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- **Chairman of Ethics Committee – Sri Manakula Vinayagar Medical College, Pondy**
- **Member of BoS - Adjunct faculty of Manipal University, SVIMS, SVIMS & Vinayaga University**
- **Member of National Task Force Curriculum Design – MOH & FW(India)**
- **Member of Quality Council of India**

Consultant:

- **Sr. Consultant - Advance Dialysis & Nutrition, & Medico-legal**
- **ZED Assessor Manufacturer**
- **NABH Ethics committee Assessor, NABH Assessor**
- **Certified LEAD AUDITOR ISO 9001:2008, ISO 18001:2007 & Medical Devices(13485)**
- **Certified Clinical Auditor, Financial cost auditor & Merger & Acquisition**

Reprocessing of Dialyzer

How to Avoid Clot and
membrane Damage in
Hemodialyzer?

Dr. Thiagarajan Thandavan, Ph.D.,

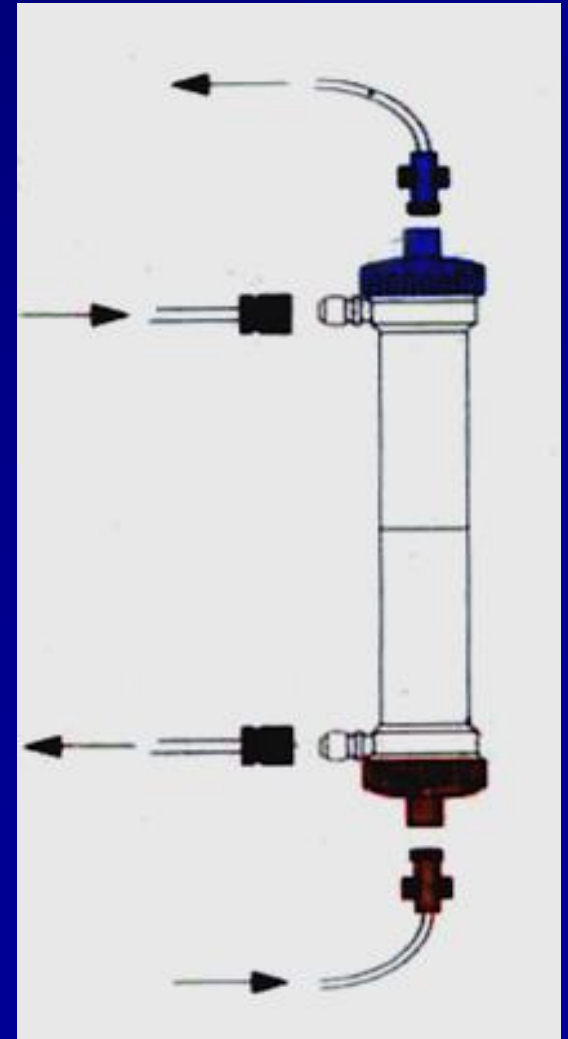
Dialyzer Priming

■ Purpose

- Removal of air / disinfectant
- Removal of manufacturing residues
- Wetting of membrane

■ Improper priming may result in:

- Patient reactions, eg. first use syndrome
- Dialyzer Clotting

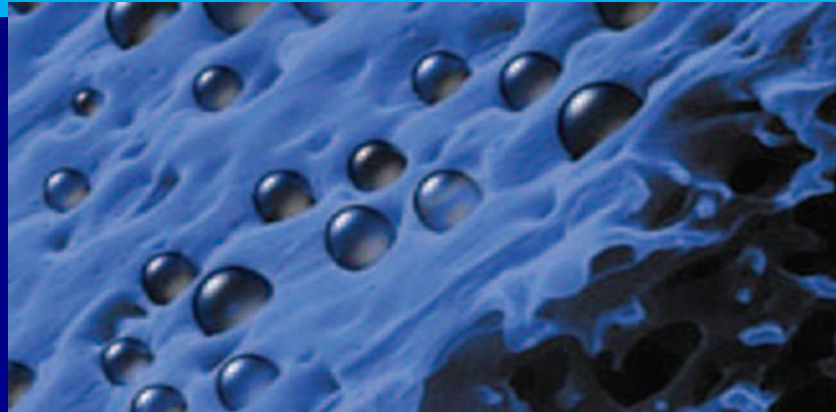


Air is Death to a Dialyzer

Air introduced into the dialyzer fibers and or not adequately rinsed out can air lock individual fibers, preventing blood flow through the fibers.

This leads to the fiber clotting and header clotting. Air can also fracture into micro bubbles that air lock pores in the membrane itself.

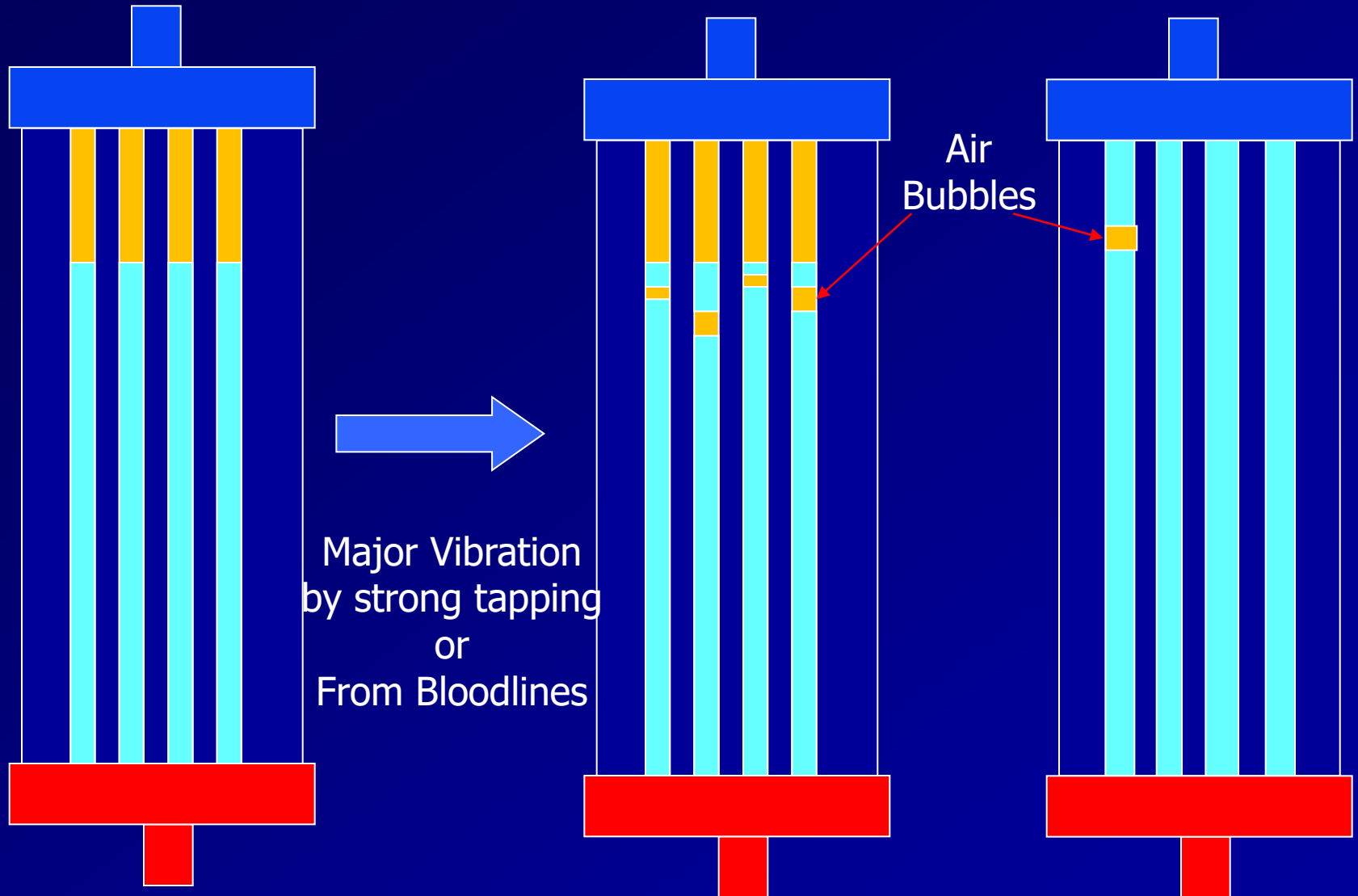
This trapped air will not allow toxins and other solutes to diffuse across the semipermeable membrane.



