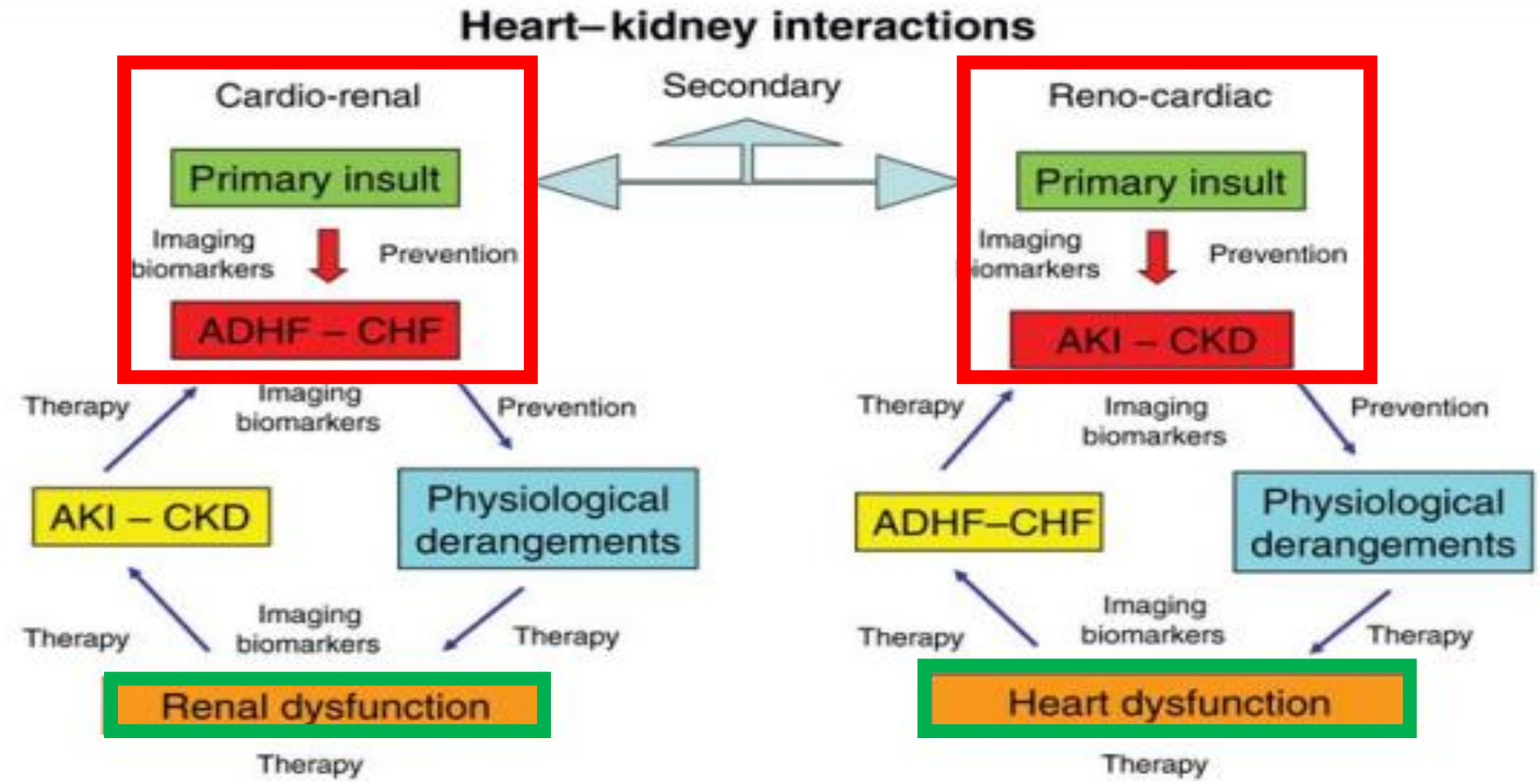
Kardiorenální interakce

Vladimír Tesař, Jan Vachek
Klinika nefrologie 1.LF UK a VFN, Praha

Cardio-renal syndromes: report from the consensus conference of the Acute Dialysis Quality Initiative

