UNITED ARAB EMIRATES
MINISTRY OF HEALTH & PREVENTION

الإمارات العربية المتحدة
وزارة الصحة ووقاية المجتمع

The First Scientific Conference on Health and Medical Research in the UAE-5-6 December 2022

Post-vaccination induced-immune response to anti-SARS-CoV-2 IgG antibodies and T-cells surrogate markers by type and vaccination regime: a retrospective cohort study

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Abstract

Background and aims: Induction of and the speed of producing anti-SARS-CoV-2 immune biomarkers might vary by the type and number of vaccine doses received. This study explores variation in post-vaccination concentration of anti-SARS-CoV-2 anti-spike IgG (anti-S IgG), anti-nucleocapsid IgG (anti-N IgG), neutralizing IgG antibodies, and T-cells reactivity by type of and number of anti-SARS-CoV-2 vaccine doses received.

Methods: In SARS-CoV-2 naturally exposed and anti-SARS-CoV-2-vaccinated labor workers, we quantified the anti-S IgG, anti-N IgG, neutralizing IgG antibodies concentration and assessed T-cells reactivity. Information on sociodemographics, medical history, history of PCR positivity to SARS-CoV-2, and type and number of received anti-SARS-CoV-2 vaccine doses was collected. Differences in antibodies concentration and T-cells reactivity by the measured characteristics and number of and type of vaccines received were investigated.

Nasal swabs were also collected at the same time of blood collection. Adjusted association between having more than a median concentration of the three IgG antibodies and T-cells response by number and type of the inoculated vaccines was quantified.

Results: 952 labor male workers (mean age of 35.5 years ± 8.4 SD) were surveyed, and their blood samples collected. Regardless of the number of doses, 92.1% of the workers were vaccinated with Sinopharm only, 1.5% received only Sputnik V Gam-COVID-Vac, 0.3% received only Pfizer/BioNTech, 4.0% primed with Sinopharm and boosted with Pfizer/BioNTech, and 0.7% had mixed vaccine types. Seropositivity to anti-S, anti-N, and neutralizing IgG antibodies was detected in 99.7%, 99.9%, and 99.3% of the workers, respectively. Of the 925 workers tested for their T-cells reactivity, 38.2% had their T-cells reactive. Every additional vaccine dose was significantly associated with increased odds of having more than a median concentration of anti-S (aOR 1.34, 95% CI: 1.02–1.76), anti-N (aOR 1.35, 95% CI: 1.03–1.75), neutralizing IgG antibodies (aOR 1.29, 95% CI: 1.00–1.66), and with having T-cells response (aOR 1.48, 95% CI: 1.12–1.95). Compared to boosting with only one dose, boosting with two doses was significantly associated with increased odds of having more than the median concentration of anti-S (aOR, 13.8, 95% CI: 1.78–106.5), neutralizing IgG antibodies (aOR, 13.2, 95% CI: 1.71–101.9), and T-cells response (aOR, 7.22, 95% CI: 1.99–26.5) but not with anti-N (aOR, 0.41, 95% CI: 0.16–1.08). Compared to priming and then boosting with Sinopharm, all participants who were primed with Sinopharm and then boosted with Pfizer//BioNTech had more than the median concentration of anti-S and neutralizing IgG antibodies and 14.6-time increased odds of having T-cells response (aOR, 14.63, 95% CI: 1.78–120.5). Compared to priming with two doses, boosting with a third dose was not while boosting with two doses was significantly associated with having more than the median concentration of anti-S (aOR: 14.2, 95% CI: 1.85–109.4), neutralizing IgG (aOR: 13.6, 95% CI: 1.77–104.3), and T cells response (aOR: 7.6, 95% CI: 2.09–27.8).

Conclusions

Boosting with only one dose or with only Sinopharm after priming with Sinopharm was not enough while boosting with two doses, particularly boosting with mRNA-based vaccine, was shown to be associated with having a high concentration of anti-S, anti-N, and neutralizing IgG antibodies and producing efficient T-cells response.

Keywords: SARS-CoV-2; COVID-19; Vaccination; Vaccines