Basic Principles of CRRT

For clinical professionals

WORKBOOK

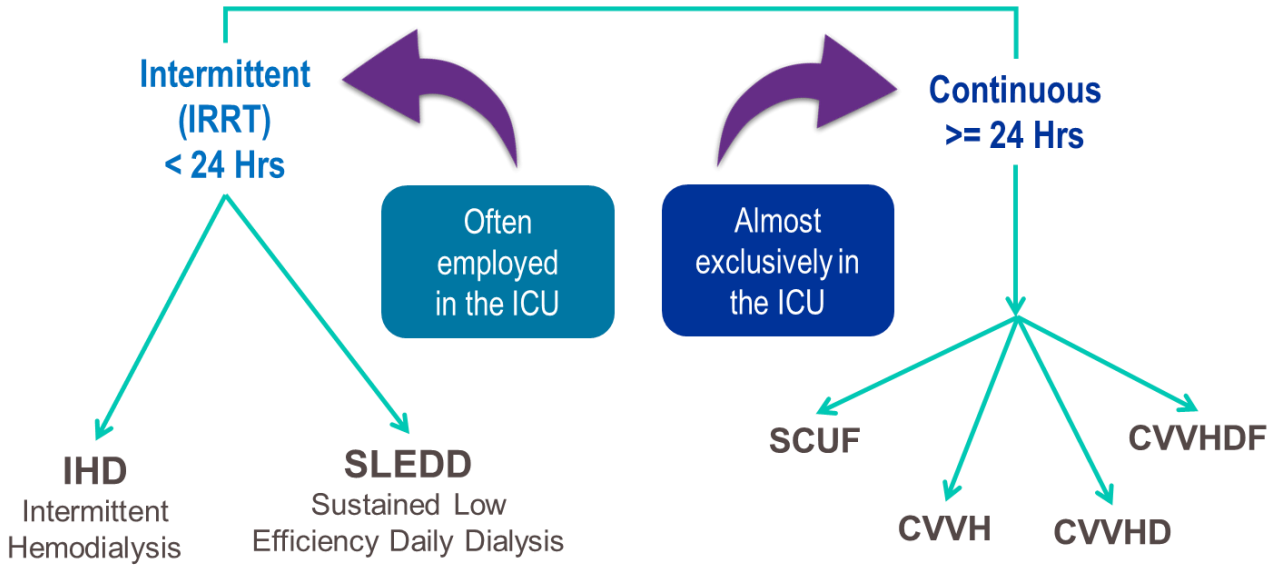
Baxter

USMP/MG230/18-0023a 07/18

CONTENTS

1 • What is RRT?

Renal Replacement Therapy (RRT) Modalities



NOTES

Prescription Comparison Summary

	IHD	SLEDD	CRRT
Dose	KT/V or URR	mL/kg/hr or KT/V or URR	mL/kg/hr
Duration	3-6 hours	6-12 hours	24 hours
Blood Flow (Qb)	150-450 mL/min	100-200 mL/min	150-200 mL/min*
Fluid Used	Dialysate only	Dialysate only	Dialysate and Replacement
Fluid Rates	300-600 mL/min	100-300 mL/min	15-60 mL/min**
Dialysate Composition	Non Sterile Dialysate	Non Sterile Dialysate	Sterile Dialysate and Replacement
Typical Net Fluid Removal Rate	Typical Net Fluid 0-1000 mL/hr	Typical Net Fluid 0-500 mL/hr	Typical Net Fluid 0-200 mL/hr

NOTES

* The blood flow rate must be adequate for the fluid removal rate.

** Based on patient body weight and dose.

2 • Fluid Movement

Body fluids exist in two major ‘compartments’.

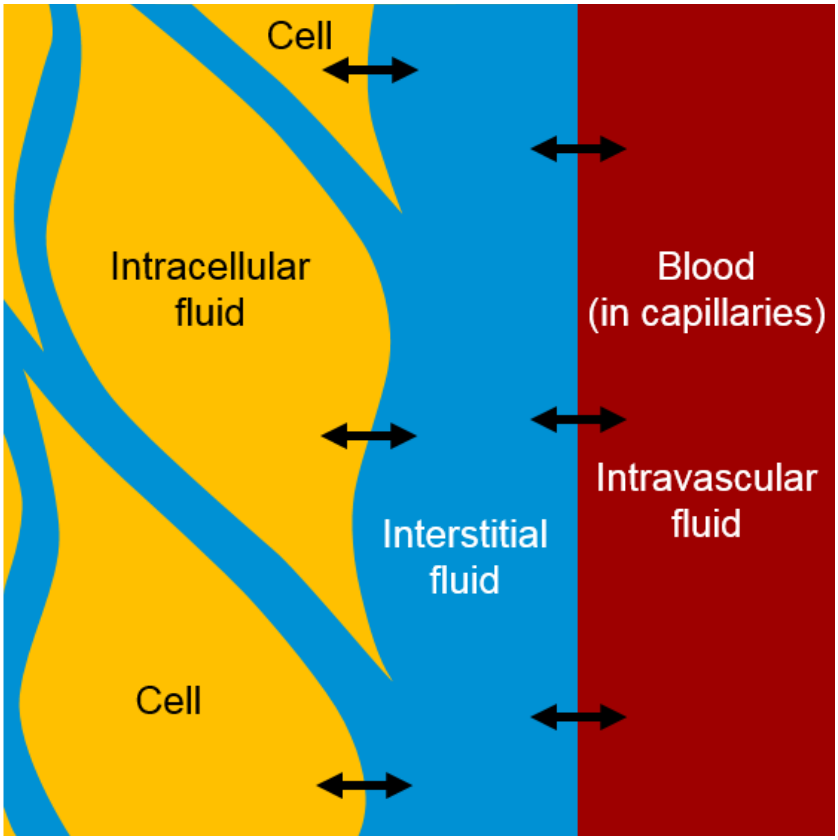
1. **Intracellular fluid** (ICF)

   = Inside the cells

2. **Extracellular fluid** (ECF)

   Outside the cells

   - interstitial fluid (ISF, surrounds all cells)
   - intravascular fluid (in plasma in the vascular system)

