NON RENAL INDICATIONS OF CRRT

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NON RENAL INDICATIONS OF (CRRT) IN ICU PATIENT

- **SIRS & Sepsis**
- **Refractory CHF and Cardiopulmonary bypass**
- Crush syndrome
- Tumor lysis syndrome
- Intoxication with dialyzable toxins or drugs
- MOF
- ARDS
- Uncontrolled hyperthermia (core temperature >39.5°C)

CRRT IN SEPSIS

DEFINITIONS

- Sepsis: is the systemic response to infection
- Severe sepsis is associated with organ dysfunction, hypo perfusion, or hypotension
- Septic Shock is associated with persistent hypotension and perfusion abnormalities despite adequate fluid resuscitation

SYSTEMIC INFLAMMATORY RESPONSE SYNDROME (SIRS)

diagnosed by presence of 2 or more of the following variables:

- Fever of more than 38°C or less than 36°C
- Heart rate of more than 90 bpm
- Respiratory rate of more than 20 bpm or a $PaCO_2$ level of less than 32 mm Hg
- white blood cell count (>12,000/μL or < 4,000/μL or >10% bands)

CAUSES OF SIRS
A. INFECTIOUS CAUSES

- Bacterial sepsis
- Burn wound infections
- Candidiasis
- Cellulitis
- Cholecystitis
- Community-acquired pneumonia
- Diabetic foot infection
- Erysipelas
- Infective endocarditis
- Influenza
- Intraabdominal infections (eg, diverticulitis, appendicitis)
- Gas gangrene
- Meningitis
- Nosocomial pneumonia
- Pseudomembranous colitis
- Pyelonephritis
- Septic arthritis
- Toxic shock syndrome
- Urinary tract infections (both male and female)

CAUSES OF SIRS

B. NON INFECTIOUS CAUSES

- Acute mesenteric ischemia
- Adrenal insufficiency
- Autoimmune disorders
- Burns
- Chemical aspiration
- Cirrhosis
- Cutaneous vasculitis
- Dehydration
- Drug reaction
- Electrical injuries
- Erythema multiforme
- Hemorrhagic shock
- Hematologic malignancy
- Intestinal perforation
- Medication side effect (eg, theophylline)
- Myocardial infarction
- Pancreatitis
- Seizure
- Substance abuse (stimulants such as cocaine and amphetamines)
- Surgical procedures
- Toxic epidermal necrolysis
- Transfusion reactions
- Upper gastrointestinal bleeding
- Vasculitis

THE PATHOPHYSIOLOGY OF SEPSIS

- The sepsis syndrome is associated with an overflow of proinflammatory and anti-inflammatory mediators, which leads to generalized endothelial damage,.
- Hemodynamic derangements including arterial hypotension, peripheral vasodilation, hypovolemia from capillary leak and myocardial depression
- **END RESULT**

TISSUE ISCHEMIA release of further cytokines multiple organ failure and altered cellular immunological responsiveness

EPIDEMIOLOGY

- Severe sepsis represents the leading cause of mortality and morbidity in critically ill patients worldwide.
- The mortality rate ranging from 30% to 50%.

PATIENT PRESENTATIONS

- Sepsis alone
- Sepsis with AKI
- Sepsis with CRS Type 5

SEPSIS AND AKI

- SEPSIS IS THE MOST COMMON TRIGGER OF AKI
- AKI occur in 19% of moderate sepsis,
  - 23% of sever sepsis
  - 51% of septic shoch
- Overall mortality rate of AKI about 45%, the mortality rate of septic AKI is 70%
- Despite the management of septic AkI the mortality still high
- Hypoperfusion, endotoxines or inflammatory mediators & ischemia is the main pathophysiological derrangment
- ATN is the main pathological changes

