Evaluation of Outer Membrane Vesicles Obtained from Predominant Local Isolate of Bordetella pertussis as a Vaccine Candidate

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ABSTRACT

Background: Pertussis is a current contagious bacterial disease caused by Bordetella pertussis (Bp). Given the prevalence of pertussis, development of new vaccines is important. This study was attempted to evaluate the expression of main virulence factors (pertussis toxin [PTX], PRN [pertactin], and filamentous hemagglutinin [FHA]) from Bp predominant strains and also compare the expression of these factors in the outer membrane vesicles (OMVs) obtained from predominant circulating Bp isolate. Methods: The physicochemical features of the prepared OMVs were analyzed by electron microscopy and SDS-PAGE. The presence of the mentioned virulence factors was confirmed by Western blotting. BALB/c mice (n = 21) immunized with characterized OMVs were challenged intranasally with sublethal doses of Bp, to examine their protective capacity. Results: Electron microscopic examination of the OMVs indicated vesicles within the range of 40 to 200 nm. SDS-PAGE and Western blotting demonstrated the expression of all three main protective immunogens (PTX, PRN, and FHA), prevalent in the predominant, challenge, and vaccine strains, and OMVs of the predominant IR37 strain and BP134 vaccine strain. Significant differences were observed in lung bacterial counts between the immunized mice with OMV (30 CFU/lung) compared to the negative control group [(6 × 10³ CFU/lung; p < 0.001). In mice immunized with OMVs (3 µg), the number of lungs recovered colonies after five days dropped at least five orders of magnitude compared to the control group. Conclusion: OMVs obtained from circulating isolates with the predominant profile may constitute a highly promising vaccine quality. They also can be proposed as a potential basic material for the development of new pertussis vaccine candidate. DOI: 10.52547/ibj.25.6.399

Keywords: Bordetella pertussis, Vaccines, Virulence factors

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List of Abbreviations:
aP, acellular vaccines; BGA, Bordet-Gengou agar; Bp, Bordetella pertussis; DPT, diphtheria, pertussis, and tetanus; FHA, filamentous hemagglutinin; LAL, Limulus amebocyte lysate; MSS, Modified Stainer-Scholte; MWG, mouse weight gain; OMV, outer membrane vesicles; PRN, pertactin; PTX, pertussis toxin; RT, room temperature; RVSR, Razi Vaccine and Serum Research Institute; TE, Tris-EDTA; TEM, transmission electron microscopy; wP, whole-cell vaccines