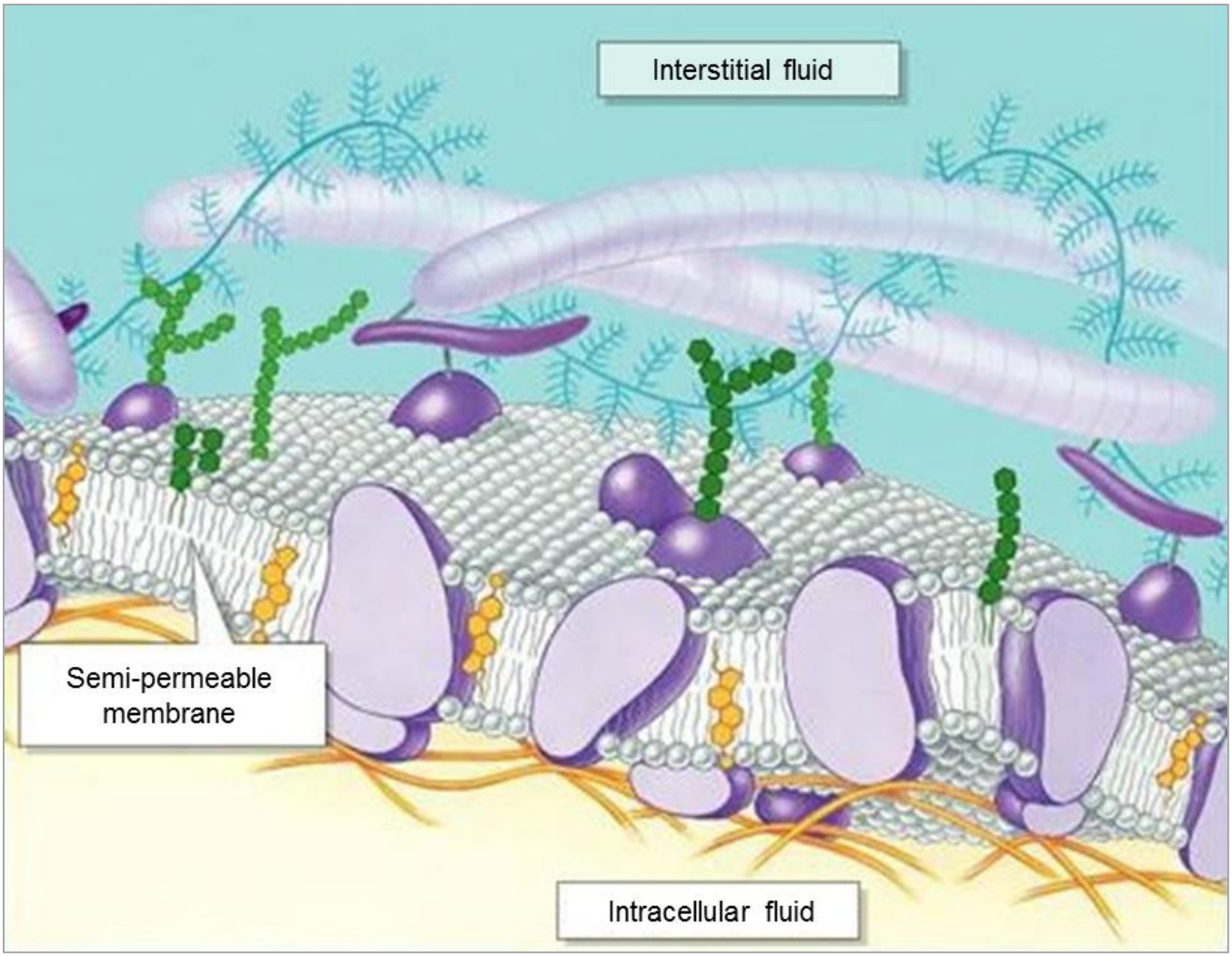


Reference

Guyton AC, Hall JE. Textbook of Medical Physiology. 11th ed. Philadelphia: Elsevier Saunders; 2005.

NOTES

Movement of Fluids and Solutes



Reference

Fluids & Electrolytes Made Incredibly Easy. 4th ed. Lippincott Williams & Wilkins; 2009.

Image adapted from Hill M. Membrane Components. University of New South Wales Cell Biology Lecture 3. 2010. Available online: http://php.med.unsw.edu.au/cellbiology/index.php?title=2010_Lecture_3 (accessed September 2012).

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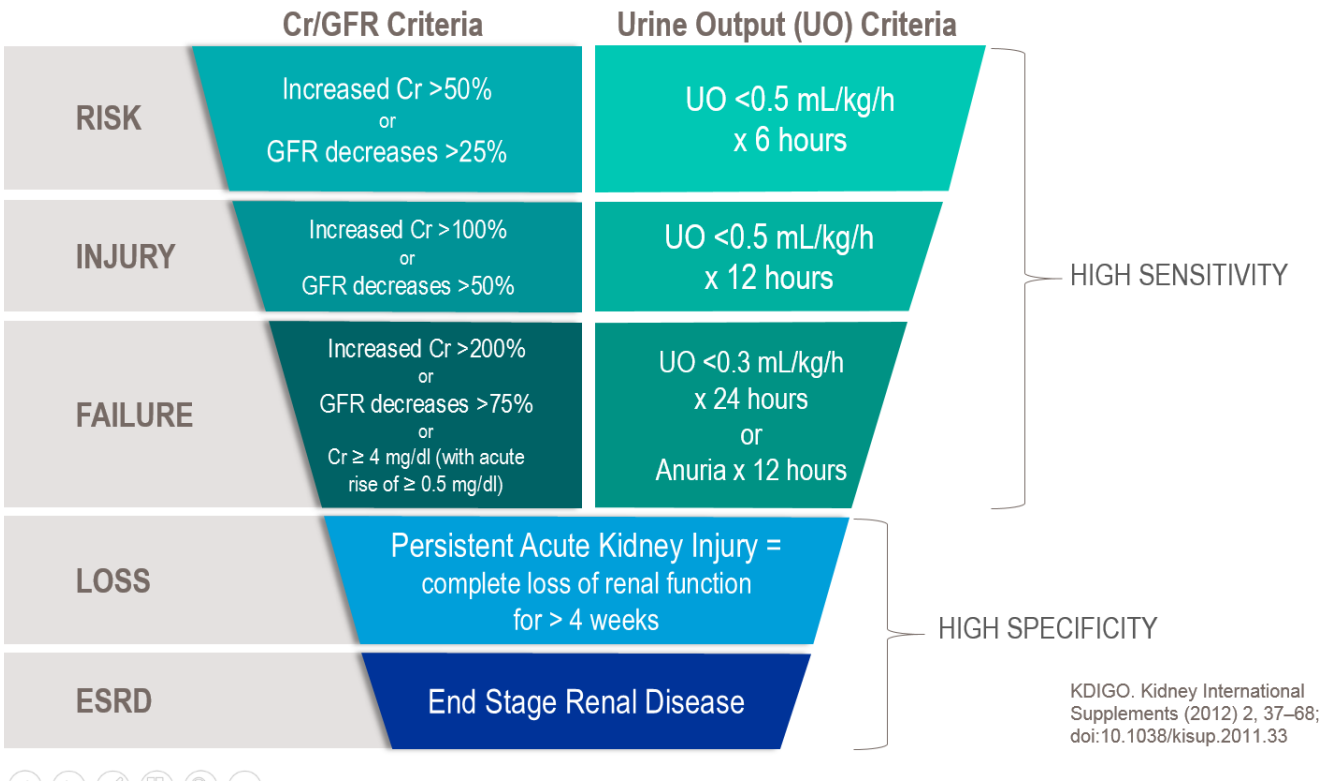
3 • CRRT Decision and Modality

Why CRRT?

