

## Novel Approach Against Central Venous Catheter Associated Infection With *Acinetobacter Baumannii* Biofilm

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Central venous catheter (CVC)-associated infections have substantial impacts on morbidity, mortality, and overall cost of health care. *Acinetobacter baumannii* causes severe infections, survives on abiotic surfaces, colonizes and develops resistant biofilm on different medical devices including CVC. The cranberry contains proanthocyanidines which possess antiadherent activity against colonic bacteria. This study aimed to assess the use of moxifloxacin/cranberry extract combination against *A. baumannii* biofilm established on CVC. *A. baumannii* biofilm was developed on silicone CVC and visualized by electron microscopy. The biofilm was treated according to the method described by Aslam et al. Briefly, segments (1 cm) of silicone CVC (Cook, Inc., Bloomington, IN) were incubated in bacterial suspensions (106 CFU/ml) in Mueller Hinton broth to allow biofilm formation. After incubation at 37°C for 24 h, segments were aseptically removed. Four sets of catheter segments (3 segments/each) were suspended for 6 h at 37°C in one of the following solutions: moxifloxacin (0.16 µg/mL), cranberry aqueous extract (10 mg/mL), Mox-Cran combination, or normal saline (NS) as a control. Catheter segments were rinsed 3 times with NS to remove planktonic bacteria. These seg-

ments were individually sonicated for 5 min and vortexed for 30s in 1 ml NS. Aliquots (100 µL) of the sonicated fluids and their dilutions were inoculated onto Mueller Hinton agar plates. Each set of experiments was repeated three times. Bacterial colonies (CFU/cm) were counted after incubation for 24 h. The average colony count of each set of experiment was calculated. The average values of the treated sets were divided by the average value of the control percent for calculation of the percentage biofilm reduction in each treatment as compared to the untreated control (NS). Using ANOVA, the significance level for all analyses was <0.05. The effect of moxifloxacin alone was similar to the untreated control. Cranberry extract could reduce the biofilm by almost 90%. Moreover, MoxDran combination could synergistically and completely (100%) eradicate *A. Baumannii* biofilm from CVC. There is a dire need for developing novel strategies against microbial biofilms on medical devices, such as the use of combination between safe anti-adherent extracts with antimicrobial agent as a catheter lock solution, to retrieve the infected vascular catheters. The results of this study revealed a promising antibiofilm activity of moxifloxacin/cranberry extract combination for eradication of mature *A. baumannii* biofilm from CVC (therapeutic approach). Since biofilm prevention is much easier than its eradication, we hypothesize that impregnation or coating of medical devices, including CVC, with such novel and safe combination might be an outstanding tool against biofilm development (prophylactic approach).

## Application of Magnetoelastic Thick Films for Wireless, In Vivo Monitoring of Pressure at Abdominal Aortic Aneurysm

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According to the National Center for Health Statistics, cardiovascular diseases remain the number one killer in the United States. Among the various types of cardiovascular diseases, the aortic aneurysm is ranked number nine. The abdominal aortic aneurysm (AAA), in particular, is an abnormal, localized dilation of the abdominal aorta wall caused by weakened or diseased aorta walls. One of the treatments for this disease is using an endovascular surgery at which an endovascular graft is delivered to the aneurysm site through the femoral arteries. The deployment of the endovascular graft will exclude blood flow to the aneurysm, thus preventing further expansion of the aneurysm sac. Although this technique is preferred over open surgeries due to its minimal invasiveness, an event known as the endoleak, where the endovascular graft fails to retain the blood and leads to leakage to the aneurysm sac, may occur. Here, we are developing a novel pressure monitoring system to remotely and continuously measure the pressure in the aneurysm sac. The main component of the system is a pressure-sensitive material, made of a magnetoelastic, magnetically soft film attached or coated on the endovascular graft.

When under an AC magnetic field (excitation field), the magnetoelastic film generates a secondary magnetic field. Due to its magnetoelastic property, the amplitude of the secondary field varies with applied stresses, allowing remote pressure monitoring. To eliminate noises from the excitation field, the generated secondary field is measured at twice the excitation frequency to obtain the 2nd-order harmonic field, which is used for tracking the pressure variations. A scaled-up prototype of the pressure monitoring system was constructed and examined to demonstrate the feasibility of this technology. A commercial magnetoelastic thick film, Metglas 2826MB from Metglas, Inc., was attached on a polycarbonate substrate and covered by a thin polycarbonate protective layer. The substrate was then embedded in a plastic tube with flowing liquid to represent the condition of an aorta. Liquid pressure in the tube was altered during the experiment by restricting or relaxing the flow channel. In this study, a 10 mm × 40 mm film (Film A) and a 5 mm × 40 mm film (Film B) were fabricated and tested. The amplitude of the 2nd-order harmonic field produced by the films was inversely proportional to the fluid pressure. It was also shown that films with different sizes exhibited different signal sensitivity with the smaller film (Film B) exhibited greater sensitivity. This experiment indicates that feasibility of the pressure monitoring technology.