European Heart Journal (2010) **31**, 703–711

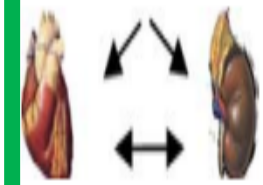
Claudio Ronco[1,2*], Peter McCullough[3], Stefan D. Anker[4,5], Inder Anand[6],



Cardio-renal syndromes: report from the consensus conference of the Acute Dialysis Quality Initiative

European Heart Journal (2010) **31**, 703–711

Table I Cardio-renal syndromes: classification, definitions, and work group statements

Syndromes	Acute cardio-renal (type 1)	Chronic cardio-renal (type 2)	Acute reno-cardiac (type 3)	Chronic reno-cardiac (type 4)	Secondary CRS (type 5)
Organ failure sequence					
Definition	Acute worsening of heart function (AHF–ACS) leading to kidney injury and/or dysfunction	Chronic abnormalities in heart function (CHF-CHD) leading to kidney injury or dysfunction	Acute worsening of kidney function (AKI) leading to heart injury and/or dysfunction	Chronic kidney disease (CKD) leading to heart injury, disease and/or dysfunction	Systemic conditions leading to simultaneous injury and/or dysfunction of heart and kidney
Primary events	Acute heart failure (AHF) or acute coronary syndrome (ACS) or cardiogenic shock	Chronic heart disease (LV remodelling and dysfunction, diastolic dysfunction, chronic abnormalities in cardiac function, cardiomyopathy)	AKI	CKD	Systemic disease (sepsis, amyloidosis, etc.)

Cardiorenal Syndrome in Western Countries: Epidemiology, Diagnosis and Management Approaches

Kidney Dis 2016;2:151–163

Claudio Ronco[a] Luca Di Lullo[b]