GUIDE LINES MANAGEMENT OF SEPSIS/SHOCK/ INTUBATED/SEVER ILL PATIENTS IN ICU

- **Initial-Lab: CBC (Diff.), CRP, Lactat, crea, BUN, Electrolyte, Liver function test, CK; PT, INR, PTT; in case of sever ill patient at least 2x/d Lab (CBC, PT, INR, PTT, Electrolyte crea, BUN)**
- **stop oral Medications all Medications should be intra venous**
- **intubate COPD: inhalatation of bronchodilated Medications with Salbutamol / Atrovent**
- **Ulcer prophylaxis medications with 40 mg omeprazol iv/d or Ranitidin 2x 50 mg iv/d**
- **Heparin iv: initial 200 IU/h, then after PTT**
- **iv expectorant**
- **5-Lumen central line and arterial canula insertion,**
- **after central line insertion measure the central vein blood oxygen saturation, CVP**
- **Check : Volume ?!, CVP?!, Hb?!**
- **target: SvO2 within 6 hrs >70%, if there is no improvment after Volume replacement give Dobutamin; if SvO2>70% control every shift or more**
- **Standard-catecholamine: Dobutamin/Noradrenalin**
- **Sever Sepsis: after Intubation and central line insertion: Blood culture (2x), Tracheal secretion, Urine cult, Urine R/E, Wound swab (befor Antibiotics); start early with broad spectrum Antibiotic therapy (e.g. Pipril/Combactam) within the first 4-6h of admission**
- **Diagnostic: XR-Thorax, Abdomen in case of acute abdomen + ultra sound Abdomen, CT; Echo, cardiac enzyme, CT-Thorax in case of (Pneumonia/ COPD);**
- **Analgic-sedation in case of intubated Patients:**
- **Stable Patient with infection exacerbated COPD: Propofol/Sufenta, or Ketanest (1-2mg/kg/h)**
- **unstable Patient: Dormicum/Fentanyl**
- **Volume: according to request septic Patients may needs over 6000 ml/24 hr. In case of Oliguria/ Anuria Lasix perfusion 0-20mg/h, if the required volume is replaced**
- **potassium (target: 4-4,5 mmol/l), in case of sever hypokalemia**
- **target : BS<150 mg/dl, sol. Insulin (als Perfusor)**
- **Diuresis: >1-2 ml/kg/h**
- **Put the intubated patient at 40° (for orthostatic Pneumonia prophylaxis)**
- **Nutrition, (target : BS<150 mg/dl)**
- **Hydrocortisone 100 mg iv X3**

- **Consider CRRT**

INDICATION OF CRRT IN SEPSIS

- Sepsis represent the most non-renal indications for CRRT.
- CRRT is possible in septic patients even when they are haemodynamically unstable; such treatment is given to balance hypercatabolism and fluid overload.

RENAL REPLACEMENT THERAPY

- We suggest that continuous renal replacement therapies and intermittent hemodialysis are equivalent in patients with severe sepsis and acute renal failure because they achieve similar short-term survival rates (grade 2B).

- We suggest the use of continuous therapies to facilitate the management of fluid balance in hemodynamically unstable septic patients (grade 2D)

Dellinger RP et al Crit Care Med 2008; 36:296-437

MECHANISM OF CRRT IN SEPSIS

- Hemofiltration removes most soluble mediators of sepsis; inflammatory mediators, e.g. (cytokines, complement activation products) which are middle molecules
- high volume' and convective modalities have the advantage of;
  - removing higher molecular weight substances, which include many inflammatory mediators
  - Has adsorptive effect on some immune mediators
  - Some mediators has cell adhesion that cannot be removed by HF
- By removing the inflammatory cytokines this lead to decrease in the inflammatory response

TIMING OF INITIATION OF CRRT

- A. sepsis alone; starting of CRRT is controversial
- B. septic AKI
  - Raised BUN is considered to be indicator of starting therapy rather than s. creatinine.

1. Early initiation of therapy when BUN less than 150mg/dl.
2. Late initiation at level above 200mg/dl

- Early seems better out come to prevent further deteriorations

DOSING OF HF IN SEPSIS

- the conventional renal dose (20 ml/kg per hour), has been used to treat AKI. This dose is not able to clear inflammatory mediators.
- Continuous and intermittent high-volume hemofiltration (HVHF) 50–70 ml/kg/h a day,
- very-high-volume treatment at 100–120 ml/kg/h for 4–8 h (previously called ‘pulse’ HVHF).

PRESCRIPTION OF PULSE HIGH-VOLUME HAEMOFILTRATION TECHNIQUE

- Excellent vascular access is required, with a large catheter (13.5 or 14 Fr), using an adequate location (right int. jugular is the best followed by femoral approach, while the subclavian route should not to be used.
- Blood flow rates of 250–300 ml/min, as permitted by the access, were used to achieve a filtration fraction of 20–25% and to prevent premature clotting of extracorporeal circuit.
- UF rate of 85 ml/kg per hour for 6 hours/day followed by standard continuous venovenous haemofiltration (UF rate 35 ml/kg per hour) for 18 hours,

PREDICTORS OF IMPROVEMENT

- significant reduction in vasopressor requirements (noradrenalin dose)
- improvement in systolic blood pressure
- Predicted mortality rates decreased based on (APACHE II score and on SAPS II score)
- Increase of the inflammatory markers in effluent fluid and decrease its level in the blood

TERMINATION OF THE TREATMENT

- Treatments given on a daily basis, and terminated if;
- the patient died
- if the physician considered the septic process have ended
- the patient's clinical parameters improved.

