A search for serologic correlates of immunity to Bordetella pertussis cough illnesses

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In a pertussis vaccine efficacy trial in Germany we collected sera from vaccinees (DTaP or DTP) after the third and fourth doses of vaccine or at comparable time periods in DT vaccine recipients. In addition, sera were collected from a randomized sample of subjects in each vaccine group at approximately 3-month intervals from which antibody kinetic curves were constructed, which allowed us to estimate specific antibody values to pertussis toxin (PT), filamentous hemagglutinin (FHA), pertactin and fimbriae-2 at the time of exposure in the household setting. The imputed geometric mean antibody values to PT, pertactin and fimbriae-2 at the time of household exposure to Bordetella pertussis infection were higher ($p < 0.07$ or lower) in non-cases compared with cases. A multivariate (classification tree) analysis found that only pertactin and PT were significant in protection. Subjects with an imputed pertactin value of <7 EU ml-1 had a 67% (18/27) chance of infection regardless of the PT value. If the pertactin value was >or = 7 EU ml-1 and the PT value >or = 66 EU ml-1 all subjects were non-cases. If the pertactin value was >or = 7 and the PT value was <66 EU ml-1 the predicted probability of being a case was 31% (15/49). Logistic regression analysis also found that high versus low pertactin values were associated with illness prevention following household exposure. In the presence of antibody to pertactin, PT and fimbriae-2, the additional presence of antibody to FHA did not contribute to protection. Our data support historical data indicating that agglutinating antibodies are associated with protection and also recent serologic correlates data and clinical efficacy data which indicate that multicomponent vaccines containing pertactin and fimbriae have better efficacy than PT or PT/FHA vaccines.

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