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Evaluation of a rapid diagnostic assay for detection of SARS CoV-2 antigen in nasopharyngeal swab

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Severe Acute Respiratory Syndrome coronavirus 2 (SARS-CoV-2), the virus causing causing Coronavirus disease 2019 (COVID-19) was reported for the first time in Wuhan (Hubei, China) in December 2019 (1, 2) and has become a major public health concern all over the world. Early diagnosis is crucial for patient management and outbreak control. Most tests currently used for detection of SARS-CoV-2 rely on viral RNA amplification by using RT-PCR and require a few hours before results release. Hence, highly sensitive immunological diagnostic methods that directly detect viral antigens in clinical samples would be very helpful for rapid and accurate diagnosis of COVID-19.

Here, we evaluated a rapid diagnostic test, COVID-19 Ag Respi-Strip CORIS (BioConcept®, Gembloux, Belgium), for detection of the SARS-CoV-2 antigen in nasopharyngeal secretions. The assay is ready to use and based on a nitrocellulose membrane technology with colloidal gold nanoparticles sensitized with monoclonal antibodies directed against highly conserved SARS-CoV-2 nucleoprotein antigens. We compared this test with RT-PCR, the current reference assay in virology laboratories of three university

hospital groups from Assistance-Publique-Hôpitaux de Paris (APHP), (Saint-Antoine-Tenon-Trousseau, Saint-Louis-Lariboisière and Kremlin Bicêtre-Paul Brousse). Different RT-PCR methods were used (RealStar Altona®, Anatolia®, Cobas 6800 Roche®, Allplex™ 2019-nCoV Assay Seegene®). All assays amplify SARSCoV2 E gene. Cycle threshold (Ct) values were recorded. Nasopharyngeal samples were tested prospectively within a few hours after collection and without any cooling or freezing step, from April 1st to April 15th 2020. Swabs were collected in various transport media (COPAN UTM 3ml, Virocult 1 ml, Eswab Amies 1 ml, 4MRT 3 ml, 0.9% NaCl buffer and COBAS ROCHE). The first four samples collected in COBAS medium tested gave invalid results. We therefore excluded such samples from the study. Analysis included 138 nasopharyngeal samples of which 94 (68.8%) were positive for SARS-CoV-2 by RT-PCR. Compared to RT-PCR, the specificity of the test was 100% (CI 95%: 91.8-100). Among the 94 RT-PCR positive samples, the rapid test only detected 47 specimens, resulting in a sensitivity of 50.0% (95 CI: 39.5-60.5). In nine positive and eight negative tests, control lines were barely visible. Median of E gene Ct values differed significantly between positives (median =21, Interquartile range (IQR) [17.0-23.0]) and negatives (28.3, IQR:[25.6-33.0]) antigenic test results ($p<0.0001$) (Figure 1). A study conducted by the manufacturer mentioned a sensitivity of 76.7% for samples positive with a Ct value under 25 (3). In our study, the test would have a sensitivity of 82.2 % for Ct values under 25.

In our study, the COVID-19 Ag Respi-Strip CORIS ® had a sensitivity of 50% compare to RT-PCR. The test was more sensitive for high viral loads and could perhaps be used for patients within a few days after symptoms onset when the load in upper respiratory tract is at its peak. Considering current low COVID 19's prevalence of 0.19 % in France, prospective studies should be conducted to determine the best settings for its implementation.

References

1. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, Zhang L, Fan G, Xu J, Gu X, Cheng Z, Yu T, Xia J, Wei Y, Wu W, Xie X, Yin W, Li H, Liu M, Xiao Y, Gao H, Guo L, Xie J, Wang G, Jiang R, Gao Z, Jin Q, Wang J, Cao B. 2020. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 395:497–506.

2. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, Zhao X, Huang B, Shi W, Lu R, Niu P, Zhan F, Ma X, Wang D, Xu W, Wu G, Gao GF, Tan W; China Novel Coronavirus Investigating and Research Team. 2020. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med 382:727–33.

3. Mertens P, De Voe N, Martiny D, Jassoy C, Mirazimi A, Cuypers L, Van den Wijngaert S, Monteil V, Melin P, Stoffels K, Yin N, Mileto D, Delaunoy S, Magein H, Lagrou K, Bouzet J, Serrano G, Wautier M, Leclipteux T, Van Ranst M, Vandenberg O, and LHUB-ULB SARS-CoV-2 working diagnostic group. Development and Potential Usefulness of the COVID-19 Ag Respi-Strip Diagnostic Assay in a Pandemic Context. 2020 Frontiere in medecine https://www.frontiersin.org/articles/10.3389/fmed.2020.00225/full?&utm_source=Email_to_authors_&utm_medium=Email&utm_content=T1_11.5e1_author&utm_campaign=Email_publication&field=&journalName=Frontiers_in_Medicine&id=551560

Figure 1. COVID-19 Ag Respi-Strip CORIS results according to real-time PCR Ct values. All cycle threshold values of E gene real-time PCR positive assays are shown for positive and negative COVID-19 Ag Respi-Strip CORIS assay results. Results gathering Ct values for all real-time PCR positive assays are depicted by squares. Ct values between samples positive or negative for the antigenic assay are significantly different (* indicates a p-value < 0.0001). Ct values corresponding to the Cobas 6800, Allplex, Anatolia, and RealStar assays are depicted by triangles, diamonds, circles and reversed triangles respectively.

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