CRRT IN CARDIAC PATIENTS

HISTORY

- CRRT was first described in 1977 for the treatment of diuretic-unresponsive fluid overload in the ICU by cardiologist called Kramer.

PRESENTATION OF CARDIAC ICU PATIENTS

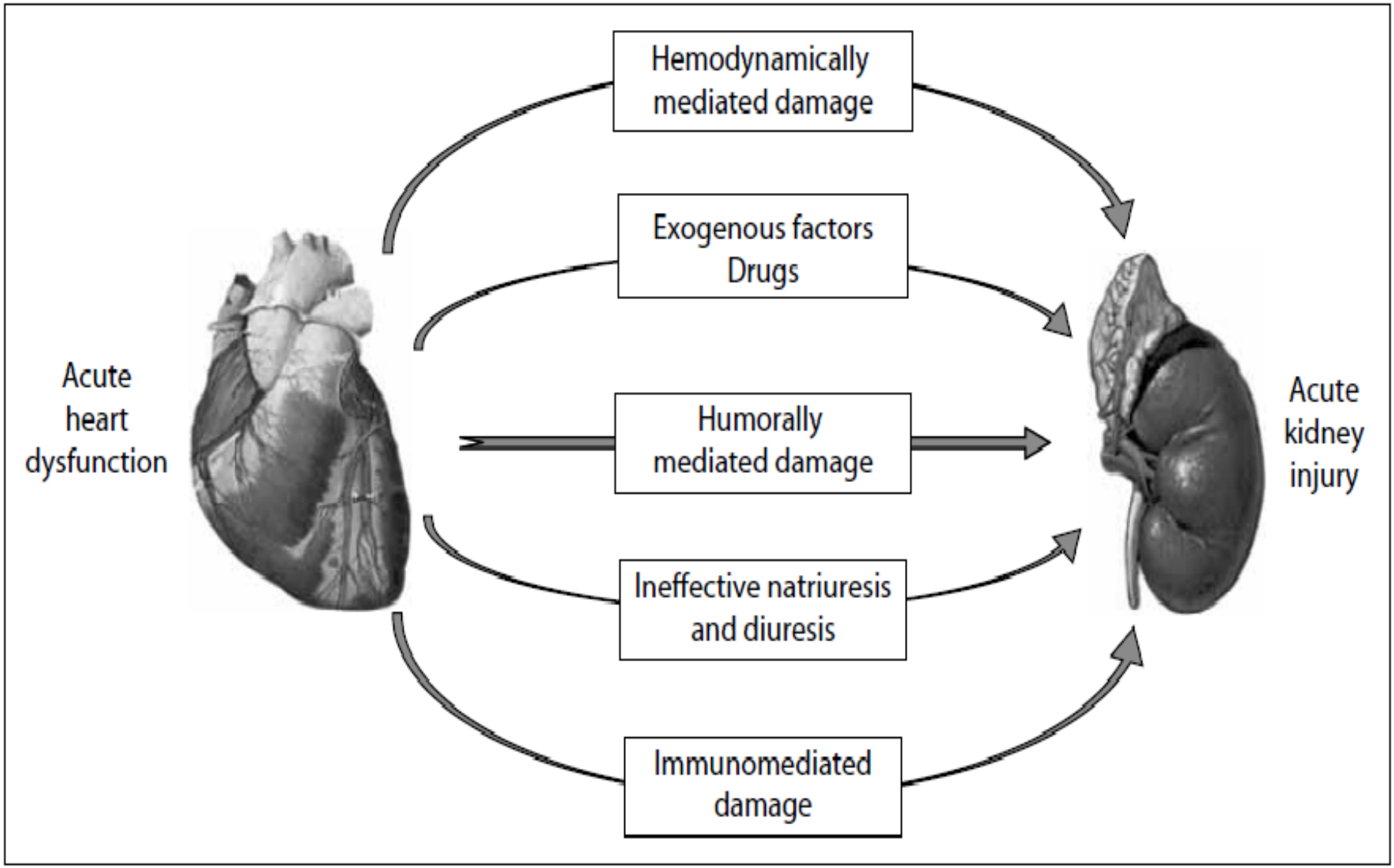
- Cardiac without renal involvement, eg post CP bypass surgery, CHF
- CRS type I,II
- Cardiac, AKI and sepsis, CRS type 5

