COMMENTARY

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DIAGNOSTIC TESTS FOR COVID-19 (SARS-COV-2) – ILLUSTRATIVE VIEW

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ABSTRACT

Awareness of SARS CoV-2 diagnostic testing is still in hit-and-trial phases all over the world. Usage for SARS-CoV-2 infections Reverse Transcriptase - Polymerase Chain Reaction (rT-PCR) and IgM/IgG serology by Enzyme Linked Immunosorbent Assay (ELISA) or Electro-Chemiluminescent Immunoassay remains the main diagnosis stay, advancing day by day through ongoing study and comprehensive trials. However, in both children and adults, the time course for PCR positivity and seroconversion continues to differ, which often involves a large population of asymptomatic individuals that are theoretically considered negative, posing a significant threat to the local group.

KEYWORDS:

COVID-19, SARS - CoV - 19, Polymerase chain reaction, Enzyme linked immunosorbant assay, antibodies, immunoglobulins.

BACKGROUND

COVID-19, i.e. Coronavirus disease abbreviation 2019, is now a global health concern for a day. On 11 March 2020, its spread was announced by the Director of the World Health Organization as a pandemic disease. [(1)] The viral pathogen that causes this disease belongs to the family of Coronaviridae and is ultimately described as Corona Virus 2 Severe Acute Respiratory Syndrome (SARS-CoV-2). The sequence closely matches the homologous virus (SARS-CoV-1) that previously triggered the outbreak of SARS in 2003. [(2)] Awareness of SARS CoV-2 diagnostic testing is still at an initial stage and is improving day by day through studies and comprehensive patient and exposed population trials. It is really important to have a good and simple understanding of the essence of tests and the interpretation of their results, which can contribute a great deal with patient care.

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Therefore, this commentary describes how the two types of diagnostic tests widely used for SARS-CoV-2 infections are interpreted: Reverse Transcriptase Polymerase Chain Reaction (rt-PCR) and IgM/IgG serology by Enzyme Linked Immunosorbent Assay (ELISA) or Electro Chem-iluminescent Immunoassay techniques as their results can differ over time.

DETECTION OF VIRAL RNA BY RT-PCR

This is the most widely used examination carried out for the diagnosis of COVID-19 and is considered a successful one. Recently, it is accomplished using nasopharyngeal swabs or other specimens of the upper respiratory tract, like throat swab or saliva. A variety of RNA gene targets are used by different manufacturers. Most experiments target 1 or more of the genes Envelope (Env), Nucleocapsid (N), Spike (S), RNA polymerase based on RNA (RdRp) and ORF1. [3] Viral RNA can become positive in most symptomatic patients with COVID-19 within one week of symptoms and peaks as early as day 1. It becomes undetectable and then undetectable by week 3. In a few cases, rT-PCR detected viral RNA 6 weeks after the first positive test, while in some other cases, rT-PCR detected viral RNA positively after 2 consecutive negative tests 24 hours apart. [4] This can be entirely due to the error of research, reinfection or reactivation. For specimens other than nasopharyngeal swabs, the time-line of PCR positivity is distinct. It was noted that the PCR positivity in sputum decreased more slowly and was still positive after the nasopharyngeal swabs were negative. [5]

The rT-PCR positivity was highest in bronch-oalveolar lavage (93%), followed by sputum (72%), nasal swab (63%) and pharyngeal swab (32%), according to a review of 205 patients with reported COVID-19 infection. [6] False negative results were also seen due to incorrect sampling timing in relation to the onset of disease, its defective technique, especially nasopharyngeal swabs. As the primer architecture is unique to the genomic sequence of SARS-CoV-2, the specificity of most rT-PCR tests is 100%. Owing to technical errors or contamination of reagents, false positive findings can also occur.

DETECTION OF SARS-COV-2 ANTIBODIES

It is indirectly possible to diagnose COVID-19 infection by testing the immune response to infection with SARS-CoV-2. Serological diagnosis plays a very important role in patients with a mild to moderate degree of disease that progress late after 2 weeks of disease onset. With the criteria for rapid diagnosis, it has become a valuable tool to understand the community's extent of COVID-19 and to recognise resistant individuals or those who are potentially shielded from being infected. As early as the fourth day after the onset of symptoms, IgM and IgG antibodies have been shown to be positive; they are also at higher levels during the second and third weeks of illness. [7] In all of these patients, IgM and IgG seroconversion occurred between the third and fourth weeks of clinical disease onset, according to a report performed by Xiang et al in 85 patients. IgM starts to fall by week 5 and reaches a lower level, almost vanishing by week 7, but IgG levels continue to remain past 7 weeks. [8] (Figure 1). IgM and IgG antibody tests based on ELISA have greater than 95% accuracy for COVID-19 diagnosis. By testing paired serum samples with the initial PCR and then the second one 2 weeks later, the diagnostic accuracy can be further improved. Rapid point of care tests have been produced by different manufacturers for the detection of antibodies with variable consistency, sensitivity and specificity. It does not disclose the existence of the antigens used by them. These are strictly qualitative in nature and only suggest that SARS-CoV-2 antibodies are present or absent. [9] Few prominent companies such as Roche have introduced

