Role of cell surface properties and cell wall protein profiles on the early stages of *S. epidermidis* biofilm development

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Aims

Staphylococcus epidermidis is a coagulase-negative *Staphylococcus* that has emerged in recent years as a major nosocomial pathogen, associated with infections of implanted medical devices. *S. epidermidis* adheres easily to biomaterials and has the ability to develop biofilms, which constitute one of the most important virulence factors. Initial adhesion of bacteria to the biomaterial surface is thought to be a key step in the colonization of indwelling medical devices and is mostly dependent on bacterial cell surface characteristics and on the nature of the material surface. The better understanding of these features is of extreme importance for the development of effective adhesion control mechanisms that will prevent biofilm formation and thus, the infection of medical devices.

Hence, this study aims at evaluating the role of cell surface properties as well as the importance of cell wall (CW) proteins in the adhesion ability of eight *S. epidermidis* strains to acrylic, a biomaterial normally used in the manufacture of indwelling medical devices.

Methods

Bacterial adhesion was carried out through static assays in 6-well tissue culture plates, where the coupons were placed in contact with the bacterial suspension for 2h. After, the adhered cells were quantified by microscopic observation and enumeration.

Cell hydrophobicity and surface tension components were determined by contact angle measurements.

CW fractions of the *S. epidermidis* strains under study were extracted with a digestion buffer solution under soft agitation and protoplasts were removed by centrifugation; protein profiles were analysed by SDS-PAGE.

Results

S. epidermidis IE214 and IE186 were the strains showing the highest adhesion extension and, in opposition, strains IE75 and LE7 showed the lowest levels of initial binding to acrylic. Considering cell surface properties (surface tension parameters and degree of hydrophobicity), there were no significant differences among the strains assayed, except for strain IE214. Moreover, no relationship was found between cell surface hydrophobicity and adhesion ability. According to the analysis of CW proteins profile, a significant percentage of the proteins detected was common to all strains studied. However, the most adhering strains expressed a high number of proteins which could be associated with the initial adhesion process, such as Bhp and AtlE, while in the profiles of strains IE75 and LE7 none of these proteins were detected.

Conclusions

The present results show that bacteria surface physicochemical properties seem to have no significant effect on initial bacterial adhesion. On the contrary, specific interactions involving CW proteins seem to be essential in promoting initial adhesion to the substrate, according to the profiles of the most adhering strains. Those proteins are potential virulence factors that should be taken into consideration as appropriate targets for the development of novel therapies against staphylococcal infections.