DEFINITION OF CRS

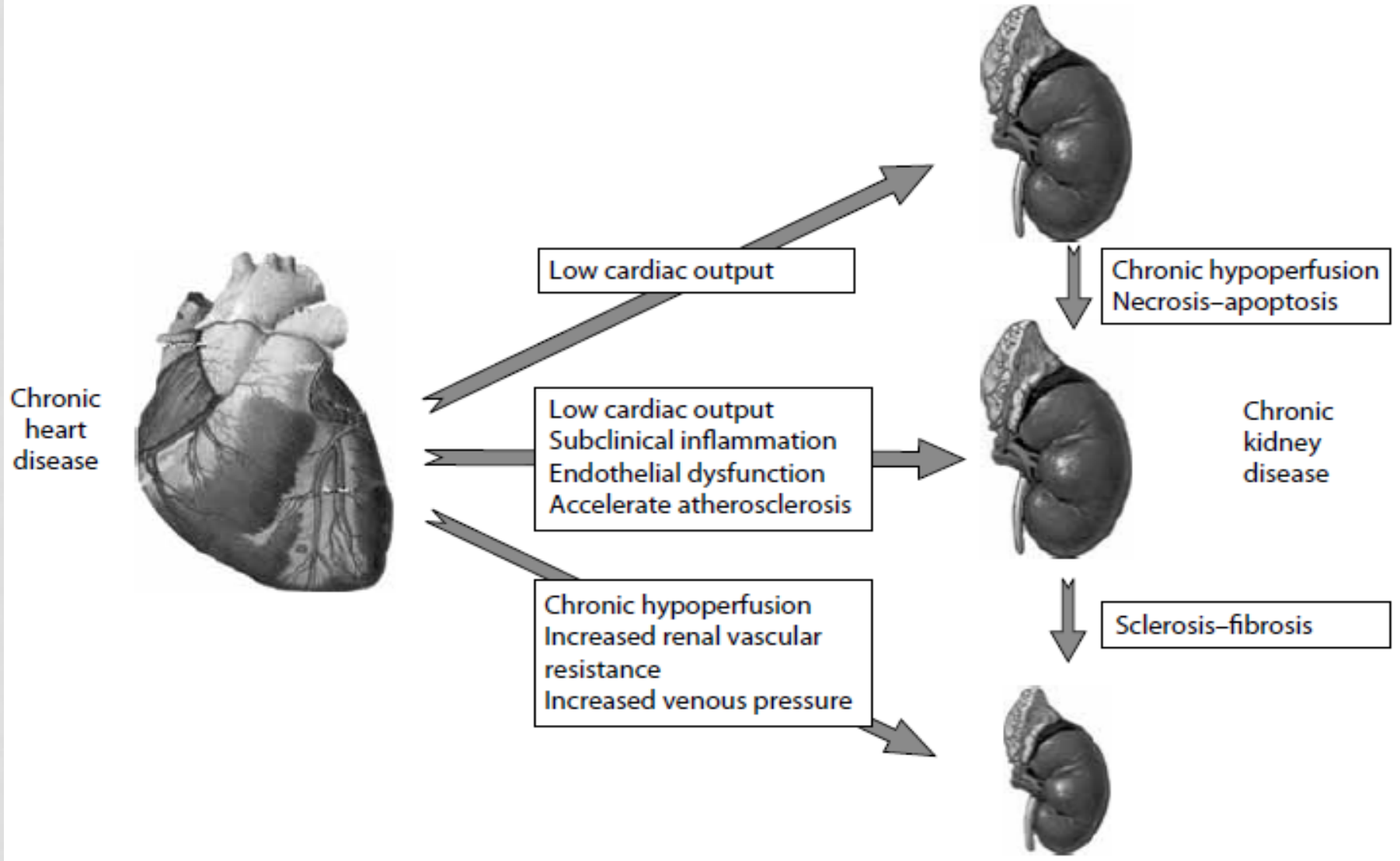
Is a disorder of the heart and kidneys whereby acute or chronic dysfunction in one organ may induce acute or chronic dysfunction of the other .

