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Numerical Simulation on Bacteria-Carrying Particles Transport and Deposition in an Open Surgical Wound

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Abstract : Wound infected poses a serious threat to the surgery on the patient during the process of surgery. Understanding the bacteria-carrying particles (BCPs) transportation and deposition in the open surgical wound model play essential role in protecting wound against being infected. Therefore BCPs transportation and deposition in the surgical wound model were investigated using force-coupling method (FCM) based computational fluid dynamics. The BCPs deposition in the wound was strongly associated with BCPs diameter and concentration. The results showed that the rise on the BCPs deposition was increasing not only with the increase of BCPs diameters but also with the increase of the BCPs concentration. BCPs deposition morphology was impacted by the combination of size distribution, airflow patterns and model geometry. The deposition morphology exhibited the characteristic with BCPs deposition on the sidewall in wound model and no BCPs deposition on the bottom of the wound model mainly because the airflow movement in one direction from up to down and then side created by laminar system constructing airflow patterns and then made BCPs hard deposit in the bottom of the wound model due to wound geometry limit. It was also observed that inertial impact becomes a main mechanism of the BCPs deposition. This work may contribute to next study in BCPs deposition limit, as well as wound infected estimation in surgical-site infections.

Keywords : BCPs deposition, computational fluid dynamics, force-coupling method (FCM), numerical simulation, open surgical wound model
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