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## Letter to the Editor

## Isolation gown contamination during healthcare of confirmed SARS-CoV-2-infected patients



Sir,

Healthcare workers are highly exposed to the risk of acquisition of coronavirus disease 2019 (COVID-19) [1]. Severe acute respiratory coronavirus 2 (SARS-CoV-2) can survive in stools and in respiratory specimens and persist on inanimate surfaces for several days [2–4]. Against this background, personal protective equipment (PPE) of healthcare workers should include face masks, eye protection, and long-sleeved gowns [1]. Additional protection is required for nursing care (gloves, plastic apron) or pulmonary rehabilitation (gloves, plastic apron, and filtering facepiece 2 mask). Long-sleeved gowns are the second-most-used item of PPE after gloves and can be contaminated by contact or droplets during patient care. No data are available about the rate of long-sleeved gown contamination by SARS-CoV-2 during patient care and its usefulness in highly contagious patients according to the nature of the care. We investigated long-sleeved gown contamination by SARS-CoV-2 in our infectious disease ward during healthcare of patients considered at high risk of transmission in four situations: long-sleeved gown kept in place near the head of the patient (<50 cm) for 24 h, clinical examination, nursing care, and pulmonary rehabilitation.

The patients had documented SARS-CoV2 infection established by reverse transcription–polymerase chain reaction (RT–PCR) and chest computed tomography; respiratory signs such as coughing and/or digestive signs such as diarrhoea; and had not received antiviral treatment for SARS-CoV-2. Non-woven long-sleeved gowns were sampled with two dry swabs on the sleeves (one swab per sleeve) and on the chest plate (one swab). Sampling was standardized and consisted in 20 rubs per swab using each side of the swab. The swabbed area was 40 cm long by 10 cm wide. For each patient, four samplings of non-woven gowns were scheduled, four from chest plates and four from sleeves. One gown, hung less than 50 cm from the head of the patient on the day of inclusion, was sampled after 24 h; the gown used by the doctor after the clinical examination and the gown worn by the healthcare worker after nursing care were sampled at day 1; the gown used by the physiotherapist was sampled after respiratory rehabilitation. To validate the sampling method, we contaminated a 40 × 10 cm piece of non-woven gown with a solution of SARS-CoV-2 (cycle

threshold,  $C_T$ : 20) and sampled it at different times: immediately, and then after 1, 4, 8, 12, and 24 h. Each test was positive with the same  $C_T \sim 33$ .

SARS-CoV-2 detection has been performed with a real-time one-step RT–PCR targeting RNA-dependent RNA polymerase (IP2 and IP4), according to the protocol of the Institut Pasteur, Paris (available at: [https://www.who.int/docs/default-source/coronaviruse/real-time-rt-pcr-assays-for-the-detection-of-sars-cov-2-institut-pasteur-paris.pdf?sfvrsn=3662fcb6\\_2](https://www.who.int/docs/default-source/coronaviruse/real-time-rt-pcr-assays-for-the-detection-of-sars-cov-2-institut-pasteur-paris.pdf?sfvrsn=3662fcb6_2)).

Six patients were included (Table I) and, of the 48 scheduled samples, 42 were analysed. Six RT–PCR were not performed because of technical problems or because pulmonary rehabilitation was not needed. Only two of the 21 samples from sleeves were positive for SARS-CoV-2. They were taken from long-sleeved gowns after nursing care (patient 3, duration of care 25 min) and after pulmonary rehabilitation (patient 2, duration 30 min). Nursing care comprised assistance with personal care, patient mobilization in the bed or in a chair, monitoring of vital parameters, bed-making and cleaning of the patient environment (Table I).

