

To vaccinate or not to vaccinate

Covid-19 has caused a great deal of uncertainty and challenge with our daily lives, and because it has historically caused mild respiratory illness, we are not as familiar with its role in human health. That has resulted in less medication available for treatment, reliable and rapid testing options, adequate vaccination strategies and predictability of outcome. In general viruses border on not meeting the definition of a living organism. They are simply genetic material inside a protein shell and the only function is to replicate themselves using the manufacturing plant of other organism's cells. Corona viruses, specifically, have spike proteins on the surface which gives them the stereotypical Corona appearance under electron microscope. Corona viruses have been known to infect mammals and birds and typically cause gastrointestinal or respiratory tract disease. Previous outbreaks of a more severe respiratory illness occurred in 2002 with SARS coV1 and in 2012 in the Middle East with MERS. This variant caused a mortality rate of up to 40% but affected primarily Middle Eastern countries with the exception of Korea. SARS CoV2 as part of the coronavirus family also possesses the spike protein on the surface which our immune systems can recognize and use as a means of developing immunity.

Essentially we are faced with either getting the disease or getting the vaccination. Technology for creating the current vaccine involves a novel approach to vaccine Manufacturing. This creates some uncertainty as to potential side effects but the science involved is incredible. A short discussion of vaccination basics will help demonstrate the technology involved.

In the past, vaccinations have involved either replication of virus and then attenuating to make it not capable of causing disease or the manufacture of specific viral proteins that can be injected to elicit an immune response. Replicating a virus in the laboratory however takes considerable time or the manufacture of proteins derived from the virus also can involve considerable resources and extensive time requirements. Human genetics involves DNA within the cells and a portion is exposed and the genetic message written out as a strand of messenger RNA (mRNA). That message is then read by the floor manager at the Manufacturing Plant and the appropriate protein is produced. Current vaccination involves creating a strand of mRNA that codes for the spike protein on the surface of the virus and injecting that message as part of the vaccine. The question is how to get that message inside the cell where it can result in the production of spike protein. Those strands of the message have been placed within fat globules which are new and no particle size and can combine with the fat of the cell wall and transmit the message internally. Therefore the vaccination relies on the individual to manufacture the spike protein themselves which the immune system can then respond to.

Long-term complications from the use of this technology as a vaccination are not known as the approach has not been used in the past. However, it is reasonable to assume that the side effects or allergic reactions to the vaccine will be similar to those experienced with other vaccinations. The risk is not zero from the vaccination; however, the risk of significant severe complications is quite low. Therefore, when evaluating whether to proceed with vaccination each individual should weigh the risk of getting the disease and having severe complications from the disease itself against the risk of taking the vaccination which for most people will be quite small.

For any viral infection one of the first responses by the immune system is to produce antibodies (B cells or humoral immunity) to neutralize the virus. The initial antibody is IgM class which increases within 24-48 hours of the infection and begins to disappear at 2 weeks. At that time the IgG antibody level is detectable which would indicate resolved infection and that class of antibody is thought to be responsible for long-term immunity. So if the IgM is positive but the IgG is negative it indicates acute infection. If both are positive it would be sub-acute approximately 2 weeks after onset of infection. If IgG is positive and IgM is negative then it indicates previous

infection. One concern is that the level of IgG antibody drops fairly quickly after Covid-19 infection below detectable levels and therefore may represent loss of immunity. However, a different branch of the immune system (T cell or cellular immunity) which assists in the elimination of the viral infection may play a greater role in long-term immunity. So how long does immunity post infection or post vaccination last? No data will be available to know for sure until significant time has passed after contracting the disease or receiving the immunization. The question of duration of immunity will not be answered until adequate time has passed post infection.