the detection of antibodies using the famous and very sensitive electrochemiluminescence immunoassay technique using the sandwich process. For the determination of antibodies against SARS-CoV-2, the anti-SARS-CoV-2 assay uses the recombinant protein representing the nucleocapsid (N) antigen. As stated in their literature, the overall specificity is 99.81% with a 95% lower confidence interval of 99.65%, while the sensitivity after 6-14 days of PCR confirmation ranges up to 65.5 -100%. [10]

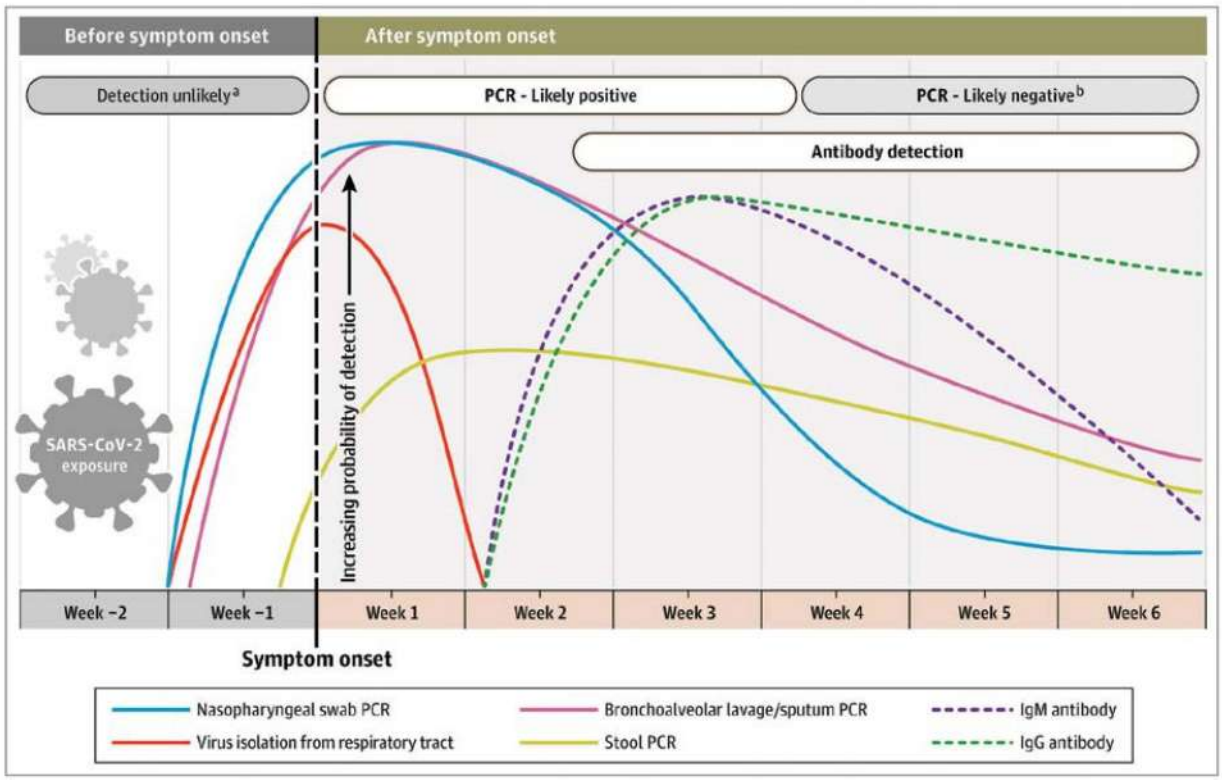

Figure 1: Adapted from: COVID-19: Screening a. COVID-19: Screening, testing, PUI, and returning to work – REBEL EM – Emergency Medicine Blog. 2020

CONCLUSION

For clinical correlation, a very useful timeline of diagnostic markers for COVID-19 detection has been devised. The time course for the PCR positivity and seroconversion seem to differ in children and in other age groups, which also involves a large population of asymptomatic individuals that are never diagnosed. There is still a major question that needs to be answered, i.e. how long the possible immunity lasts in asymptomatic as well as symptomatic people infected with the latest SARS-CoV-2.

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