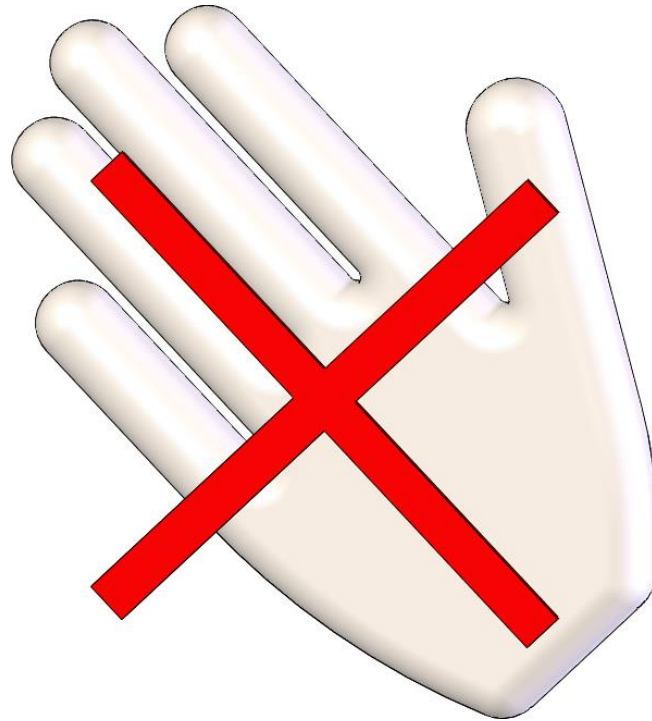
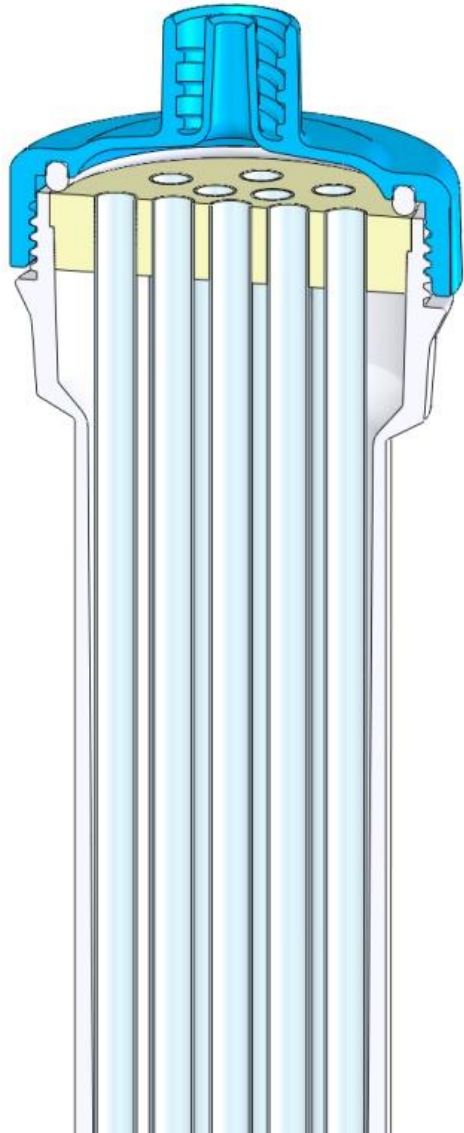
Priming

- Always prime the dialyzer & Blood lines with Blood flow rate of 100-150ml/min

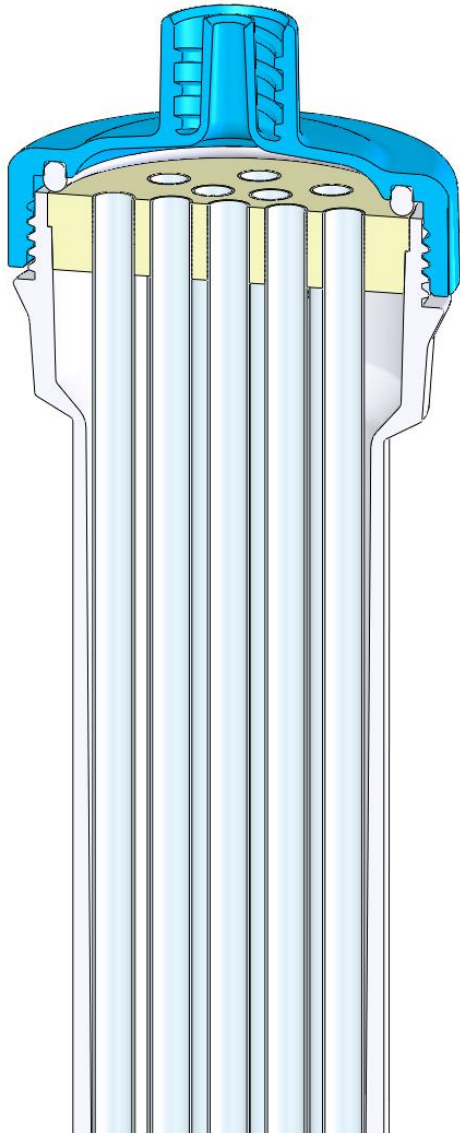
Air Block Phenomenon



Never touch while fibers being filled up...

