STUDY OF BIOFILM FORMATION ON BIOMATERIAL SURFACES

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ABSTRACT

The nature of biomaterial surface influences bacterial adhesion. Adherence of bacteria to biomaterials is the first stage in the development of a device related infection. The ability of bacterial cells to attach to biomaterial surfaces is dependent on the physico-chemical characteristics of the bacterial cell, the bacterial growth conditions and the biomaterial surface chemistry. In the present work an attempt was made to investigate the different growth media on the surface properties of bacteria isolated from indwelling urinary catheters and on their ability to adhere to polyurethane. The role of biomaterial conditioning film formation on the adherence of the isolates to polyurethane and on the polymer surface characteristics were also examined.

INTRODUCTION

Microorganisms have a strong tendency to become associated with surfaces(1). Once microorganisms are attached to a substratum surface, a multistep process starts leading to the formation of a complex, adhering microbial community that is termed a 'biofilm'. Biofilms can be beneficial, to degrade environmental hazardous substances in the biomaterials implants (2). Urinary catheters are tubular, latex, or synthetic polymeric biomaterial, primarily fabricated from either polyurethane or silicone. silicone devices are inserted through the urethra into the bladder to measure urine output, collect urine during surgery, prevent urinary retention, or control urinary incontinence (3). In a recent clinical survey, the microbial colonisers of indwelling urinary catheters are *P. aeruginosa* and *Proteus vulgaris*(4,5).

EXPERIMENTAL DETAILS

For cell surface hydrophobicity determination (BATH) technique was used. Bacterial isolates *P. aeruginosa*, and *Proteus vulgaris* were cultured in Mueller-Hinton broth (MHB) or in human urine(HU) in an atmosphere containing 5% CO₂ and then harvested by centrifugation. Three replicates were performed for each organism to enable statistical comparison of the results. Zeta potentials were determined by using Malvern Zetasizer IV. Zeta potentials were measured to a

precision of ± 1 mV for all isolates. Contact angles of the polyurethane were determined in triplicate by the Wilhelmy plate technique using a CAHN Dynamic Contact Angle Analyser. To study the bacterial adherence to urinary catheters the radiometric assay was used. Effect of conditioning film formation on adherence to polyurethane was also studied. The scanning electron microscopy and transmission electron microscopy were used to document biofilms on urinary catheters removed from patients.

RESULTS & DISCUSSION

The results presented in this study indicate that in vivo conditions should be stimulated as far as possible when carrying out in vitro bacterial adherence assays. The process of conditioning film formation on a biomaterial surface will impact on bacterial adhesion to it.

CONCLUSION

The deposition of host macromolecules on to the biomaterial surface is also a modifier of bacterial adhesion. Polyurethane treated with human urine had greater numbers of adherent MHB-cultured bacteria than untreated polyurethane, although conditioned polyurethane displayed reduced numbers of adherent human urine cultured bacteria.

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