medicaid	16 (30.2%)	4 (19.0%)	4 (25.0%)
County of residence			
Queens	26 (49.1%)	11 (52.4%)	4 (25.0%)
Nassau	15 (28.3%)	7 (33.3%)	4 (25.0%)
Suffolk	12 (22.6%)	2 (9.5%)	7 (43.8%)
Brooklyn	-	1 (4.8%)	1 (6.3%)

COVID-19, coronavirus disease 2019.

Table III
Procedure details

	Prior COVID-19 positive converted to negative (n = 53)	Asymptomatic COVID-19 positive, procedure delayed (n = 21)	Asymptomatic COVID-19 positive, case performed before negative test (n = 16)	P values (comparing groups of asymptomatic patients)
Age	49.2	42.2	44.6	.73
Average ASA score	2.2	2.0	2.1	.81
Average CCI	2.0	1.1	1.7	.51
Anesthesia type				.51
General	29 (54.7%)	16 (76.2%)	11 (68.8%)	
Regional	18 (34.0%)	4 (19.0%)	4 (25.0%)	
Local	-	1 (4.8%)	-	
Unknown	6 (11.3%)	-	1 (6.3%)	
30-d readmissions	4	0	0	-
Major complications	2	0	0	-

ASA, American Society of Anesthesiologists; CCI, Charlson comorbidity index; COVID-19, coronavirus disease 2019.

Table IV
Procedure specialty breakdown

	Prior COVID-19 positive converted to negative (n = 53)	Asymptomatic COVID-19 positive, procedure delayed (n = 23)	Asymptomatic COVID-19 positive, procedure performed before negative test (n = 16)	Positive COVID-19 test after procedure (n = 3)
Gastroenterology	18	1	3	1
General surgery	15	7	-	1
Urology	6	2	1	-
Orthopedics	4	3	4	1
Vascular surgery	3	-	-	-
Neurosurgery	2	-	-	-
OB/GYN	2	2	6	-
Plastic and reconstructive surgery	1	-	-	-
Pediatric surgery	1	-	-	-
Interventional radiology	1	1	2	-
Surgical oncology	-	2	-	-
ENT	-	2	-	-

COVID-19, coronavirus disease 2019; ENT, ear, nose, and throat; OB/GYN, obstetrics and gynecology.

Table V
Patients who tested positive after procedures

	Patient 1	Patient 2	Patient 3	Average
Age (y)	74	26	21	40.3
Time from procedure until positive test (d)	36	4	19	19.67
Disease course	Symptomatic, not hospitalized	Asymptomatic	Asymptomatic	-
ASA Score	2	2	1	1.67
CCI	3	0	0	1

ASA, American Society of Anesthesiologists; CCI, Charlson comorbidity index.

1 in Brooklyn County (6.3%). The breakdown of insurance types for these patients was as follows: 11 patients (68.8%) had private insurance, 1 patient (6.3%) had Medicare, and 4 (25.0%) had Medicaid (Table II).

For the patients who underwent their procedures before converting to a negative test, the average age was 44.6 years, ASA was 2.1, and CCI was 1.7. Eleven of these patients (68.8%) had general anesthesia, 4 patients (25%) had regional anesthesia, and 1 patient (6.3%) was unknown (Table III). The specialty breakdown was as follows: 3 gastroenterology, 1 urology, 4 orthopedic surgery, 6 OB/GYN, and 2 IR (Table IV).

There were no significant differences in age, ASA, or CCI between asymptomatic patients who had procedures delayed by a positive test and those who underwent their procedures before testing negative (age, $P = .73$; ASA, $P = .81$; CCI, $P = .51$). There were no significant differences in type of anesthesia used for the 2 groups of asymptomatic patients ($P = .51$). There were no major complications or 30-day admissions in any of these 37 asymptomatic patients, regardless of whether or not their procedure was delayed (Table III).

Patients who tested positive for COVID-19 after procedures

Additionally, there were 3 patients who tested positive for COVID-19 after their ambulatory procedures. These patients tested positive an average of 19.7 days after their procedure. Two of the 3 were asymptomatic. One was tested owing to known exposure to someone with COVID-19, and the other was having presurgical testing for another procedure. The symptomatic patient presented to the emergency room with symptoms of fever and cough 36 days after his ambulatory procedure and did not require hospitalization (Table V).

