Assurance Scientific Laboratories

COVID-19 (Coronavirus)

Birmingham, Ala. (March 12, 2020) – Assurance Scientific Laboratories (Assurance) has completed the validation of a real-time PCR panel to identify COVID-19 which will be used under the FDA's Emergency Use Authorization. We are now receiving patient specimens for testing.

On January 20, we received the sequence data and began working on assays to detect COVID-19 and now have three validated assays completed. Recently, the FDA has granted Emergency Use Authorization (EUA) to commercial labs to offer this testing to the public. In addition to COVID-19 testing, we currently test for the four most common seasonal coronavirus types: 229E, NL63, OC43, and HKU1.

Information on Coronaviruses:

Coronaviruses (CoV) are positive sense single stranded RNA viruses with a genome size of 27-34 kilo bases which make it one of the largest RNA viruses. Coronaviruses are approximately 0.125 microns making it too small to be filtered by a facemask. CoV can be divided into four genera: alpha, beta, delta, and gamma. The alpha and beta coronaviruses are known to infect humans. Four coronaviruses are endemic globally and account for 10-30% of all upper respiratory infections in adults,[1] usually the common cold. NL63 and HKU1 are occasionally associated with more severe respiratory infections including pneumonia.

In 2002, a severe atypical pneumonia which caused an acute respiratory distress syndrome was described in Guangdong Province, China. This virus was found to be a betacoronavirus now known as SARS—Severe Acute Respiratory Syndrome. SARS has a mortality rate of 10% with 20-30% requiring mechanical ventilation support.[2] SARS created a pandemic with approximately 8100 infected in 24 countries.[1] In 2012, another pathogenic form of a betacoronavirus was detected in the Middle East which also caused a severe form of respiratory failure—Middle East Respiratory Syndrome (MERS). MERS is a more zoonotic pathogen thought to be transmitted from the camel as an intermediate host. Unlike SARS, MERS did not spread rapidly. MERS was nosocomially transmitted mostly via a few super-spreaders.[3] MERS remained mostly in Saudi Arabia infecting approximately 2500 people and killing 858. [3]

SARS and MERS both cause severe atypical pneumonias. However, there are significant differences between the 2. MERS patients experience more GI and renal complications with more severe respiratory compromise necessitating mechanical ventilation in 60-90% of those infected.[2] This can be explained by the virus's affinity for different host receptors. MERS binds to a host receptor (DPP4) which is found in the lower airways, GI tract, and kidneys.[3] SARS binds to ACE2 receptors which are more predominant in the upper and lower respiratory tracts.[2,3,4] Both receptors are located throughout the body which explains different manifestations of the infection.

COVID-19:

A new, novel coronavirus (nCoV, now named COVID-19) was detected in December 2019 after 41 people were hospitalized with an atypical pneumonia of unknown etiology in Wuhan City, China (population 11 million). These cases were suspiciously similar to both SARS and MERS. Investigation revealed that these patients visited a local fish and wild animal market. Within 9 days of the original outbreak, a team of investigators had identified the virus as a novel coronavirus.[5]

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The virus was isolated and sequenced on January 10, 2020. Full genome sequencing and phylogenic analysis indicated that COVID-19 is a distinct clade of betacoronavirus associated with both SARS and MERS. Sequence data supports similar amino acid homology with SARS, specifically in its preference to bind to ACE2 receptors.[6] Unfortunately, this lends to more pandemic potential with human-to-human transmission. Subsequent studies have determined COVID-19 to have a basic reproduction number (R0) = 2.2.[7] This means that an infected person will infect 2.2 uninfected people during the course of illness. For comparison, seasonal flu outbreaks tend to have an R0 of 1.2-2.2.[8]

The diagnosis of COVID-19 was originally made using electron microscopy and viral culture.[1,2,8] Once the sequencing data became available, real-time PCR was used to rapidly detect specific nucleic acid sequences from lung aspirates, sputum, and throat swabs. Additional lab data and lung CT findings are also used to confirm the diagnosis. The most common lab abnormalities observed are depressed total lymphocytes, prolonged prothrombin time, and elevated LDH.[1] CT findings show bilateral ground glass opacities with crazy-paving patterns and consolidation. CT shows greatest severity at 10-14 days with slow resolution afterwards lasting 30+ days.[10] Disease severity appears to correlate with time of most contagious, although ample studies have yet to be reported to confirm this.

Only 15% of those infected with COVID-19 become severely ill requiring hospitalization.[11] So far, patients have been adults > 30 yrs. with the average age in the mid 50's and with co-morbidities. Generally, the older and sicker are more likely to require ICU and die.

The most common symptoms at onset of illness are fever, fatigue, dry cough, myalgia, and dyspnea. Less common are headache, dizziness, abdominal pain, diarrhea, nausea, and vomiting. Approximately 10% present with a 1-2 day prodrome of diarrhea and nausea before fever and dyspnea. The average time from onset to dyspnea is 5 days, hospitalization 7 days, and 8 days to ARDS.[9,10]

Currently hospital discharge criteria include: 1. afebrile for > 3 days, 2. significantly improved respiratory symptoms (paO2, SaO2), 3. improved chest CT, 4. 2 consecutive negative PCR tests taken at least 24 hours apart.[10]

Follow-up studies for those discharged are concerning because follow up PCR testing is detecting COVID-19 nucleic acid sequences at days 5-13 post discharge. This indicates a possible carrier state or re-infection.[12] There is not enough data at this time to draw a conclusion.

For the latest information regarding COVID-19, please visit the CDC's website at www.cdc.gov

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