Rapid antibody test for SARS-CoV-2 infection diagnosis

Journal Article, Prospective study

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Li Z, Yi Y, Luo W, et al. Development and clinical application of a rapid IgM-IgG combined antibody test for SARS-CoV-2 infection diagnosis. J Med Virol. 2020 Feb 27. doi: 10.1002/jmv.25727.

Summary

Methods

- Recombinant SARS-CoV-2 spike protein (antigen) was conjugated to gold nanoparticles and adsorbed on the conjugate pad of the lateral flow device. Anti-human IgG and anti-human IgM were immobilized at test lines on the chromatographic strip.
- Upon application of plasma/sera from the patient, the anti-SARS CoV-2 antibodies present in the sample, bind to the gold conjugated antigen. This complex then binds with the immobilized anti-IgM or anti-IgG further down the strip, resulting in positive, visible bands of IgM or IgG or both.
- 525 cases, including 397 PCR confirmed COVID-19 cases and 128 negative cases were tested with the lateral flow device, from 8 hospitals (in 6 provinces) in China. The authors also compared the efficacy of this device with both fingerstick and venous blood samples.

Results

- 352 (of 397) samples tested positive with the rapid antibody assay, of which 256 had a positive result with both IgM and IgG antibodies. 12 samples from the 128 negative cases also tested positive with the antibody assay. Overall, the assay showed sensitivity of 88.66% and specificity of 90.63%.
- The time frame of sample collection (day 8 to day 33 from symptom onset) were available only from one site with subset of 58 positive patients, where 55 (94.83%) were positive for both IgM and IgG antibodies. Two had only IgG and one only IgM positivity in this subset.
- Consistent detection was noted with the serum, plasma and fingerstick blood samples from 7 positive and 3 control samples.

Conclusion

- Lateral flow device was successful at detecting both anti-spike protein IgG and IgM with a high sensitivity and specificity from patient plasma, sera as well as fingerstick blood.

Appraisal:

- This study was based on the assumption that SARS CoV-2 antibody responses and dynamics would resemble earlier SARS infections and therefore, IgM antibodies would be present within 3–6 days of SARS CoV-2 infection. However, recent literature showed that median time to total, IgM and IgG antibody seroconversion was 11, 12 and 14 days, respectively, by ELISA. (Zhao J, et. al., Clin Infect Dis. 2020 Mar 28.).
- While it is suggested that the device is equally efficacious with venous and fingerstick blood, the number of blood samples used for comparison of efficacy of venous plasma/sera with fingerstick blood was too low.
- The design is based on the published sequence of SARS CoV-2 spike protein but doesn't discuss polymorphisms.
- Possible cross-reactivity with other circulating coronaviruses was not studied.
- Infection time point was not available in majority of the studied samples, which undermines the extrapolation of rapid assay's usefulness in real time.

Opinion:

This assay has the potential to track COVID-19 antibody responses but this paper does not present evidence about its efficacy as an early diagnostic tool or its possible success with a variety of genotypes. Therefore, this may have a limited degree of success in detecting infected individuals. This method of rapid IgM-IgG combined antibody test for SARS-CoV-2 infection diagnosis needs further validation.

Real time RT-PCR for SARS CoV-2 remains the mainstay of diagnosis at present. Till date, 23 antibody based (IgM, IgG) rapid tests have been validated at NIV, Pune. ICMR guidance on rapid antibody kits state that the rapid assays are not recommended for diagnosis of COVID-19 infection (dated 16.04.2020). WHO too does not recommend the use of antibody based rapid diagnostic test for patient care, based on current evidence.

Appraisers

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