CLASSIFICATION

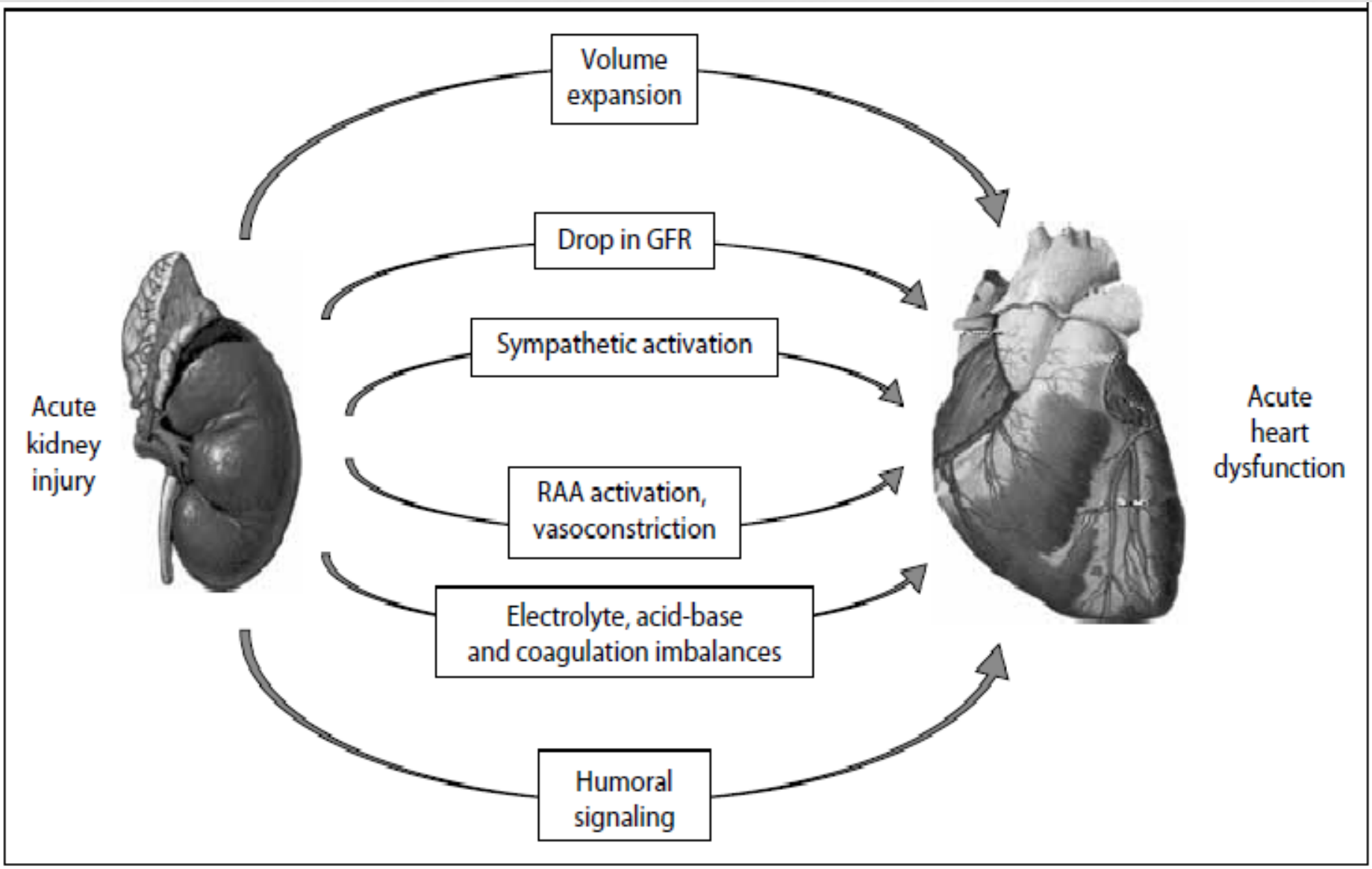
1-CRS type1(acute CRS)
2-CRS type2(chronic CRS)
3-CRS type3(acute RCS)
4-CRS type4(chronic RCS)
5-CRS type5(secondary CRS)



