KARDIO-RENÁLNÍ SYNDROM: JAK TO VIDÍM U LŮŽKA

Doc MUDr Marek Nalos PhD, EDIC, FCICM
JIP, I. Interni klinika (MJIP)
FN Plzen

1

Definition of Cardiorenal syndrome (CRS)

The Working Group of the National Heart, Lung, and Blood Institute in **2004**

Result of interactions between the kidneys and other circulatory compartments that **increase circulating volume**, exacerbating the symptoms of heart failure

Acute Dialysis Quality Initiative - consensus approach in **2008**
2 major CRS phenotypes
cardiorenal and renocardiac syndromes

Risk factors: obesity, diabetes, hypertension, HF, atherosclerosis, endothelial cell dysfunction, anemia and disorders of iron metabolism, and chronic inflammation

Symptoms related to volume overload and an ineffective circulation: dyspnea, fatigue, and chronic pain

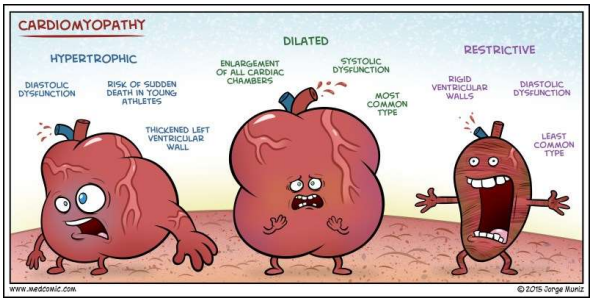
2

Classification of CRS Based on the Consensus Conference of the Acute Dialysis Quality Initiative

Phenotype	Nomenclature	Description	Clinical Examples
Type 1 CRS	Acute CRS	HF resulting in AKI	ACS resulting in cardiogenic shock and AKI, AHF resulting in AKI
Type 2 CRS	Chronic CRS	Chronic HF resulting in CKD	Chronic HF
Type 3 CRS	Acute renocardiac syndrome	AKI resulting in AHF	HF in the setting of AKI from volume overload, inflammatory surge, and metabolic disturbances in uremia
Type 4 CRS	Chronic renocardiac syndrome	CKD resulting in chronic HF	LVH and HF from CKD-associated cardiomyopathy
Type 5 CRS	Secondary CRS	Systemic process resulting in HF and kidney failure	Amyloidosis, sepsis, cirrhosis

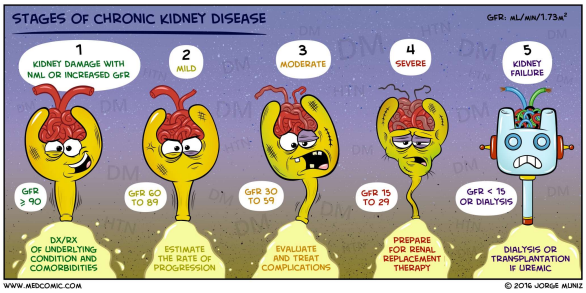
3

Type I CRS



4

Type III CRS



5

Type I CRS

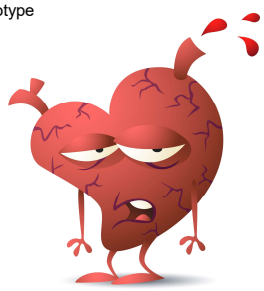
AKI in the setting of AHF

Up to 40% of patients hospitalized for AHF present with a type 1 CRS phenotype

Conventional explanation:
inability of the failing heart to generate forward flow resulting in prerenal hypoperfusion

Inadequate renal afferent flow activates RAAS axis,
Sympathetic nervous system
Arginine vasopressin secretion

