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Pre-procedural screening for COVID-19 with nasopharyngeal polymerase chain reaction testing

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Editor—Non-emergent procedures ceased in many regions early in the coronavirus disease 2019 (COVID-19) pandemic to ensure adequate hospital resources for patient surges. As restrictions lift, we must resume normal operations while keeping patients, clinicians, and staff safe. An early case series from China reported poor outcomes for patients undergoing surgeries while unknowingly infected.[1] Coupled with concerns over clinician and staff exposure, these data led many centres to screen patients before procedures, primarily with nasopharyngeal polymerase chain reaction (PCR) testing.[2–4] We sought to assess the frequency of positive pre-procedural COVID-19 tests, to identify patient/procedural factors associated with testing positive, and to evaluate the need for more than one test.

We conducted a retrospective cohort study of all adult cases (surgeries and procedures) scheduled at the University of Miami Hospital and Clinics from April 1, 2020 to June 9, 2020. During this time, institutional practice was to obtain one or more nasopharyngeal PCR tests ≤72 h before procedures. Case-specific data, results of all PCR tests, and answers to screening questions (about symptoms, exposure, and travel) were obtained. Cases with no interpretable test results or set of screening questions within 7 days pre-procedure were excluded (Supplementary Fig. S1).

We used summary statistics to describe the cohort and χ^2 and Mann–Whitney testing to compare cases stratified by test positivity. On April 16, it became possible to provide indications for testing upon order entry; thus, as a sensitivity analysis, we separately evaluated cases with tests done within 7 days pre-procedure which were specifically marked as 'pre-procedural' (in contrast to, for example, symptoms concerning for COVID-19). The low test positivity rate precluded multivariable modelling. Among cases with more than one test, we evaluated the predictive accuracy of the first test for the second test. Institutional Review Board (IRB) approval was obtained from the University of Miami (#20200739).

Our cohort consisted of 4176 cases (3804 patients). Of these patients, 51.7% were male with a median age of 60 (interquartile range, 49–69) yr. Only 19 (0.5%; 16 patients) had at least one positive test (Table 1). Positive PCR cases were more likely to have positive symptoms screens (15.8% *vs* 3.4%; $P=0.003$); symptoms screening had low sensitivity (15.8%) and positive predictive value (2.1%) for PCR positivity. Out of 3536 cases (3240 patients) with at least one test marked specifically as 'pre-procedural', only eight (0.2%; seven patients) had at least one positive PCR test.

There were 480 (11.5%) cases with more than one test performed within 7 days pre-procedure (median time between tests was 1.75 [inter-quartile range, 0.98–3.20] days). Compared with cases with only one test performed, these multi-test cases were more commonly inpatients (35.2% *vs* 10.2%, $P<0.001$) undergoing elective procedures (65.4% *vs* 49.9%, $P<0.001$), often by otolaryngology (46.7% *vs* 2.1%, $P<0.001$). Nine (1.9%) cases had either of their first two tests positive; three on test #1, five on test #2, and one on both. The negative predictive value of the results of the first test for the results of the second test was 98.9%; the positive predictive value was 25.0%, specificity 99.4%, and sensitivity 16.7%.

Table 1 Characteristics of cohort cases.

	Full cohort (N=4176)		Test marked 'pre-procedural' (N=3536)	
	No (+) test N (%)	≥1 (+) test N (%)	No (+) test N (%)	≥1 (+) test N (%)
Number of cases, N (%)	4157 (99.6)	19 (0.5)	3528 (99.8)	8 (0.2)
Screening questions				
Had symptoms*, n (%)	142 (3.4)	3 (15.8)	91 (2.6)	1 (12.5)
Had exposure or travel, n (%)	36 (0.9)	0 (0.0)	29 (0.8)	0 (0.0)
Age, median (IQR), yr	60 (49–69)	56 (44–68)	60 (49–69)	53 (43–64)
Male sex, n (%)	2147 (51.6)	10 (52.6)	1808 (51.2)	5 (62.5)
Race				
White, n (%)	3064 (73.7)	13 (68.4)	2625 (74.4)	5 (62.5)
Black, n (%)	542 (13.0)	0 (0.0)	440 (12.5)	0 (0.0)
Asian, n (%)	56 (1.3)	0 (0.0)	42 (1.2)	0 (0.0)
Multiracial, n (%)	79 (1.9)	1 (5.3)	63 (1.8)	1 (12.5)
Unknown/other, n (%)	416 (10.0)	5 (26.3)	358 (10.1)	2 (25.0)
Ethnicity				
Hispanic, n (%)	2045 (49.2)	14 (73.7)	1734 (49.1)	6 (75.0)
Non-Hispanic, n (%)	1882 (45.3)	5 (26.3)	1590 (45.1)	2 (25.0)
Unknown, n (%)	230 (5.5)	0 (0.0)	204 (5.8)	0 (0.0)
Comorbidities†				
Hypertension, n (%)	1562 (37.6)	3 (15.8)	1278 (36.2)	1 (12.5)
Diabetes mellitus‡, n (%)	730 (17.6)	2 (10.5)	577 (16.4)	1 (12.5)
Congestive heart failure, n (%)	152 (3.7)	0 (0.0)	96 (2.7)	0 (0.0)
Chronic lung disease¶, n (%)	449 (10.8)	1 (5.3)	353 (10.0)	0 (0.0)
Number of other comorbidities, median (IQR)§	1 (0–2)	0 (0–1)	1 (0–2)	0 (0–1)
Patient type*,‖				
Emergency, n (%)	39 (0.9)	1 (5.3)	22 (0.6)	0 (0.0)
Ambulatory	3062 (73.7)	9 (47.4)	2864 (81.2)	5 (62.5)
Inpatient, n (%)	542 (13.0)	5 (26.3)	200 (5.7)	1 (12.5)
Direct-admit for case, n (%)	514 (12.4)	4 (21.1)	442 (12.5)	2 (25.0)
Case type*				
Elective, n (%)	1788 (43.0)	2 (10.5)	1460 (41.4)	0 (0.0)
Urgent, n (%)	148 (3.6)	2 (10.5)	59 (1.7)	0 (0.0)
Emergent, n (%)	90 (2.2)	1 (5.3)	46 (1.3)	0 (0.0)
Trauma, n (%)	8 (0.2)	0 (0.0)	4 (0.1)	0 (0.0)
Unknown, n (%)	2123 (51.1)	14 (73.7)	1959 (55.5%)	8 (100.0)
Service line*,#				
Otolaryngology, n (%)	295 (7.1)	7 (36.8)	267 (7.6%)	4 (50.0)
Gastroenterology, n (%)	1082 (26.0)	3 (15.8)	917 (26.0%)	2 (25.0)
General surgery, n (%)	119 (2.9)	1 (5.3)	103 (2.9%)	1 (12.5)
Neurosurgery, n (%)	213 (5.1)	3 (15.8)	158 (4.5%)	1 (12.5)
Orthopaedics, n (%)	115 (2.8)	1 (5.3)	90 (2.6%)	0 (0.0)
Surgical oncology, n (%)	240 (5.8)	2 (10.5)	177 (5.0%)	0 (0.0)
Vascular surgery, n (%)	79 (1.9)	2 (10.5)	54 (1.5%)	0 (0.0)