Table 1. Classification of CRS

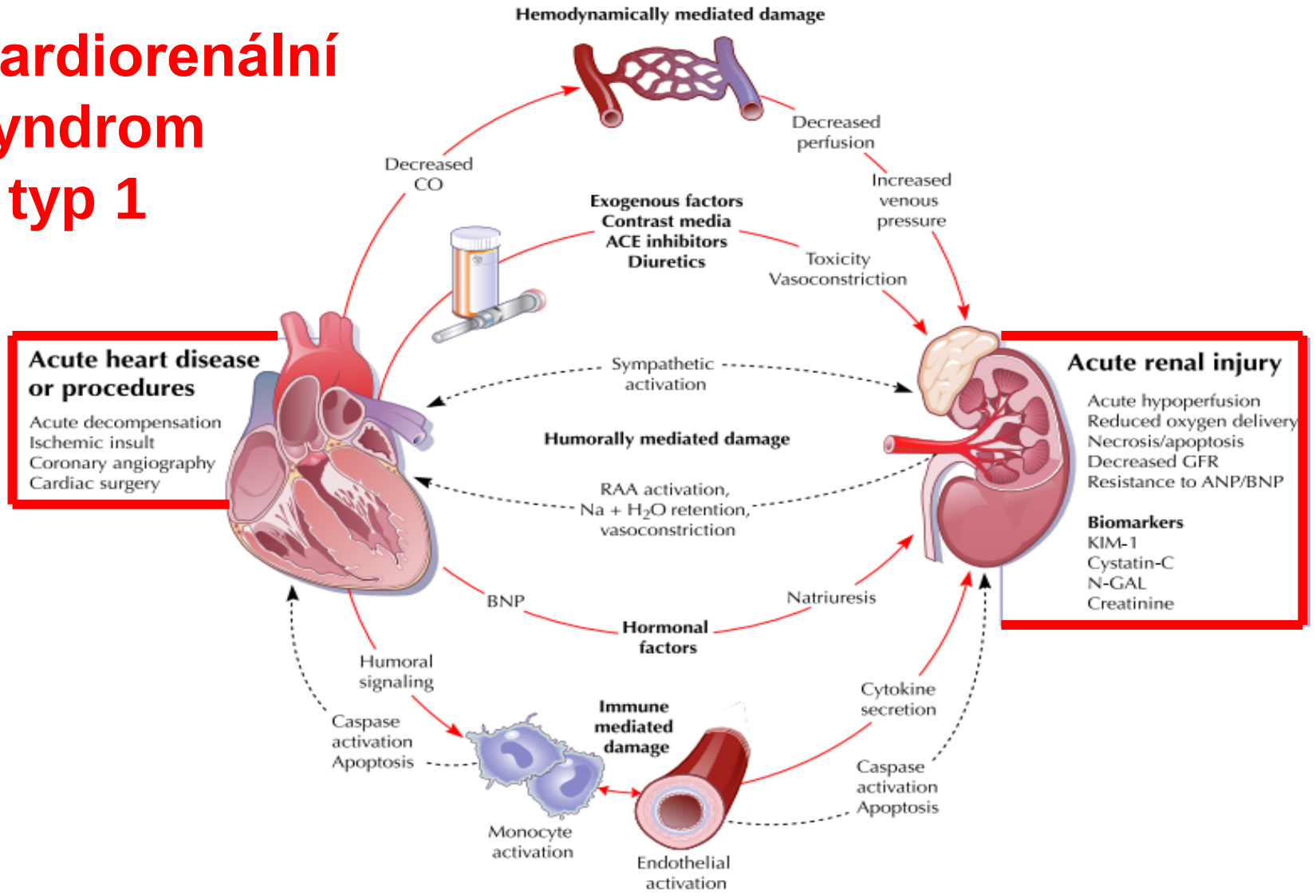
Type	Denomination	Description	Example
1	Acute cardiorenal	Heart failure leading to AKI	Acute coronary syndrome leading to acute heart and kidney failure
2	Chronic cardiorenal	Chronic heart failure leading to kidney failure	Chronic heart failure
3	Acute nephrocardiac	AKI leading to acute heart failure	Uremic cardiomyopathy AKI related
4	Chronic nephrocardiac	CKD leading to heart failure	Left ventricular hypertrophy and diastolic heart failure due to kidney failure
5	Secondary	Systemic disease leading to heart and kidney failure	Sepsis, vasculitis, diabetes mellitus

Cardiorenal Syndrome

(J Am Coll Cardiol 2008;52:1527–39) © 2008

Claudio Ronco, MD,* Mikko Haapio, MD,† Andrew A. House, MSc, MD,‡ Nagesh Anavekar, MD,§ Rinaldo Bellomo, MD¶