Discussion

In this study, we retrospectively identified 93 patients who underwent an ambulatory procedure between May and July 2020 and had a positive COVID-19 nasal swab PCR. Fifty-three of these patients had prior COVID infection and tested negative at pre-procedural testing. Of these patients, 4 required 30-day admission, and 2 had major complications requiring a second procedure; however, none of these complications were found to be connected to their prior COVID history. Thirty-seven patients were asymptomatic and tested positive for COVID-19 during preprocedural testing. Twenty-one of those patients had their procedures delayed for an average of 28.6 days until they tested negative, while the other 16 patients had their procedures performed before testing negative. There were no significant differences in age, ASA score, CCI, or type of anesthesia used in asymptomatic patients who had their procedures delayed compared with those who were not delayed. No major complications or 30-day admissions were

identified for any of the asymptomatic patients. Three patients tested positive for COVID-19 an average of 19.7 days after their ambulatory procedures.

Most hospitals across the United States have adopted universal testing of patients undergoing procedures on an inpatient or outpatient basis. However, it is well documented that there are still issues with testing. A positive nasopharyngeal PCR indicates that viral RNA is present, which supports exposure within the past 21 days; however, it does not necessarily confirm that a patient is currently infectious or has COVID-19. Additionally, the false-negative rate for some tests is known to be up to 30%, and false positives also occur owing to cross-reactivity with other coronaviruses.¹¹ This creates several pitfalls associated with universal testing. First, false-negative results can lead to a false sense of reassurance among health care workers and lapses in personal protective equipment compliance. Second, false positives can result in unnecessary delays in care. This study showed an average delay of 28.6 days for relatively low-risk ambulatory procedures was associated with a positive test.

We identified 16 asymptomatic COVID-positive patients who underwent a procedure before testing negative, and all were discharged home the same day without complications or admissions. In comparison, prior data reported for COVID-positive patients undergoing surgical procedures is not encouraging, but the patients in those studies were older and the procedures higher risk. Lei et al reported a series of 34 asymptomatic patients from Wuhan, China who underwent elective surgery early in the outbreak and were found to be COVID-positive soon after. They found that 44.1% of patients required intensive care unit (ICU) admission owing to respiratory failure, 32.4% developed acute respiratory distress syndrome, and 20.6% died.¹² The patients in their series were older (mean age 55 years) and 13 of 15 patients requiring ICU admission underwent “moderate risk, complex procedures” with a mean operative time of 200 minutes. Although we do not have operative times to contrast, anecdotally the procedures included in our study were less complex and shorter. Similarly, Gruskay et al reported a series of COVID-positive patients in need of essential orthopedic procedures.¹³ Of 9 asymptomatic patients, 8 promptly underwent surgery, and 25% required ICU admission afterwards. Of 7 symptomatic patients, 1 expired before surgery, and 6 were operated on with 1 patient expiring after surgery for a hip fracture (17% post-operative mortality rate).¹³ However, the average age of their patients was 63.9 years for asymptomatic patients and 66.0 years for symptomatic patients versus 42.2 years in our study. Additionally, their patients were generally undergoing high-risk procedures, with 4 patients in both their symptomatic and asymptomatic groups having hip fractures. As Mi et al reported, outcomes of COVID-positive patients admitted for acute fracture care are poor (40% mortality) regardless if surgery is performed or not.¹⁴ On the other hand, our data suggests that in well-selected young and relatively healthy COVID-positive patients, time-sensitive same day procedures can be performed safely.

Another interesting aspect of our study that warrants discussion is that we report good outcomes for patients who recently recovered from COVID-19 and then underwent ambulatory procedures. Fifty-three patients recovered from COVID-19 infection before preprocedural COVID testing with 22 of those patients previously requiring hospitalization. Of those 53 patients, 4 required admission after their procedure, and 2 required reoperation. However, none of these complications were related to their prior COVID history but rather were owing to known potential risks of the procedures performed. Another 21 patients had their procedures delayed until they tested negative for COVID, but then had their procedures performed without any complications or admissions noted. Overall, 70 of 74 patients who had recovered from COVID-19 infection (94.6%) underwent same day ambulatory procedures without any short-term complications. Additionally, we reported an average time of 56.5 days for conversion to a negative test for those patients with prior COVID infection and 25.5 days for those asymptomatic positive patients who had their procedures delayed, which was a significant difference. We feel this difference is explained by 2 factors: less abundant testing earlier in the pandemic and more frequent testing of the patients with delayed procedures owing to pressure from treating physicians. Regardless, our data suggests that it is relatively safe to perform ambulatory procedures on patients who have recovered from COVID-19, whether their positive test came a few weeks or a few months prior.

There were 3 patients in our study who tested positive for COVID-19 after their ambulatory procedure. Even if we assume that their COVID-19 infection was owing to nosocomial exposure, it would correspond to a negligible rate of infection (3 of 3,672 vulnerable patients or 0.082%). However, 1 patient was diagnosed 4 days after the procedure, and the other 2 were diagnosed 19 and 36 days after, which implies exposure before the procedure and after the procedure, respectively, given the approximately 7- to 10-day incubation period of COVID-19. Fortunately, only 1 of these patients was symptomatic, and none required hospitalization. Similarly, Couto et al reported a series of 300 patients who underwent ambulatory procedures during the pandemic under similar preoperative testing protocols and reported no cases of COVID transmission in their patients.¹⁵ This suggests that with the appropriate presurgical testing and perioperative precautions, ambulatory surgery centers can safely continue to function and decompress volume from overburdened hospitals as the pandemic continues.

