

Effects of Saline Nebulisation on SARS-CoV2 Spreading and Exhaled Bio-aerosol Particles in Hospitalised COVID-19 Patients



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Background and Aim of the Work

The SARS-CoV2 is transmitted between people through respiratory droplets, bio-aerosols and contact routes. An increased risk of transmission has been associated with aerosol generating procedures, including nebulised treatment. Interestingly, it has been reported that, in healthy volunteers, nebulisation of isotonic saline reduced the number of exhaled bioaerosol particles expired due to modifications of the surface tension and viscous forces on lung-lining fluid (1).

The aim of this study was to investigate the effects of 0.9% saline nebulisation on SARS-CoV-2 spreading in patients with COVID-19.

Methods

Air samples of the patient's hospital room environment were collected using five suction XR5000 pumps (SKC Inc., PA, US) around the patient's bed (Fig. 1) according with international pharmaceutical guidelines (ISPE) on assessing particulate containment. Pumps were equipped with 0.45 µm PTFE filter running at 3 L/min for 3 hours. The airborne viral load captured within each pump filter was detected and quantified using a real-time polymerase chain reaction assay.

To measure the number of expired particles, each patient was asked to breathe normally for 3-5 min through a mouthpiece connected to an optical particle counter (Climet, Ultimate 100, CA, US). The tests were conducted before and after the administration of a 0.9% saline with a PARI LC Plus Jet nebuliser (PARI, Germany).

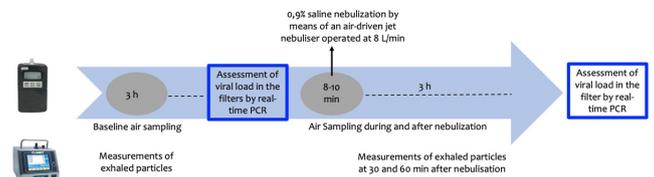


Fig. 1: Study protocol scheme, day 1 (admission to the hospital), air sampling and baseline measurements of exhaled aerosol particles and day 2 analysis.

Results

SARS-Cov2 was detected in only 12% of the samples independently of the sampling areas. In addition, SARS-Cov2 detection differs substantially among the different sampling areas, with more virus detected in the pumps positioned close to the patient in the baseline detection. On the contrary, after nebulisation, the virus was detected in the air samplers at the end of the bed where the air intakes were also present.

Table 1. Presence or absence of SARS-CoV2 in the sampling pumps of five patients where the analysis of the exhaled bioaerosol was conducted.

Pt	Sample	Baseline	Nebulisation
1	A	Present	Present
	B	Absent	Absent
	C	Absent	Absent
	D	Absent	Absent
	E	Absent	Absent
2	A	Absent	Absent
	B	Absent	Absent
	C	Absent	Absent
	D	Absent	Absent
	E	Absent	Absent
3	A	Present	Absent
	B	Absent	Absent
	C	Absent	Absent
	D	Absent	Absent
	E	Present	Absent
4	A	Present	Present
	B	Absent	Absent
	C	Present	Absent
	D	Absent	Absent
	E	Present	Absent
5	A	Absent	Absent
	B	Absent	Absent
	C	Present	Present
	D	Absent	Absent
	E	Present	Present

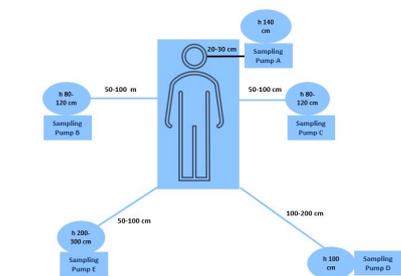


Fig. 2: Positioning, heights and distances of the five suction pumps from the patient's hospital bed.

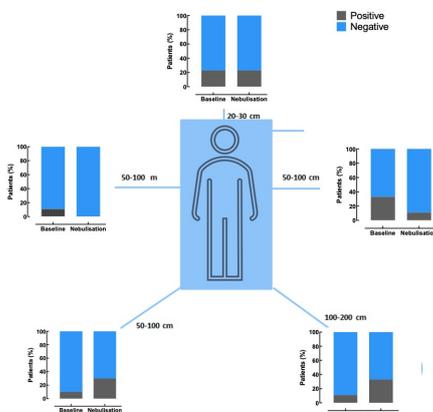


Fig. 3: Results of SARS-CoV2 detection in the suction pumps before and after saline nebulisation according with the different five sampling sites.

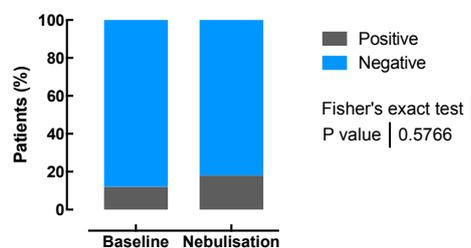


Fig. 4: Overall results of SARS-CoV2 detection before and after saline nebulisation in eleven patients with COVID-19. (n=11, 110 samples)

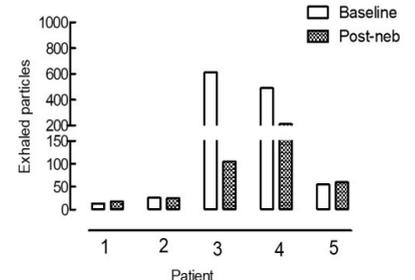


Fig. 5: Absolute number of exhaled particles before and after saline nebulisation obtained in five COVID-19 patients.

Conclusions: In this pilot study, we found that saline nebulisation does not change SARS-Cov2 spreading. Interestingly, patients who emitted large numbers of exhaled particles showed a reduction in the virus detection in the sampling areas. These results, albeit preliminary, suggest that there is no compelling reason to alter aerosol delivery devices for patients with established nebuliser-based regimens.