? **Why choose CRRT instead of the intermittent form of renal replacement therapies?**

NOTES

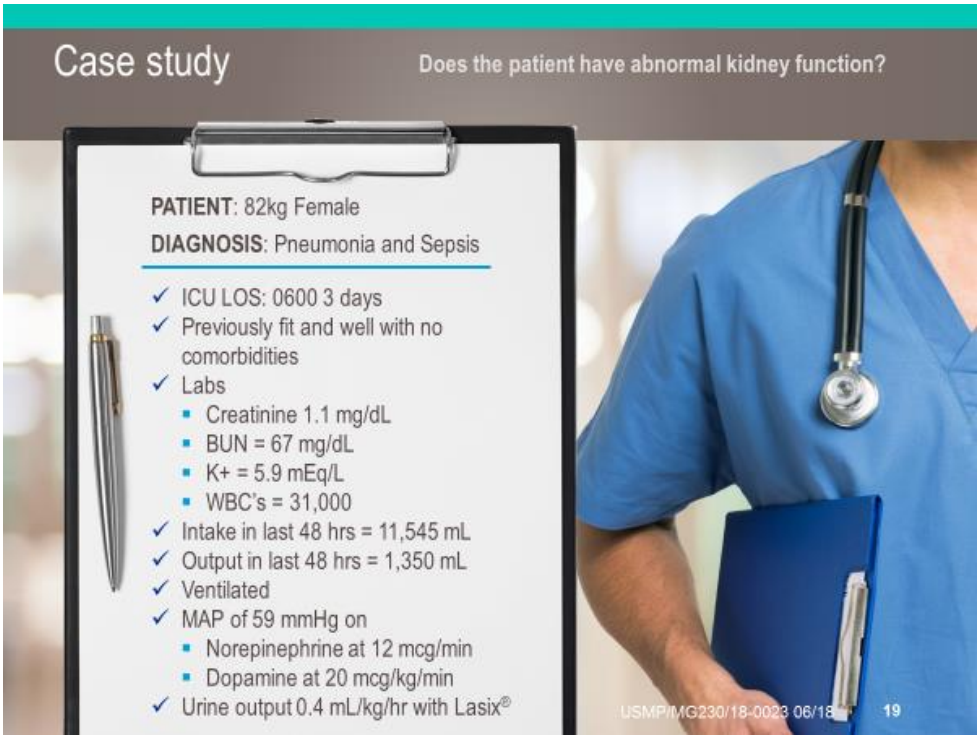
RIFLE Criteria for Diagnosis of AKI



KDIGO. Kidney International Supplements (2012) 2, 37–68; doi:10.1038/kisup.2011.33

Case Study

This case study is presented only as an example and is not to be considered as medical advice for any specific patient.



PICARD formula = **total fluid intake** (in liters)

MINUS **total fluid output** (in liters)

DIVIDED BY **baseline body weight**

MULTIPLIED BY **100**

? **According to this case study, does the patient have abnormal kidney function?**

? Is the patient hemodynamically stable?

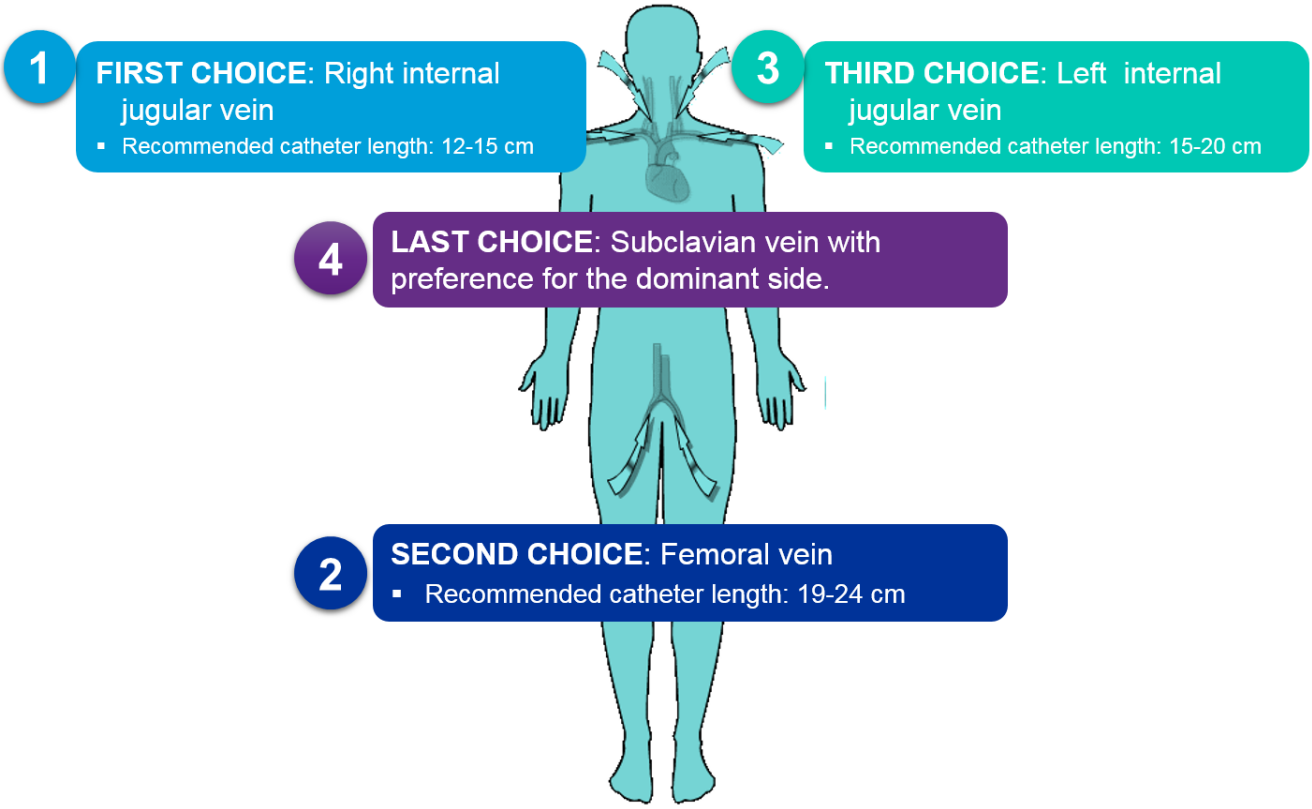
? What is % FO?

