In vitro Quantification of Biofilm Reduction of the PSM BLUcath™ Indwelling Urinary Catheter

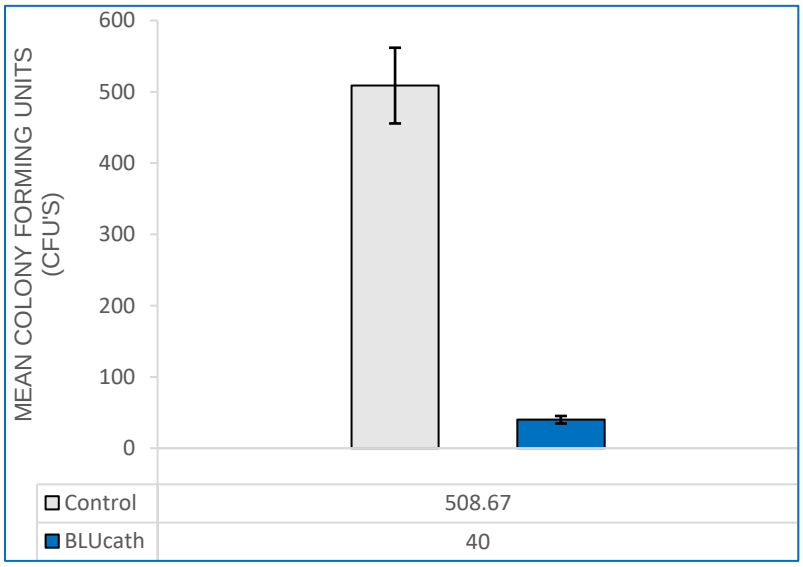
Introduction and Objectives

Catheter Associated Urinary Tract Infections (CAUTI) have plagued the medical field since the introduction of the indwelling urinary catheter. A primary cause of CAUTI is the growth and formation of bacterial biofilms on the exterior surface of the device.[1] The Portela Soni Medical BLUcath™ is a novel indwelling urinary catheter that incorporates a urethral flushing mechanism designed to cleanse the urethra and prevent biofilm formation. The objective of this study is to evaluate the efficacy of the BLUcath™ flushing mechanism in the prevention of *In vitro* biofilm formation.

Methods

The following protocol was adapted from the work of Mandakhalikar *et al.* (2018). DH5α chemically competent *E. coli* were transformed with the pUC19 plasmid following the manufacture's protocol. Ampicillin resistance was confirmed by plating transformed cells on LB-Amp agar plates and incubating at 37ºC overnight. A single colony was selected and expanded in 3mL LB-Amp broth at 37ºC overnight with shaking at 225 rpm. The 3 mL of expanded culture was added to 50mL fresh LB-Amp broth and incubated overnight at 37ºC in static conditions. This culture was passaged twice under static conditions to promote type II pilus formation to enhance biofilm formation.[2] Artificial urethras were created by forming a cellophane sheath 15cm in length and 2cm in width. The artificial urethras were catheterized with 18F BLUcath™ catheters. Each urethra+catheter complex was then submerged in 150mL fresh LB-Amp broth inoculated with 50mL of DH5α culture. Following an overnight incubation at 37ºC in static conditions, experimental group catheters were flushed with 100mL of sterile saline. Control group catheters were not flushed. Urethra+catheter complexes were removed from cultures and the urethras were cut off. Each catheter was gently dipped into sterile saline to remove any non-adherent, planktonic bacteria. Finally, each catheter was cut into segments and placed in 40mL sterile saline and vortexed on high for two minutes to remove any adherent bacteria/biofilm. 2µL of the vortexed saline was spread on LB-Amp agar plates and incubated overnight. Colonies were counted to determine colony forming units (CFUs). An unpaired T-test was used to determine the statistical significance of the difference in mean control group CFU vs mean flush group CFU.

Results



BLUcath™ Reduces 92.14±0.28% of Adherent Bacteria with a Single Saline Flush.

A significant reduction was seen in mean control group CFU (508.67±53.11, n=3) vs mean flush group CFU (40.00±5.29, n=3). An unpaired t-test revealed statistical significance where t(4)=15.2073, p=0.0001. Mean CFU reduction was calculated at 92.14±0.28%.

Conclusions

The PSM BLUcath™ indwelling urinary catheter shows statistically significant efficacy in *In vitro* biofilm reduction.

References

1. Verma, Amit et al. "Differences in Bacterial Colonization and Biofilm Formation Property of Uropathogens between the Two most Commonly used Indwelling Urinary Catheters" Journal of clinical and diagnostic research : JCDR vol. 10,6 (2016): PC01-3.
2. Mandakhalikar, Kedar Diwakar et al. "Extraction and quantification of biofilm bacteria: Method optimized for urinary catheters" Scientific reports vol. 8,1 8069. 23 May. 2018, doi:10.1038/s41598-018-26342-3