**In Vitro Clearance Performance of the Manual Single Lumen Alternating Micro-Batch (mSLAMB) - Potential Use in Austere Medical Environments**

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### Introduction

- Most blood-based renal replacement therapies (RRT) use a double lumen access catheter.
- A single lumen alternating micro-batch (SLAMB) has been developed; a variation of this single-lumen system is the manual SLAMB-HF (mSLAMB) kit.\(^1\)
- mSLAMB does not require electricity, a battery, or a pump. It uses syringes and gravity, making it potentially useful for medical situations in austere environments.

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### Purpose

To determine if the mSLAMB can achieve adequate small solute clearance.

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### Methods

- *In vitro* clearance experiments were conducted with the mSLAMB.
  - mSLAMB was connected to a 2-liter bag of a mixture of expired blood and 0.9% NaCl, which was spiked with urea to achieve a blood urea nitrogen (BUN) concentration of 50 - 120 mg/dL. Expired blood has a potassium level of 9.9 - 16.6 meq/L.
  - Three sets of experiments were conducted, each with a different ratio of hemofiltration fluid to blood volume.
  - The first set was hemofiltration series in a one-to-one ratio, with 100 cc of blood and 100 cc of hemofiltration fluid pulled. Our second and third sets of experiments had a one-to-two ratio and a one-to-three ratio, respectively.
  - Three different dialyzers were also tested: Polyflux 6H, Rexeed 25S, and Nipro Cellentia 17H.
  - Eight cycles were performed, and the urea and potassium concentrations were measured after each cycle.
  - The data were normalized by percent removed.

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### Results

- The mean urea reduction ratio (URR) was 27.4 ± 7.1% after 8 cycles. The predicted URR was 20.9 ± 3.2%.
  ![Figure 1: Actual vs. Predicted URR Across All Experiments](image)
  - The mean percentage reduction of potassium was 23.4 ± 9.3%.
  - Mean cumulative URR after each cycle was: (1) 13.3 ± 7.6%, (2) 14.3 ± 9.3%, (3) 18.5 ± 5.7%, (4) 20.0 ± 6.0%, (5) 23.2 ± 5.2%, (6) 25.8 ± 7.5%, (7) 27.9 ± 6.6%, (8) 27.4 ± 7.1%.
  - Mean potassium reduction for cycles 1-8 were: (1) 11.4 ± 4.9%, (2) 12.8 ± 9.5%, (3) 16.5 ± 5.4%, (4) 17.2 ± 6.7%, (5) 20.0 ± 6.0%, (6) 22.5 ± 8.8%, (7) 23.0 ± 7.5, (8) 23.4 ± 9.3%.
  - Clearance rates did not differ between the three different filters and membrane types.
  - The largest reduction percentage for both urea and potassium occurred after the first cycle.

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### Conclusion

- The mSLAMB disposable system removes urea and potassium effectively.
- The efficiency of the mSLAMB was similar across three different sizes of dialysis filters and membrane type making it versatile.
- mSLAMB only requires manual syringe labor and gravity, allowing healthcare workers to offer dialysis in austere environments with limited resources. This creates a potential availability of dialysis services worldwide allowing medical professionals to treat people where they could not before.

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