? Is staging of AKI appropriate?

? Can we remove fluid in this patient?

4 • Access Considerations

Preferences for Catheter Insertion



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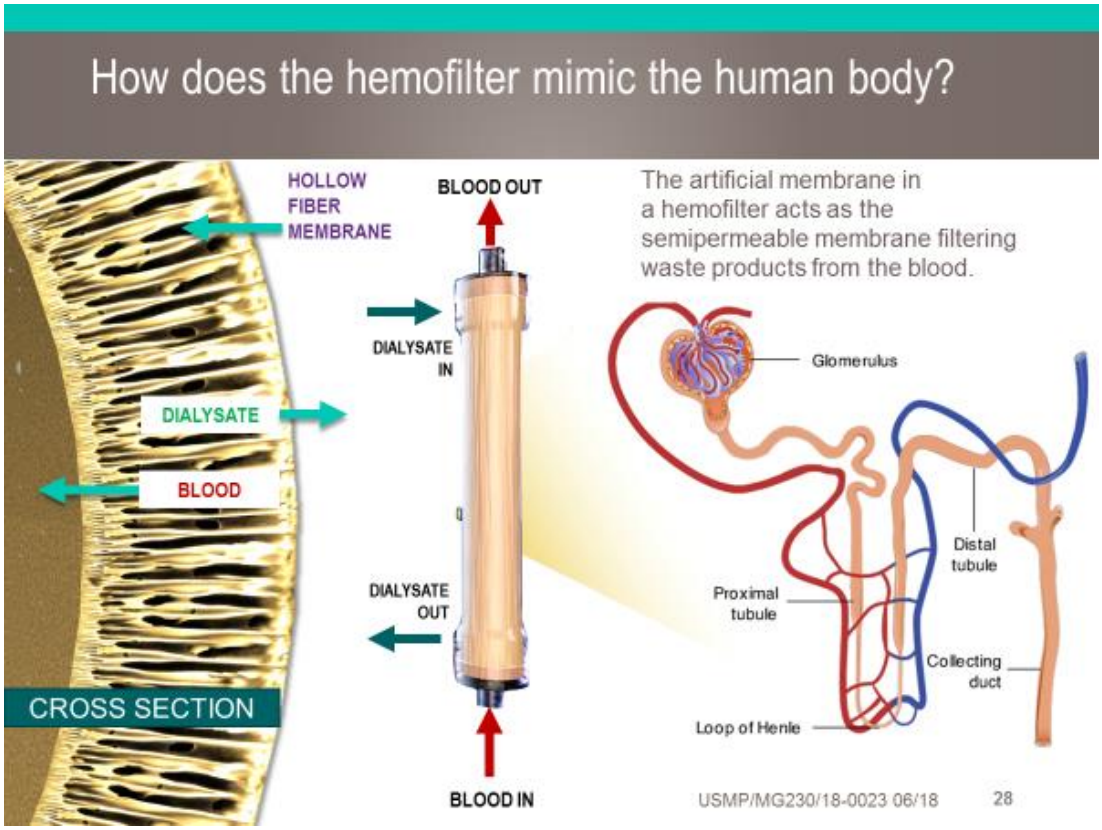
5 • Disposables: The Hemofilter

How Does the Hemofilter Mimic the Human Body?



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6 • Basic Principles of Solute Transport

Molecular Transport Mechanisms

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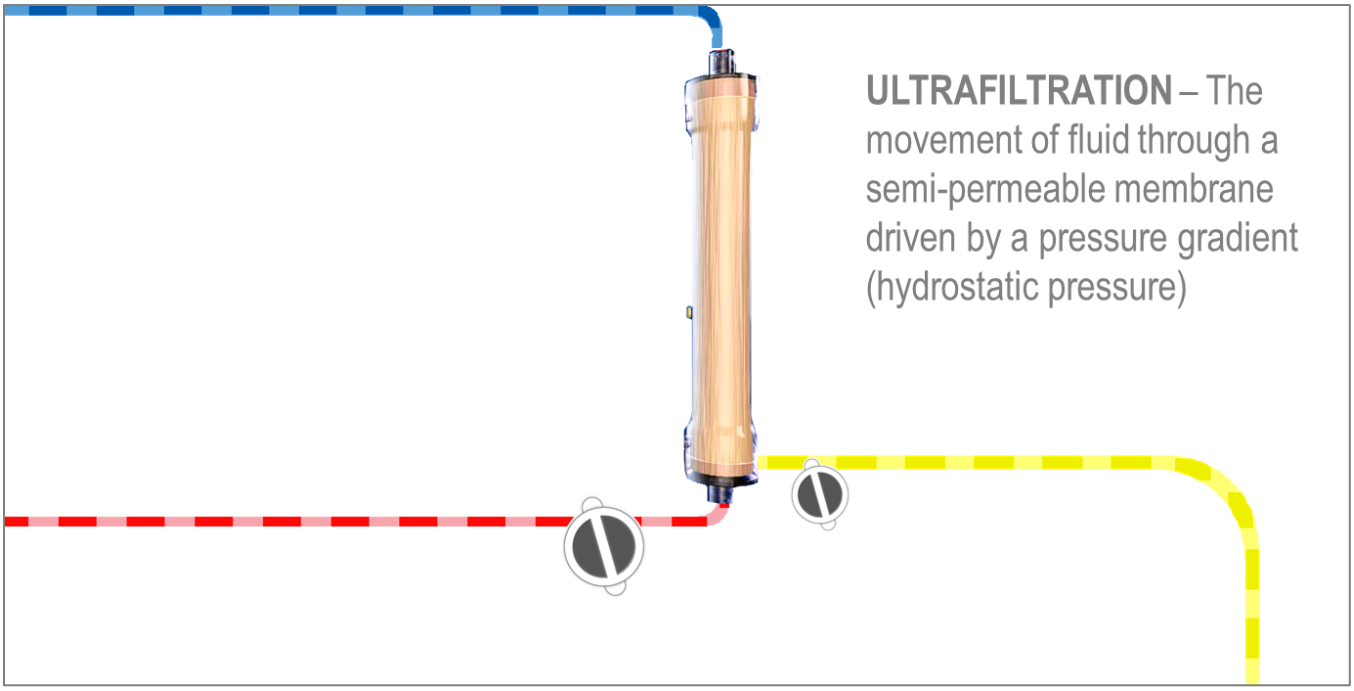
Ultrafiltration