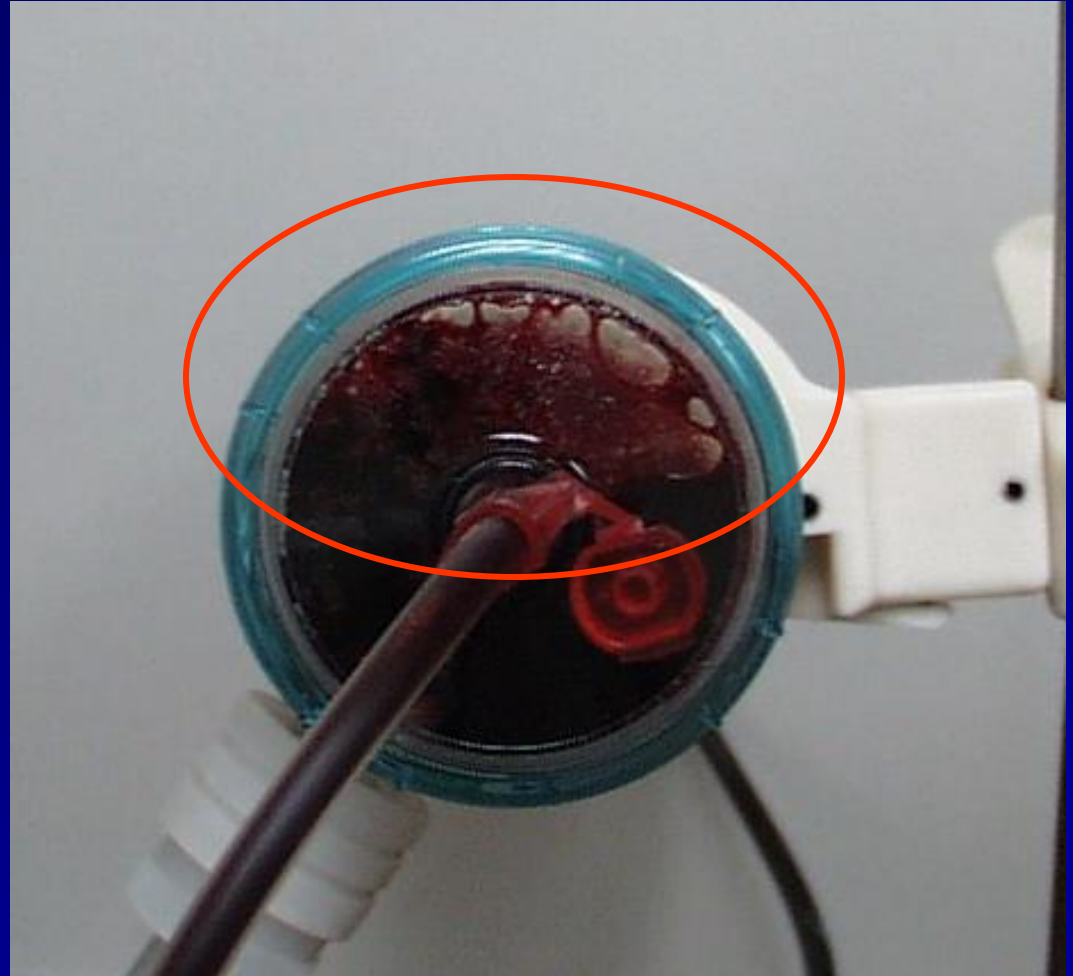


What if touched while filling



Air in the Dialyzer

Unless some action is taken to remove this air, it may remain in the dialyzer for the entire treatment.



Air in the Dialyzer

The air will block fibers and not allow any more blood to flow through causing those fibers to clot off.



Air in the Dialyzer

At the end of treatment the area where air was trapped will often contain clots.