The status of the pandemic in the greater NYC area during our study should be mentioned for context. At the start of our study period on May 15th, there was a 6.8% positive test rate for NYC (which includes Queens and Brooklyn counties) and a 7.1% positive test rate for Long Island (Nassau and Suffolk counties).¹⁶ In contrast, at the end of data collection on July 18th, the positive test rate for NYC was 1.3% and for Long Island was 0.9%. In comparison, the highest positive test rates during the height of the pandemic were 59.4% in NYC on March 29th and 54.9% in Long Island on March 31st, while positive test rates reached a low of 0.6% for both regions later in the summer. As we are beginning to experience a “second wave” of cases in New York State, positive test rates of 1.3% to 4.1% for NYC and 1.4% to 4.7% for Long Island were reported in November 2020.¹⁶ This demonstrates that although COVID-transmission rates in the community were far lower during our study period than at the height of the pandemic, the positive test rates experienced in the early summer months are similar to those we are seeing in the late fall in the greater NYC area.

Since our data does not capture potential cases of transmission from patients to health care providers, it is worth mentioning that the safety of the staff at our ambulatory surgery centers is of the utmost importance. In our health system, we recommend that all staff with patient care roles adhere to strict precautions for

personal protection, similar to those outlined by Gilat et al.¹ At minimum, all providers with direct patient care roles are advised to wear a surgical mask, gloves, and eye protection at all times when interacting with patients. Social distancing, maintaining a minimum of 6 feet from patients or coworkers, is encouraged whenever possible. For patients known to have a positive COVID-19 test, N95 respirator masks must be worn at all times by nearby staff, and proper airborne precautions should be adhered to. Additionally, people within the operating room should be limited to required staff, especially when aerosol generating procedures such as intubation are required, and anyone present during an aerosol generating procedure should wear an N95 mask and eye protection, regardless of the patient’s COVID-19 test results. By adhering to these guidelines, our goal is to ensure the protection of both staff and patients from COVID-19 transmission, even in the inevitable setting of a false-negative test result.

There are certainly limitations to our study. First, it is limited by its retrospective nature. There are other clinical parameters and data points that would have been interesting to evaluate, but they are not routinely collected before ambulatory procedures, so they were not available for our retrospective review. Second, we were limited to only data within our health care network’s electronic medical record. This means that we could not capture COVID tests performed at facilities outside of our health system, and we may have also missed patients who presented to other hospitals with complications and for subsequent care. Third, the data used in this study is largely epidemiological and lacks a comparison group, so our abilities to declare statistical significance is very limited. Lastly, because our database only has records of performed procedures, we were unable to search for COVID-positive patients who had procedures cancelled but not rescheduled. This is why we can only report numbers relative to the number of procedures performed, and the 1.00% of asymptomatic patients who tested positive for COVID-19 in our study is not a good surrogate for the general population. Given these major limitations, further studies using larger datasets are needed to validate the findings of our study before the conclusions can be applied clinically.

Despite the limitations, we feel our study adds important information to the growing body of COVID-19 literature. To the best of our knowledge, our study is the first to report relative safety of performing ambulatory procedures on patients who previously tested positive for COVID-19. It also reports outcomes that are much more encouraging than those previously reported for performing procedures on asymptomatic COVID-positive patients, albeit on younger patients undergoing shorter and less complex procedures. Procedures that were delayed for a positive COVID test were delayed for nearly a month, which begs the question, is this delay in care necessary in properly selected patients? Our hope is that the results of this study will stimulate other institutions to study and report similar information so that the medical community can better understand how to manage a growing population of COVID-positive and COVID-recovered patients.

In conclusion, positive tests in asymptomatic patients led to significant delays in care, with an average procedure delay of 28.6 days. None of the patients who underwent ambulatory procedures after a positive COVID-19 test had any COVID-related complications, regardless of whether or not the procedure was delayed until testing negative. This suggests that it is relatively safe to perform ambulatory procedures on patients who previously tested positive for COVID-19, as long as they are asymptomatic. The rate of nosocomial spread associated with ambulatory procedures appears to be negligible with the appropriate perioperative testing and precautions. Further studies using larger datasets are needed to validate the findings of our study before these conclusions can be applied clinically.

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Conflict of interest/Disclosure

None of the authors have any disclosures to report.

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