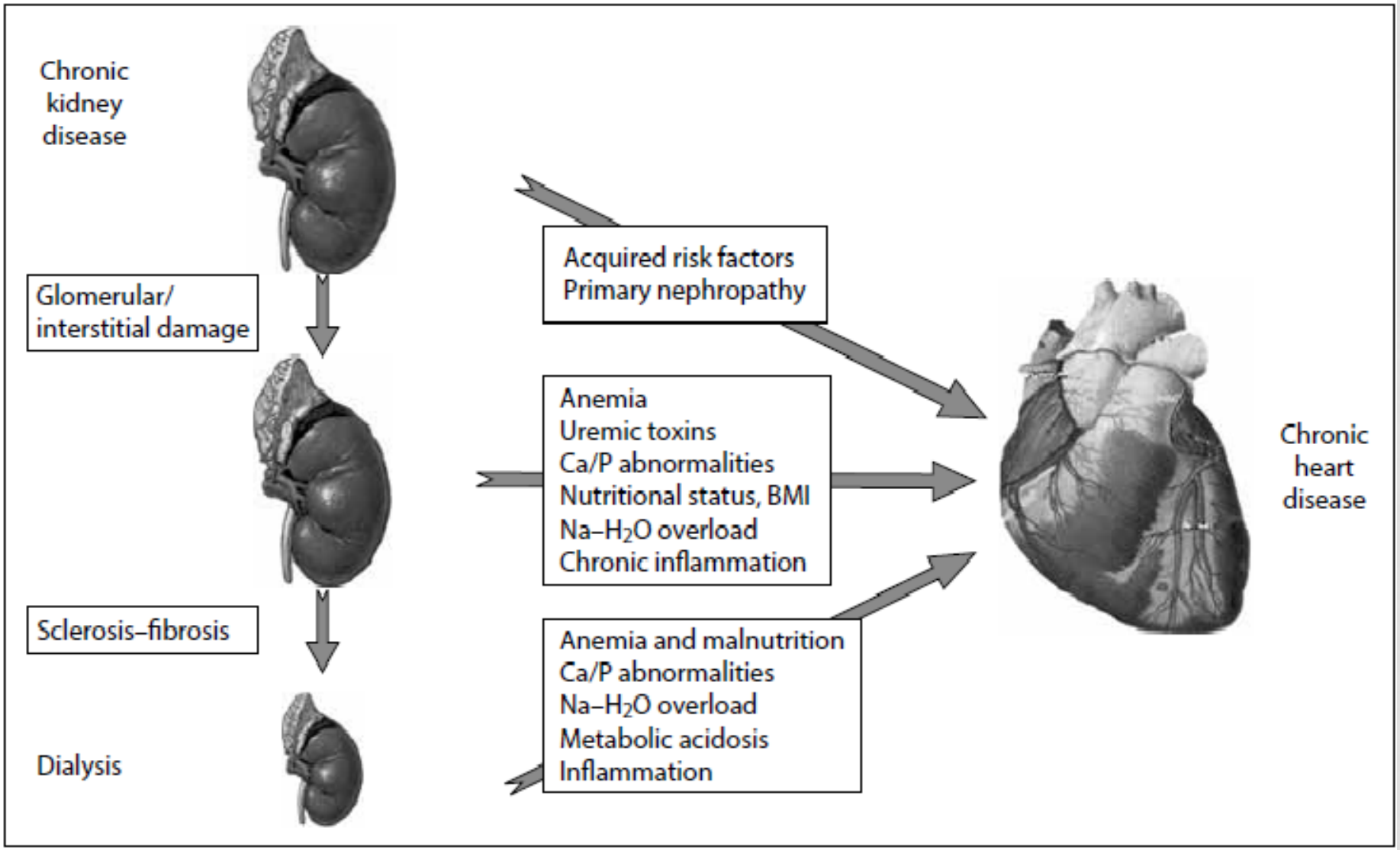
the major pathophysiological interaction in type1 CRS



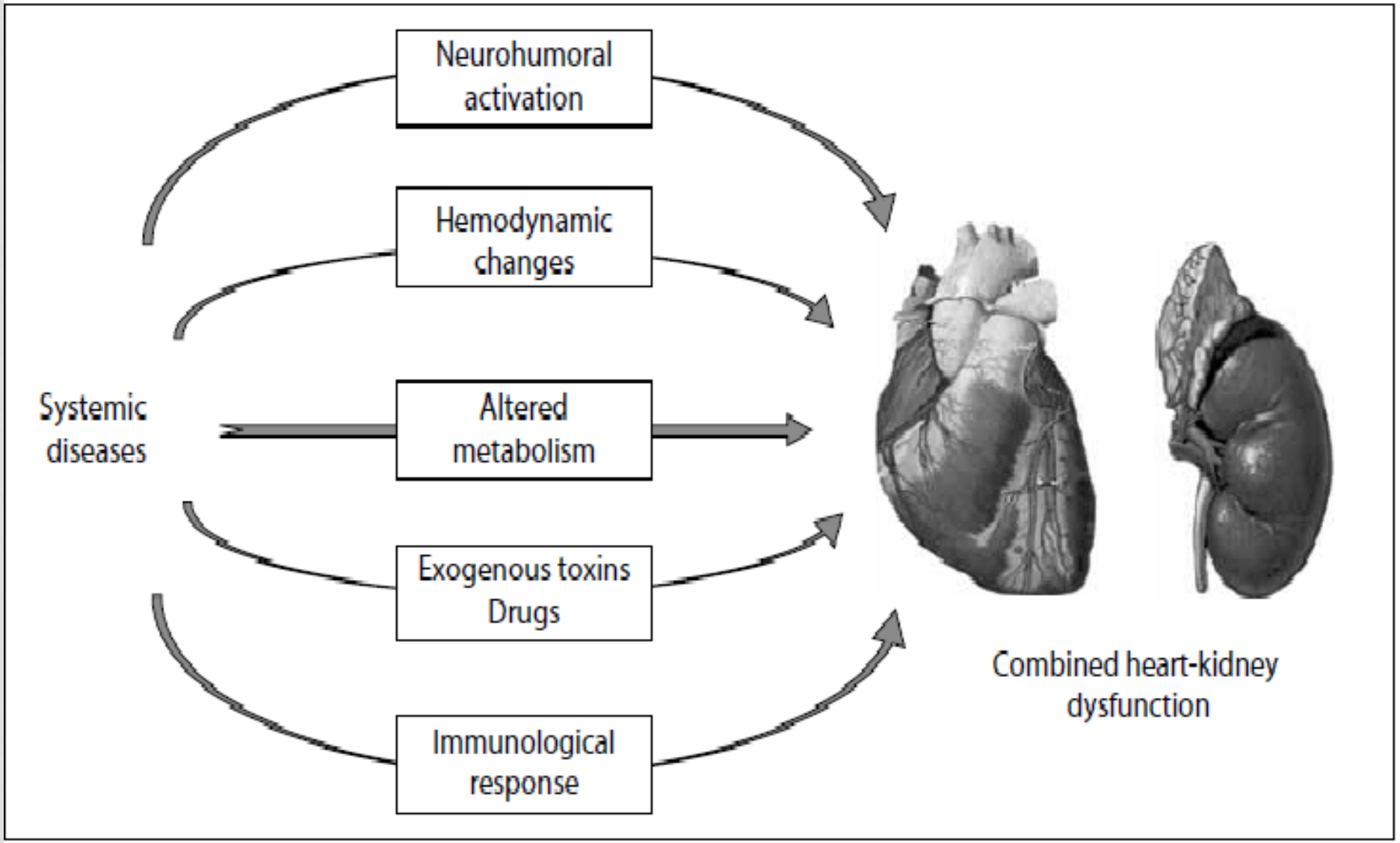
the major pathophysiological interaction in type 2 CRS