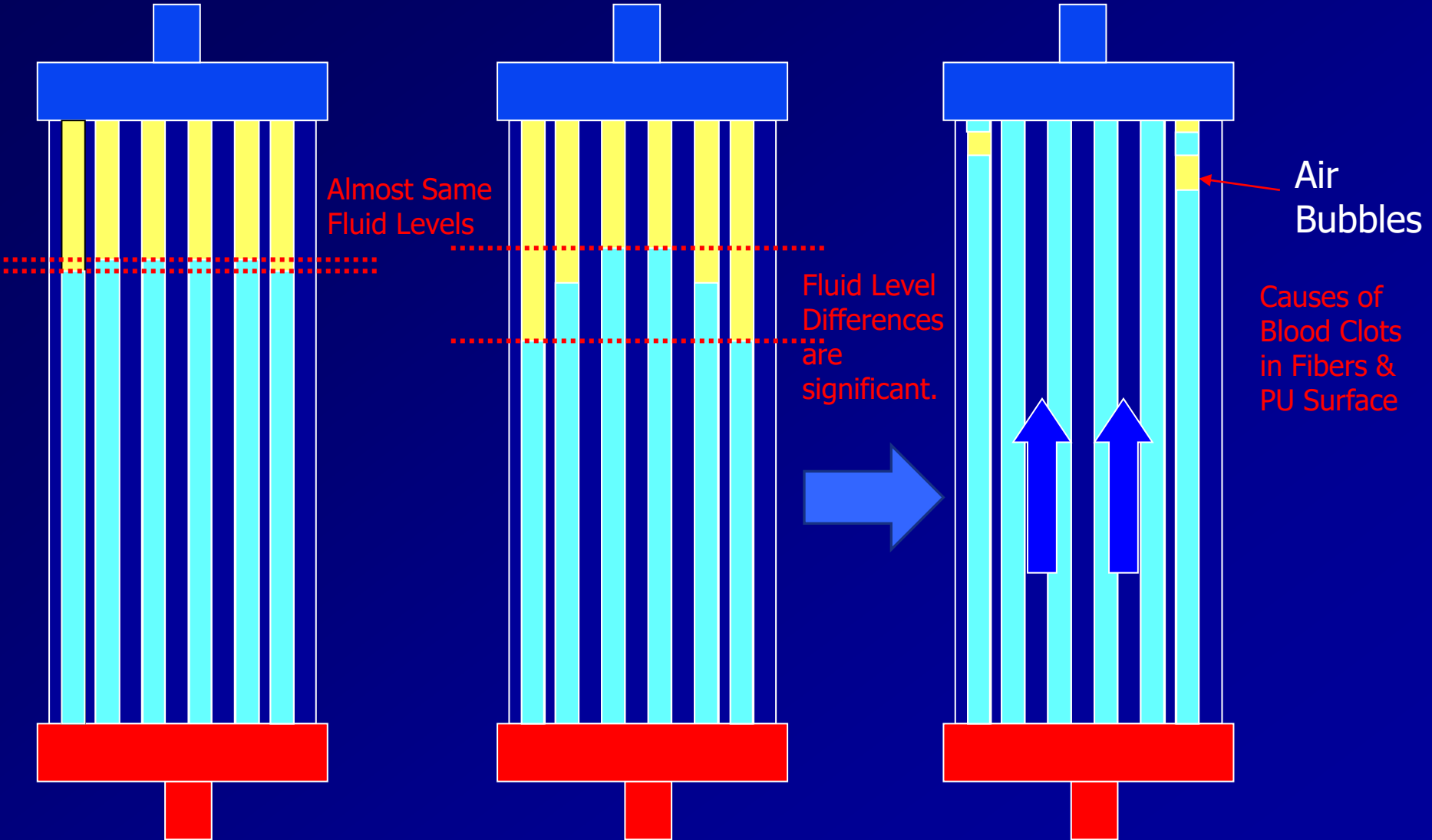


Priming Speed in Dialyzer

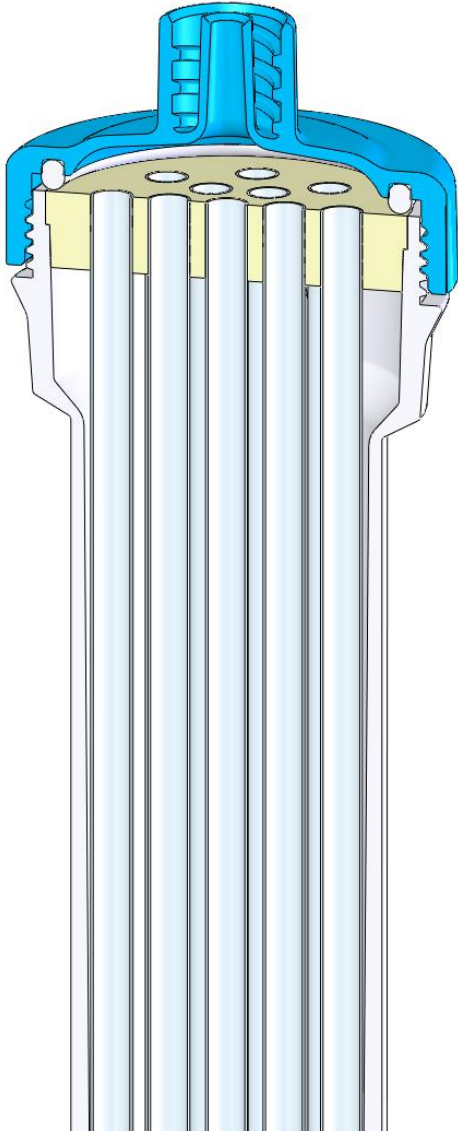
Slow Priming Speed
< 150 mL/min

Higher Priming Speed
> 350 mL/min

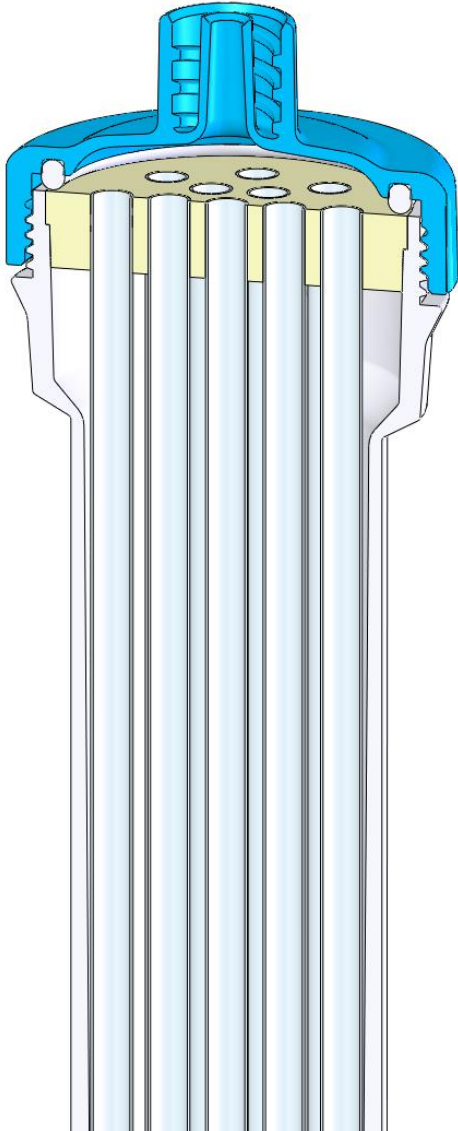
Air bubbles captured
in peripheral fibers



Slow Priming Speed < 150mL/min

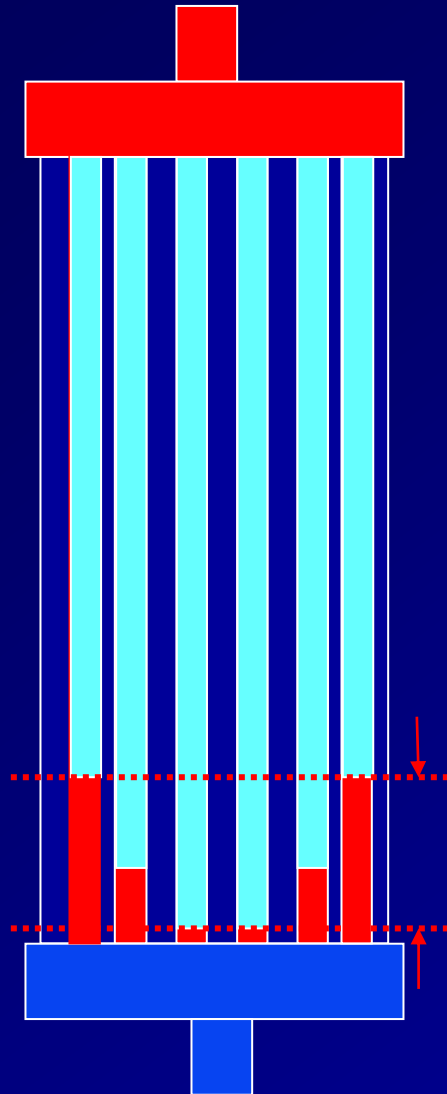


Higher Priming Speed > 200mL/min



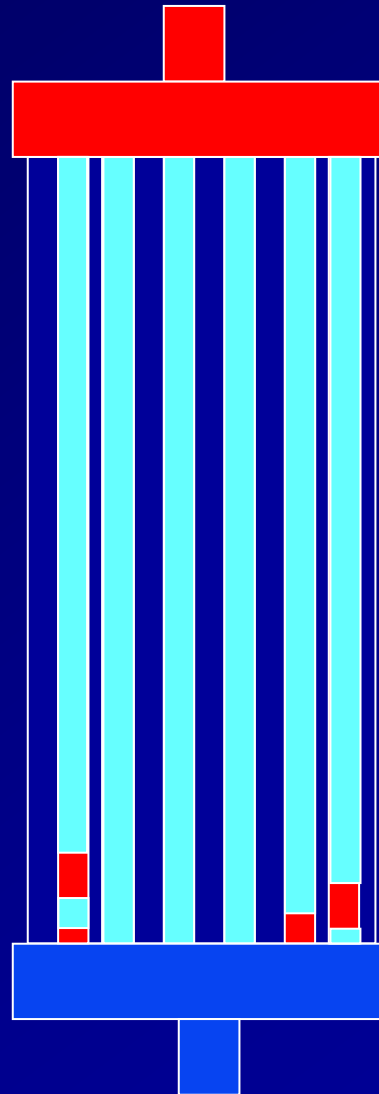
Rinse-back Speed in Dialyzer

Higher Rinse-back Speed
> 300 mL/min



Fluid Level Differences are significant.

