We present further analysis of the previously proposed water infused surface protection (WISP) technology, an active method to reduce protein adsorption and effectively disrupt adsorbed protein sheaths on the inner surface of CVCs” Sutherland et al (2018).

Abstract:

Central venous catheters (CVCs) are implanted in the majority of dialysis patients despite increased patient risk due to thrombotic occlusion and biofilm formation. Current solutions remain ineffective at preventing these complications and treatment options are limited and often harmful. We present further analysis of the previously proposed water infused surface protection (WISP) technology, an active method to reduce protein adsorption and effectively disrupt adsorbed protein sheaths on the inner surface of CVCs. A WISP CVC is modeled by a hollow fiber membrane (HFM) in a benchtop device which continuously infuses a saline solution across the membrane wall into the blood flow, creating a blood-free boundary layer at the lumen surface. Total protein adsorption is measured under various experimental conditions to further test WISP performance. The WISP device shows reduced protein adsorption as blood and WISP flow rates increase (P < 0.040) with up to a 96% reduction in adsorption over the no WISP condition. When heparin is added to the WISP flow, protein adsorption (0.097[+0.035/-0.055] µg/mm² ) is reduced when compared to both bolus administration and nondoped WISP, 0.406(+0.056/-0.065) µg/mm² (P = 0.001) and 0.191 (+0.076/-0.126) (P = 0.029), respectively. Additionally, when heparinized WISP is applied to a
preadsorbed protein layer, 0.375(+0.114/-0.164) µg/mm², it displays the ability to reduce
the previously-adsorbed protein, 0.186(+0.058/-0.084) µg/mm² (P = 0.0012), suggesting
aptitude for intermittent treatments. The WISP technology not only shows the ability to
reduce protein adsorption, but also the ability to remove preadsorbed material by effectively
delivering drugs to the point of adsorption; functionalities that could greatly improve clinical
outcomes.

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Central Venous Catheter Protein Adsorption and Water Infused Surface Protection