Hemodiafiltration: the effect of pre-dilution and post-dilution

### Post-dilution

In post-dilution the filtration fraction is the rate-limiting factor.

Filtration fraction is the relationship of the ultrafiltration rate to the plasma water flow rate.

Filtration Fraction (FF):

\[
FF = \frac{\text{Ultrafiltration rate}}{\text{Blood flow} \times (1 - \text{hematocrit})}
\]

**High filtration fraction (over 0.3) causes filter malfunction**

Concentrated blood in the filter interacts with the membrane, coating it in shredded blood cell fragments and protein debris. You can fight this by increasing the blood flow rate, but very high blood flow rates are usually impossible in hemodynamically unstable ICU patients.

**Advantages of Post-Dilution:**
- High efficiency, low volume of replacement fluid is required

**Disadvantages of Post-Dilution:**
- Efficiency is limited by attainable blood flow rate
- The filter destroys your blood cells and gets clogged

### Pre-dilution

In order to achieve high rate of solute clearance, one needs to achieve high rates of ultrafiltration, with high filtration fraction.

This causes problems. If you concentrate the blood in the filter, the blood cells and proteins begin to interact with the filter. The filter membrane gets encrusted with proteins and ends up clotting.

In order to avoid this, pre-dilution replacement fluid is added to the blood, diluting the hematocrit.

This solves problems. The filter-clogging effects of hemoconcentration are relieved. However, the efficiency of the solute removal is also decreased (the concentration gradient is diminished).

**Advantages of Pre-Dilution**
- Efficiency is not dependent on your blood flow rate
- Diluting the blood pre-filter results in a concentration gradient which causes solutes to move out of red blood cells and into the plasma!

**Disadvantages of Pre-Dilution**
- Low efficiency means high replacement fluid volumes are required