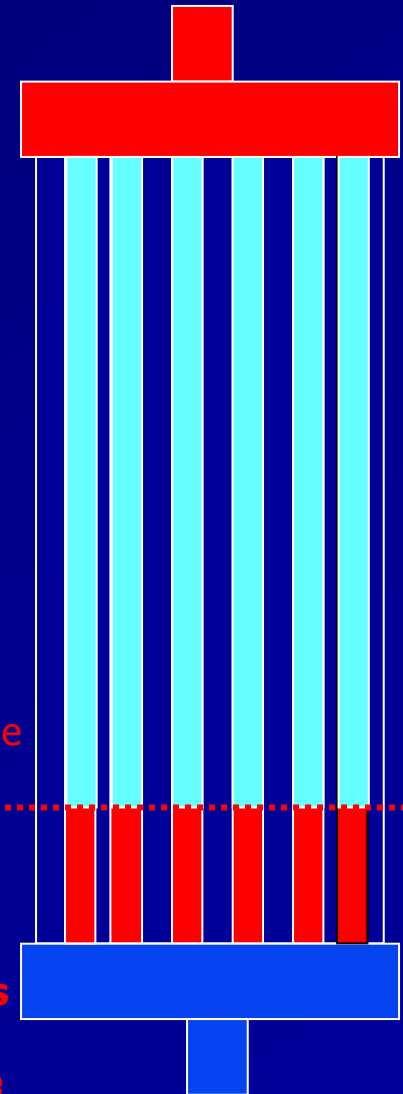
Residual blood in peripheral fibers



Almost Same Fluid Levels

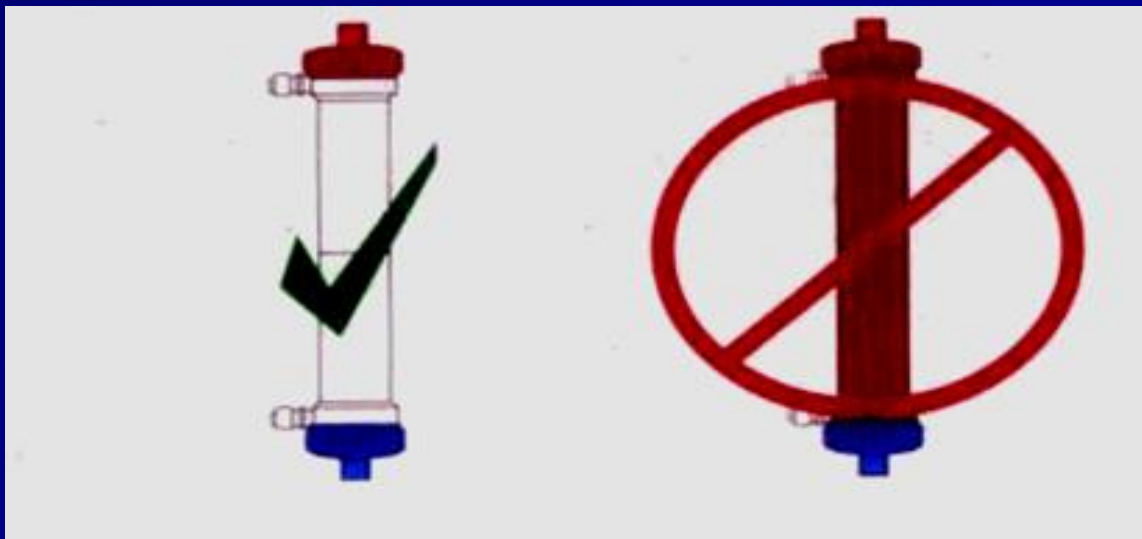
Causes of Blood Clots in Fibers & PU Surface

Slow Priming Speed
< 150 mL/min



Precautions: End of Treatment

- Minimize residual blood
- Re-circulate saline through dialyzer and tubing
- Remove and reprocess ASAP (as soon as possible)
- Longer delays result in fewer uses



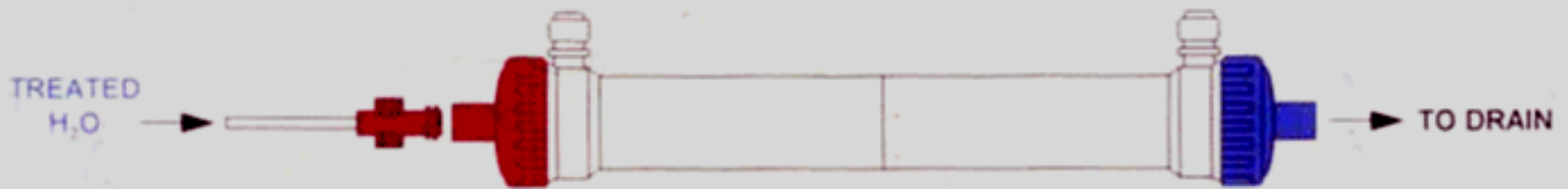
Steps in Dialyser Reprocessing

- Rinsing & reverse Ultrafiltration.
- Cleaning.
- Tests of dialyser performance; Pressure leak, Fibre bundle volume.
- Disinfection / sterilization.
- Documentation / Labelling.
- Storage.

Steps in Cleaning - 1

- Water rinse of blood compartment
 - Max. flow rate: 1 – 2 L/min
 - Max. Pressure: 15 – 20 psi
 - May be both $A \rightarrow V$ and $V \rightarrow A$
 - Rinse for 1 -3 min. till fluid is clear
- Water rinse of dialysate compartment
 - Max. flow rate: 1 – 2 L/min
 - Max. Pressure: 15 – 20 psi
 - Rinse for 0.5 – 1 min.

Water Rinse of Blood Compartment



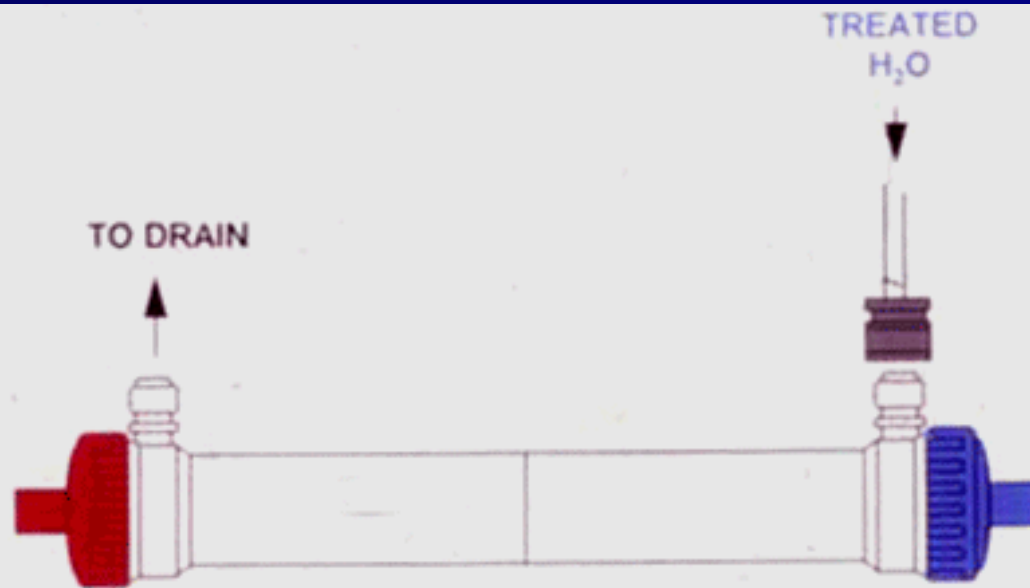
Max Pressure: 15 - 20 PSI

Max Flow Rate: 1 - 2 l/min

**Flush 1 to 3 minutes until flush is clear
(Optional: Repeat for Venous header)**

**Note: Flush from Arterial to Venous or Venous to Arterial can
affect cleaning and should be evaluated by specific clinics**

