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EVALUATION OF SARS-COV-2 AIR CONTAMINATION IN HOSPITALS WITH CORIOLIS µ AIR SAMPLER

MONITOR VIRUS CONTAMINATION WITH THE CORIOLIS µ AIR SAMPLER

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CONTEXT

The current pandemic of Covid-19 has shown the vulnerability of our healthcare systems when faced with viral infections without a known treatment. Understanding the transmission behavior of SARS-CoV-2 in the air will be a crucial step to managing the current out break and design the appropriate prevention and control measures. In this document, we present how researchers in Imperial College have been evaluating SARS-CoV-2 surface and air contamination in a hospital during the peak of the COVID-19 pandemic in London, using surface swabs and the Coriolis µ air sampler coupled with RT-qPCR and viral culture.

PROTOCOL

- Sampling design: Surface and air samples were collected in 8 different sites including 7 clinical areas and 1 public area at a North Western London hospital, during the peak of the Covid-19 pandemic (from April 2nd to April 20th, 2020). The list of sites can be found in Figure 1. All inpatient wards were fully occupied by patients with Covid-19 at the time of sampling, apart from the Emergency Department. In each of these clinical areas, 4 air samples were collected (5 air in tsamples were collected he Emergency Department, and 3 in public areas of the hospital). Surface samples were collected by swabbing approximately 25 cm^2 of items in the immediate vicinity of each air sample.
- Collection: Sampling was carried out with the Coriolis µ air sampler (Bertin Technologies, France) at 100L/min for 10 min (corresponding to 1 m^3 of air), with 5mL DMEM.
- RT-qPCR Analysis: The RNA extraction step was realized on 140 µL of sample using Qiagen viral RNA mini kit. This was followed by absolute quantitative Real-time PCR targeting the envelop (E) gene of SARS-CoV-2 with AgPath One-step RT-PCR (Life Technologies).
- Viral culture: Vero E6 (African Green monkey kidney) and Caco2 (human colon carcinoma) cells were used to culture virus from air and environmental samples.

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RESULTS

		AIR SAMPLES		
		Result	Concentration (copies/m³)	Notes
Cohort ward A	Staff room	Negative		
	Nurse station	Negative		
	Toilet B (outside the patients' bay)	Negative		
	Cohort bay B	Positive	7048	
Cohort ward B	Staff room	Negative		
	Patients' toilet (in the ward)	Suspect	464	
	Male bay	Suspect	1335	
	Male bay (side room)	Suspect	163	
Adult acute admission unit	Ward managers office	Negative		
	Nurse station	Positive	404	
	Patient bay 2	Negative		
	Patient bay 1	Negative		
Adult emergency department	'Green' majors	Negative		
	Nurse station	Negative		
	Ambulatory waiting	Negative		
	Patient assessment cubicles			
	Male toilet (next to the nurse station)			
	Resus bay (last patient > 2 hours)	Suspect	35	
Hospital public areas	QEQM main entrance	Suspect	1574	
	Male toilet at QEQM main entrance	Suspect	1545	
	Lift area QEQM ground floor	Negative		
Temporary CPAP ward	Nurse station	Suspect	1922	
	CPAP unit	Suspect	31	< 1m from 2 patients
		Negative		> 2 m from patients
	PPE doffing area	Negative		
Adult ICU	Staff room	Suspect	249	
	Nurse station inside ICU	Negative		
	Bay area	Suspect	164	
	Side room bay area	Suspect	307	
Operating theatres	Operating theatres	Negative		Before tracheostomy
		Negative		During tracheostomy
		Suspect	1163	During tracheostomy
		Negative		During tracheostomy
	Total	2/31 (6.4%) positive; 12/31 (38.7%) suspect		

Figure 1: PCR results from air samples. Samples where both of the PCRs performed from an air or surface sample detected SARS-CoV-2 RNA were defined as positive, and samples where one of the two PCRs performed from an air or surface sample detected SARS-CoV-2 RNA were defined as suspected.
Adapted from [1].

Imperial College London

[1] Zhou, J. (2020). Investigating SARS-CoV-2 surface and air contamination in an acute healthcare setting during the peak of the Covid-19 pandemic in London. *Medrxiv.*

CONCLUSION

SARS-CoV-2 RNA was detected on 114/218 (52.3%) of the surface samples and 14/31 (38.7%) of the air samples collected with the Coriolis µ air sampler. The concentrations detected indicated a viral load that would not be culturable, which was confirmed by viral culture assays. Viral RNA was detected on surfaces and in the air in public areas of the hospital but was more likely to be found in areas immediately. These results show that the Coriolis µ air sampler can be used successfully to evaluate SARS-CoV-2 air contamination, and also set guidelines for the use of PPE, social distancing, and hygiene in acute healthcare settings.

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