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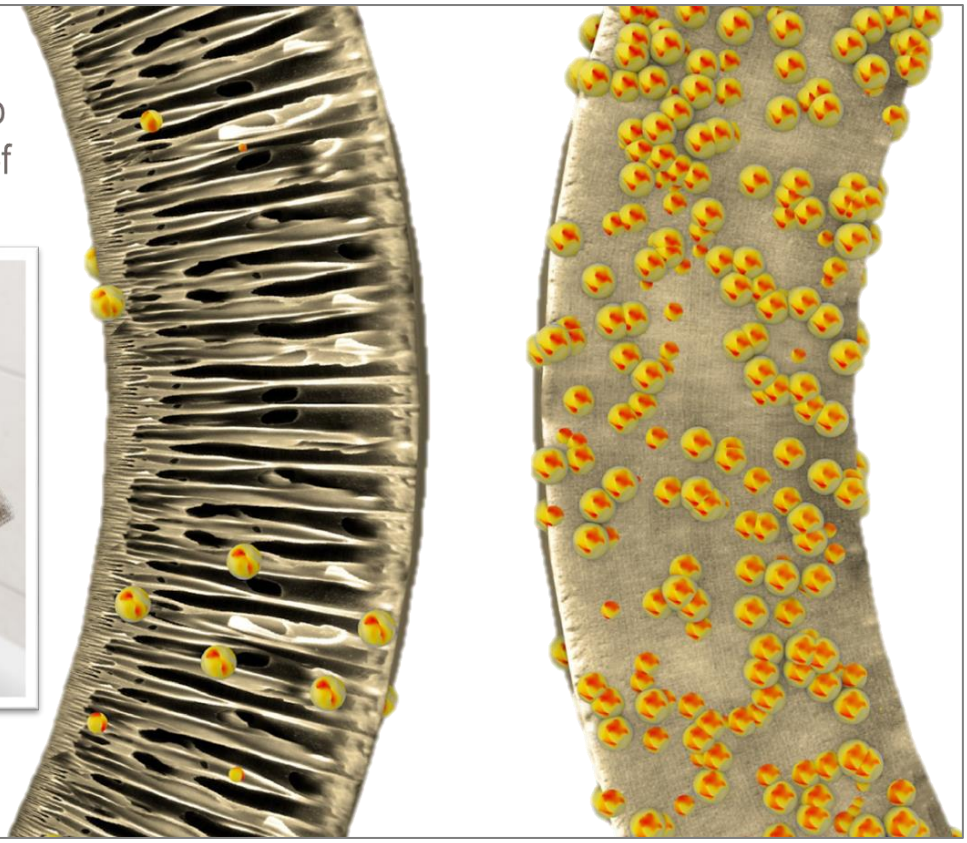
Adsorption

ADSORPTION – Molecular adherence to the surface or interior of the membrane.



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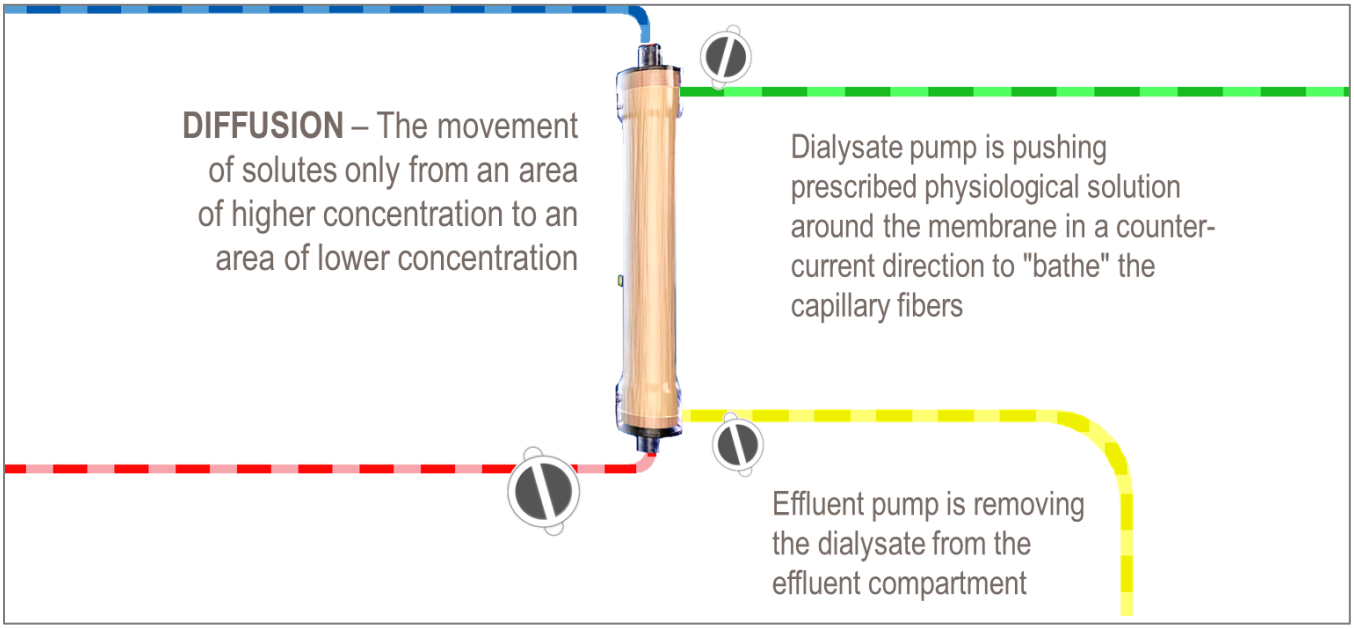
Diffusion = Hemodialysis



