Protective immunity post-COVID-19 infection

Source: Emerging Science Group of the Public Health Agency of Canada. Emerging Evidence on COVID-19: Rapid Review on Protective Immunity. Full report available from: phac.evidence-donnees.probantes.aspc@canada.ca

Background: Understanding the extent and limits of protective immunity has important implications for the COVID-19 pandemic. An evidence review was conducted to address whether antibodies to SARS-CoV-2 confer immunity against reinfection; to determine if protective immunity lasts more than six months; and to identify if past infection with the original wild-type SARS-CoV-2 protects against the current variants of concern (VOC).

Method: Three separate searches relevant to reinfection, immunity, and VOC and immunity were conducted in 20 databases to identify relevant reviews and primary research in the form of peer-reviewed publications or pre-prints. Evidence published before February 11, 2021 was included.

Results: There were 49 studies identified, including 15 cohort studies on risk of reinfection, 21 studies on antibody kinetics and other immunity markers >6 months post initial infection, 10 studies on immunity and the new VOCs and three systematic reviews. In the appendix, 21 case reports of confirmed reinfection were summarized.

Documented cases of confirmed reinfection of COVID-19, based on genomic data, are rare. In most cohort studies, reinfection was based on serology, documented proof of a non-infected phase between infections and polymerase chain reaction (PCR) evidence of reinfection.

- Cohort studies on reinfection that targeted the general population or healthcare workers indicate a low risk of reinfection (0%–3.4%) compared to the COVID-19 in the susceptible population (1.3%–27.7%). Data on time to reinfection was highly variable, with a median of 52–172 days across studies and a range of 13–250 days.
- Older age, duration of symptoms, and number of symptoms were correlated with higher IgG antibody levels after primary infection. Higher and prolonged serum IgG antibody levels were correlated with a lower risk of reinfection.

Protective immunity lasts at least six months:

- Immunity following an infection arises from both B-cell and T-cell responses. Memory B-cell and T-cell activity was elevated and expanded beyond six months post infection in eight studies, which may be better measures of long term protective immunity than circulating antibodies. CD4+ T-cell activity continued to be detected in 92% of individuals between 6–8 months following infection.
- Twenty studies reported on circulating antibodies, eleven of which reported >86% of people remained positive for SARS-CoV-2 specific neutralizing antibodies (NAbs) ≥6 months after infection and levels were higher among people who had been hospitalized for COVID-19 compared to those who had been mildly symptomatic.

There is preliminary evidence that the extent of cross-protection of the original wild-type SARS-CoV-2 for VOC depends on the variant. In vitro evidence shows consistent neutralization of B.1.1.7 and reduced neutralization of B.1.351 by convalescent or vaccinated sera to wild-type SARS-CoV-2. Further research on how other immune responses (e.g. T-cell and B-cell) are affected by variants is a knowledge gap.

Conclusion: Reinfection with SARS-CoV-2 virus is rare but can occur. Despite a lot of variability in both antibody and T-cell response, protective immunity appears to last at least six months. Research and surveillance monitoring on reinfection and post vaccine infections coupled with sequencing data are needed to study the extent of cross protection between the original wild-type virus and VOC.