Fluid retention, increased preload, and worsening pump failure

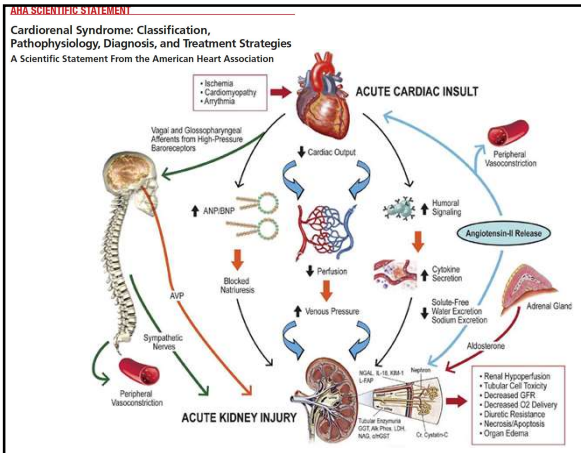


6

Concept of **elevated central venous pressures**
renal venous hypertension, increased renal resistance
ultimately impaired intra renal blood flow

HFpEF - obesity, insulin resistance

7



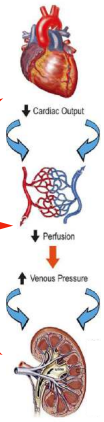
The mechanistic relations between failing heart and kidneys are bidirectional and complex

8

AKI in the setting of AHF?

AHF in the setting of AKI?

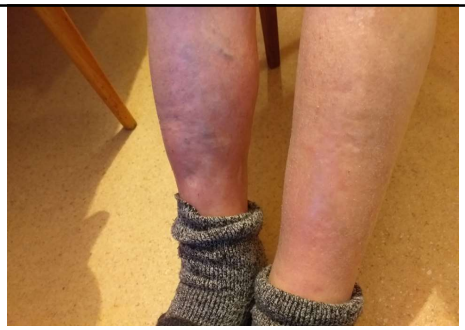
1. Relevant hemodynamic parameters (ECHO)
2. Clinical assessment of perfusion status (CRT)
3. Detection of renal injury (urine microscopy, renal ultrasound).
4. Excluding alternative reasons for worsening cardiac or renal function



9

DIAGNOSTIC STRATEGIES IN CRS

10



Infection - a common trigger for acute cardiorenal syndrome
Pneumonia
Cellulitis (ruze)
UTI
Infections in diabetics (higher risk for CRS)

11

DIAGNOSTIC STRATEGIES IN CRS

Biomarkers

Markers of Glomerular Filtration and Integrity

Cystatin, Creatinine ?, albuminuria

Markers of Renal Tubular Injury

Urine microscopy, number of renal tubular epithelial cells and granular casts

Cardiac Biomarkers in CRS

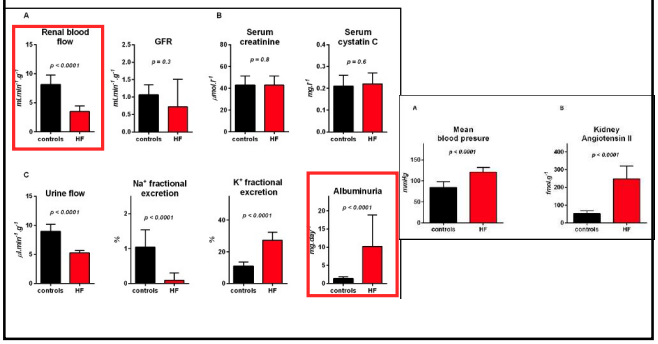
?BNP, NT-BNP, Troponin?

12

Kidney Response to Heart Failure: Proteomic Analysis of Cardiorenal Syndrome

Kidney Blood Press Res 2018;43:1437-1450

Vojtech Melenovsky[a] Ludek Cervenka[a] Ondrej Viklicky[a] Janka Franekova[a]
Tereza Havlenova[a] Matej Behounek[b] Martin Chmel[b] Jiri Petrak[b]



13

DIAGNOSTIC STRATEGIES IN CRS

Imaging Modalities - Heart

Echocardiography - diagnosing the congestive state
CVP, PAP, RV diameter, LAP (E/E' >15), LVEF, CO

