Detection of the SARS-CoV-2 in different biologic specimens from positive patients with COVID-19, in Northern Italy

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Abstract

Coronavirus disease 2019 (COVID-19)diagnosis is based on molecular detection of SARS-CoV-2 in respiratory samples such as nasal swab (NS). However, the evidence that NS in patients with pneumonia were sometimes negative raise the attention to collect other clinical specimens. SARS-CoV-2 was shown in 10.3%rectal swabs (RS), 7.7% plasma,1% urine, 0% feces from 143NS positive patients. Potential infection by fluids different from respiratory secretion is possible but unlikely.

By December 2019, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus started a new pandemic respiratory disease named 2019 novel Coronavirus infectious disease (COVID-19).[1,2]Lombardy region (Northern Italy) has been involved in a dramatic COVID-19 epidemic episode since February 20th with a rapid increase in the rate of infected patients. At the time of writing, the number of infected people in Italy was higher than 97,000 with more than40% of cases reported in the Lombardy Region.[2]

To date, the diagnosis of COVID-19 is based on detection of SARS-CoV-2 RNA in respiratory samples such as nasal swab (NS).[3]However the evidence that NS in patients with COVID-19 pneumonia were sometimes negative raise the attention to collect other clinical specimens that may be useful for etiologic diagnosis since bronchoalveolar lavage (BAL) collection is not always possible.[4] In the present study, we examined the presence of SARS-CoV-2 RNA in multiple biologic specimens collected simultaneously to respiratory samples from COVID-19 patients in order to determine the detection rate of viral RNA and the possibility of transmission by alternative routes.[5]

Overall, 143 patients with a confirmed diagnosis of COVID-19 by RT-PCR in respiratory samples and admitted to Infectious Diseases Department or at the Intensive Care Unit at Fondazione IRCCS Policlinico San Matteo, were included in the study. In detail,104/143 (72.7%) were males, and the mean age was 66.2 years (range, 2-94 years). Of them, 143 NS, 107 rectal swabs (RS), 85 urine, 26 plasma, and 5 feces were examined. We examined 18 urine and 39 RS samples from 59 NS patients admitted to the emergency room department with respiratory distress.

Total nucleic acids (DNA/RNA) were extracted from 200 µl of samples using the QIAsymphony® instrument with QIAsymphony® DSP Virus/Pathogen Midi Kit (Complex 400 protocol) according to the manufacturer's instructions (QIAGEN, Qiagen, Hilden, Germany). Specific real-time RT-PCR targeting RNA-dependent RNA polymerase and E genes were used to detect the presence of SARS-CoV-2 according to the WHO guidelines[1] and Corman et al. protocols.[3]

Median and range were given for quantitative variables, while qualitative variables were shown as percentages or frequencies.

A total of 366 specimens corresponding to 143 consecutive patients were examined. In detail 11/107 (10.3%) patients had a COVID-19 positive RS, 2/26 (7.7%) COVID-19 positive plasma, while only 1/98 (1%) had a COVID-19 positive urine sample. None of the 5 stool specimens tested positive.

The median viral load detected in respiratory samples was 4 x 10^6 copies/ml (range 17.3-36.9),while was 4.1 x 10^6copies/ml(range 1.7-6.5)in RS and 2.9 x 10^6copies/ml (range 2.9 - 3) in two positive plasma (Table 1). The most common clinical features of hospitalized patients with COVID-19 were fever, dry cough, dyspnea, diarrhea, asthenia, and respiratory disorders as pneumonia and sore throat.

None of the 116 specimens (59 NS, 18 urine, and 39 RS), from 59 COVID-19 negative control patients, tested positive.

Table 1. RNA load test results of the 145 hospitalized patients SARS-CoV-2 positive by real-time RT-PCR.

	NS (143)	RS (107)	URINE (85)	PLASMA (26)	FECES (5)
Positive test results no (%)	143 (100%)	11 (10.3%)	1 (1.2%)	2 (7.7%)	0
RNAload (log10)/ml,median	4 (3.9)	4,1 (1.8)	5.0*	2.9 - 3*	ND
Range	17.3-36.9	1.7-6.5	ND	ND	ND
95% CI	28.8-30.4	2.9-5.3	ND	ND	ND

Legend: NS, nasal swab; RS, rectal swab;ND, no data;*median were not available for one/two positive value.

The transmission of SARS-CoV-2 through direct contact with infected secretion or aerosol droplets is well known.[5] However, in the past epidemics caused by other Coronavirus (SARS-CoV-1 and MERS-CoV), viral RNA was also detected in several clinical specimens such as 42% urine, 97% stool and 50% plasma.[6-8] In this respect, these materials have been considered as useful clinical samples to improve laboratory diagnosis.

Also, the possibility of different SARS-CoV-2 transmission routes could be contemplated. In this brief report, we described the presence of the virus in different clinical samples, including RS, plasma, and urine, supporting the evidence of a potential shed of the virus through fecal-oral or body fluid routes.

In this study, the highest rate of positive RT-PCR for SARS-CoV-2 was detected in RS specimens (10.3%), suggesting that SARS-CoV-2 may be transmitted by the fecal route.[5] However, this rate is lower than SARS-CoV-1.

Focusing on plasma samples, we reported only a few cases of positive RNA detection in plasma (7.7%), but higher than that reported by Wang et al.,[5] suggesting a systemic infection can occur although less frequently with respect to 50% SARS-CoV-1.[9]

The SARS-CoV-2 was rarely detected in urine, and, to date, no other authors reported a significant presence of the virus in urine of COVID-19 patients.

Although SARS-CoV-2 was detected in specimens from multiple sites of patients with positive NS for COVID-19, no positive results were obtained in patients with negative NS, supporting the hypothesis that respiratory samples represent the gold standard for COVID-19 molecular diagnosis.

Transmission of SARS-CoV-2 by respiratory droplets and other way routes highlights the risk of contagious via environmental contamination with infected clinical specimens, highlighting the importance of protection and decontamination procedures despite extensive contamination of inanimate surfaces.[10] Longitudinal studies should be performed to evaluate the incidence of SARS-CoV-2 RNA in specimens different from respiratory samples.

Conflict of interest information

The Authors have no conflicts of interest to declare.

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