First use syndrome, sindrome da squilibrio dialitico, emolisi e altre complicanze acute gravi in corso di emodialisi

P. Fabbrini

Diagnosis, Treatment, and Prevention of Hemodialysis Emergencies

Manish Saha and Michael Allon

Given the high comorbidity in patients on hemodialysis and the complexity of the dialysis treatment, it is ***remarkable how rarely a life-threatening complication occurs during dialysis****. The low rate of dialysis emergencies can be attributed to numerous safety features inmodern dialysismachines;meticulous treatment and testing of the dialysate solution to prevent exposure to trace elements, toxins, and pathogens; adherence to detailed treatment protocols; and extensive training of dialysis staff to handle medical emergencies*

Clin J Am Soc Nephrol 12: 357–369, 2017.

Table 1. Major dialysis emergencies

Type of Emergency	Estimated Frequency, per Million HD Sessions	Refs.
Dialysis disequilibrium		
Air embolism	8.5–33	Tennankore *et al.* (31), Wong *et al.* (32)
Hemolysis		
Vascular access hemorrhage		
Venous needle dislodgement	14–91	Tennankore *et al.* (31), Wong *et al.* (32), VA study (65), Pennsylvania patient safety study (64)
Allergic reaction	21–170	Villarroel and Ciarkowski (71), Daugirdas *et al.* (72), Simon *et al.* (129)
Cardiac arrest	70	Karnik *et al.* (2)
Errors in following the HD prescription		

HD, hemodialysis.

Clin J Am Soc Nephrol 12: 357–369, 2017.

Hemodialysis Emergencies: Core Curriculum 2021

Keiko I. Greenberg and Michael J. Choi

Dialyzer Reactions and Other Allergic Reactions (first use syndrome)

