

New thesis on different aspects of a new automatic urinometer

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Martin Slettengren at the research group Thoracic Anesthesiology and Intensive Care, Department of Molecular Medicine and Surgery, will defend his thesis "Evaluation of an automatic urinometer including use of silicone oil to decrease biofilm formation due to proteinuria, hemoglobinuria and bacterial growth" on January 14, 2021. Main Supervisor is Jan van der Linden.

What's the main focus of your thesis?

The thesis covers different aspects of a new automatic urinometer, that uses capacitance to continuously register urine output and is connected to a standard urinary catheter.

The new automatic urinometer was compared with a manual urinometer, using a measuring cylinder as a gold standard for control measurements, both in [adult patients](#) in the Cardiothoracic Intensive Care Unit and in [pediatric patients](#) in the Pediatric Intensive Care Unit (studies 1 and 2).

Furthermore, we investigated if the incorporated [silicone](#) oil in the automatic urinometer may

decrease the amount of microbial [biofilm formation](#) on the plastic surface behind which the capacitance measurement takes place (study 3) and if silicone oil may decrease biofilm by albumin and free hemoglobin in urine that is commonly seen in postoperative cardiothoracic patients (study 4).

Which are the most important results?

The automatic urinometer measured urine output significantly better (study 1) or equally (study 2) compared with the manual urinometer. Moreover, the nursing staff appreciated the automatic urinometer significantly more regarding handling and user friendliness. Also the staff saved a lot of time by using the automatic urinometer compared with the manual urinometer and importantly, the automatic urinometer always measured hourly urinary output correctly.

The silicone oil that is included in the automatic urinometer significantly decreased the amount of microbial biofilm in vitro from a number of normal uropathogenic bacteria, resistant strains, and *Candida albicans*. Finally, the silicone oil also decreased the amount of biofilm formed on the plastic measurement membrane from albumin and free hemoglobin.

How can this new knowledge contribute to the improvement of people's health?

Correct measurement of patients' diuresis is important in order to calculate the water balance and to early detect a pending kidney failure. The numerous benefits of the automatic urinometer, including improved ergonomics, the possibility to show trends/curves/prediction, time saving and measurement at the correct time should be beneficial in the [intensive care](#) unit, in the operating theater and not at least in the normal ward, where normally the nursing staff will not have enough time to measure urinary output hourly. When introducing a new measuring device clinically it is of vital

importance to prove that it works and measures correctly, which we have done in this thesis.

The second part of the thesis, which evaluated the effect of silicone oil on biofilm formation, is important as silicone oil enables the automatic urinometer to function adequately for a much longer duration also in patients with ongoing urinary tract infection, albuminuria or free hemoglobinuria. In particular, albuminuria and free hemoglobinuria are commonly found in postoperative cardiothoracic patients. Further studies are needed to evaluate if clinical use of the automatic urinometer may decrease the incidence of ascending urinary tract infections in patients that need to have indwelling urinary catheters .

Finally, one may speculate if detection of albuminuria or free hemoglobinuria by the urinometer may be used clinically as a very early sign of kidney injury alternatively to trigger the start of measures to prevent acute kidney injury.

What are your future ambitions?

I will continue to focus on my clinical work as a cardiothoracic anesthetist but I would also like, in parallel, to conduct clinical research for the benefit of our patients.

More information: Slettengren M, Linnros M, van der Linden J. Silicone oil decreases biofilm formation in a capacitance-based automatic urine measurement system. [Manuscript]
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