IQR, inter-quartile range; PCR, polymerase chain reaction.

*$P<0.05$ for comparison between 'no positive test' and 'one or more positive test' in full cohort; none of the comparisons in the subcohort of cases including only tests marked to be 'pre-procedural' had $P<0.05$.

† Comorbidities were determined from International Classification of Diseases, 10th Revision codes from all patient encounters within our health system since 2012 based on the strategy outlined by Elixhauser and colleagues.[5,6] The median number of patient encounters across cases for the full cohort was seven (IQR 2–22) with 191 cases (4.6% of cohort) with no prior patient encounters; for the subcohort of cases including only tests marked to be 'pre-procedural', the median number of patient encounters across cases was seven (IQR 3–21) with 110 cases (3.1% of subcohort) with no prior patient encounters.

‡ Includes diabetes mellitus with and without chronic complications.

¶ Includes chronic pulmonary disease and pulmonary circulation disorders.

§ Cases on patients without prior encounters within our health system (n=191, 4.6% of full cohort; n=110, 3.1% of subcohort of cases including only tests marked to be 'pre-procedural') were assumed to have 0 comorbidities.

‖ 'Ambulatory' describes outpatients who come in for their procedure and are discharged after it (never admitted as inpatients); 'Direct-Admit for Case' describes outpatients who come in for their procedure and are admitted as inpatients post-procedurally.

All other service lines: anaesthesiology (full cohort n/subcohort n) n=4/1; cardiology, n=195/94; cardiothoracic, n=78/65; colorectal, n=174/143; dermatology, n=1/1; endocrine, n=13/12; gynaecology, n=19/19; gynaecology oncology, n=54/42; gynaecology urology, n=11/11; head and neck, n=1/1; hepatology, n=13/12; obstetrics, n=1/0; oculoplastic, n=49/43; ophthalmology, n=906/881; oral surgery, n=6/5; pain, n=11/11; plastics, n=32/29; podiatry, n=16/11; pulmonary, n=2/2; radiation oncology, n=16/11; sports medicine, n=58/58; thoracic, n=49/32; and urology, n=305/278 had no cases with one or more positive tests; these service lines were included in χ^2 testing.

In sum, we found that very few (one in 220) cases had a positive COVID-19 PCR within 7 days pre-procedure; this rate was substantially lower (one in 442) if testing was specifically for 'pre-procedural' indications. Pre-procedural testing is intended to protect patients from morbidity and clinicians and staff from exposure. However, when prevalence is low, testing costs (i.e. financial, resources) coupled with procedural delays from false positive results cannot be ignored. The exact point prevalence of COVID-19 active infection in Miami during the study period is not known; yet, antibody testing of residual sera collected by a commercial laboratory from April 6, 2020 to April 10, 2020 estimated COVID-19 prevalence of past infection in South Florida to be 1.9% (95% confidence interval: 1.0–3.2%).[7] With 5% community prevalence, a positive result from a test with 70% sensitivity and 99% specificity will be found in likely uninfected people approximately one in every five tests (Supplementary Fig. S2).

Our data are limited by their single-centre nature. We were unable to reliably assess the indication for COVID-19 testing in all cases; however, ineffectively excluding symptomatic patients likely biases us towards overestimating screening positivity rates.

Our analysis shows that there is little role for obtaining more than one test pre-procedurally. And, as we learn more about the incubation period, risk of asymptomatic transmission, and exposure potential of COVID-19, it will be important to reconsider policies advocating for testing every patient pre-procedurally, even once.

Authors' contributions

Responsible for the conception and design of the study, revising the article critically for important intellectual content, and final approval of the submitted manuscript: all authors
Responsible for data acquisition: HBG, PRW, MMS
Responsible for data analysis and primary manuscript drafting: HBG

Declarations of interest

The authors declare that they have no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bja.2020.08.011.

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Tracheal intubation in COVID-19 patients: update on recommendations. Response to *Br J Anaesth* 2020; 125: e28–37

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