Letters

RESEARCH LETTER

Incidence of COVID-19 in Pediatric Surgical Patients Among 3 US Children's Hospitals

The coronavirus disease 2019 (COVID-19) pandemic continues to spread, with more than 4.6 million confirmed cases worldwide as of May 19, 2020. Children appear less susceptible, with the Chinese Center for Disease Control and Prevention reporting that children constitute only 2.16% of confirmed cases.[1] This may underestimate the true incidence of COVID-19 in children. Children are more likely to be asymptomatic or mildly symptomatic and thus less likely to be tested. The purpose of this study was to determine the incidence of COVID-19 in pediatric patients presenting for surgery at 3 tertiary care children's hospitals across the United States.

Methods | After universal preoperative screening for COVID-19 was instituted at the Children's Hospital of Philadelphia in Philadelphia, Pennsylvania, Texas Children's Hospital in Houston, and Seattle Children's Hospital in Seattle, Washington, all children younger than 19 years without known COVID-19 were tested. Data collection across all 3 hospitals began March 26, 2020, and ended April 22, 2020. All 3 hospitals use an in-house laboratory-developed reverse transcriptase–polymerase chain reaction assay to detect the severe acute

Table 1. Demographics and Preoperative RT-PCR Result Stratified by Hospital

Characteristic	No. (%)			
	Children's Hospital of Philadelphia, Philadelphia, PA	Seattle Children's Hospital, Seattle, WA	Texas Children's Hospital, Houston	All 3 hospitals
Surgical dates	March 26, to April 22, 2020	March 26, to April 20, 2020	March 30, to April 20, 2020	March 26, to April 22, 2020
Surgical patients[a]	339 (26.18)	500 (38.61)	456 (35.21)	1295 (100)
Age, mean (SD), y	7.00 (5.98)	7.69 (6.28)	7.25 (5.66)	7.35 (5.99)
Male	186 (54.87)	266 (53.31)	264 (57.89)	716 (55.33)
Race				
White	197 (58.11)	269 (53.80)	374 (82.2)	840 (64.91)
Black	55 (16.22)	35 (7.00)	59 (12.97)	149 (11.51)
Other[b]	87 (25.66)	196 (39.20)	22 (4.84)	305 (23.57)
Ethnicity				
Hispanic	35 (10.57)	87 (18.75)	214 (47.24)	336 (26.92)
Non-Hispanic	296 (89.43)	377 (81.25)	239 (52.76)	912 (73.08)
Surgical procedure type[c]				
Neurosurgery	43 (12.68)	26 (5.20)	27 (5.92)	96 (7.41)
Orthopedics	54 (15.93)	62 (12.40)	72 (15.79)	188 (14.52)
Plastics	23 (6.78)	01 (0.20)	15 (3.29)	39 (3.01)
Ophthalmology	11 (3.24)	15 (3.00)	25 (5.48)	51 (3.94)
Otolaryngology	39 (11.50)	73 (14.60)	43 (9.43)	155 (11.97)
Urology	15 (4.42)	39 (7.80)	19 (4.17)	73 (5.64)
General surgery	97 (28.61)	113 (22.60)	167 (36.62)	377 (29.11)
Cardiothoracic	28 (8.26)	17 (3.40)	44 (9.65)	89 (6.87)
Oral and maxillofacial surgery/dental	3 (0.88)	46 (9.20)	10 (2.19)	59 (4.56)
Interventional radiology	4 (1.18)	76 (15.20)	0[d]	80 (6.18)
Gastrointestinal	35 (10.32)	5 (1.00)	31 (6.80)	71 (5.48)
Oncology	9 (2.65)	4 (0.80)	1 (0.22)	14 (1.08)
Other	3 (0.88)	23 (4.60)	6 (1.32)	32 (2.47)
ASA physical status classification system				
1	59 (17.61)	105 (21.56)	119 (26.10)	283 (22.14)
2	111 (33.13)	157 (32.24)	146 (32.02)	414 (32.39)
3	137 (40.90)	187 (38.40)	139 (30.48)	463 (36.23)
4	26 (7.76)	37 (7.60)	52 (11.40)	115 (9.00)
5	2 (0.60)	1 (0.21)	0	3 (0.23)
ASA emergent	79 (23.30)	64 (12.80)	42 (9.21)	185 (14.29)
Inpatient[e]	80 (23.60)	206 (41.20)	58 (13.36)	344 (27.02)
RT-PCR positive	9 (2.65)	2 (0.40)	1 (0.22)	12 (0.93)

Abbreviations: ASA, American Society of Anesthesiologists; RT-PCR, reverse transcriptase–polymerase chain reaction.