Dialysis Disequilibrium Syndrome

Air Embolism

Venous Needle Dislodgement

Hemolysis

Vascular access hemorrages

Dialysis water contamination

Clinical Kidney Journal, 2021, vol. 14, Suppl 4, i59–i71

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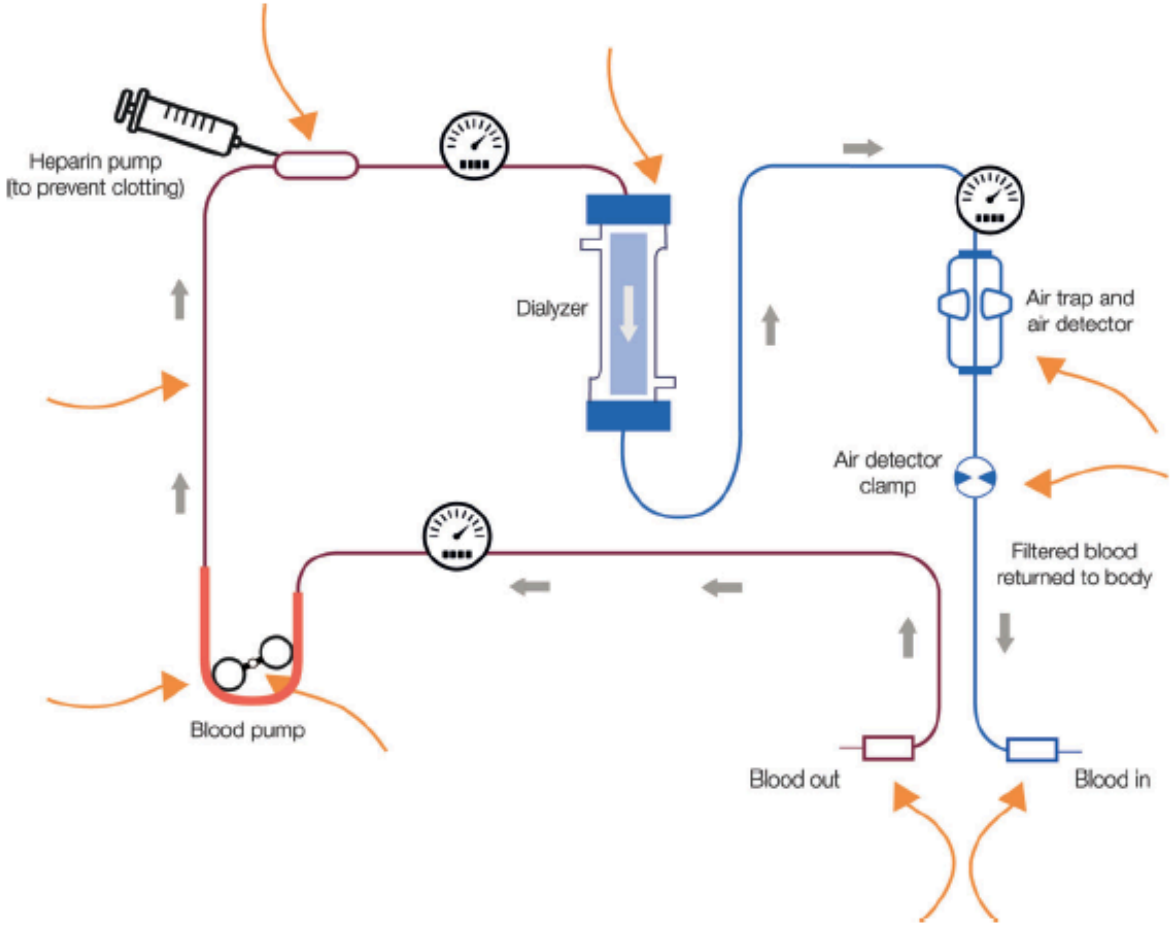
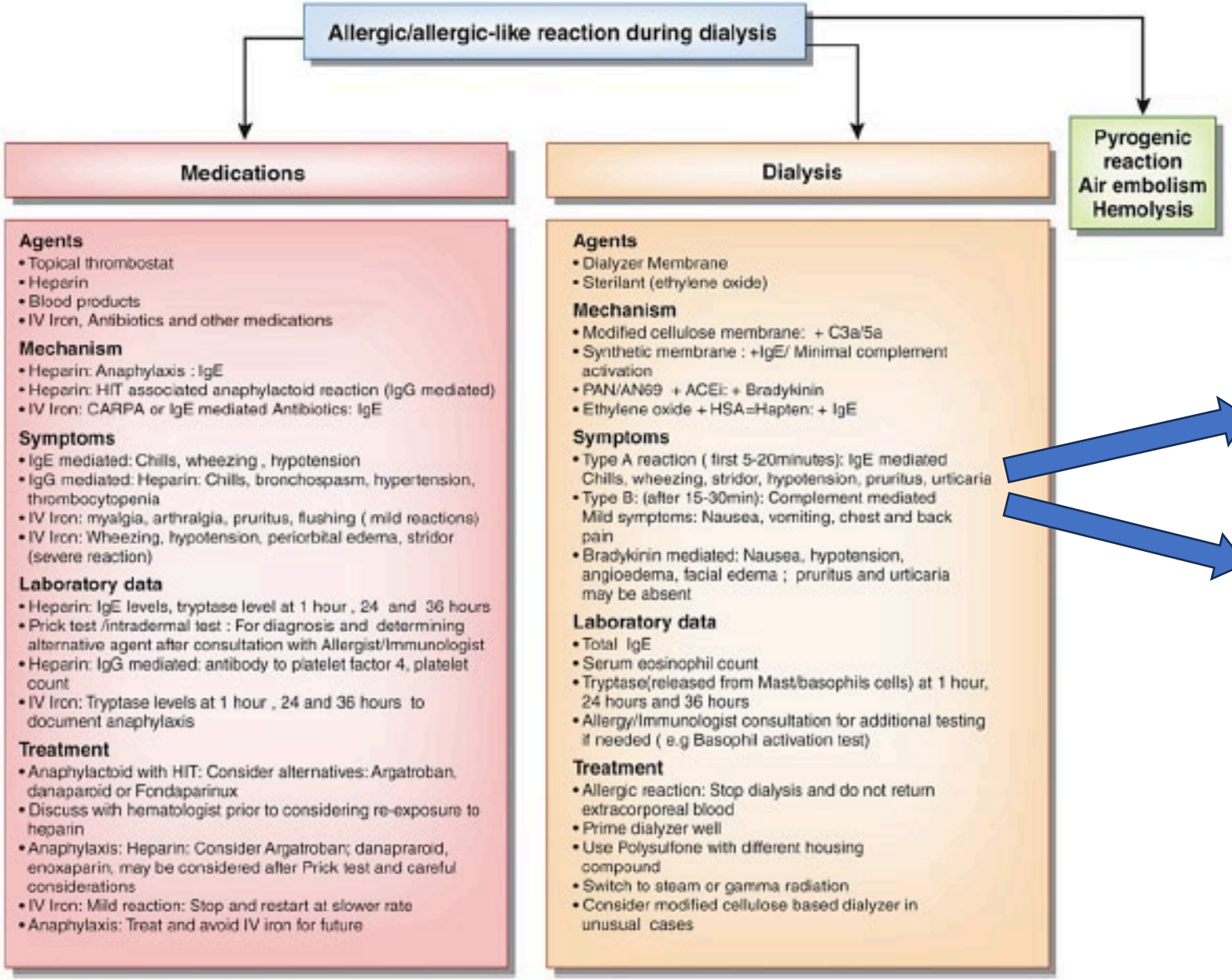
CKJ Review



L'intero circuito dialitico rappresenta uno stress per l'organismo In più punti e in più momenti del trattamento, si possono attivare meccanismi nocivi talora in grado di autoalimentarsi, con complicanze talora anche letali.

DIALYZER REACTIONS AND OTHER ALLERGIC REACTIONS (FIRST USE SYNDROME)



Reazione tipo A: precoce , IgE mediata, potenzialmente molto grave e più rara

Reazione tipo B, più tardiva, mediata dal complemento , solitamente più lieve

Clin J Am Soc Nephrol 12: 357–369, 2017.

DIALYZER REACTIONS AND OTHER ALLERGIC REACTIONS (FIRST USE SYNDROME)

Emergency	Pathogenesis	Clinical Presentation	Management/Prevention
Dialyzer reaction	Hypersensitivity reaction to dialyzer membrane or membrane sterilization method Type A: IgE-mediated anaphylaxis to ethylene oxide, formaldehyde, or polysulfone dialyzer; or high bradykinin levels from ACEI use with AN69 membrane; Type B: complement activation by cuporphane or polysulfone/ polyethersulfone membrane	Type A: pruritus, urticaria, laryngeal edema, bronchospasm, dyspnea, chest pain, vomiting, hypoxia, hypotension, or cardiac arrest usually occurring within first 20-30 min of HD session Type B: chest pain, back pain, nausea, or vomiting; symptoms less severe than in Type A and occur later in HD session	Type A: stop dialysis without returning blood from circuit to patient; fluids, epinephrine, corticosteroids, antihistamines if indicated; use different dialyzer and avoid ethylene oxide sterilization; avoid ACEI with AN69 dialyzers Type B: switch to a different dialyzer

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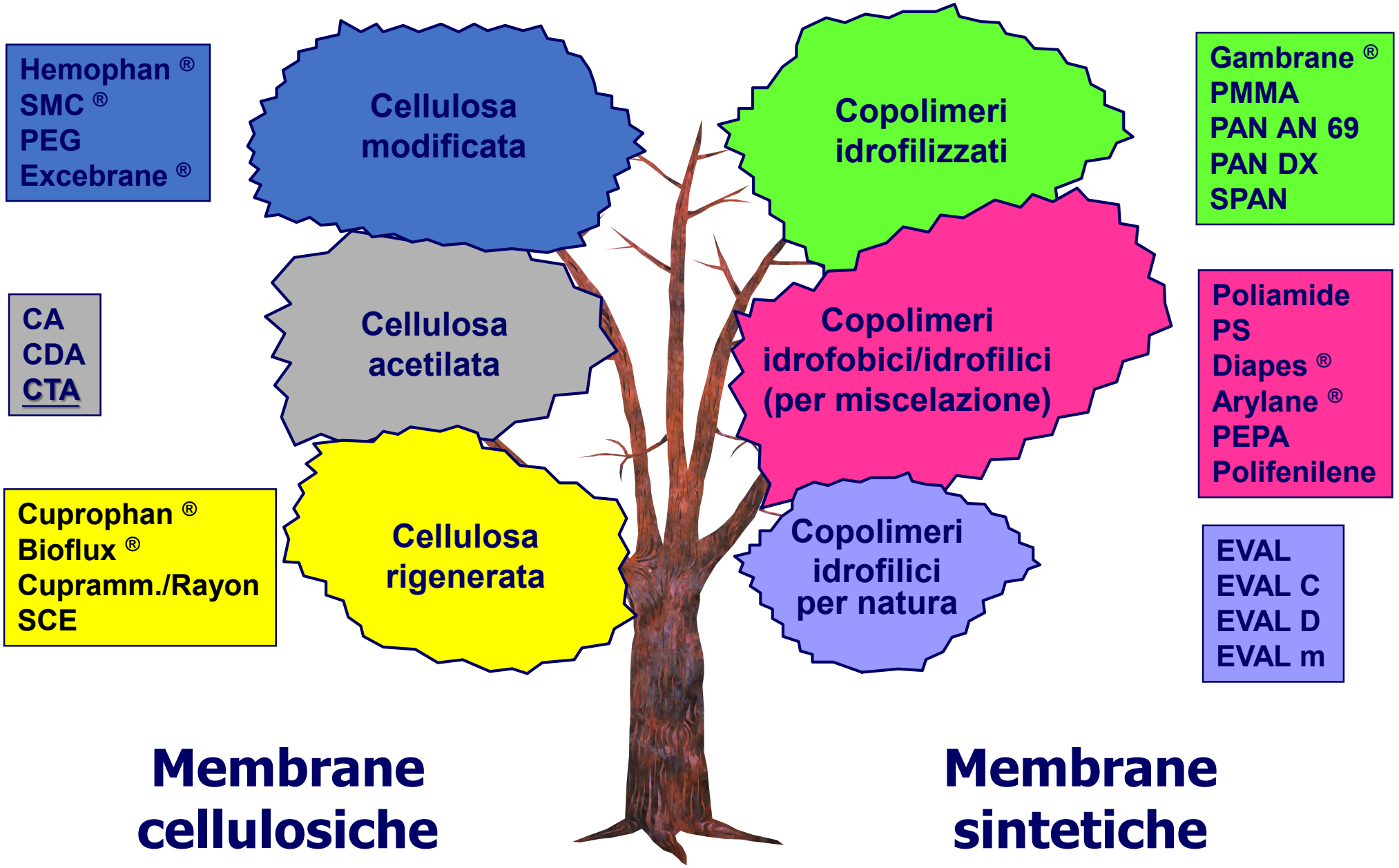
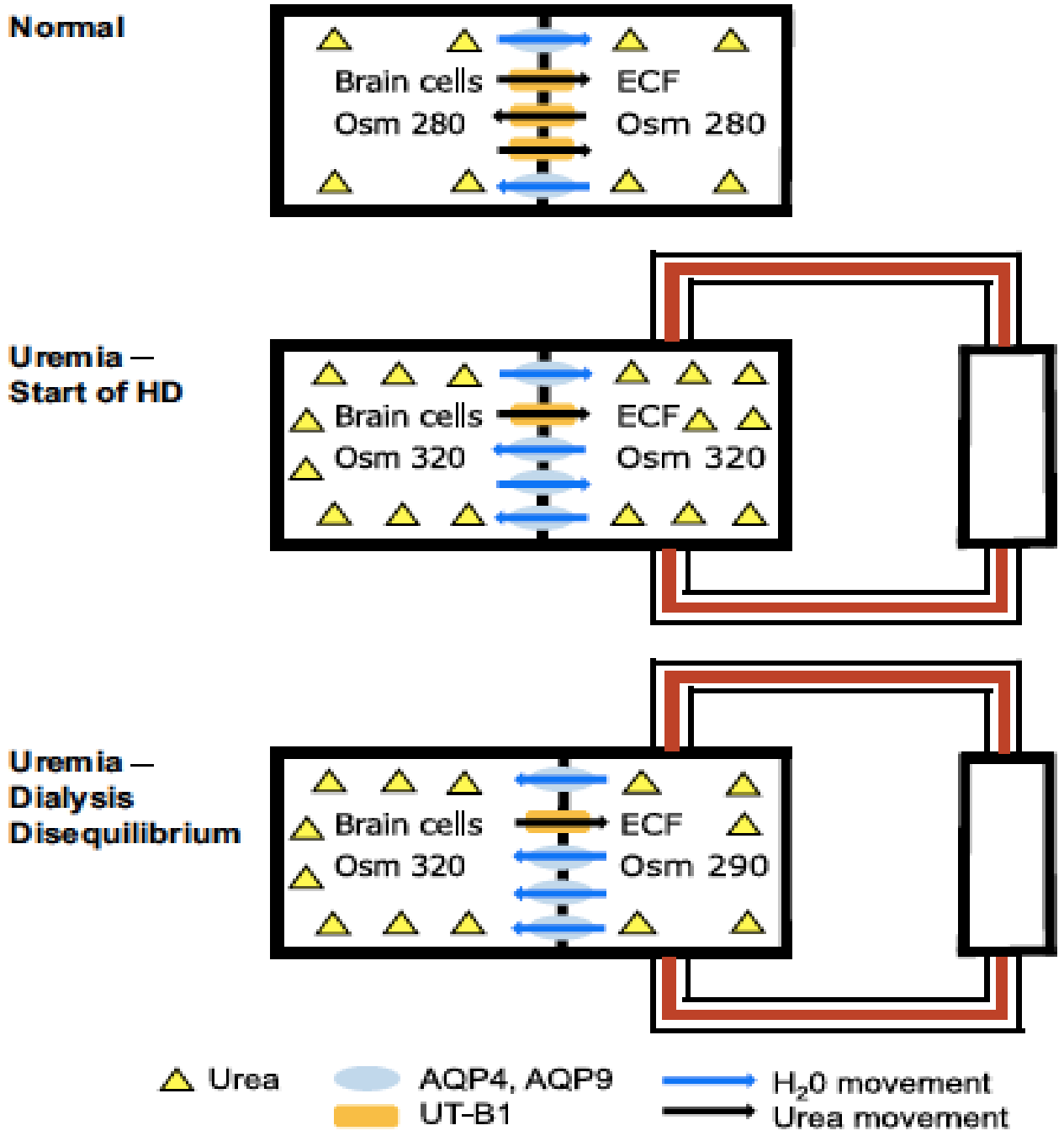