Kardiorenální syndrom - typ 1



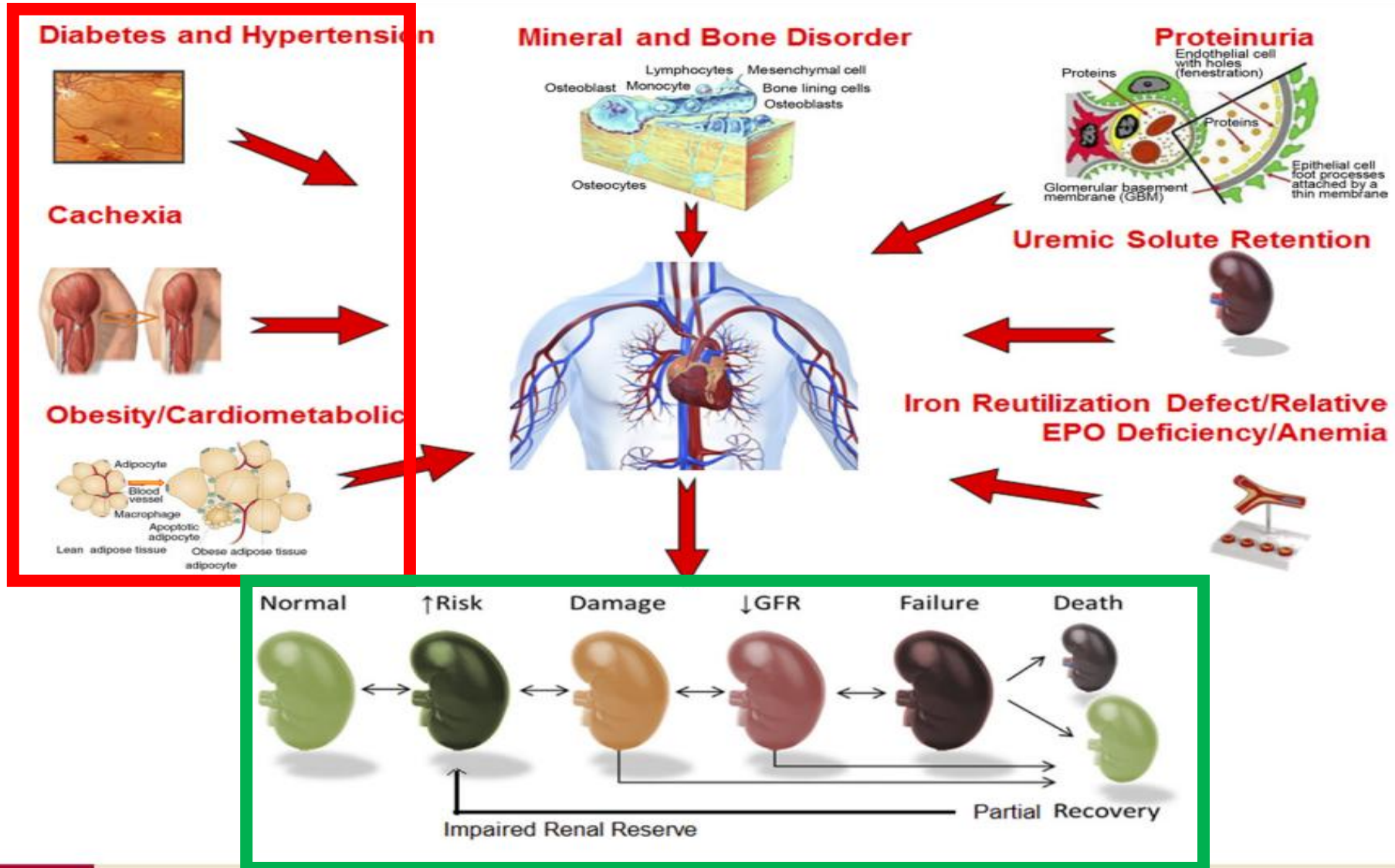
Cardiorenal Syndrome Type 1

(J Am Coll Cardiol 2012;60:1031–42) © 2012

Pathophysiological Crosstalk Leading to Combined Heart and Kidney Dysfunction in the Setting of Acutely Decompensated Heart Failure

Claudio Ronco, MD,*† Mariantonietta Cicoira, MD,‡ Peter A. McCullough, MD, MPH§‖¶#

