Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Letter to the Editor

Limited protection against SARS-CoV-2 infection and virus transmission after mRNA vaccination

Stang and coworkers have recently reported in the Journal that "RT-PCR test results as gold standard for assessing and controlling infectiousness fail"[1]. The authors analyzed two scenarios and used Ct25 and Ct30 as thresholds for infectiousness and conclude that more than the half of their patient cohort was unlikely to have been infectious, i.e. the group of patients tested positive at Ct values >25 or >30.

While we agree that Ct values are insufficient to determine the infectiousness we would like to add that also for the cohort of vaccinated individuals the Ct values are rather misleading. As shown in an early released study vaccinated people can not only become infected with SARS-CoV-2 but the virus can successfully be isolated by cell culture approaches, at least for a shorter time slot as in unvaccinated people[2]. Thereby, the viral loads as determined by the Ct values do not significantly differ between vaccinated and unvaccinated cohorts. While the group from Berlin analyzed an outbreak with the alpha variant, we made similar observations, also including the wild type strain.

In their recent report, Liu and coworkers demonstrated neutralization of newly emerged SARS-CoV-2 variants after properly completed BNT162b2 vaccination[3] and referred to a previous publication, which already showed neutralizing of the B.1.1.7 variant[4].

The first case series resulted from screening examination of medical stuff at a local maximum health care provider including a 54 year old male with mild common cold symptoms twelve weeks after second vaccination with BNT162b2. Analysis with the SARS-CoV-2 two target PCR assay (Altona Diagnostics, Hamburg, Germany) revealed CT-values of 23 for the E- and S-gene, while the positive control showed a CT-value of 28. This patient was infected with the SARS-CoV-2 α-variant determined by different probe-based melting curve assays according to the manufacturer (VirSNiP SARS-CoV-2 Spike, TIB-MolBiol, Berlin, Germany), which detected the mutations delHV69/70, N501Y, and P681H. In addition two asymptomatic healthcare staff members were tested SARS-CoV-2 positive (CT-values 36/36 and 30/30; E-/S-gene respectively) after proven contact with a COVID-19 patient, despite being completely vaccinated with BNT162b2. The fourth patient was infected 8 weeks after the second vaccination dose and suffered from serious common cold symptoms lasting one week, while being RT-PCR positive (CT-values between 30 and 33) for three weeks.

Regarding humoral immunity, Anchini and colleagues[5] convincingly showed that after BNT162b2 vaccination previously uninfected individuals had a significantly lower neutralizing antibody titer after administration of a second vaccine dose compared to previously infected individuals after a single dose, despite remarkable antibody titres specifically binding SARS-CoV-2 spike protein. This finding as well as the fact of an aged immune system[6], [7] must be taken into account when real-world effectiveness of Covid-19 vaccines is discussed.

In this context we investigated a nursing home outbreak in which 12 patients tested positive for SARS-CoV-2 with CT-values between 24 and 37, although all received the second vaccine dose >80 days ago and although staff and visitors were tested negative by rapid antigen tests.

Most striking was that - until the end of April 2021 - 119 cases with confirmed positive PCR results >14 days after second vaccination were reported including one case of fatal SARS-CoV-2 pneumonia. In 37 cases CT-values were <30 with a negative correlation of SARS-CoV-2-mRNA load and days post vaccination. Moreover, in several cases subsequent infections were confirmed by contact tracing (details to be published separately) suggesting that actual SARS-CoV-2 vaccines do not lead to sterile immunity. Considering that all these observations have been made in the relatively small area of Cologne and its surroundings without any claim on completeness this is absolute relevant for further strategies, especially as the findings suggest an insufficient immunity, lack of protection against colonization or infection, and a residual risk for transmission despite SARS-CoV-2 vaccination. For this reason, easing of pandemic-related restrictions or exemptions from hygiene measures based on the vaccination status seems doubtful.

Although determination of SARS-CoV-2 vaccination success, at least as antibody titre (arbitrary units / ml), is not part of the actual vaccination campaign, a vaccine-induced immune response in up to 92% cases must be assumed[8]. Nevertheless, studies on overall neutralizing capacity do not take into account effects like specific T-cell release, heterogeneous antibody populations, or the occurrence of non-spike mutations influencing viral replication and immune response, which was also discussed by Liu et al.[3]. Another effect that should also be considered is the general non-lasting triggering of the innate immunity by contact with foreign RNA[9-11].

This may explain why vaccination based neutralizing effects in some cases seem to be less sustained than assumed. In this context the "green passport", which is still considered in Europe and Israel, is just a vaccination certificate not more, not less. The individual risk for severe/life threatening COVID-19 may be significantly reduced although fatal courses remain possible, but it must be taken into account that any vaccinated individual may become an, at least short term, spreader of the virus.

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