Dialysate Compartment Rinse



Flush to drain for 30 to 60 seconds

Note: Flow rates higher than 1 - 2 l/min may damage the fibers

Steps in Cleaning - 2

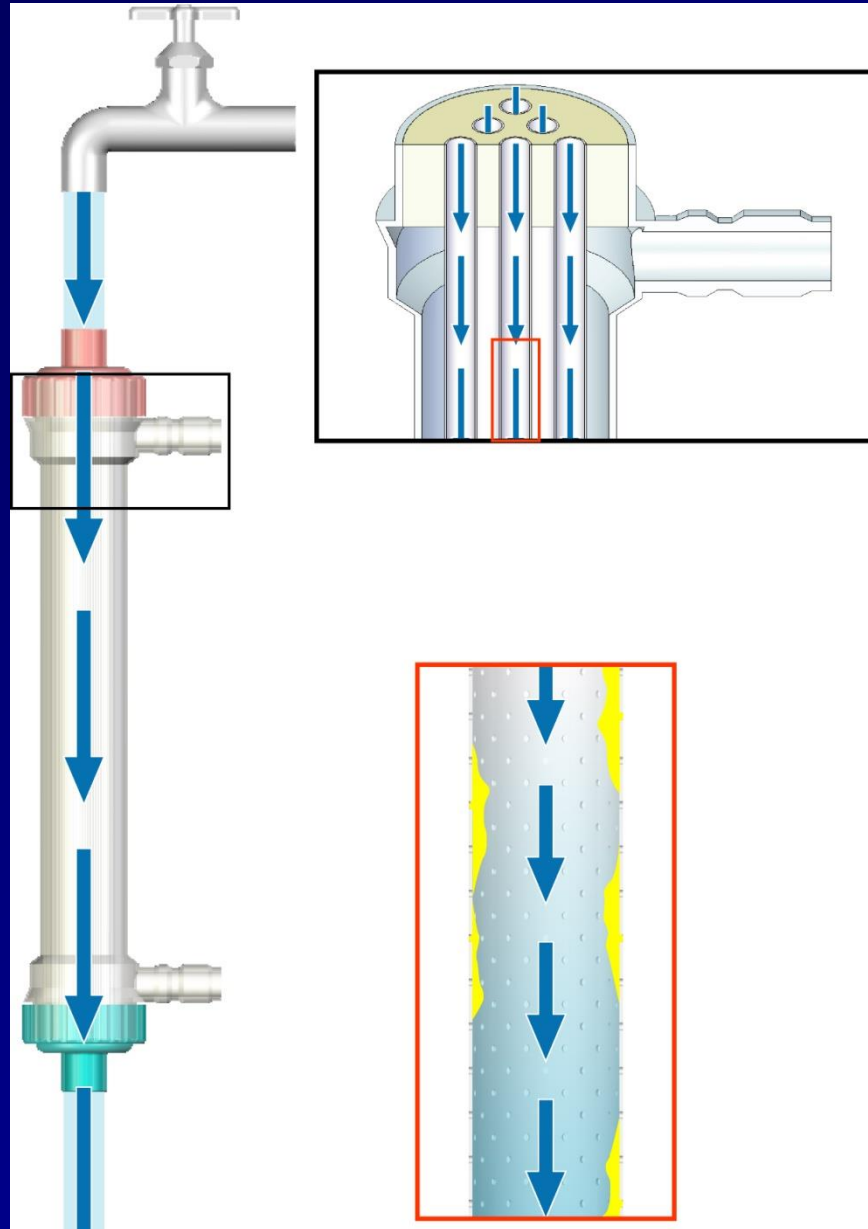
■ Reverse Ultrafiltration

- Max. Pressure: 15 – 20 psi
- Open both blood ports
- Clamp one dialysate port
- Connect other dialysate port to water source
- Reverse ultrafilter for 3 -5 min. till fibers are clean
- Reverse ultrafiltration may also be with cleaning Solution.

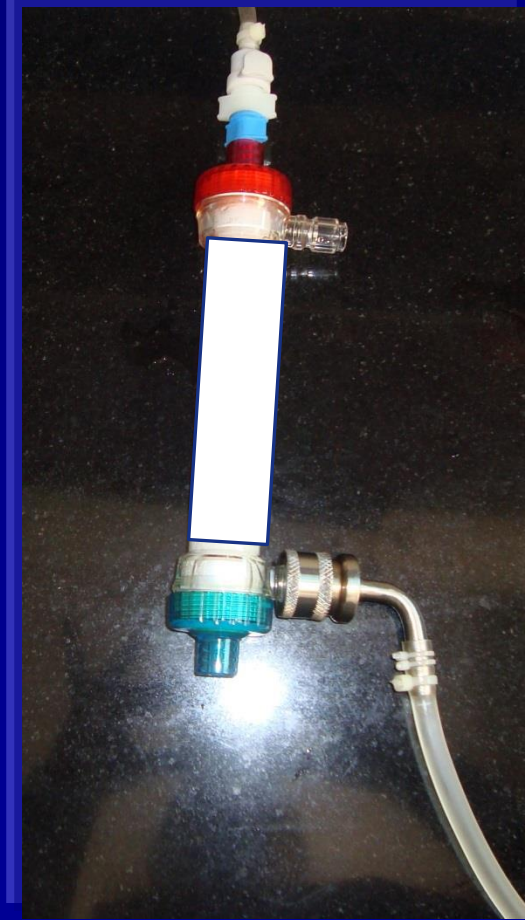
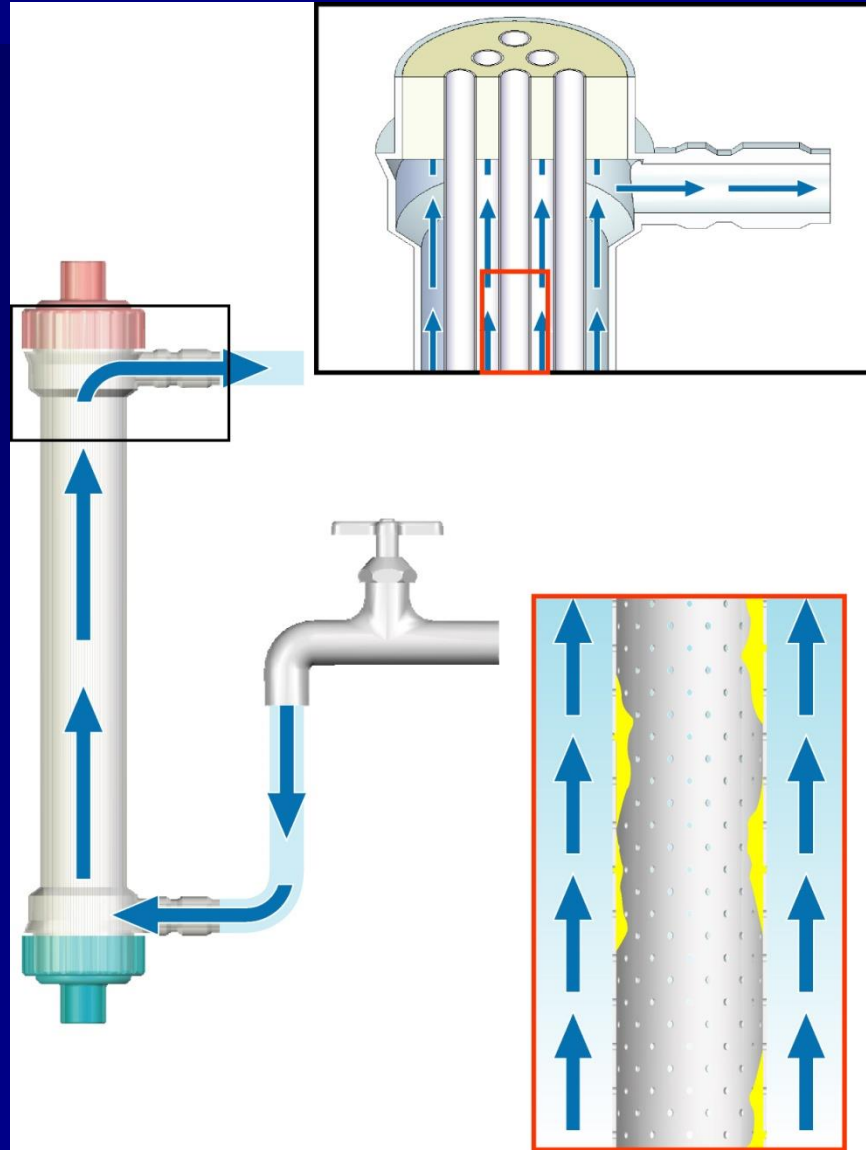
■ After reverse UF, fibers need to be re-inflated

