Novel Anti-Infective Urinary Catheter and Drainage System using Soft Robotic Technology

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<th>Background &amp; Unmet Need</th>
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| - Urinary tract infections (UTIs) are the most common type of hospital acquired infections, with over 250,000 incidences per year  
  - The majority (75%) of hospital-acquired UTIs are linked to conventional indwelling urinary catheters  
  - The Centers for Disease Control and Prevention estimates that the cost of treating Catheter-associated UTIs (CA-UTIs) is $350 million per year  
  - However, new catheter materials and alternative catheter designs have thus far failed to significantly reduce the incidence of CA-UTIs  
  - There are ~75 M indwelling Foley catheters utilized annually worldwide, with an estimated global Foley catheter market of ~$1 B in 2018  
  - **Unmet Need**: There is a pressing need for innovations in catheter design that reduce the risk of CA-UTIs | - **The Technology**: A novel urinary catheter and drainage system designed to reduce the risk of developing CA-UTIs by using soft robotic actuation to actively open the drainage eyelet without changing the cost of catheter production  
  - The revised catheter has a drainage eyelet that resembles a slit, such that it is closed during introduction into the urethra, partially open once in the bladder, and fully open once inflated (as one would do for the retention balloon)  
  - This novel design reduces the likelihood of a biofilm being loaded into the eyelet during introduction as is the case with conventional catheters  
  - **PoC Data**: In a simulated experiment, the novel catheter significantly reduced contamination (12x less) compared to a standard catheter  
  - The novel catheter was also shown to not impair flow rate compared to a standard catheter, and retained its actuation ability after repeated usage |

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**Patents:**  
PCT Application Filed

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Technology Applications

• Reduced incidence of CA-UTIs in patients that require an indwelling catheter
• Improved treatment and outcomes for patients suffering from urinary incontinence

Technology Advantages

• Novel catheter design is amenable to production with existing machinery, thus no increased costs
• Soft robotic actuation requires simple inflation, requiring no additional training for nurses compared to use of conventional catheters

Supporting Data / Figures

Figure 1: A. Improved catheter design includes an active drainage eyelet to reduce the risk of biofilm formation during catheter insertion. B. Actuating catheter significantly reduced contamination compared to a standard catheter in a simulated experiment (experimental overview in Figure 2).

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Figure 2: A. The actuating eyelet (top) and retention balloon (bottom) at various inflation volumes. B. Actuating catheter provided a similar flow rate as a standard catheter even after repeated use. Note that at zero inflation volume, flow still occurs to avoid safety issues. C. The actuating catheter shows reproducible inflation diameters after repeated usage.

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