Culprit hemodynamic contributors

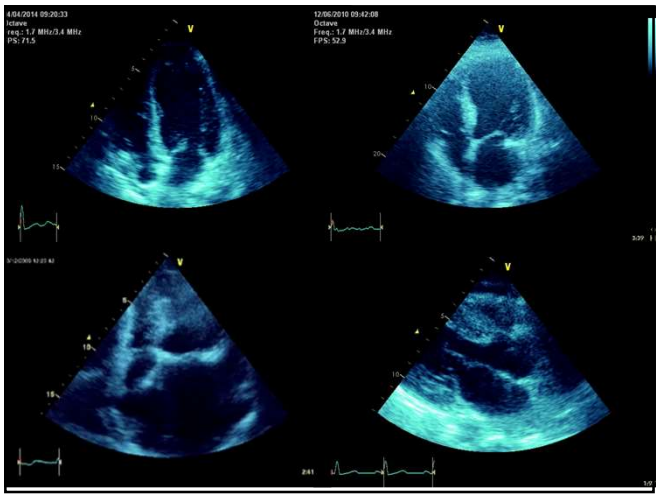
1. Pulmonary hypertension
2. Cardiogenic shock
3. Valvular dysfunction (mitral regurgitation or tricuspid regurgitation)
4. Assessment of volume overload
5. RV failure

Decreasing LVEF or increased LV filling pressure (systolic and diastolic HF)

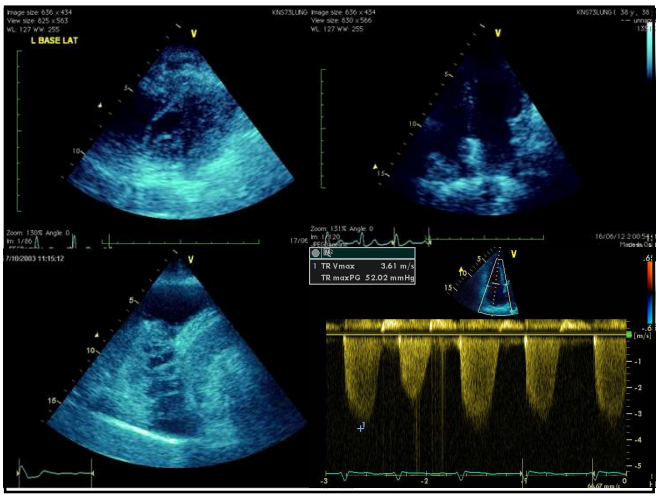
Increasing **PA pressure**, **RV diameter** independently associated with higher incidence of CRS

Cardiac magnetic resonance imaging

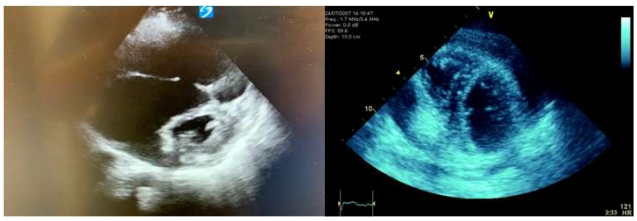
14



15

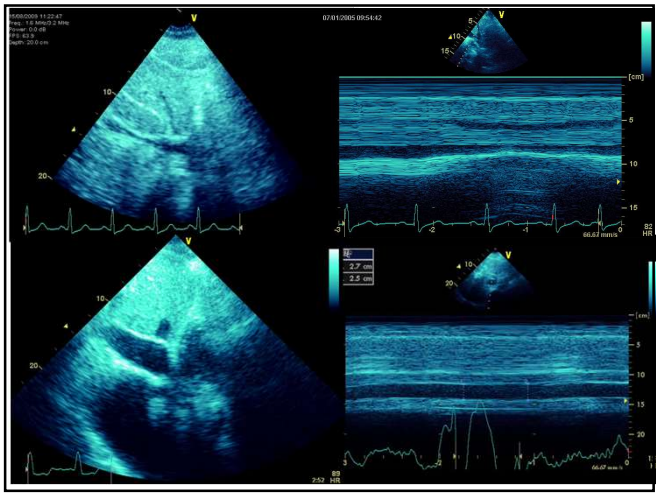


16



interventricular asynchrony and pericardium-mediated RV-LV interactions

17



18

The effects of declining RV function and elevated RV afterload on renal hemodynamics are common but relative contribution unclear

