Recirculation

- Hemodialysis access recirculation occurs when dialyzed blood returning through the venous needle exits through the arterial needle and back into the machine again instead of going through the patient's circulation.
- This already dialyzed blood enters into the machine circuit and mixes with undialyzed blood.
- This reduces the efficiency of dialysis by decreasing the concentration of solutes across the dialysis membrane.

Causes

1. If there is low access blood flow (less than the set blood pump flow)then the blood gets stolen from the venous side into the arterial side to keep up with the pump.

- Low access blood flow is caused by venous **stenosis,** intra-access **stenosis** or arterial inflow **stenosis**

When Do You Suspect Recirculation?

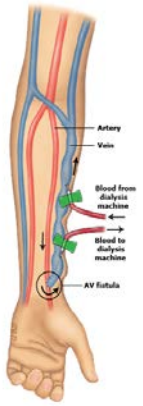
- If the KT/V is below target despite maximal prescription
- If other electrolyte parameters are out of target despite adequate prescription and dietary modifications (sometimes the potassium is a clue)

Measuring Recirculation

- Using Recirculation Measurement is not a good way to try and routinely check for fistula stenosis.
- Recirculation is a LATE indicator of stenosis and measurement of access flow is much better.
- Recirculation values of 5-10% should prompt a fistulogram or duplex for flow assessment.

- Increased recirculation can occur with increased blood flow.
- Therefore, at times increasing the blood flow to improve the KT/V in the setting of recirculation may be the wrong thing to do.

Diagram showing AV fistula for hemodialysis



This drawing shows an AV fistula in a person's arm. An AV fistula is under the skin. A doctor makes an AV fistula by doing surgery to connect an artery directly to a vein. It is usually done in the lower arm but can be done in the upper arm. During hemodialysis, two needles are put into the access to remove and return blood to the body.

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- % Recirculation = (Peripheral – Arterial) divided by (Peripheral – Venous) x 100
- If there is NO RECIRCULATION then this is 0.

Measuring Technique

- **Three-needle urea-based technique –** The three-needle urea-based approach **used to be the common method** for measuring recirculation.
- **The 2006 K/DOQI guidelines state that the three-needle urea-based approach not be used to measure recirculation [4]. This method involved obtaining simultaneous measurement of BUN from the peripheral blood, predialyzer arterial line, and postdialyzer venous circuit**.
- **The three-needle method overestimates recirculation**. This is because the BUN obtained from a peripheral vein in the contralateral (ie, nonaccess) arm is often higher than the BUN in the blood entering the access, even in the absence of recirculation. BUN is higher in blood obtained from the nonaccess arm because of the following [7]:
- •Arteriovenous disequilibrium (also called cardiopulmonary recirculation)
- •Venovenous disequilibrium

- Arteriovenous recirculation occurs when dialyzed blood (thus with a low urea concentration) returns to the central veins and dilutes the blood returning from the systemic circulation, which has a high urea concentration. The net effect is that the urea concentration in central venous blood and, therefore, in blood leaving the left heart and entering the hemodialysis access, is lower than the urea concentration in peripheral venous blood.

- Venovenous disequilibrium results from decreased perfusion of the contralateral arm (and other tissue beds) during dialysis [7]. As a result, urea removal in that limb is diminished in comparison to well-perfused compartments. Thus, the urea concentration in the veins of the contralateral arm is higher than in central venous blood or blood entering the fistula. This difference increases with time [8].

- **In addition to inaccuracies in the measurement of BUN, this method requires that peripheral blood be drawn from a separate needle stick**