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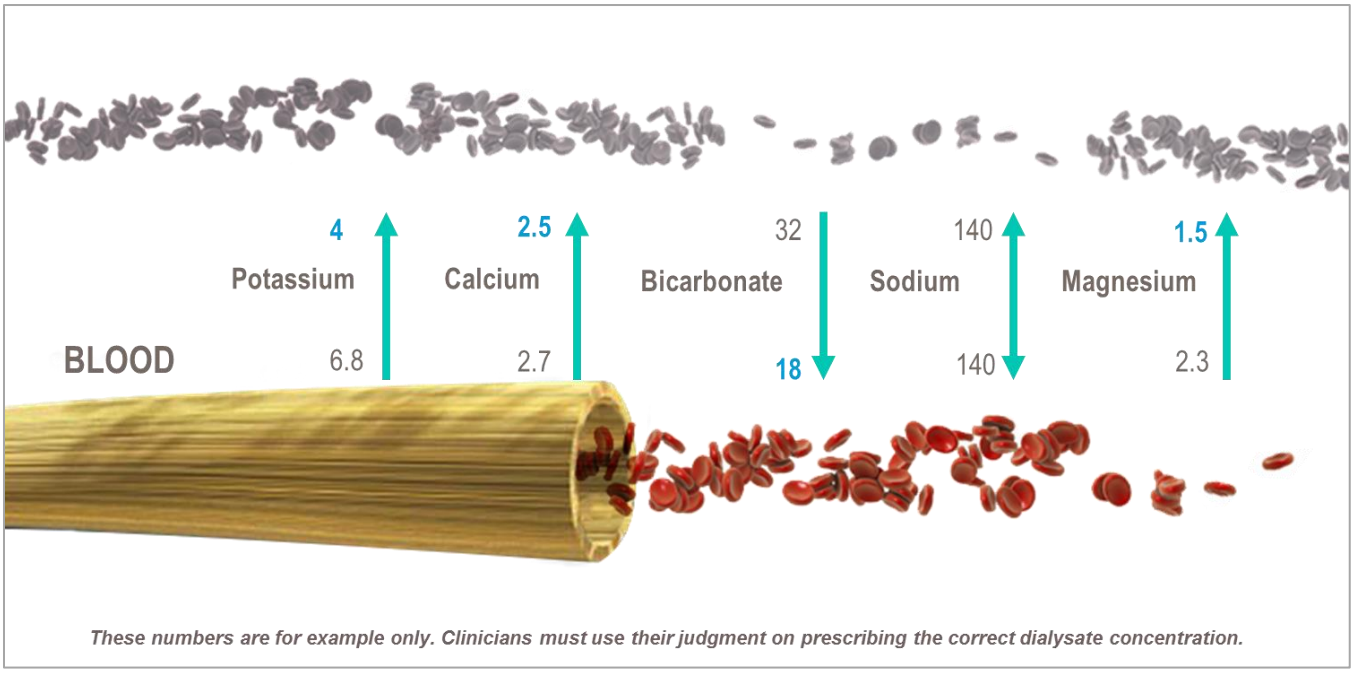
How does diffusion work?



These numbers are for example only. Clinicians must use their judgment on prescribing the correct dialysate concentration.

NOTES

Major Factors Affecting Diffusion

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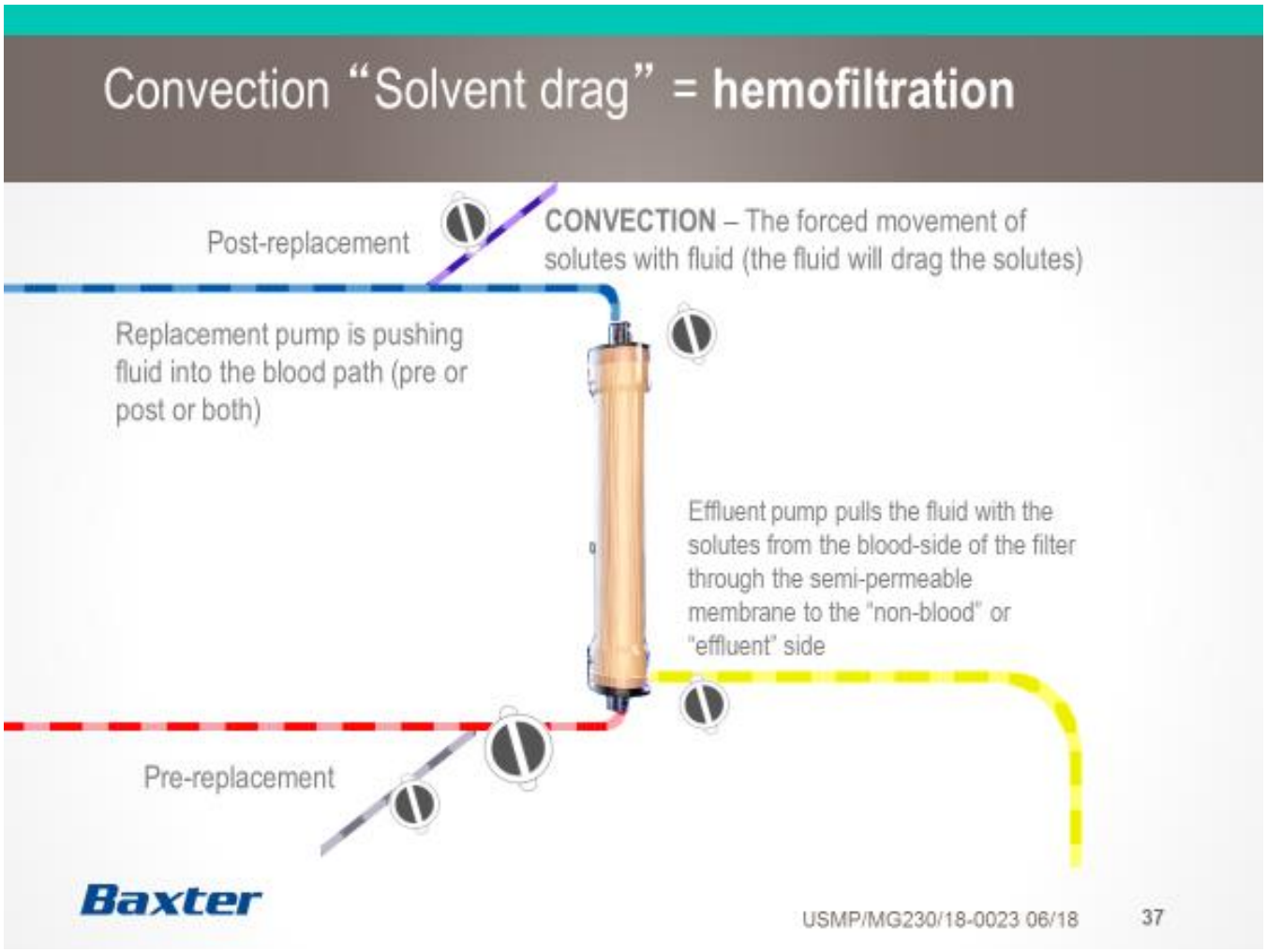
Convection "Solvent Drag" = Hemofiltration