Predispoziční faktory kardiorenálního syndromu 1.typu



KDIGO Clinical Practice Guideline for Acute Kidney Injury

VOLUME 2 | ISSUE 1 | MARCH 2012

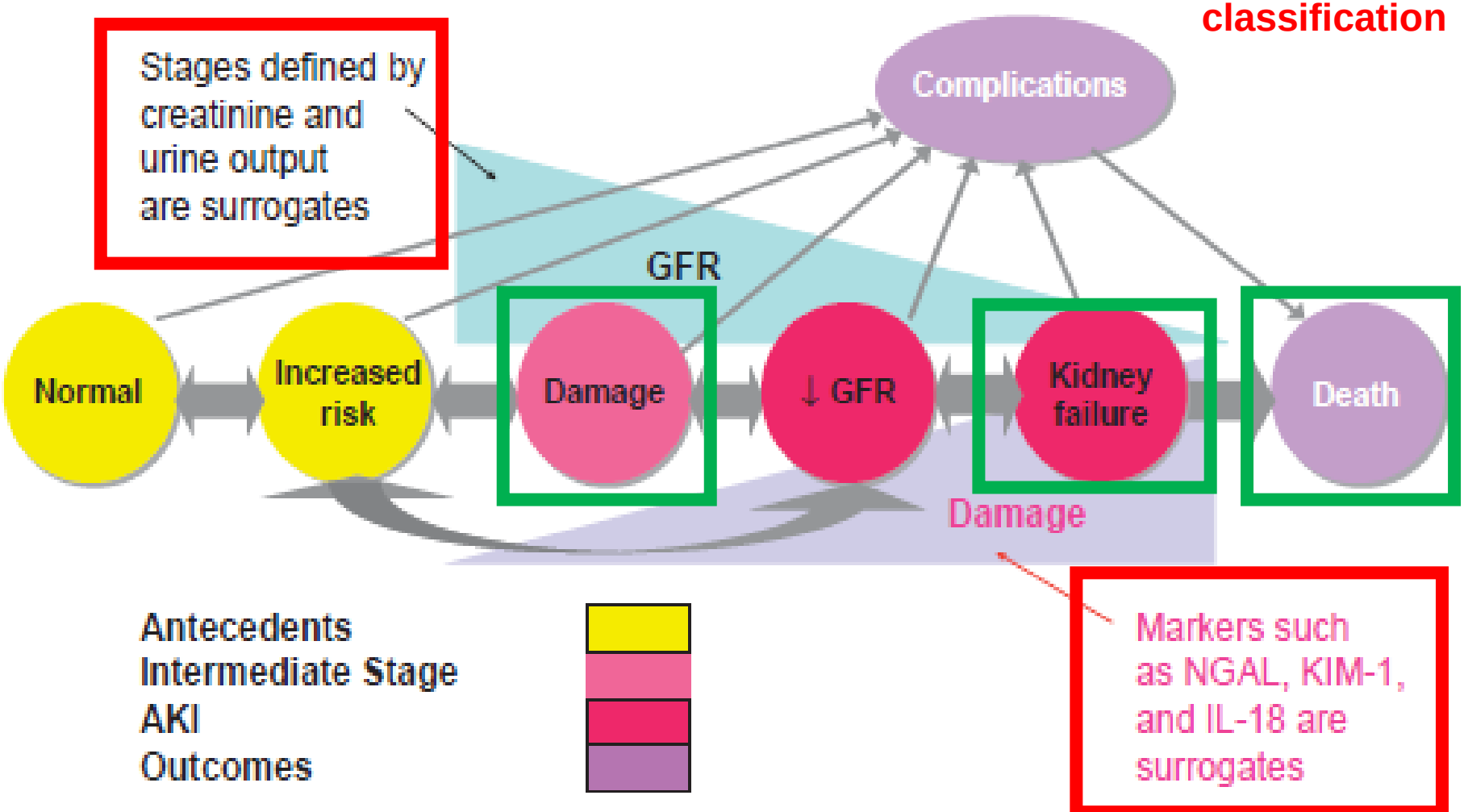
http://www.kidney-international.org

John A Kellum, MD, FCCM, FACP
University of Pittsburgh School of Medicine
Pittsburgh, PA

Norbert Lameire, MD, PhD
Ghent University Hospital
Ghent, Belgium

Vývoj akutního poškození ledvin (AKI)