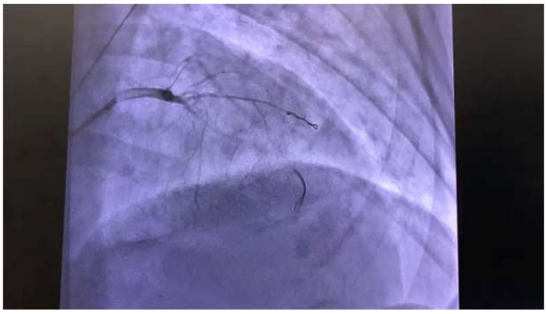
post hoc analysis of the ESCAPE trial
Right atrial pressure - the only hemodynamic parameter **associated with baseline renal dysfunction**

Evaluation Study of Congestive Heart Failure and Pulmonary Artery Catheterization Effectiveness
The ESCAPE Trial

Dr. Martin Stepan ©

19

ROLE OF CORONARY ISCHAEMIA



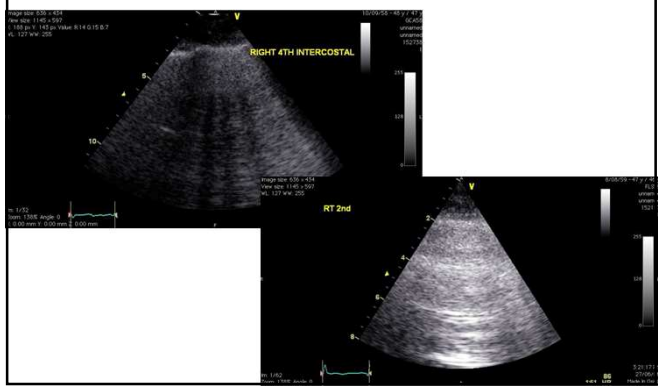
20

CARDIAC MRI

Uremic cardiomyopathy (**type 4 CRS**)
Myocardial fibrosis in patients with uremic cardiomyopathy
gadolinium-enhanced cardiac MRI
high prevalence of coronary artery disease and also a non-infarct pattern typical of more diffuse fibrosis

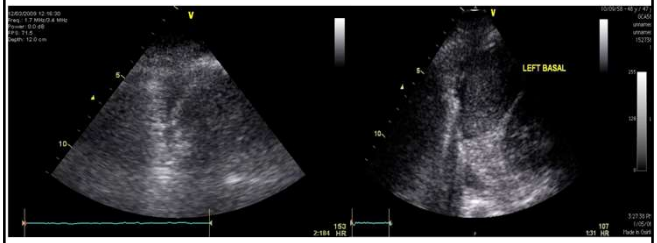
21

Interstitial lung oedema anterior chest



22

Interstitial-alveolar oedema lung base



23

Imaging Modalities - Kidney

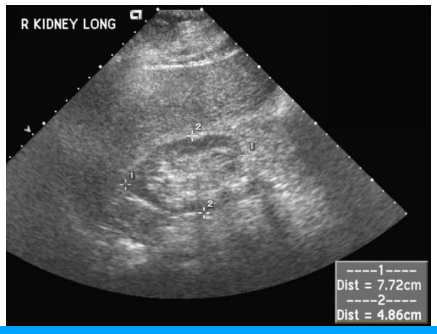
Renal ultrasonography and intrarenal venous flow patterns - emerging tools in identifying renal venous congestion

Patients with **discontinuous intra renal venous flow** poorest prognosis (<40% survival at 1 year)