To our knowledge, our small study is the first to characterize the contamination of PPE with SARS-CoV-2 in real field conditions after provision of care to infected patients. Appropriate PPE when administering care to patients with acute respiratory infections can include a combination of medical or surgical masks, gloves, long-sleeved gowns, and eye protection (goggles or face shields) [5]. For COVID-19, the recommended PPE are gloves, masks, goggles or face shields, and long-sleeved gowns, with respirators recommended over masks for aerosolizing procedures [6]. During the COVID-19 pandemic, healthcare facilities are experiencing difficulty in accessing the PPE needed and are having to identify alternative ways to provide patient care [7]. We wanted to determine whether plastic aprons could be an alternative to gowns. In our study, one sleeve sample out of six was positive after nursing care and one out of four after respiratory rehabilitation. No sample out of six was positive after simple clinical care. No torso samples were positive for SARS-CoV-2. Surprisingly, samples from gowns placed near the patient's head for 24 h yielded negative results although the patients had been coughing. This study has several limitations. Our analytical methods identified viral RNA, which does not signify viral infectivity. Also, as expected, our validation experiments showed that the gown sampling method had low efficiency. Thus, we assume that high viral loads could have been present on the sleeves immediately after care and we cannot rule out that lower viral loads were present on the torso of the gowns.

**Table 1**  
Description of COVID-19 patients and results of SARS-CoV-2 tests on long-sleeved gowns

Variable	Patient no.					
	1	2	3	4	5	6
Sex (age, years)	M, 71	F, 72	M, 67	M, 53	M, 71	M, 67
Severe infection risk factor						
Chronic renal failure	Stage IV		Dialysis			
Type 2 diabetes	Insulin. Controlled	Insulin. Non-controlled	No insulin. Complications	No insulin. Non-controlled	No insulin. Controlled	No insulin. Complications
Cardiovascular disease	HBP		HBP, IHD, arrhythmia	Heart rhythm disorder	HBP, IHD, arrhythmia	HBP
Cirrhosis		Child C				
Symptoms						
Time prior to inclusion (days)	6	3	14	7	23	11
Fever >38°C	+	–	+	+	+	+
Cough	+	+	+	+	+	–
Dyspnoea	+	+	–	+	+	+
Intense fatigue	+	–	+	–	+	+
Anosmia/ageusia	–	–	–	–	+	–
Diarrhoea	+	+	+	+	–	+
Chest computed tomography						
Ground-glass opacification	+	+	+	+	+	+
Crazy-paving	+	–	+	+	–	–
Condensation	–	+	+	+	+	+
Lobes infected	5	3	5	4	5	5
Extension	Moderate	Moderate	Severe	Moderate	Critical	Severe
RT–PCR SARS-CoV-2						
Clinical samples						
Nasopharyngeal	Positive	Positive	Positive	Positive	Positive	Positive
Blood	Positive	Positive	Negative	Negative	Negative	ND
Stool	Positive	Positive	Positive	ND	ND	ND
24 h bed head LSG <sup>a</sup>						
Chest plate	Negative	Negative	Negative	ND	Negative	Negative
Sleeves	Negative	Negative	Negative	ND	Negative	Negative
Clinical examination LSG						
Chest plate	Negative	Negative	Negative	Negative	Negative	Negative
Sleeves	Negative	Negative	Negative	Negative	Negative	Negative
Nursing care LSG						
Duration (mn)	45	30	25	40	20	40
Chest plate	Negative	Negative	Negative	Negative	Negative	Negative
Sleeves	Negative	Negative	Positive	Negative	Negative	Negative
Pulmonary rehabilitation LSG						
Duration (mn)	25	30	ND	20	ND	20
Chest plate	Negative	Negative	ND	Negative	ND	Negative
Sleeves	Negative	Positive	ND	Negative	ND	Negative

RT–PCR, reverse transcription–polymerase chain reaction; +, presence; –, absence; HBP, high blood pressure; IHD, ischaemic heart disease; ND, not done; LSG, long-sleeved gown.

<sup>a</sup> Long-sleeved gown left during 24 h at least 50 cm from the bed head.

We conclude that long-sleeved gowns should be mandatory for high-exposure care. Aprons could be an alternative but only in low-exposure environments and in association with hand hygiene extended to the forearms.

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None declared.

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