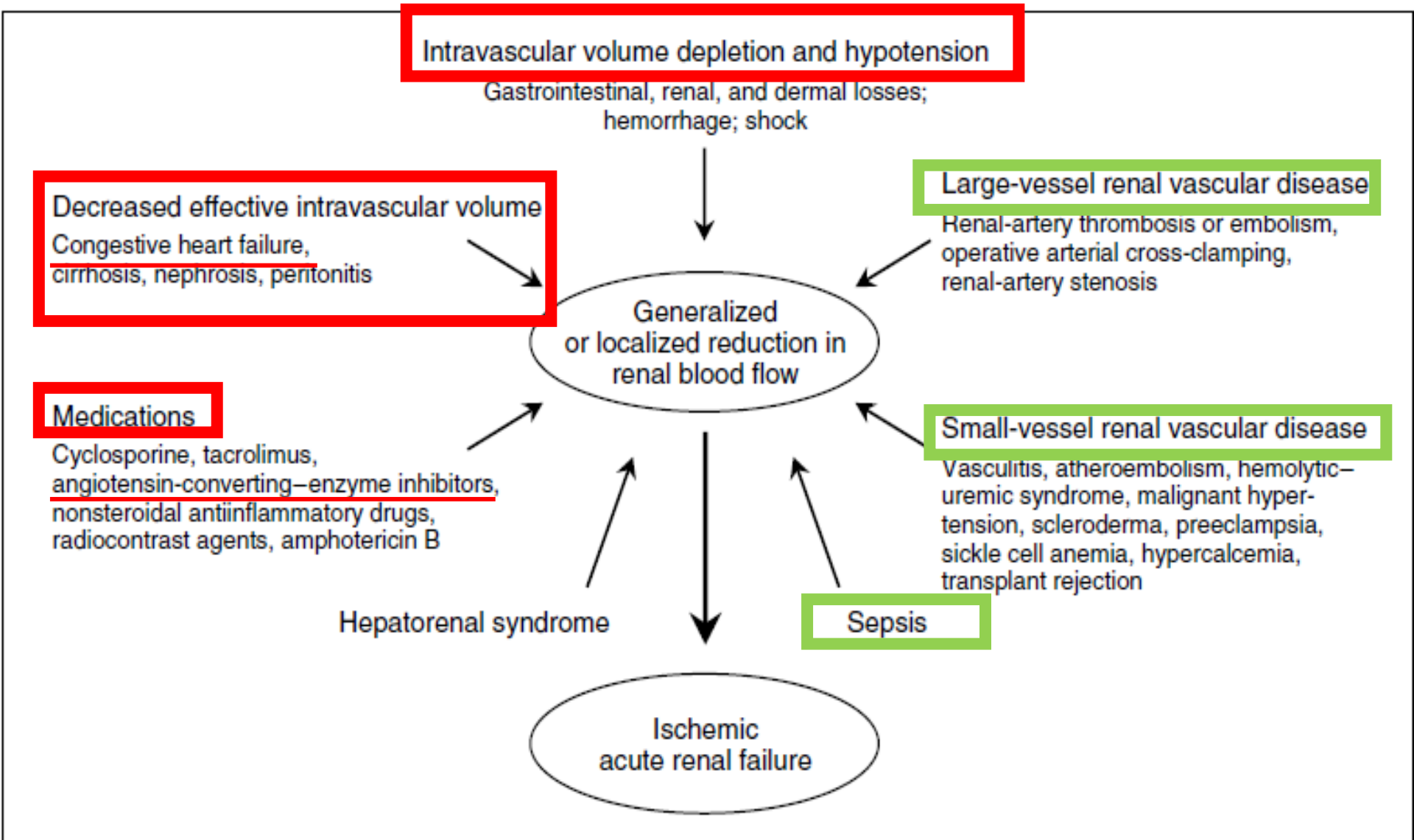
RIFLE classification



ACUTE RENAL FAILURE

RAVI THADHANI, M.D., MANUEL PASCUAL, M.D., AND JOSEPH V. BONVENTRE, M.D., PH.D.

