Optimizing Dialysis Adequacy
In Dialysis Patients with Central Venous Catheters

Even though central venous catheters (CVCs) are prone to thrombosis and infection, 80.9% of patients use a catheter at initiation of HD, and 21.1% of prevalent patients continue that use. (Note the 2019 KDOQI updated definition of CVC dysfunction: failure to maintain the prescribed extracorporeal blood flow required for adequate hemodialysis without lengthening the prescribed HD treatment.) Yet, catheter dysfunction remains a serious cause for concern for hemodialysis providers. Two potential pitfalls to achieving adequate catheter dose delivery include:

• A fibrin sheath can block the catheter’s lumen, thus impeding flow and causing a severe drop in dialysis dose delivery.
• The close proximity of the catheter’s arterial entry and venous return ports make recirculation and underdialysis likely.

Note: if any intervention occurs, such as the use of a thrombotic agent, the Delivered Flow and Recirculation measurements can be repeated to determine the effectiveness of the intervention.

Delivered Blood Flow and Recirculation to Optimize Catheter Dialysis Measurements

Compare Transonic Delivered Blood Flow reading with the hemodialysis machine’s pump setting. If the disparity is more than 10%, check for kinked tubing. A fibrin sheath might be restricting inflow and reducing dose delivery. The optimization of hemodialysis for catheter connection configuration with the Transonic Hemodialysis Monitor can be used to then check for recirculation. If the connection is then reversed, the Delivered Flow and Recirculation measurements should then be repeated to determine the best catheter configuration.

• The nurse can adjust the dialysis delivery parameters (time, pump setting etc.) to compensate for recirculation and deliver the prescribed dose of dialysis to the patient.
• Dialysis lines may be reversed. Reversing the lines might also correct high recirculation.

The nurse should report unusual delivered blood flow and recirculation readings to the Patient Care Team and/or nephrologist to ensure optimum short- and long-term management of the patient’s hemodialysis treatment.

Optimizing HD Adequacy in Catheters

Catheter Configuration with the Transonic HD Monitor

Step 1:

**MEASURE DELIVERED BLOOD FLOW RATE**

With the bloodlines configured as normally used (document configuration), measure flow. Transonic Delivered Blood Flow Rate (Qb) is within 0-10% of the hemodialysis machine’s set blood pump speed or delivery flow rate.*

**YES**

**TRANSONIC DELIVERED BLOOD FLOW RATE (QB) IS WITHIN 0-10% OF HEMODIALYSIS MACHINE’S SET, OR DELIVERY FLOW READING***

Current blood pump setting is maximizing the Delivered Blood Flow with the current catheter to bloodline configuration.

**PROCEED TO RECIRCULATION MEASUREMENT**

**NO**

**TRANSONIC DELIVERED BLOOD FLOW RATE (QB) IS >10% LOWER THAN THE HEMODIALYSIS MACHINE’S SET BLOOD PUMP SPEED OR DELIVERY FLOW READING***

Only proceed if both catheter lumens had blood return with treatment initiation.

Using aseptic technique, reverse the catheter configuration by reversing the bloodlines to the opposite lumens of the catheter used for the initial measurement. Document configuration.

Repeat the blood flow measurement.

**YES**

**TRANSONIC DELIVERED BLOOD FLOW RATE (QB) IS WITHIN 0-10% OF THE HEMODIALYSIS MACHINE’S SET OR DELIVERY FLOW READING***

Current blood pump setting is maximizing the Delivered Blood Flow with the current catheter to bloodline configuration.

**PROCEED TO RECIRCULATION MEASUREMENT**

**NO**

**TRANSONIC DELIVERED BLOOD FLOW RATE (QB) IS 10% LOWER THAN THE HEMODIALYSIS MACHINE’S SET BLOOD PUMP SPEED**

Carefully document measurement and catheter configurations.

Proceed to recirculation measurements with both catheter configurations.

Escalate the results of the findings to the nephrologist for possible catheter evaluation or prescription adjustment to address catheter dysfunction.

