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Rapid detection of methicillin-resistant *Staphylococcus aureus* in orthopaedic surgery

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Orthopaedic surgical site infections (SSIs) occur between 6,000 to 20,000 cases annually, increasing average hospital stay and costs as well as morbidity and mortality rates. Here we propose a real-time sensing method for immediate detection of methicillin-resistant *Staphylococcus aureus* (MRSA), one of the most common pathogens causing SSIs. It does not require conventional procedures of bacterial identification such as sample collection, culturing and other laboratory work. The mechanism is based on the immunoreaction between PBP2a, a protein exclusively present on the surface of MRSA, and the antibody against it. The anti-PBP2a antibody is immobilized on a screen-printed electrode via an organic self-assembled monolayer. This probe then is connected to an impedance analyzer for quantification of surface modification corresponding to antigen-antibody interaction. The sensing activity was measured by exposing the antibody-linked electrode to serial dilutions of recombinant PBP2a protein (1 pg/ml to 100 ng/ml) or to bacterial cultures (10^6 cells/ml). Responding time was also investigated. The results indicated that this MRSA (PBP2a) sensor was able to detect its target within a wide range of concentration in less than 5 minutes. To confirm the selectivity of this approach, the working probe was immersed in the non-resistant *Staphylococcus aureus* culture or MRSA culture. A significant impedance shift was observed only when the MRSA was present. Our pilot studies demonstrated that this sensing method is able to fulfill the requirements for a real-time diagnostic device and that it can be used to rapidly evaluate bacterial infection during operation.

Biography

Anand K Agarwal is an orthopaedic spine surgeon, life science business strategist and entrepreneur in vertebral augmentation technology for the past 10 years. Currently he is Research Professor at the Engineering Center for Orthopaedic Research Excellence at the University of Toledo as Director of Product Development and Bio-Skills Laboratories. He is also a board member, key opinion leader and chairperson of various medical device companies. He holds memberships of the North American Spine Society, European Spine Society, German Spine Society, British Spine Society, Indian Spine society and International Society of Advancement of Spine Surgery.

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