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The Utility of Paired Upper and Lower COVID-19 Sampling in Patients with Artificial Airways

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Background

- The Centers for Disease Control and Prevention (CDC) recommends upper respiratory tract (URT) polymerase chain reaction (PCR) testing as the initial test for detection of SARS-CoV-2.
- Lower respiratory tract (LRT) testing for mechanically ventilated patients is recommended as an additional option.
- LRT testing is variably performed and logistically challenging given risk of aerosolization with specimen collection.
- Concordance between the results of URT and LRT testing is unknown.

Objectives

- To evaluate the concordance between paired URT and LRT specimens in children undergoing pre-admission/procedure screening or diagnostic testing.
- To inform best practices surrounding optimal SARS-CoV-2 testing in children with artificial airways.

Methods

- We performed a single center cross-sectional study including children with artificial airways who had paired URT and LRT SARS-CoV-2 PCR testing over a 5 month period between 4/1/2020 and 8/31/2020.
- Artificial airways was defined as the presence of tracheostomies or endotracheal tubes.
- URT specimens included nasopharyngeal (NP) swabs and aspirates. LRT specimens included tracheal aspirates and bronchoalveolar lavages.
- URT and LRT specimens were classified as paired if the two specimens were collected within 24 hours.
- Tests were classified as diagnostic versus screening based on the indication selected in the order.

Table 1. Demographics

Demographic	N=242
Female sex Male sex	51% 49%
ICU Level Care	102 (43%)
Median Age in Years	4.9 (IQR 1.3-13.9)
Type of Test Performed	
XPRT XPRESS SARS-CoV-2	33 (14%)
SARS-CoV-2 LDT	209 (86%)

Table 2. All valid paired URT and LRT samples (total N = 235 pairs)

Lower Respiratory Tract	Upper Respiratory Tract			
	Negative	Negative	Positive	Total
		218	10	228
	Positive	0	7	7
	Total	218	17	235

Table 3. Paired URT and LRT samples obtained for screening reasons (N= 144 pairs)

Lower Respiratory Tract	Upper Respiratory Tract			
	Negative	Negative	Positive	Total
		138	3	141
	Positive	0	2	1
	Total	138	5	144

Table 4. Paired URT and LRT samples obtained for suspected SARS-CoV-2 (N = 44 pairs)

Lower Respiratory Tract	Upper Respiratory Tract			
	Negative	Negative	Positive	Total
		33	6	39
	Positive	0	5	5
	Total	33	11	44

Results

- A total of 37,007 tests were performed at our institution during the study period with 3.13% test positivity.
- Paired specimens: A total of 242 paired specimens were obtained during the study period. Of these, 7 were excluded as they had at least 1 result that was either invalid or inconclusive.
- Of the remaining 235 pairs analyzed:
 - 144 were performed for screening reasons
 - 44 were performed for diagnostic reasons
 - 47 did not have a specified indication.
- Overall, 225/235 (96%) paired specimens were concordant, including 218 negative from both sources and 7 positive from both sources.
- 10 paired specimens (4%) were discordant. (Table 2)
- Screening discordance: 3 out of 5 positive tests were discordant where testing was positive from URT and negative from LRT.
- Diagnostic discordance: 5 of 11 positive tests were discordant where testing was positive from URT and negative from LRT.
- Importantly, in our cohort, there were no instances of a LRT positive specimen with a negative URT specimen.

Conclusions

- Overall, most (96%) paired specimens yielded concordant results.
- Discordance occurred in 4% of cases, but only reflecting a positive result from URT and negative from LRT.
- These data support the CDC recommendation that URT specimens are the preferred initial SARS-CoV-2 test in the pediatric population.
- There appears to be little utility to the addition of LRT specimens for either diagnostic or screening purposes in children.