An academic hospital experience screening mRNA COVID-19 vaccine risk using patient allergy history

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Clinical Implications

Screening algorithms employed for vaccine allergy risk assessment before administration of the first dose of the Pfizer-BioNTech COVID-19 mRNA vaccines were integral to rollout and can now be revised based on insights gained on epidemiology and mechanisms.

Higher than expected rates of anaphylaxis have been reported with the Pfizer-BioNTech and Moderna mRNA COVID-19 vaccines when compared with historical vaccine anaphylaxis trends.[1] Although the mechanism for such reactions remains unclear, and current anaphylaxis classification schemes may be overly sensitive, early interest has been placed on polyethylene glycol (PEG) 2000 present in the lipid nanoparticle carrier system of these mRNA COVID-19 vaccines.[2] In order to attempt to preempt allergic reactions, use of mRNA COVID-19 vaccines has been contraindicated in patients with known allergy to PEG and previously contraindicated in those with known allergy to PEG derivatives such as polysorbate where small studies have suggested cross-reactivity with PEG.[3,4] The Centers for Disease Control (CDC) have recommended caution and avoidance of vaccination with these mRNA vaccines in those with a history of injectable medication or vaccine anaphylaxis where PEG and polysorbate may be present as excipients, but these allergies are thought to be quite rare overall.[2-4] However, the effectiveness of risk stratification by allergy history is unknown and may be stymied by creating unnecessary perception of mRNA COVID-19 vaccine risk and hesitancy in patients, increased complexity for vaccination sites, and a referral burden to allergists for pre-vaccination risk assessment. Therefore, we examined the outcomes of screening mRNA COVID-19 vaccine risk using patient-reported anaphylaxis history at a single academic hospital employee vaccination program.

Our study presents a retrospective cohort study performed under institutional review board (IRB) approved protocols from Vanderbilt University Medical Center (VUMC), IRB #210328. Between December 17, 2020, and March 17, 2021, 23,035 sequential health care workers and other affiliates who, at the time of vaccination, met criteria based on the Tennessee Department of Health COVID-19 Vaccination Plan[5] received the first dose of the Pfizer-BioNTech mRNA COVID-19 at VUMC Occupational Health sites. The Pfizer-BioNTech was the only formulation of an mRNA COVID-19 vaccine available at VUMC at the time. In collaboration between the Division of Allergy and the Occupational Health Clinic at VUMC, a screening algorithm for stratification of mRNA COVID-19 vaccine risk was developed using CDC and expert guidance[6,7] (Figure 1) and employed at the time of Occupational Health vaccination appointments. Individuals with a history of anaphylaxis to an injectable medication, vaccine, oral PEG3350, or unknown cause (idiopathic) triggered a focused review of the implicated cause by the Allergist On-Call by telephone. If the implicated drug in a previous potentially allergic reaction did not contain PEG or polysorbate, individuals were recommended to proceed to vaccination with a 30-minute observation. If the implicated drug likely contained PEG or polysorbate or the cause unknown, subsequent tolerance of PEG or polysorbate containing medications was questioned. If subsequent tolerance of PEG or polysorbate was known, individuals were recommended to proceed to vaccination with a 30-minute observation. If subsequent tolerance of PEG or polysorbate was not known, individuals did not proceed to vaccination and were referred to the Drug Allergy Clinic for assessment before immunization. Calls were logged in REDCap (Research Electronic Database Capture) hosted at VUMC at the time of the focused review by the Allergist On-Call.[8] Demographics (age, sex), anaphylaxis history, subsequent tolerance of PEG and polysorbate if applicable, and dose 1 recommendation were recorded. In addition, the Occupational Health Clinic used a REDCap project to capture individuals who reported an adverse reaction to the Pfizer-BioNTech mRNA COVID-19 vaccine. Those who reported a suspected allergy-related adverse reaction to dose 1 administration were referred by Occupational Health to the Drug Allergy Clinic. All charts were subsequently reviewed for the outcomes of dose 1 administration, including if a referral was placed before receipt of dose 1 or after dose 1 for an adverse reaction. In those who were referred to the Drug Allergy Clinic, PEG and polysorbate skin testing results, by previously reported protocols,[3] if applicable, and recommendation on proceeding to dose 1 were also reviewed.

Of 23,035 individuals screened before dose 1 of the Pfizer-BioNTech mRNA COVID-19 vaccine, 31 reported a high-risk allergy history that triggered a focused review by the Allergist On-Call (Figure 2). The implicated causes included 14 injectable medication anaphylaxis, 9 idiopathic anaphylaxis, 8 vaccine anaphylaxis, and 0 oral PEG3350 anaphylaxis. For those reporting a high-risk allergy history, the median age was 40 years (interquartile range, 30-53 years) and 71% were female (3 of 31 individuals were missing age and sex data) (Table I). Of the 31 individuals with a high-risk allergy history, 28 (90%) were recommended to proceed to dose 1 of the Pfizer-BioNTech mRNA COVID-19 vaccine based on implicated cause known to not contain PEG or polysorbate or known subsequent tolerance of a PEG or polysorbate containing medication or vaccine (Table I). Of the 3 individuals recommended to not proceed to dose 1 and referred to the Drug Allergy Clinic for assessment, 1 referral was for vaccine anaphylaxis possibly containing polysorbate and unknown subsequent tolerance of PEG and polysorbate, and 2 referrals were for idiopathic anaphylaxis with unknown subsequent tolerance of PEG or polysorbate. Of the 28 high-risk allergy history workforce members who proceeded to the first dose of the Pfizer-BioNTech COVID-19 mRNA