CT abdomen

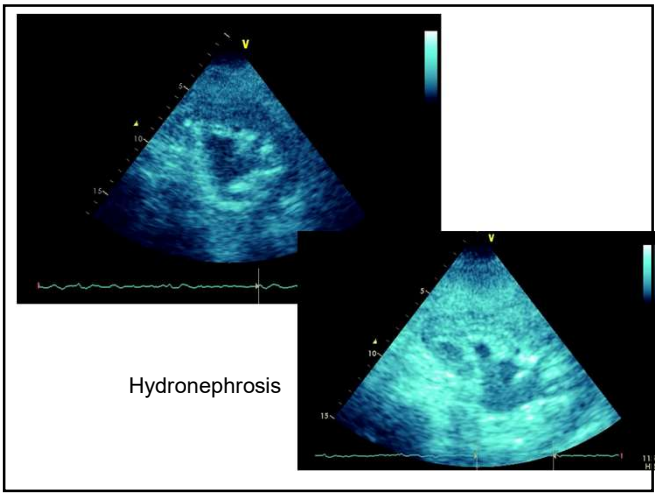
24

Renal ultrasonography
information on chronicity of disease - renal size, echogenicity, cortical thickness, and abnormal corticomedullary ratios - helpful in identifying CRS phenotype



Atrophic small irregular (scarred) kidney

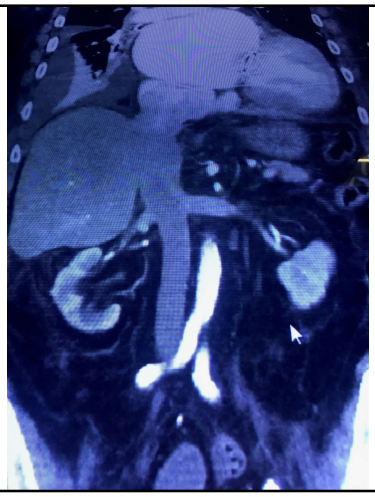
25



Hydronephrosis

26

CT abdomen



27

TREATMENT STRATEGIES IN CRS

Decongestive Therapies
Diuretics

Reductions in extracellular fluid volume are limited by the degree of plasma refill from the extracellular fluid into the intravascular space. Impairment plasma refill further triggers endogenous production of hormones such as angiotensin II and vasopressin

A **careful clinical assessment of the degree of plasma refill is critical** in avoiding maladaptive neurohormonal responses to impaired plasma refill when decongestive therapies are administered.

rationale for use of thiazide-type diuretics to augment furosemide-induced sodium excretion.

high-dose intermittent furosemide appears to be safe and effective in AHF

Ultrafiltration

Ultrafiltratio
use of ultraf

Ultrafiltration in Decompensated Heart Failure with Cardiorenal Syndrome

ainst the
1 CRS

Bradley A. Bart, M.D., Steven R. Goldsmith, M.D., Kerry L. Lee, Ph.D.,

N Engl J Med 2012;367:2296-304.

28

Neurohormonal Modulation and Inotropic Therapy

Neurohormonal modulation in the AHF setting has failed to improve hard clinical and renal end points in large randomized studies.

Inotropes can be beneficial by improving CO and reducing venous congestion

Inotropic therapy for AHF and reduced EF
favorable acute hemodynamic effects
long-term cardiovascular outcomes are **not affected**
presence of arrhythmias, ischaemia, and worsening long-term myocardial function

ROSE-AHF trial - no difference in decongestion, renal function, or clinical outcomes when a 72-hour infusion of **low-dose dopamine** compared with placebo **in AHF**

29

PALLIATIVE CARE IN CRS

High mortality, healthcare resource use, poor quality of life with advanced CRS

Bone and mineral disorders - high rates of skeletal fractures with falls and pain

Nonsteroidal anti-inflammatory agents are contraindicated

Depression is a highly prevalent symptom

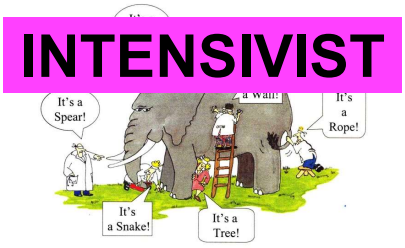
Patients may benefit from palliative care

The symptom burden with HF and advanced CKD being comparable to that in patients with advanced lung and pancreatic cancer.

30

FUTURE DIRECTIONS IN CARDIORENAL MEDICINE

Dedicated cardiorenal **interdisciplinary team** that spearheads early identification of patients with decompensated CRS and jointly manages appropriate clinical interventions



31

Dekuji za pozornost

32