the major pathophysiological interaction in type3 CRS



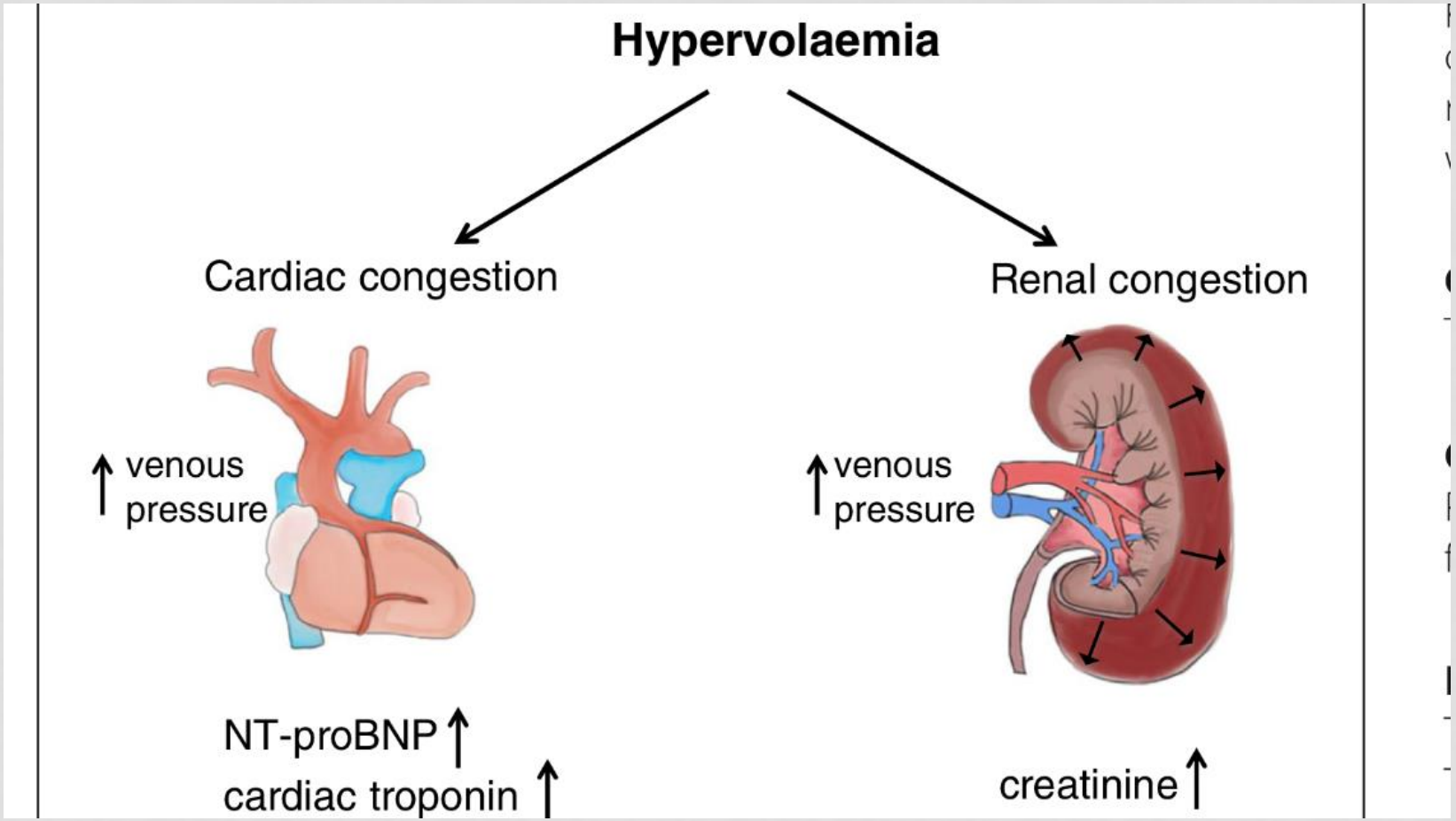
the major pathophysiological interaction in type4 CRS