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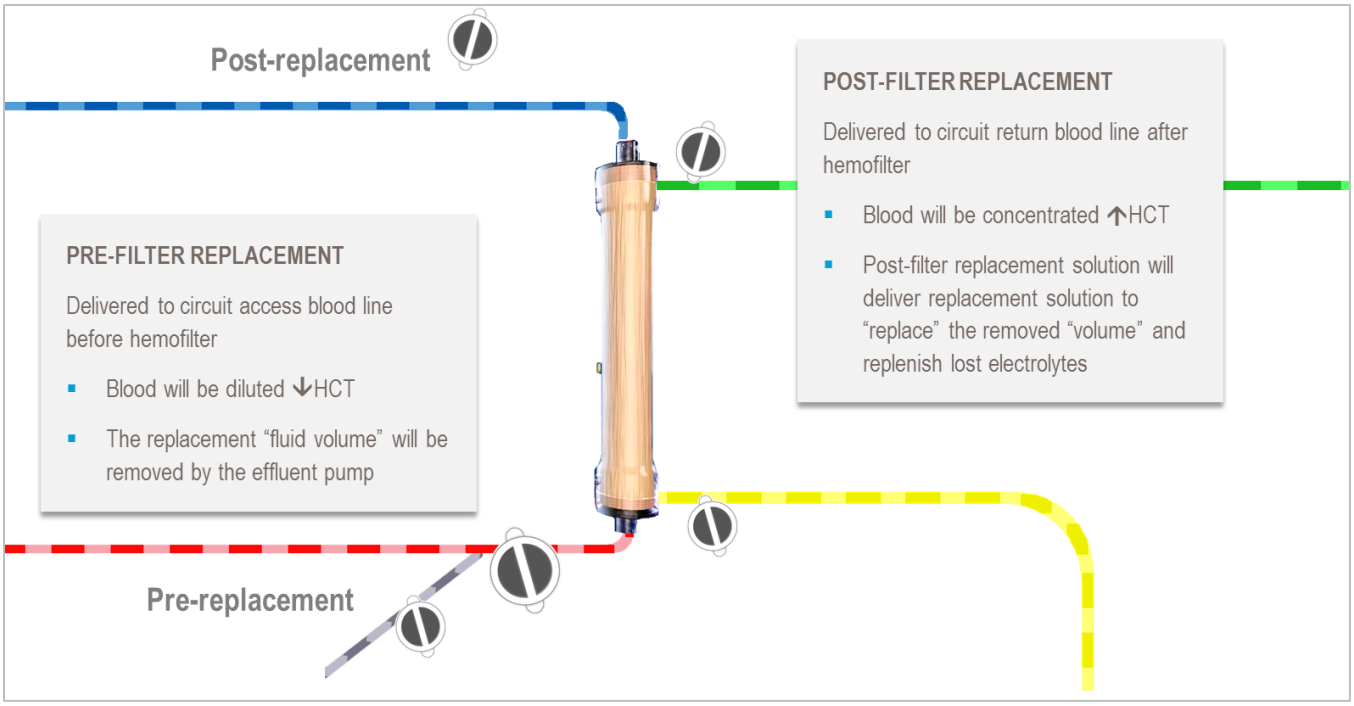
Major Factors Affecting Convection

SOLUTE REMOVAL by convection depends on:

- High Membrane permeability
- Molecular size
- Degradation of filter membrane (can decrease performance)
- Replacement fluid flow rate (pressure gradient)

NOTES

Pre- and Post-filter Replacement



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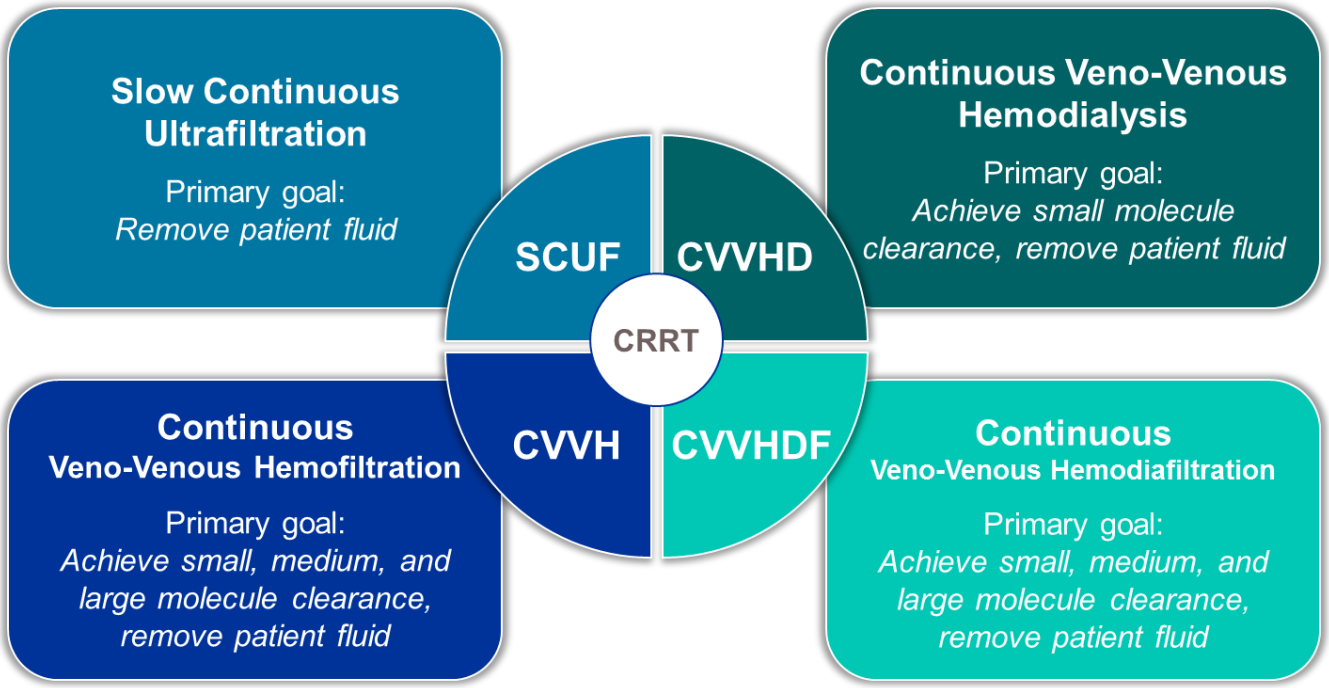
CRRT Modes of Therapy



NOTES

The Role of Solutions in CRRT

Dialysate and Replacement fluids are used to facilitate the removal of solutes from the patient's blood using the basic principles of molecular transport.