[a] Percentages were calculated from the total of all 3 hospitals.

[b] The other category included Asian, Native Hawaiian or other Pacific Islander, American Indian or Alaska Native, other, or declined to answer.

[c] May have more than 1 procedure per surgical case, with sum greater than 100%.

[d] Texas Children's Hospital did not perform universal screening for procedures performed outside of the operating room.

[e] Inpatient was defined as having been admitted to the hospital ≥2 days before surgery.

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Table 2. Characteristics of Pediatric Surgical Patients by RT-PCR Result

Characteristic	RT-PCR, No./total No. (%)		P value
	Positive (n = 12)	Negative (n = 1283)	
Age, mean (SD), y	11.25 (6.39)	7.32 (5.98)	.03
Male	8/12 (66.67)	708/1282 (55.23)	.43
Race			
White	9/12 (75.00)	831/1282 (64.82)	.76
Black	1/12 (8.33)	148/1282 (11.54)	
Other[a]	2/12 (16.67)	303/1282 (23.63)	
Hispanic	2/12 (16.67)	334/1236 (27.02)	.42
ASA physical status classification system			
1	1/10 (10.00)	282/1268 (22.24)	.78
2	5/10 (50.00)	409/1268 (32.26)	
3	3/10 (30.00)	460/1268 (36.28)	
4	1/10 (10.00)	114/1268 (8.99)	
5	0	3/1268 (0.24)	
ASA emergent	6/12 (50.00)	179/1283 (13.95)	.001
Inpatient[b]	3/12 (25.00)	341/1261 (27.04)	.87
Preoperative symptoms[c]			
Any symptom	6/12 (50)	157/1283 (12.24)	.001
Cough	1/12 (8.33)	51/1186 (4.30)	.41
Fever	3/12 (25.00)	72/1077 (6.69)	.04
Rhinorrhea	2/12 (16.67)	34/1204 (2.82)	.047
Diarrhea	1/12 (8.33)	34/689 (4.93)	.46
Conjunctivitis	0/12 (0.00)	3/989 (0.30)	.96
Travel outside US	0	6/740 (0.81)	.76
Travel outside region	0	10/320 (3.13)	.59
Known exposure to COVID-19	2/10 (20.0)	12/715 (1.68)	.001

Abbreviations: ASA, American Society of Anesthesiologists; COVID-19, coronavirus disease 2019; RT-PCR, reverse transcriptase–polymerase chain reaction.

[a] The other category included Asian, Native Hawaiian or other Pacific Islander, American Indian or Alaska Native, other, or declined to answer.

[b] Inpatient defined as having been admitted to the hospital ≥2 days before surgery.

[c] Patient may have more than 1 symptom. If symptom was not explicitly mentioned, this was treated as missing data.

respiratory syndrome coronavirus 2 virus. Retrospective record review was performed for demographics, clinical symptoms, and laboratory results. Race and ethnicity were self-reported. The institutional review boards of all participating hospitals approved the investigation with waiver of consent and multicenter sharing of deidentified data. Mann-Whitney *U* test, χ^2 test, Fisher exact test, and multivariate logistic regression were conducted. Statistical significance was set at 2-sided *P* value less than .05.

Results | Overall, 1295 pediatric surgical patients were included in this study, with a mean (SD) age of 7.35 (5.99) years. Overall incidence of COVID-19 was 0.93% (12 of 1295) (**Table 1**). However, there was a significant difference in incidence across hospitals, ranging from 0.22% (1 of 456) to 2.65% (9 of 339). Notably, at Children's Hospital of Philadelphia, 5 of 9 patients with positive COVID-19 results were from a single township with a positive risk rate of 55.56% vs 1.51% (5 of 330) in all other patients (risk ratio, 36.67; *P* = .001). Of 12 patients with COVID-19, 6 (50%) had preoperative symptoms vs 157 of 1283 patients (12.24%) who tested negative for COVID-19 (**Table 2**). Fever (3 of 12 [25.0%] vs 72 of 1077 [6.7%]), rhinorrhea (2 of 12 [16.7%] vs 34 of 1204 [2.8%]), and known COVID-19 exposure (2 of 10 [20.0%] vs 12 of 715 [1.7%]) were more common in patients with COVID-19. On multivariate regression, age (odds ratio, 1.10; 95% CI, 1.00-1.23; *P* = .048) and American Society of Anesthesiologists emergent classification (odds ratio, 5.66; 95% CI, 1.70-17.80; *P* = .001) were associated with COVID-19.