- Rinse blood compartment with water for 1 – 3 min.

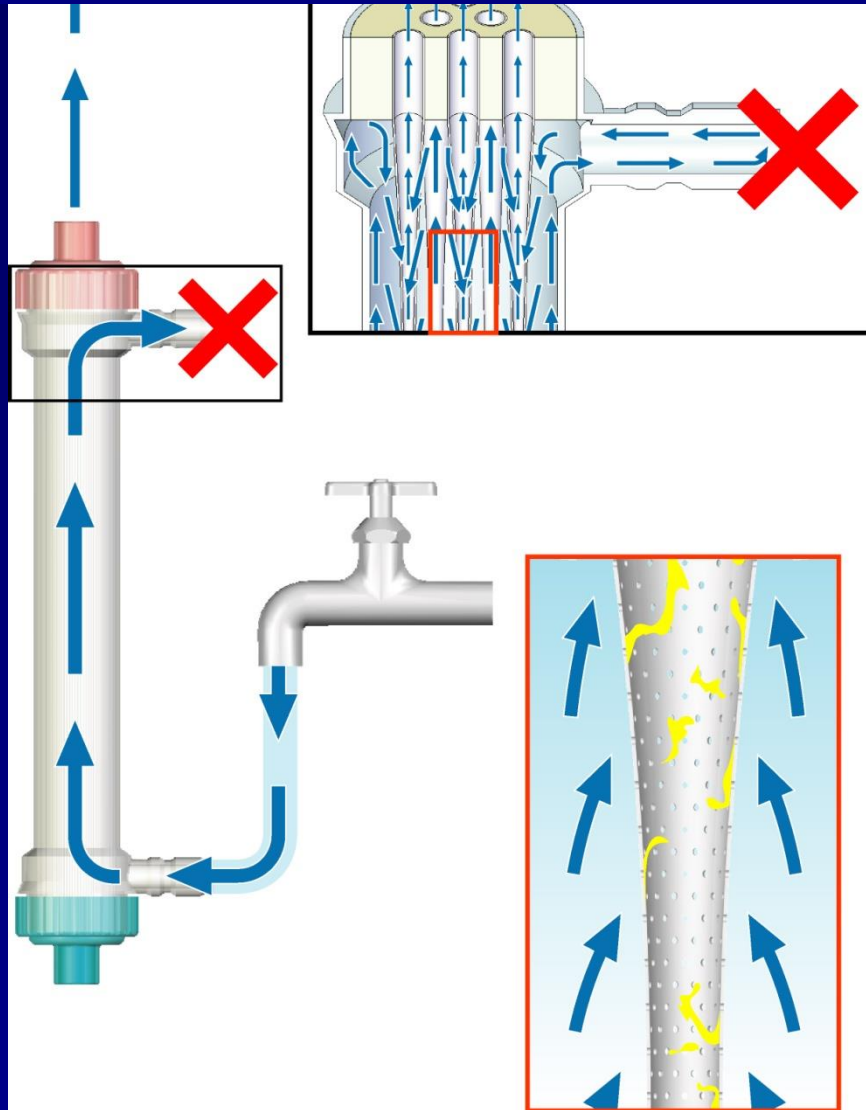
Blood Compartment Rinse



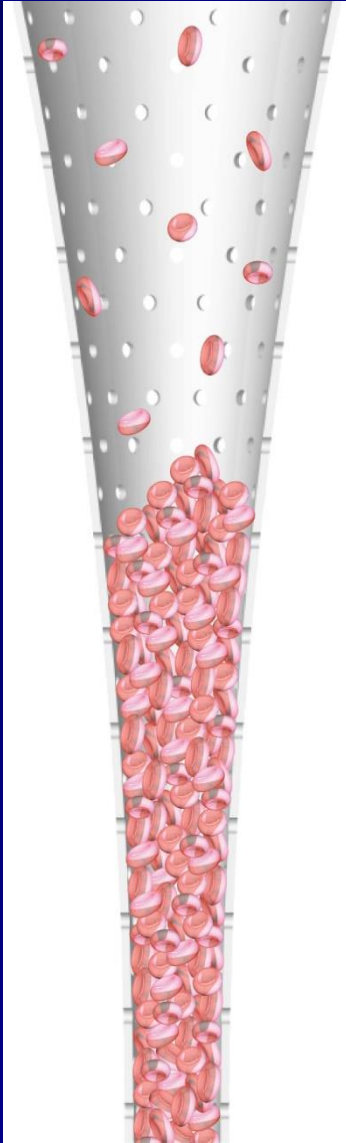
Dialysate Compartment Rinse



RUF (Reverse Ultrafiltration)