the major pathophysiological interaction in type 5 CRS

AKI & HEART

- The other major cause of AKI after sepsis is cardiovascular surgery including valve replacement, CABG
- 1% need RRT
- Development of AKI in cardiac patients associated with high mortality
- Risk factors; age, male, DM, PVD, CKD, operation duration, use of contrast media
- Hypoperfusion & ischemia is the most common pathophysiology seen in these patients
- Presnce of elevated Cardiac troponon I, T, NT- proBNP levels predicted the development AKI


Hypervolaemia
Cardiac congestion
Renal congestion
↑ venous pressure
↑ venous pressure
NT-proBNP ↑
cardiac troponin ↑
creatinine ↑

INDICATIONS OF CRRT IN ICU CARDIAC PATIENTS

1. Post OP Cardiopulmonary bypass
2. diuretic resistance of Acute or chronic CHF.
3. elevated cardiac biomarkers in non cardiac with AKI
4. Reduced UOP Less than 0.3ml/kg/h in CRS

MECHANISM OF CRRT IN CHF

ultra filtration of fluid at very slow and continuously,(SCUF) lead to;

- Decreased myocardial oedema,
- decrease in left ventricular end-diastolic pressure.
- Optimization of the Starling relationship, increased myocardial performance,
- Removal of circulating myocardial depressant factors

BENEFITS OF CRRT IN CHF

- CRRT, is easily tolerated and useful for control of intravascular and extravascular volume.
- It restores dry body weight, and prolongs symptom-free and oedema-free time.
- CRRT prevents treatment-associated ischaemic renal injury, by avoidance of intravascular volume depletion and hypotension which is seen with standard IHD
- The use of standard IHD can be lethal in such patients.

PREDICTORS OF IMPROVEMENT

- Improvements in cardiac function and hemodynamic
- Improvements of cardiac index
- improvement in systolic blood pressure

CONCLUSION I

- **Early initiation of CRRT** will improve quality of life & decrease morbidity and mortality.
- **A patient is considered to require CRRT when**:
  - There is an acute fall of GFR
  - There is a clinical significant solute imbalance/toxicity
  - Volume overload.
- **In all vasopressor-dependent patients CRRT is the standard of care**
- **CRRT can be started safely in any patient**

SO..WHEN SHOULD ONE START CRRT?

There are no "proven" criteria, BUT....

- Early seems good
- Clinical judgments has a important role

CONTROVERSIES ABOUT THE USE OF CRRT

- Who should prescribe the CRRT in the ICU, the intensivist or internist or the nephrologists?
- Who should manage the CRRT circuit , the ICU or haemodialysis nurses?
- do the costs of CRRT compare favorably with other modalities?

WHETHER INTENSIVISTS OR NEPHROLOGISTS SHOULD PRESCRIBE THE CRRT?

- in Australia, intensivists have taken over the task of treating AKI without any reference to nephrological opinion or intervention.
- in the USA nephrologists mostly control the prescription and application of CRRT.
- In other countries, there may be a combined approach or a predominance of one group over another.
- the ideal arrangement is full collaboration between intensivist and nephrologist, such collaboration should be encouraged whenever possible.

WHETHER ICU OR HAEMODIALYSIS NURSES SHOULD SET UP AND RUN THE CRRT?

- depends on:
  - institutional logistics,
  - continued nursing education,
  - sufficient numbers of `expert' nurses within a given ICU.


THANK YOU
For your attention