

Improving Adequacy, Heparin Anticoagulation and Dialyzer Efficiency with New Bloodline Technology

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Introduction

- For all Hemodialysis (HD) tubing sets, increased pump speed results in increased circuit pressures
- Due to this rise in circuit pressures, HD tubing sets are limited in performance (delivering blood to be processed by the dialyzer)
- Conventional HD tubing also involves blood-air contact, typically in the arterial and venous chambers
- We evaluated Medisystems' Streamline HD tubing sets, designed to lower circuit pressures, and eliminate blood-air contact by using new technology components (Figure 1)

Figure 1: New Technology in Streamline, designed to eliminate blood-air contact



Pressure Oscillating Diaphragms (PODs) allow arterial and venous pressure measurement without blood-air contact

Venous "vortex" chamber allows air bubble detection; is run without an air gap; "vortex" flow of blood designed to minimize clotting

Materials & Methods

- 67 patients were measured on lab draw days in 2 periods:
 - "Pre-SL" period using Fresenius Combiset® bloodlines
 - "Post-SL" period using Streamline after a 2 month transition
- Prescription adjustments were made to blood flow and dialyzers
- Heparin dose was reduced based on rinseback quality:
 - Where possible, total heparin (bolus + hourly) was reduced by 30%, and administered as bolus only

Data Collection

- For each month, data was collected from lab results and from standard machine treatment data:
 - Single pool Kt/V
 - Delivered treatment blood flow
 - Average arterial pressure
 - Dialysate flow
 - Dialyzer type
- Needle gauge size, access type and treatment times were not modified
- Heparin data was collected based on total monthly facility purchases, and divided by # of treatments performed

Results

| | Pre-SL | Post-SL | Improvement | N | P-Value |
|--|--------|---------|-------------|----|---------|
| Average Blood Flow (Qb, mL/min) | 431 | 453 | 5% | 30 | 0.003 |
| % patients with Increase in Qb | - | 43% | - | 30 | - |
| Average Arterial Pressure (AP, - mmHg) | 209 | 176 | 16% | 30 | <0.001 |
| % patients with Improved AP | - | 70% | - | 30 | - |
| Average spKt/V | 1.50 | 1.59 | 6% | 67 | 0.024 |
| % patients spKt/V>1.2 | 88% | 93% | 5% | 67 | - |
| % patients spKt/V>1.4 | 66% | 76% | 10% | 67 | - |
| % patients spKt/V>1.6 | 37% | 51% | 14% | 67 | - |

Implication of Results

| | Pre-SL | Post-SL | Improvement | N |
|---|---------|---------|--------------|----|
| Cost per treatment: Dialyzers | \$12.64 | \$10.12 | \$2.52 (20%) | 67 |
| % patients on small dialyzers | 0% | 27% | 27% | 67 |
| % patients on medium dialyzers | 18% | 60% | 42% | 67 |
| % patients on large dialyzers | 82% | 13% | -69% | 67 |
| Heparin cost per treatment* See Figure 3 | \$1.64 | \$0.70 | \$0.96 (57%) | 67 |

* 3-month rolling average cost based on total heparin supplies purchased. Pre-SL = Mar to Apr 2009; Post-SL = Jan to Mar 2010

Conclusion

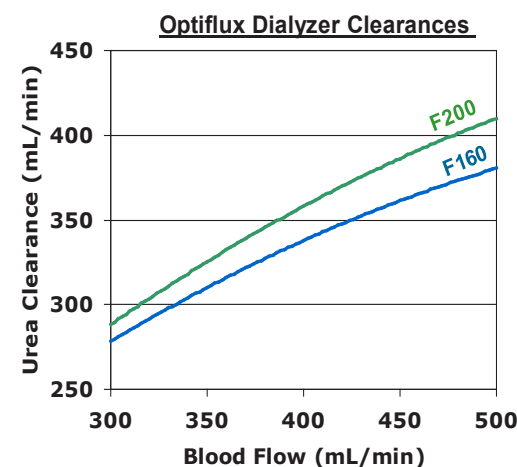
- With Streamline, we were able to significantly increase blood flows while lowering circuit pressures
- With the increased blood flows, we were able to increase Kt/V while making more efficient use of dialyzers
- By lowering our heparin usage, we were able to lower overall heparin costs despite rising heparin prices during the period

Objective

In evaluation of Streamline (SL) blood tubing sets, we hypothesized that:

- With reduced turbulence and circuit pressures, we would be able to raise pump speeds (blood flow)
- The increase in blood flow and liters of blood processed would enable us to make more efficient use of dialyzers while maintaining Kt/V (Figure 2)
- The reduction in blood-air contact would allow us to lower our average heparin usage

Figure 2: Increased Blood Flow Leads to Dialyzer Efficiencies, While Maintaining Clearance



Source: Optiflux dialyzer specification/data sheets; standard kinetic modeling

Figure 3: Heparin Cost per Treatment

Measured as 3-month rolling average of total monthly purchases divided by # treatments performed:

