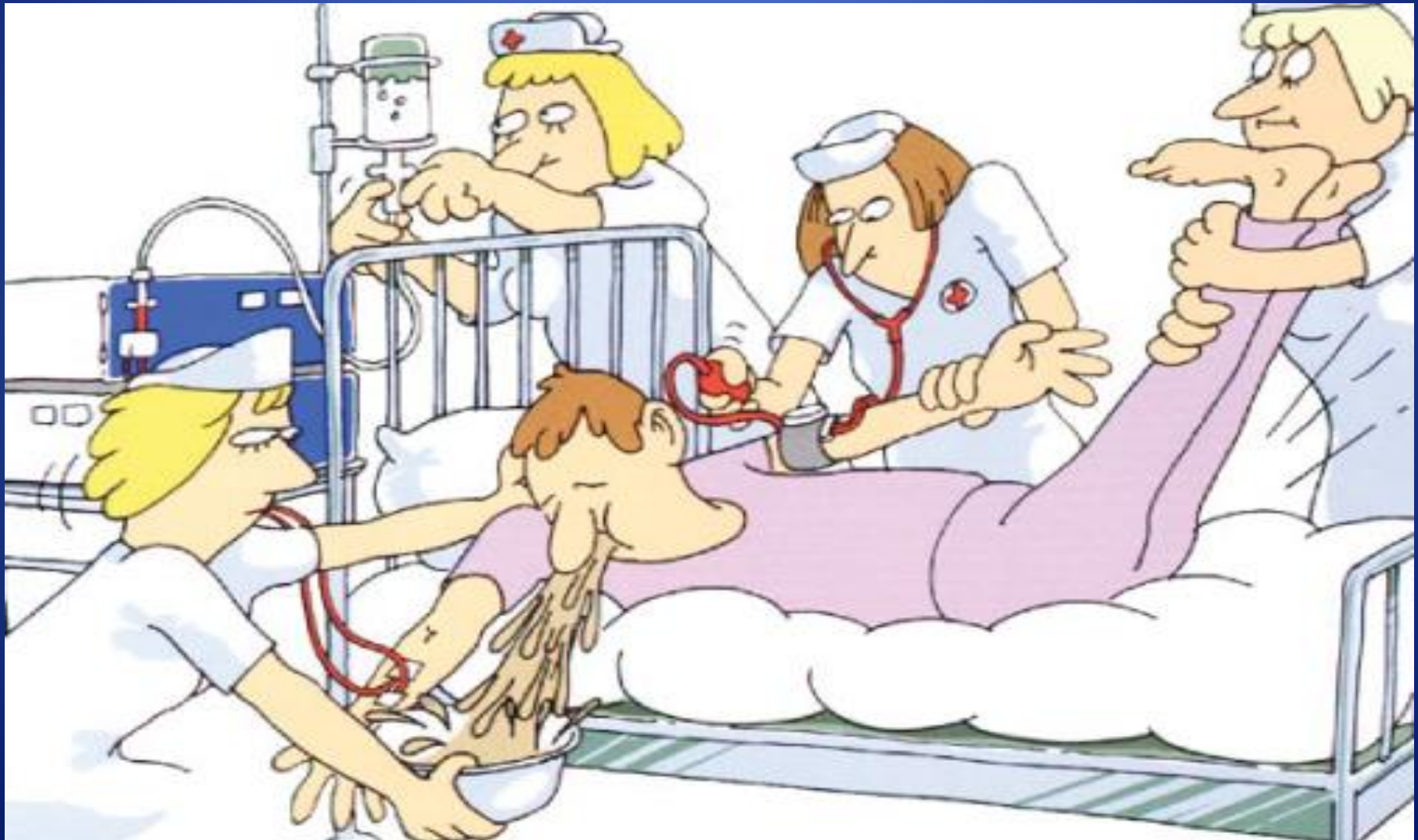


Complications in HD patients



Complications During HD

hypotension (20%-30% of dialyses),
cramps (5%-20%),
nausea and vomiting (5%-15%),
headache (5%),
chest pain (2%-5%),
back pain (2%-5%),
itching (5%),
fever and chills (<1%).

Hypotension During HD

- ✓ Is the most frequent problem in chronic HD patients (it occurs in 20-50% of patients).
- ✓ Incidence of hypotension during HD has not been declined in the recent past 20 years. Because acceptance of more older and more severe ill patients in HD and **shorter times** HD
- ✓ Intra-dialysis hypotension contributes to overall patients morbidity, limits fluid removal during dialysis and increases the need for nursing interventions.

Intradialytic hypotension

- ❑ **Definition:** A decrease in systolic BP ≥ 20 mm Hg or a decrease in MAP ≥ 10 mm Hg associated with symptoms.
- ❑ **Complication:** cardiac arrhythmias, coronary and/or cerebral ischemic events
- ❑ **Long-term side effects:** volume overload due to suboptimal ultrafiltration, LVH, and interdialytic hypertension

Clinical **P**atterns of **D**ialysis-associated Hypotension

1. *Episodic hypotension*, which typically occurs during the latter stages of dialysis; this is associated with vomiting, muscle cramps, and other vagal symptoms (**such as yawning**).
2. *Chronic persistent hypotension*, which may occur in long-term patients in whom predialysis systolic blood pressures of less than 100 mmHg are frequently observed.

Etiology Of Hypotension During HD (1)

- ✓ Rapid fluid removal (more than patient tolerability).
- ✓ Underestimation of dry weight.
- ✓ Rapid reduction of plasma osmolality.
- ✓ Autonomic neuropathy.
- ✓ Diminished cardiac reserve.
- ✓ Use of acetate rather than bicarbonate as the dialyset buffer.
- ✓ Intake of antihypertensive drugs prior of dialysis.
- ✓ Use of low sodium concentration in dialysate.

Etiology Of Hypotension During HD (2)

- Ingestion of meals during or just before dialysis.
- Arrhythmia or severe pericardial effusion.
- Inflammatory reaction to dialysis membrane.
- Rare causes such as sepsis, air embolism, hemolysis, bleeding.
- sudden release of adenosine due to ischemia

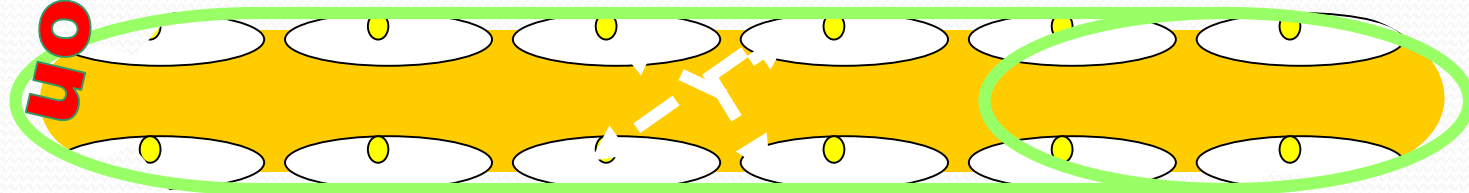
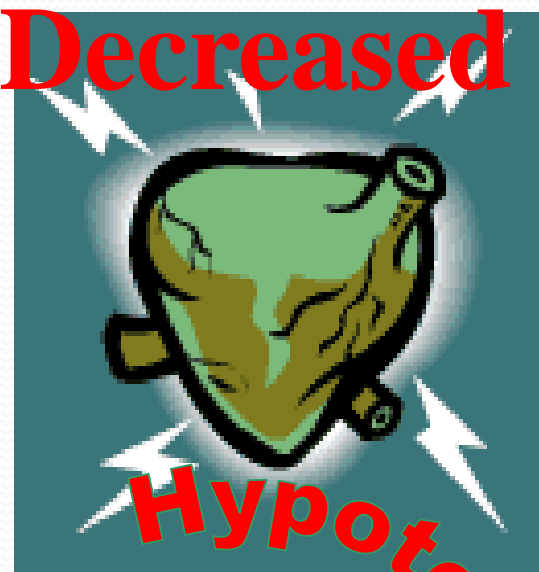
Ischemia

ATP breakdown

Decreased CO

Adenosine release

Vasodilatation



Risk Factors of Dialysis Hypotension

- A third of dialysis patients
- Low body mass
- Poor nutritional status and hypoalbuminemia
- Severe anemia
- Advanced age (Age > 65 years old)
- Cardiovascular disease
- Large interdialysis weight gain
- Low blood pressure (predialysis systolic BP <100 mm Hg)

Prevention of Hypotension During HD (1)

- Exclude cardiac causes and treat it.
- Avoid eating during HD.
- Withhold antihypertensive agents on the day of HD.
- Reassess of dry weight.
- Correction of anemia with Erythropoetin.
- Sequential UF.
- Constant UF # UF modeling.
- Caffeine as an adenosine receptor blocker

Prevention of Hypotension During HD (2)

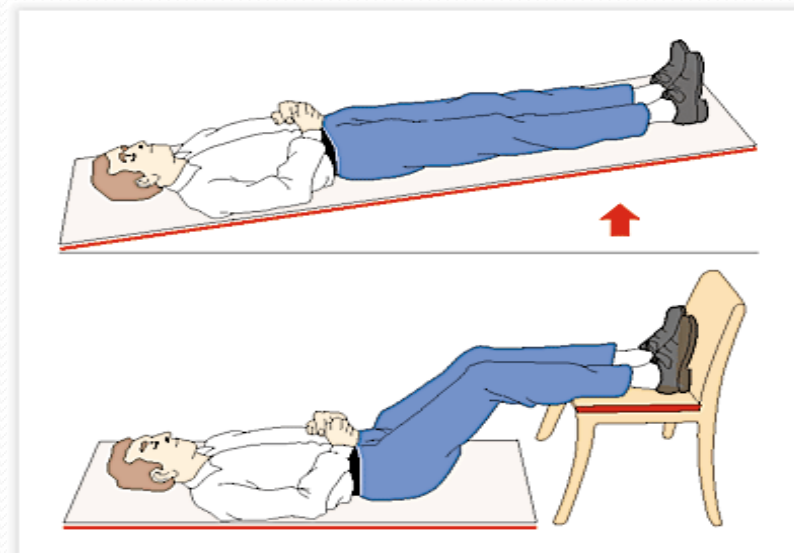
- Cool temperature dialysis.
- Change of acetate dialysis to bicarbonate dialysis.
- Adjust dialyset sodium and Ca^{++} .
- Sodium modeling (sodium ramping).
- Hyperoncotic albumin
- Nasal oxygen
- Mannitol infusion
- Switch to CAPD

prevention of Hypotention During HD(3)

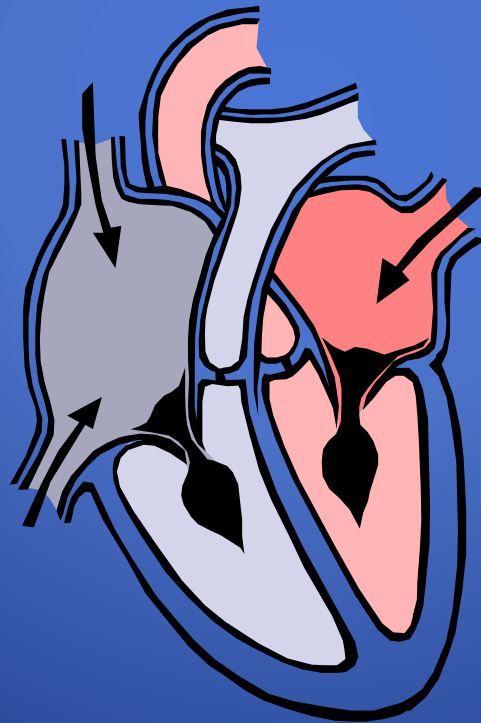
- L-Carnitine therapy
- Midodrine 2.5-10 mg before dialysis
- Blood transfusion or erythropoietin therapy
- Volume expansion
- Vasoconstrictor
- Limiting sodium intake
- Minimize interdialytic weight gain by education
- Blood sugar control
- Slow ultrafiltration
- Sodium modeling
- Raise dialysate calcium
- Lower dialysate temperature

Hypotension Tx

- Trendelenburg position
- Ultrafiltration rate should be decreased or stopped
- ↑intravascular volume (NaCl isotonic 100 ml, 40-50 ml NaCl 5%, manitol 10-15 gr = 50-75 ml 20%)
- Reduction of blood flow rate



Hypertension during HD



Consequences of hypertension in Dialysis

Cardiovascular Diseases

LVH& CHF& IHD

Malignant& Non-malignant
hypertension

Stroke (ischaemic, haemorrhagic)

Vessel wall remodelling

(hypertrophy/hyperplasia of intima&
media)

Causes of poor BP control in HD patients

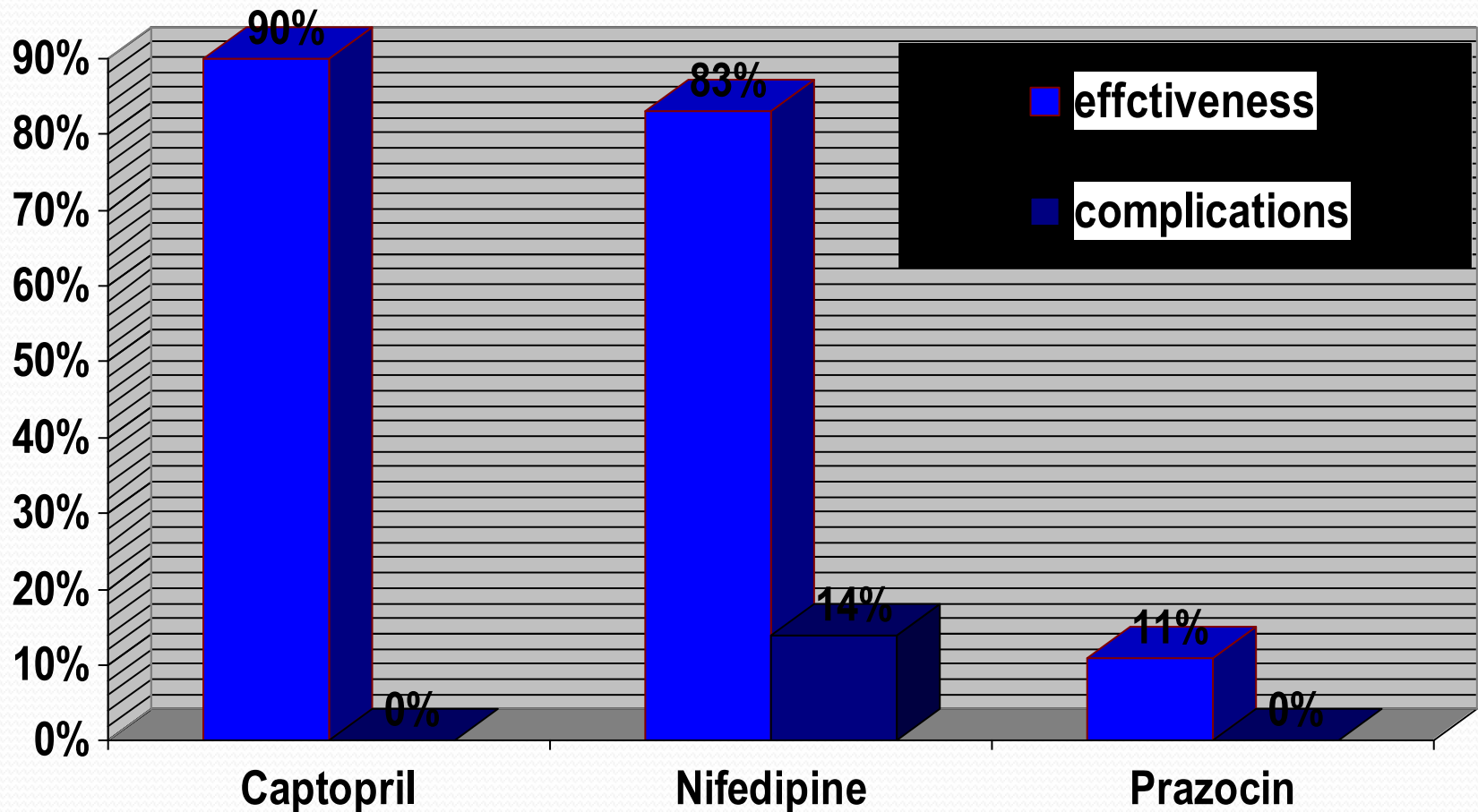
- ☐ Physician errors
- ☐ Patients non compliance
- ☐ Inadequate UF
- ☐ Inadequate dialysis
- ☐ Inadequate antihypertensive drug
- ☐ Underlying secondary hypertension
- ☐ Lack of a clear guideline for therapy

Hypertension during dialysis:

**Intermittent hypertension
in the last hours of dialysis**

Treatments: Isotonic saline?

Sub Lingual Therapy of Hypertensive Emergencies during dialysis:



Dialysis Disequilibrium Syndrom(DDS)

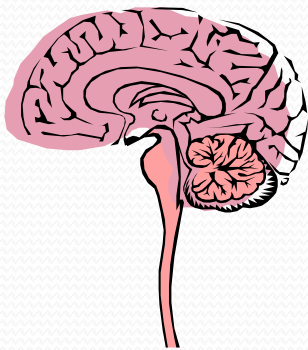
- Fast reduction in plasma osmolality,acute change in CSF PH
- Most common in initiation of dialysis(particularly in very high BUN>175 mg/dl), older age.
Acidosis,children,preexisting CNS disorders.
- Headache, nausea, vomiting, confusion, seizure, coma, death.
- Tx:stop dialysis,supportive treatment, mannitol12.5gr or 5 ml 23% NaCl.
- Prevention:short time(2 hrs),small surface dialyser, concurrent blood and dialysate flow.prophylactic phenytoin(1000mg loading then 300mg/day), mannitol.

Dialysis Disequilibrium Syndrome:

nausea and vomiting, restlessness, headaches, and fatigue during HD or in the immediate postdialysis period

Decreased urea concentration very fast

Increased brain P_{CO_2} very fast



Headache, nausea, vomiting

- Longer tx, large degree of urea removal(a variant of DDS)
- Hypoglycemia, hypo/hyperNa
- Coffein withdrawal
- hematoma
- Psychologic factors

Tx: Less intensive, more frequent dialysis
Coffein, acetaminophen



Chest pain

- Angina pectoris(ECG, enzyme, O₂, TNG)
- Hemolysis
- Air embolism



Hemolysis

- Overheating of dialysate
- Hypotonocity of dialysate
- Formaldehyde,bleach,chloramine,nitrate, copper
- Traumatic(kinking of lines,malfunction of pump)
- Stop dialysis(do not return the blood to pt) ,treat hyper K,

Air embolism

- Foam in the venous blood line
- In Seated pt unconsciousness, seizure
- In recumbent pt dyspnea, cough, chest tightness,
- Clamp venous line, stop the blood pump
- Position the pt on left side with chest and head little downward

Arrhythmia and Angina during HD

Special attention to hypokalemia and digoxin





Arrhythmia (I)

- 30-48% of dialysis patients
- Risk factor:
 - ▲ Compromised myocardium: CAD, Intermycardiocytic fibrosis, Pericarditis



Arrhythmia (II)

- ▲ Electrolyte imbalance: hypokalemia, hyperkalemia, hypercalcemia, hypermagnesemia
- ▲ Anemia
- ▲ Increased LV mass
- ▲ Advanced age
- ▲ Acetate dialysate

Hypoglycemia during hemodialysis



Insulin dose should be reduced in the dialysis days

Dialyzer reaction

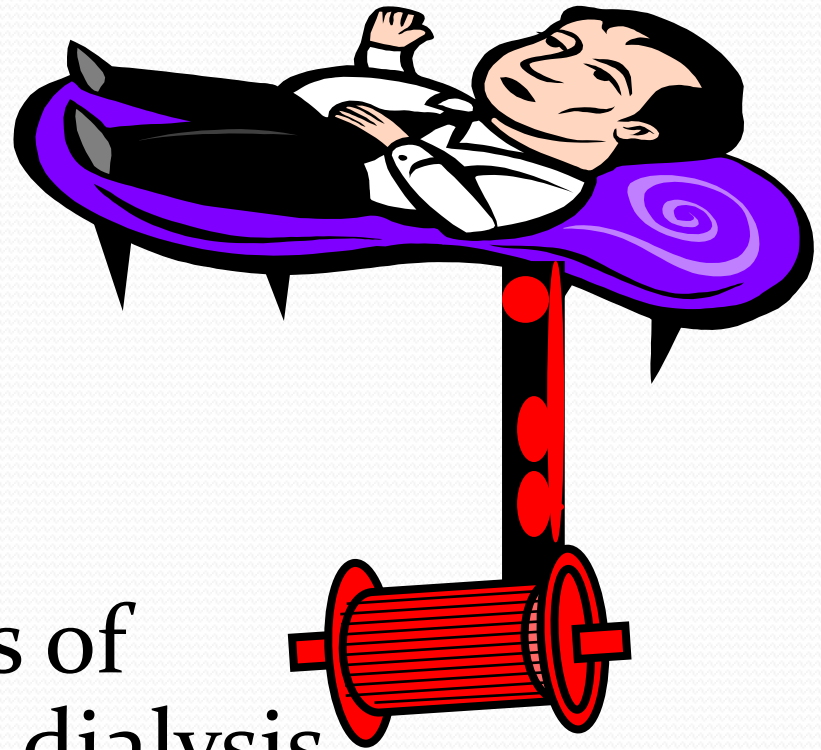
Type A (Anaphylactic)

- Rare (5/100000 dialysis)
- First 5 min ,up to 30 min
- Ethylene oxide, ACE inh. +AN69 dialysers, heparin allergy, acetate, contaminated dialysate
- Tx: Stop dialysis, do not return blood ,antihistamine, steroid, adrenaline

Blood membrane interactions

Type B

- 3-5/100 dialysis
- 30-60 min
- Chest pain, back pain
- Tx: exclude other causes of chest pain, O₂, continue dialysis, Biocompatible dialysers



Muscle Cramps

- 35-86 % of hemodialysis patients
- Lower extremities
- More common in olders, nondiabetics, anxious pts.
- Mechanisms: Rapid ultrafiltration, Intradialytic hypotension, tissue hypoxia
- Treatment: Treat hypotension, hypertonic saline, hypertonic dextrose, manitol(12.5-37.5gr), local massage, application of moist heat , Sodium modeling, carnitine supplementation

Complications of HD(others)

- Fever (endotoxemia)