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*Catheter Configurations:

- Normal Configuration: Arterial Catheter Hub to Arterial Bloodline + Venous Catheter Hub to Venous Bloodline
- Reverse Configuration: Arterial Catheter Hub to Venous Bloodline + Venous Catheter Hub to Arterial Catheter Hub

Optimizing HD Adequacy in Catheters

Catheter Configuration with the Transonic HD Monitor

Step 2:

**CHECK RECIRCULATION**
With the bloodlines configured from Step One with maximized Delivered Blood Flow Rate,

**MEASURE RECIRCULATION**
Recirculation is within 0 - 10%

- **NO**
  - **RECIRCULATION IS GREATER THAN 10%**
    - Only proceed if both catheter lumens had blood return with treatment initiation.
    - Using aseptic technique, reverse the catheter configuration by reversing bloodlines to the opposite lumens of the catheter used for the initial measurement.
  - **REPEAT RECIRCULATION MEASUREMENT**

- **YES**
  - **RECIRCULATION IS WITHIN 0-10%**
    - Current blood pump setting is maximizing Delivered Blood Flow with the current catheter to bloodline configuration.

**RECIRCULATION IS GREATER THAN 10%**
Carefully document measurement and catheter configurations.
Escalate the results of the findings to the nephrologist for possible catheter evaluation or prescription adjustment to address catheter dysfunction.

Optimizing HD Adequacy in Catheters cont.

Catheter Configuration with the Transonic HD Monitor
For Use with Fresenius 5008 or other Hemodialysis machines that have Compensated Blood Flow Rate Capabilities

Step 1:

**MEASURE DELIVERED BLOOD FLOW RATE**

With the bloodlines configured as normally used (document configuration), measure flow. Transonic Delivered Blood Flow Rate (Qb) is higher than the Fresenius 5008 set blood pump speed or within 0-10% lower than the set blood pump speed.

**NOTE:** Both higher and lower differences are displayed in **RED** on the Transonic screen.

**YES**

**TRANSONIC DELIVERED BLOOD FLOW RATE (Qb) IS HIGHER THAN THE FRESENIUS 5008 SET BLOOD PUMP SPEED OR IS WITHIN 0-10% LOWER THAN THE SET BLOOD PUMP SPEED.**

Current blood pump setting is maximizing the Delivered Blood Flow with the current catheter to bloodline configuration.

**PROCEED TO RECIRCULATION MEASUREMENT**

**NO**

**TRANSONIC DELIVERED BLOOD FLOW RATE (Qb) IS >10% LOWER THAN THE FRESENIUS 5008 SET BLOOD PUMP SPEED.**

Only proceed if both catheter lumens had blood return with treatment initiation.

Using aseptic technique, reverse the catheter configuration by reversing bloodlines to the opposite lumens of the catheter used for the initial measurement. Document configuration.

Repeat the blood flow measurement.

**YES**

**TRANSONIC DELIVERED BLOOD FLOW RATE (Qb) IS >10% LOWER THAN THE FRESENIUS 5008 SET BLOOD PUMP SPEED**

Current blood pump setting is maximizing the Delivered Blood Flow with the current catheter to bloodline configuration.

**PROCEED TO RECIRCULATION MEASUREMENT**

**NO**

**TRANSONIC DELIVERED BLOOD FLOW RATE (Qb) IS 10% LOWER THAN THE FRESENIUS 5008 SET BLOOD PUMP SPEED**

Carefully document measurement and catheter configurations.

Proceed to recirculation measurements with both catheter configurations.

Escalate the results of the findings to the nephrologist for possible catheter evaluation or prescription adjustment to address catheter dysfunction.

This protocol only applies when using Fresenius 5008 Hemodialysis Machines.

**Catheter Configurations:**

- Normal Configuration: Arterial Catheter Hub to Arterial Bloodline + Venous Catheter Hub to Venous Bloodline
- Reverse Configuration: Arterial Catheter Hub to Venous Bloodline + Venous Catheter Hub to Arterial Catheter Hub
Optimizing HD Adequacy in Catheters cont.

Catheter Configuration with the Transonic HD Monitor

For Use with Fresenius 5008 or other Hemodialysis machines that have Compensated Blood Flow Rate Capabilities cont.

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Reference: Hemodialysis Catheter Optimization (HD-152-tn) Rev A 2017
Catheter References


Transonic Systems Inc. is a global manufacturer of innovative biomedical flow measurement equipment. Founded in 1983, Transonic sells state-of-the-art, transit-time ultrasound devices for surgical, hemodialysis, perfusion, ECMO, and medical device testing applications, and for incorporation into leading edge medical devices.