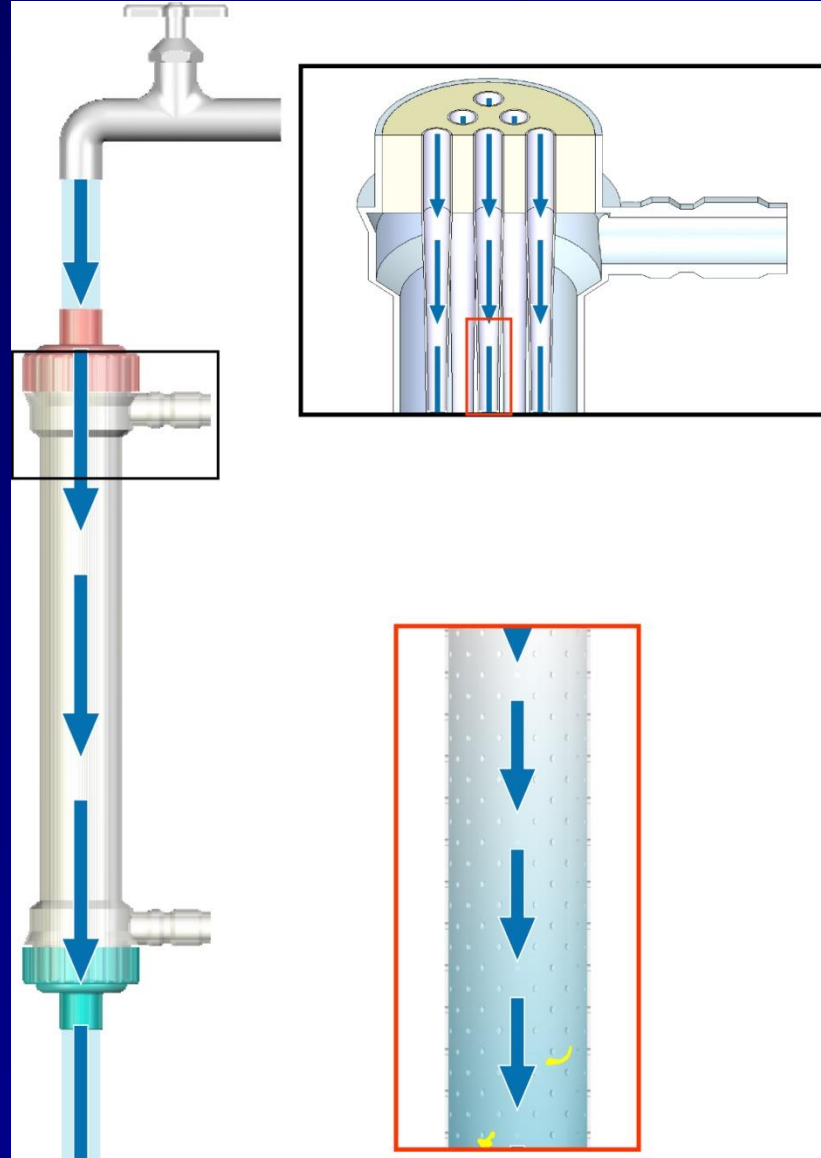


Collapsed Fibers



Collapsed fibers are generated by an excessive water pressure applied outside, then leading to blood clotting, as such.

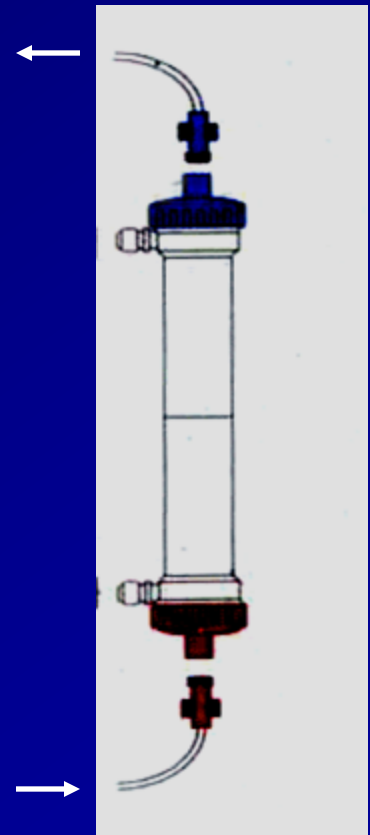
Fiber Reinflation Process (*i.e.* 2nd Blood Compartment Rinse)



Disinfectant fill: Blood Compartment

■ Blood Compartment

- Fill blood compartment with disinfectant
- Fill from bottom to top till all air is removed
- Cap both blood ports.
- Fill disinfectant in dialysate port, cap both the dialysate port caps.



■ Hydrogen Peroxide

- Used as cleaning agent.
- 3 % or less concentration.
- Does not remove protein deposits.
- Must be stored in air tight container.
- De ionized water should be used for dilution.
- Unstable.

■ Peracetic acid

- * It is used as cleaning agent & disinfectant.
- * 2 % or less concentration is used.
- * Retains protein on dialyser membrane.

| S.No. | Intended for use | Dilution Rate | Exposure Time |
|-------|------------------------|---------------|---------------|
| 1 | Dialyzer Cleaning | 2% | |
| 2 | Dialyzer Disinfection | 3.5% | 11 hours |
| 3 | Accessory Disinfection | 1% | |

Chemicals used in reprocessing

■ PAA (Renalin/Hemoclean)

- Mixture of Hydrogen peroxide, Peracetic acid & acetic acid.
- 500 ppm PAA with contact time 11 hrs.
- Strong bactericidal, sporicidal, fungicidal, Virucidal.
- Minimum concentration 1%.
- Minimum dwell time 11 hrs.
- Stable for 1 week after dilution.
- Avoid exposure to direct sunlight.
- Can be used as cleaning agent & sterilant.

| Dilution for 5 liters | Intended for use | Dilution Rate | Exposure Time |
|-----------------------|------------------|---------------|---------------|
| | Cleaning | 2% | 100ml |
| | Disinfection | 3.5% | 175ml |

■ Bleach (Sodium hypochlorite)

- Used as cleaning agent
- 1 % solution
- It disinfects
- Use of bleach in reprocessing of heat labile instruments is not recommended. It can damage the instrument's surface, pore size & KUD.
- It damages membranes
- Use of associate with heat labile instruments causes loss.

PLEASE STOP

Chemicals used in reprocessing

Formaldehyde

- The oldest agent used for disinfection.
- Formalin is a 2-4% formaldehyde sol.
- It does not have sporicidal properties.
- Minimum contact time 24 hours.
- Minimum concentration 2%.
- Low cost, stable sol., good level disinfectant.
- It's carcinogenic & causes irritation.
- Formation of Anti-N like antibodies may occur.
- Improper removal may lead to acute reaction.

PLEASE STOP

Factors affecting Reusability of dialyser.

- Inadequate Anticoagulation.
- Membrane Biocompatibility.
- Inadequate priming of dialyser.
- Low blood flow & large dialyser.
- Introduction of air in dialyser during conclusion.
- Delay in reprocessing.
- Improper use of cleaning solution.
- Excessive pressure during cleaning.
- Improper handling of dialyser.
- Patient related issues. e.g. Recent inf., Diabetics, SLE, hyperlipidemia, Thrombocytopenia, High Hct.

Strategies to Maximise Average Reuse

- Avoid delay in reprocessing.
- Achieve adequate Anticoagulation.
- Prime dialyser properly.
- Avoid air entry in dialyser during termination.
- Use adequate conc. of cleaning solution.
- Do not apply too much pressure during cleaning.
- Avoid frequent interruption during dialysis.
- Use biocompatible dialyser.
- Sheare rate factor?



THANK YOU

Thanks for your attention!!