Principle	SCUF	CVVH	CVVHD	CVVHDF
Dialysate	NO	NO	YES	YES
Replacement Fluid	NO	YES	NO	YES
What is removed	Fluid	Fluid and Solutes*	Fluid and some Solutes*	Fluid and Solutes*

*Clearance based on membrane properties

NOTES

Case Study

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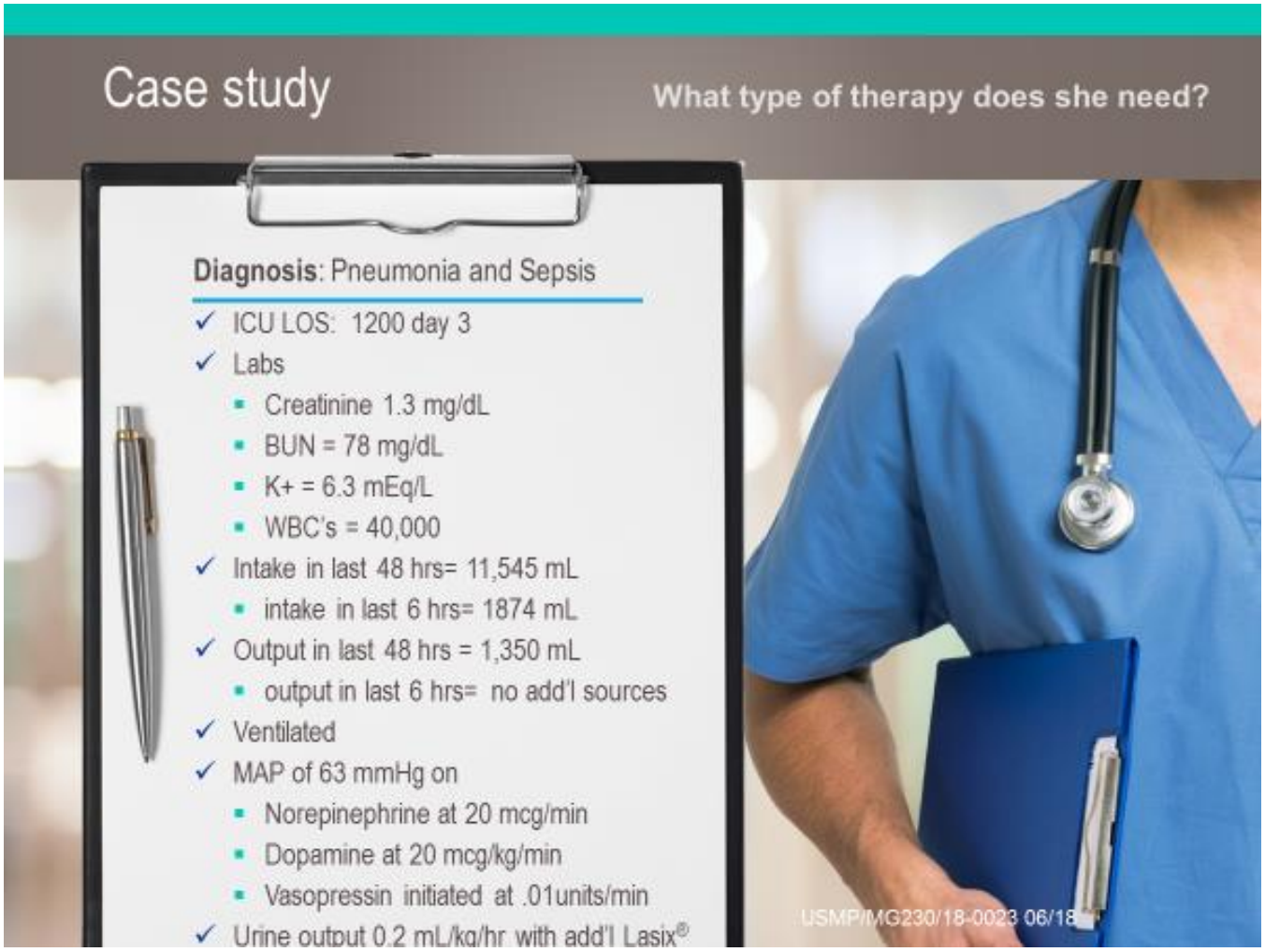

? What type of therapy does the patient need?

7 • CRRT Dosing

Example of Weight-based Dosing

$$\text{CRRT dose (mL/kg/hr)} = \frac{\text{Effluent (dialysate + replacement fluid + patient net UF)}}{\text{Patient weight}}$$

Your facilitator will work through the following example with you to calculate the prescribed dose.

EXAMPLE	
Dialysate	= 1,000 mL/hr
Replacement fluid	= 1,000 mL/hr
Patient net UF	= 200 mL/hr
Patient weight	= 70 kg
Prescribed dose mL/kg/hr	

Key Points: CRRT dosing in AKI

- ✓ Best evidence to date supports dosing a minimum of 20-25 mL/kg/h in all modalities (CVVH, CVVHD, CVVHDF).
- ✓ It is usually necessary to increase the prescription to ensure the prescribed dose is delivered. Frequent assessment of actual delivered dose is recommended.
- ✓ In determining a prescription of RRT it is mandatory to consider parameters other than small-solute clearance, such as:
  - patient's fluid balance
  - acid-base and electrolyte homeostasis
  - nutrition

8 • Anticoagulation

Anticoagulation Clinical Practice • GUIDELINES

- ✓ In a patient with AKI requiring RRT, base the decision to use anticoagulation for RRT on assessment of the patient's potential risks and benefits from anticoagulation
- ✓ It is recommended to use anticoagulation during RRT in AKI if a patient does not have an increased bleeding risk or impaired coagulation and is not already receiving systemic anticoagulation

Heparin: Systemic

- ✓ Can be contraindicated in certain patients—GI bleed, intracranial bleeding, post open heart surgery
- ✓ High-risk medication—monitored and assessed by JCAHO
- ✓ Contraindication: Heparin Induced Thrombocytopenia (HIT)

NOTES

Summary

Key Take-aways

List your top three take-aways from today's session:

1	
2	
3	

Questions and Answers

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