

# Patterns in Saline Flush Intervals Observed in Hemodialysis (HD): The Scheduling of Saline Flushes and its Correlation with HD Treatment Variables.

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## INTRODUCTION

Intradialytic clotting, specifically extracorporeal circuit clotting (ECC), is a well-established complication of hemodialysis (HD).<sup>1</sup> ECC experienced by patients receiving home hemodialysis (HHD) increases the need for anticoagulants, increases time on dialysis, and decreases overall efficacy of treatment.<sup>2</sup> Intermittent Predilution Convective Hemodialysis (IPCH), via a scheduled saline flush, addresses the risk of ECC by reducing dependence on anticoagulants and decreasing treatment interruptions. Machine intelligence continues to evolve and affords physicians, nurses, and patients an opportunity to assess and manage HHD performance.

## OBJECTIVE

1. Identify factors associated with high-pressure alarms in acute/non-home hemodialysis (HD).
2. Generate Odds Ratio (OR) and significance of machine and patient parameters associated with identified high-pressure alarms.

## METHODS

An analysis of HHD treatments delivered by the Tablo<sup>®</sup> Hemodialysis System was performed to quantify the use of IPCH in patients receiving HHD and identify associations of occurrence of high-pressure alarms with key treatment parameters. A multivariate analysis with high-pressure alarm occurrence as the dependent variable and key treatment parameters as covariates was done.

## RESULTS

**Table 1: Mean outcomes associated with treatment parameters of acute/sub-acute hemodialysis treatments.**

| parameter                              | mean      |
|--|-----------|
| Prescribed auto flush volume (ml)      | 56.421    |
| Prescribed manual flush volume (ml)    | 60.143    |
| Prescribed saline flush interval (sec) | 456.281   |
| Patient weight pre-treatment (kg)      | 89.254    |
| Cycle-time (min)                       | 180.343   |
| Blood flowrate Maximum (ml/min)        | 365.294   |
| Dialysate flowrate Maximum (ml/min)    | 299.556   |
| Ultrafiltration rate Maximum (ml/min)  | 1,128.288 |

**Table 2: Covariate associations via Odds Ratio (OR) with High-Pressure Alarming during acute/sub-acute hemodialysis treatments.**

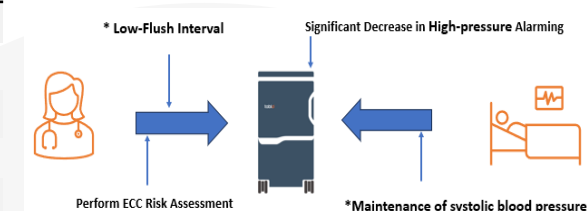
|  | OR       | Lower CI | Upper CI | p-value*   |
|--|----------|----------|----------|------------|
| Prescribed Auto Flush Volume             | 1.014128 | 1.010417 | 1.017853 | 6.3781e-14 |
| Prescribed Saline Flush Observed         | 0.998744 | 0.998539 | 0.998949 | 3.2698e-33 |
| Prescribed Auto Flush Observed           | 0.995378 | 0.994045 | 0.996713 | 1.2512e-11 |
| Cycle-Time (min)                         | 1.002027 | 1.001503 | 1.002552 | 3.2711e-14 |
| Prescribed Low Saline Flush Interval (s) | 0.088941 | 0.061303 | 0.129038 | 3.3437e-37 |
| Blood Flowrate Maximum (ml/min)          | 1.003051 | 1.002424 | 1.003678 | 1.3104e-21 |
| Tablo's Default Auto-Flush Parameters    | 0.411422 | 0.302280 | 0.559969 | 1.6341e-08 |

Positive associations with High Pressure Alarm:

Negative associations with High Pressure Alarm: Prescribed Low Saline Flush Interval, Tablo's Default Auto-Flush Parameters

A total of 44,957 treatments (424 patients) dialyzing on HHD were analyzed; mean age of 57.5±14.1, 67.2% reported as male, mean patient weight pre-dialysis 89.2±29.8 kg. The mean cycle time was 180.3±44.6 min, mean blood and dialysate flow rates of 365.3±40.9 and 299.6±10.8 ml/min, respectively. A strong negative association (OR: 0.41, CI: [0.30,0.56, p<0.001) was noted between the ability of Tablo to automatically administer a pre-treatment, scheduled saline flush and the detection of a measurable increase in pressure (venous, arterial). Similarly, the continuous monitoring of intradialytic pressure, and the prescribed saline delivery mechanism proves to be precise, with the observation of low saline flush intervals (administration of saline in short bursts) reporting a strong negative association (OR: 0.07, CI: [0.048, 0.099, p<0.001) with high-pressure alarming.

**Figure 1: Proposed methodology for decreasing incidence of high-pressure (venous/arterial) machine alarming in HHD.**



1. Davenport A. What are the anticoagulation options for intermittent haemodialysis? Nat Rev Nephrol. 2011;7(9):499-508.
2. Davenport A, Kovalik E. Anticoagulation for the hemodialysis procedure. UpToDate. Retrieved November 15, 2023 from <https://medlib.ir/upToDate/show/1840>.
3. Fulop T., Cosmin A., Juncos L. Recurring Extracorporeal Circuit Clotting During Continuous Renal Replacement Therapy Resolved after Single-Session Therapeutic Plasma Exchange. J Clin Apher. 2011; 26(4): 214-215.

## CONCLUSION

The complications of ECC can be managed by the prescription of low flush intervals within the patient's treatment. The prescribed saline flush allows for the management of pressure increases and can set a new standard of patient centered care in HHD decreasing the need for traditional anticoagulants.