Discussion | The overall incidence of COVID-19 in children undergoing preoperative universal screening was less than 1%. However, this varied greatly between the regions represented by our hospitals and even by township within the catchment area of a single hospital. While patients with COVID-19 were more likely to have preoperative symptoms, most notably fever and rhinorrhea, half of the patients with positive results had no symptoms. Additionally, some of the symptoms noted were easily attributed to unrelated conditions (eg, appendicitis).

There are several limitations to the study. While all 3 hospitals implemented standard preoperative screening for COVID-19 risk factors and symptoms, retrospective collection of these data was dependent on the quality of documentation. During the study, all 3 hospitals canceled elective surgery in anticipation of a surge. The incidence of COVID-19 in children requiring time-sensitive surgery may not represent the incidence in children undergoing elective surgery. Finally, while we attempted to capture all patients with COVID-19

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even if surgery was postponed owing to positive testing, cases may have been missed, resulting in underestimation of true incidence.

Symptomatology is an inadequate differentiator in children. There are reports of children with high viral load who are asymptomatic.[2] If children do have symptoms, they tend to be mild.[3] According to a recent Pediatric Anesthesia Leadership Council survey of 41 responding centers, 56% implemented universal preoperative screening (Thomas Long, MD, Pediatric Anesthesia Leadership Council, email communication, April 19, 2020). As demonstrated here, the value of universal screening is greatest in areas with higher prevalence.[4] As elective surgery resumes across the country, it is important to consider universal testing in the context of regional prevalence, local testing capability, and availability of personal protective equipment.

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Association of Electronic Surgical Consent Forms With Entry Error Rates

Obtaining informed consent is a vital aspect of surgical care. The consent form is a medicolegal document that conveys important information to the patient, clinicians, schedulers, nursing and operating room (OR) staff, and in some cases the court of law.[1] Handwritten, paper-based forms can have error rates as high as 50%, which can affect patient experience, patient understanding, and clinic and operating room efficiency and can result in litigation.[2-4]

Electronic-based consent forms (eConsents) have potential to improve the quality and consistency of documentation, eliminate illegible or misplaced forms, and enhance patient safety.[2-5] This article describes a feasibility trial at a large academic medical center to implement eConsents for invasive procedures.

Methods | The University of California, San Diego Medical Center is a large, regional academic medical center with 2 hospital-based operating suites and an outpatient surgery center, which was chosen for the trial. The University of California, San Diego uses a commercially available, electronic health record, Epic, which has developed functionality to sign consents electronically. A team that included surgeons, anesthesiologists, nurses, and technology analysts designed the pilot trial, which was conducted over a 6-month period. Clinicians had the ability to use either eConsents or paper-based consent forms. The University of California, San Diego institutional review board reviewed the study protocol and waived the requirement for informed consent. An internal audit of 100 eConsents and 100 paper-based consent forms was performed to assess for completeness, accuracy, and legibility.

Results | A total of 882 eConsents were successfully completed by 19 clinicians; 2 completed consents in both groups. Error rate was 1 of 100 (1%) for eConsents and 32 of 100 (32%) for paper-based forms (**Table**). One eConsent was missing a surgeon signature. Incomplete items in paper forms included date/time (18 of 100), signature (8 of 100), discussion of risks (6 of 100), procedure name (2 of 100), and name of the operating surgeon (2 of 100). The illegibility rate was 8 of 100 (8%). Several technical and workflow limitations were identified and optimized during the period to enhance the success of the eConsent tool.

Discussion | This study demonstrates the feasibility of surgical eConsents in a large, regional academic medical center. Clinicians successfully completed eConsents in busy ambulatory clinics and a same-day procedure center. Using simple technology, the error rate decreased from 32% to 1%. eConsents are environmentally friendly and eliminate the need to fax, scan, copy, or file, allowing support staff to focus on direct patient care. An eConsent is permanently present in the electronic health record and cannot be lost. The documentation of surgical risks was required; however, similar to handwritten forms,

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