Dialysis Disequilibrium Syndrome

REVERSE UREA EFFECT: This theory states that a rapid reduction of urea with HD lowers serum osmolality significantly relative to the central nervous system (CNS), generating an osmotic gradient that drives water into brain cells



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Dialysis Disequilibrium Syndrome

	Pathogenesis	Clinical Presentation	Management/Prevention
Dialysis disequilibrium syndrome	Thought to be due to rapid reduction of serum osmolality relative to the CNS, which drives water into brain cells and results in cerebral edema; urea is thought to be the predominant solute involved but idiogenic osmoles and intracerebral acidosis may also contribute	Signs/symptoms: headache, nausea/vomiting, confusion, agitation, seizures, coma, or death occurring during or soon after HD session; possible cerebral edema on imaging Risk factors: very high SUN, first HD treatment, rapid SUN reduction, extremes of age, metabolic acidosis, hyponatremia, liver disease, pre-existing neurologic conditions	Management: stop HD, provide supportive care Prevention: avoid reducing SUN by more than 40% during a short period; initiate dialysis using low blood flow; consider using higher sodium dialysate; consider CKRT

Sempre meno frequente per protocolli standardizzati di terapia durante le prime dialisi

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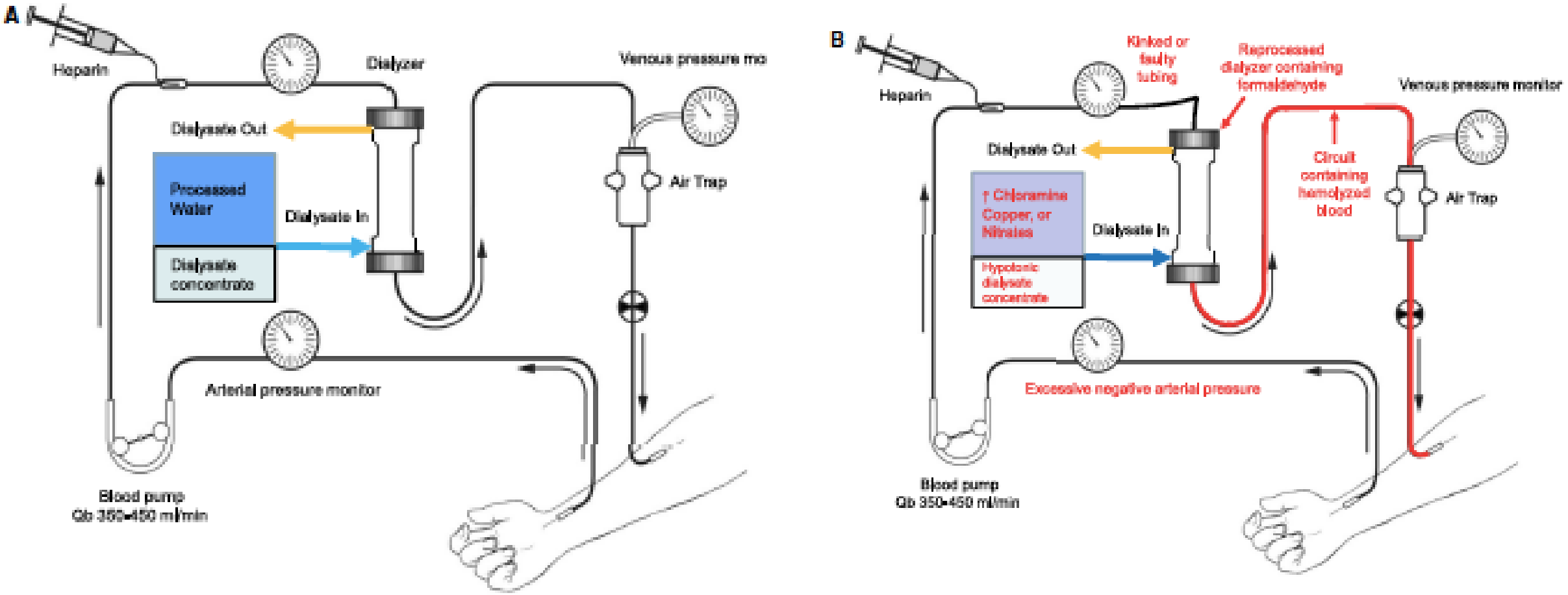
HEMOLYSIS

Emolisi fisiologica sempre presente ma di minima entità, dipende dalla maggiore pressione a cui sono sottoposti i GR nel circuito extracorporeo

Alterazioni del circuito o della composizione del dialisato, o tipologia di aghi per dialisi usati, sono tutte possibili cause di emolisi.



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HEMOLYSIS

	Pathogenesis	Clinical Presentation	Management/Prevention
Hemolysis	Red blood cell fragmentation due to high blood flow in smaller gauge needles, excessively negative arterial pressures, needle malposition, obstructed or kinked tubing, contamination of dialysate with chloramine, copper, or nitrates; exposure to formaldehyde, high dialysate temperature, hypotonic dialysate	Signs/symptoms: nausea, vomiting, diarrhea, abdominal/back/chest pain, dyspnea, chills, hypertension, arrhythmias, acute coronary syndromes, respiratory distress, severe necrotizing pancreatitis, death Key features: cherry red blood in extracorporeal circuit, pink serum due to free hemoglobin Laboratory findings: decreased hemoglobin and haptoglobin; increased LDH, bilirubin, and potassium	Management: stop HD without returning blood to patient, transfuse blood, dialyze for hyperkalemia Prevention: follow protocols for monitoring water, HD machines, and HD circuit; use appropriate blood flow rates, avoid compression of tubing; if hemolysis occurs, thorough evaluation to identify cause

