Mechanical Haemolysis and Systemic Pressure

Thomas Ryzlewicz
Measurement of the Systemic Pressure

= Pressure at the Entry of the Dialyzer
why is the Systemic Pressure Measurement simply necessary?

• to detect a critical Elevation of the mechanical Resistance early in the entire Dialysis System (Dialyzer and Bloodline)

• Condensation of Labor and Experience had developed unfavourably in nursing
the Additional Mechanical Resistance in the Dialysis System

Resistance in and in front of the Dialyzer
Resistance of the Tubule
Resistance of the Vessel

Additional Resistance, comparable to ET Impedance
the Additional Mechanical Resistance in the Dialysis System

Resistance in and in front of the Dialyzer
Resistance of the Tubule
Resistance of the Vessel

here no Alarm Monitoring(!)
Alarm Monitoring by venous Pressure
and now the Resistance in the Dialyzer increases . . .

- Resistance in and in front of the Dialyzer
- Resistance of the Tubule
- Resistance of the Vessel

here no Alarm Monitoring(!)

Alarm Monitoring by venous Pressure
. . . and now the Resistance in the Dialyzer increases . . .

Resistance in and in front of the Dialyzer

Resistance of the Tubule

Resistance of the Vessel

HAEMOLYSIS

here no Alarm Monitoring(!)

Alarm Monitoring by venous Pressure
... und wenn jetzt der Widerstand im Dialysator steigt ...
... und wenn jetzt der Widerstand im Dialysator steigt ...
Online-HDF

Thomas Ryzlewicz
“Stanley Shaldon . . . a man with the unusual ability to be proven right in the long run in almost everything he says”

editorial NEPHRON 1981 27:1
Pressures in the Dialyzer

- Low-flux-HD
- High-flux-HD
- online-HDF
Pressures in the Dialyzer

Low-flux-HD

High-flux-HD

online-HDF
Hydraulics at Highflux-HD
online-Therapie ist Herstellung von Infusionslösung!

European Pharmacopoeia 2005 kennt online-Herstellung von Infusionslösung nicht (!)

klar ist die Keimfreiheit für Infusionslösungen

ISO-Norm 11663 2009 Qualität von Dialysierflüssigkeiten und verwandten Therapien (steril und pyrogen-frei (=>EU<0,03/ml)

SAL > 6 (sterility assurance level) entspr. $10^{-8}$ Keimred./ml 3 Filter (ultra) $10^{-11}$/ml
online-Therapy is Production of Infusion-Fluid!

According to I. Ledebo
ISO-Norm 11663-2009

Tap-Water ➔ Permat ➔ Standard HD-Fluid ➔ Ultra-pure Dialysis Fluid ➔ sterile u. pyrogen-free Infusion-Fluid

Softening + Reverse-Osmosis ➔ Konzentration ➔ Ultrafiltration ➔ Ultrafiltration

Bakteriolog. Quality
CFU/ml < 10⁻² < 10² < 10⁻¹ SAL > 6
EU/ml l < 0,25 < 0,50 < 0,03 < 0,03

Employment in the Dialysis
Basics for every Dialysis Fluid Lowflux synthetic Highflux-HD u. Low.-Vol.- HDF online-HDF/HF Infusion-Fluid
**online-Therapy is Production of Infusion-Fluid!**

According to I. Ledebo

ISO-Norm 11663-2009

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### Basics for every Dialysis Fluid

- Lowflux synthetic
- Highflux-HD u. Low.-Vol.-HDF

### Employment in the Dialysis

- online-HDF/HF Infusion-Fluid

### bakteriolog. Quality

- CFU/ml: < 10^2
- EU/ml: < 0,25
- SAL: > 6
online-Therapy is Production of Infusion-Fluid!

the Ultra-System:

one step
Ultrafiltration

CFU Reduktion $10^{-5}$
SAL 3

two step
Ultrafiltration

CFU Reduktion $10^{-8}$
SAL 6

three step
Ultrafiltration
(with U-2000-Ultrafilter)

CFU Reduktion $10^{-11}$
SAL 9
how does a HDF-Regime look like?

Qd = 500 cc/min. in total, 400 cc/min. of it diffusiv and 100 cc/min. konvektiv

Qb = 400 cc/min.

Infusate 6,0 Litres/h.
HDF: Prädilution or Postdilution?

- **Disadvantage**: Reduction of the Concentration Gradient
- **Disadvantage**: Lengthening of the distances of Diffusion by the packed RBC’s
- **Disadvantage**: high Sekundary Membrane by Protein
HDF: Prädilution or Postdilution?

Prä-Dilution

Post-Dilution

Reduction of the Concentration Gradient

Lengthening of the way of Diffusion Sekundary Membrane
großflächige normale HD

- Urea Concentration (mmol/l)
- Urea Reduction Ratio
- Total Removed Urea (g)
- kT/V
4:30 h  HDF Prädilution 27 Ltr.

**Urea Concentration (mmol/l)**

**Urea Reduction Ratio**

**Total Removed Urea (g)**

**kTAV**