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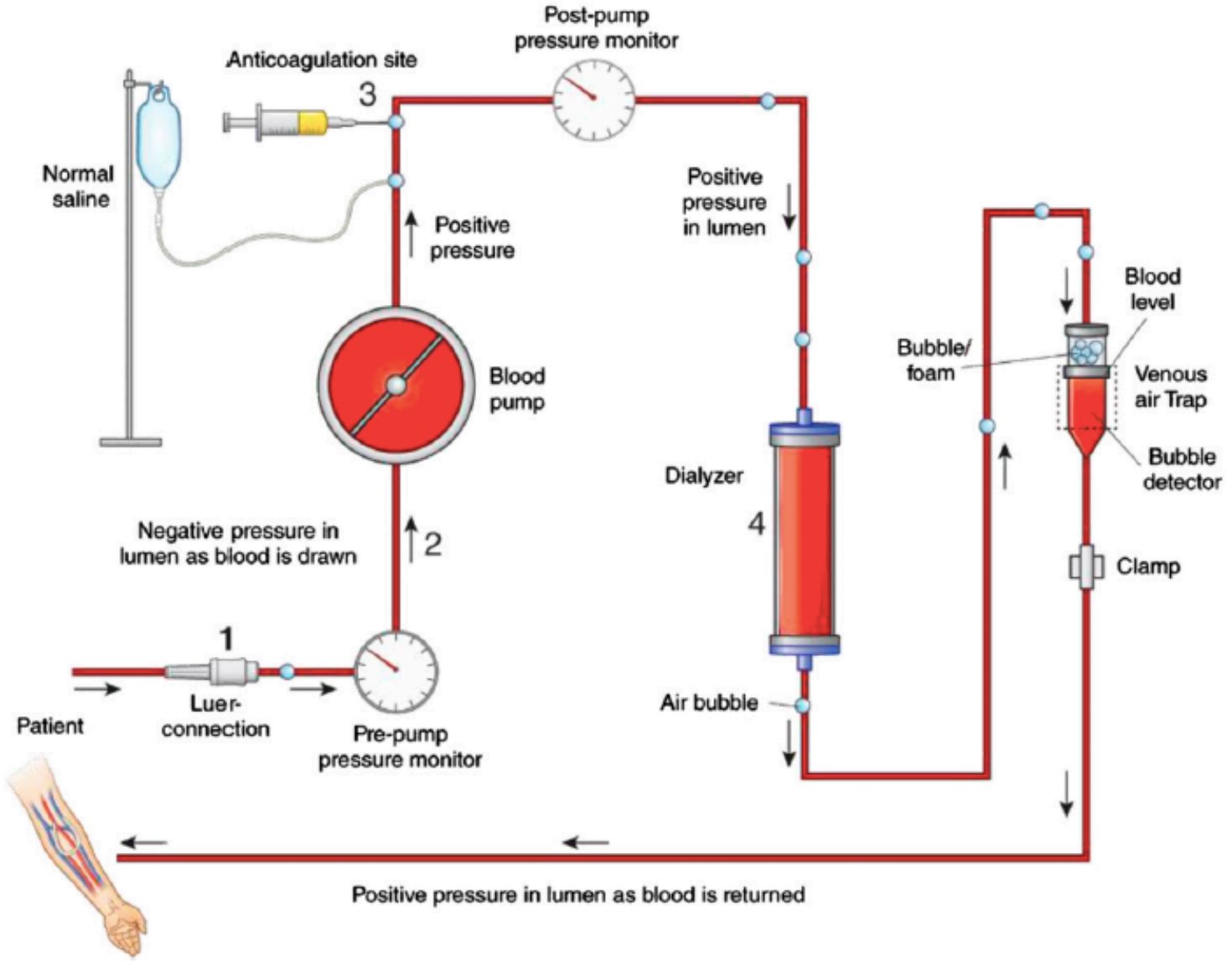
AIR EMBOLISM



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AIR EMBOLISM

	Pathogenesis	Clinical Presentation	Management/Prevention
Air embolism	Air enters bloodstream through dialysis circuit or through vascular access; causes include poor connection between arterial needle and circuit, defects in tubing in arterial portion of circuit, inadequate priming of dialyzer, improper medication administration, uncapped dialysis catheter, dialysis catheter placement/ removal	Air entering right heart/ pulmonary artery can cause pulmonary edema, hypoxia, cardiac arrest; a air in CNS can cause altered mental status, neurologic deficits, seizures, stroke, death	Management: stop HD without returning blood from extracorporeal circuit, position patient supine, administer oxygen and (if needed) fluids and vasopressors Prevention: avoid very high blood flow rates, maintain high blood level in air trap, train staff to avoid risky scenarios

Dialysis Water Contamination

Table 1. Components of Water Treatment Systems

Component[a]	Purpose/Mechanism
Pretreatment	
Temperature-blending valve	Control water temperature to ensure optimal function of reverse osmosis unit(s) by blending heated water with cold water
Multimedia depth filtration	Remove solid materials through filters that contain sand and/or coal
Activated carbon filter	Remove organic matter and chlorine/chloramine by adsorption
Softener	Remove calcium and magnesium ions by resin exchange
Water treatment	
Reverse osmosis	Remove organic and inorganic solutes by forcing water through a very tight membrane
Deionization	Remove inorganic ions by ion exchange using cationic and anionic resins
Ultraviolet	Kill bacteria through ultraviolet radiation
Endotoxin-retentive filter	Remove bacteria and endotoxin

CONCLUSIONI