THE NEW ENGLAND JOURNAL OF MEDICINE May 30, 1996



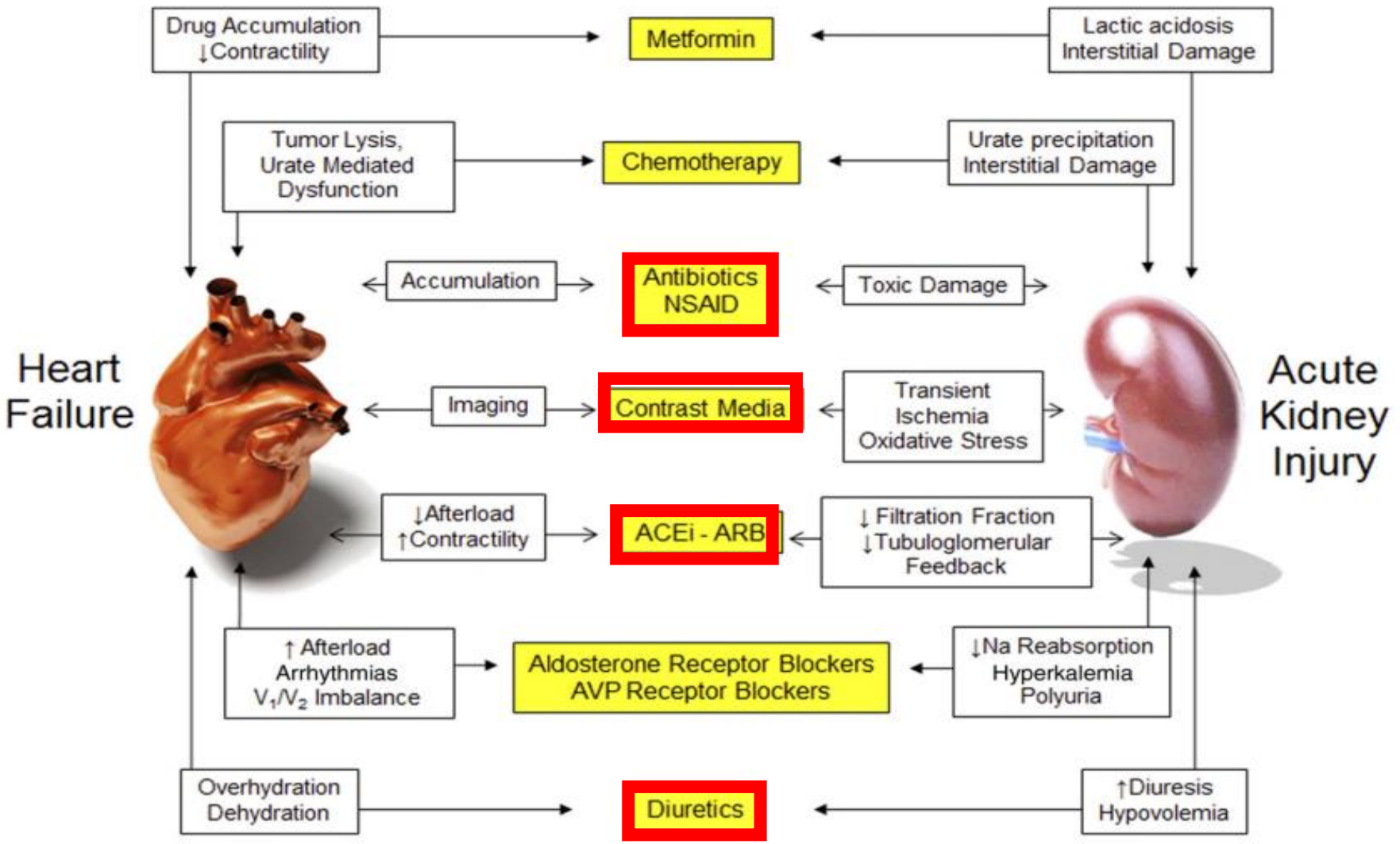
Cardiorenal Syndrome Type 1

(J Am Coll Cardiol 2012;60:1031–42) © 2012

Pathophysiological Crosstalk Leading to Combined Heart and Kidney Dysfunction in the Setting of Acutely Decompensated Heart Failure

Claudio Ronco, MD,*† Mariantonietta Cicoira, MD,‡ Peter A. McCullough, MD, MPH§‖¶#

Iatrogenní příčiny CRS 1



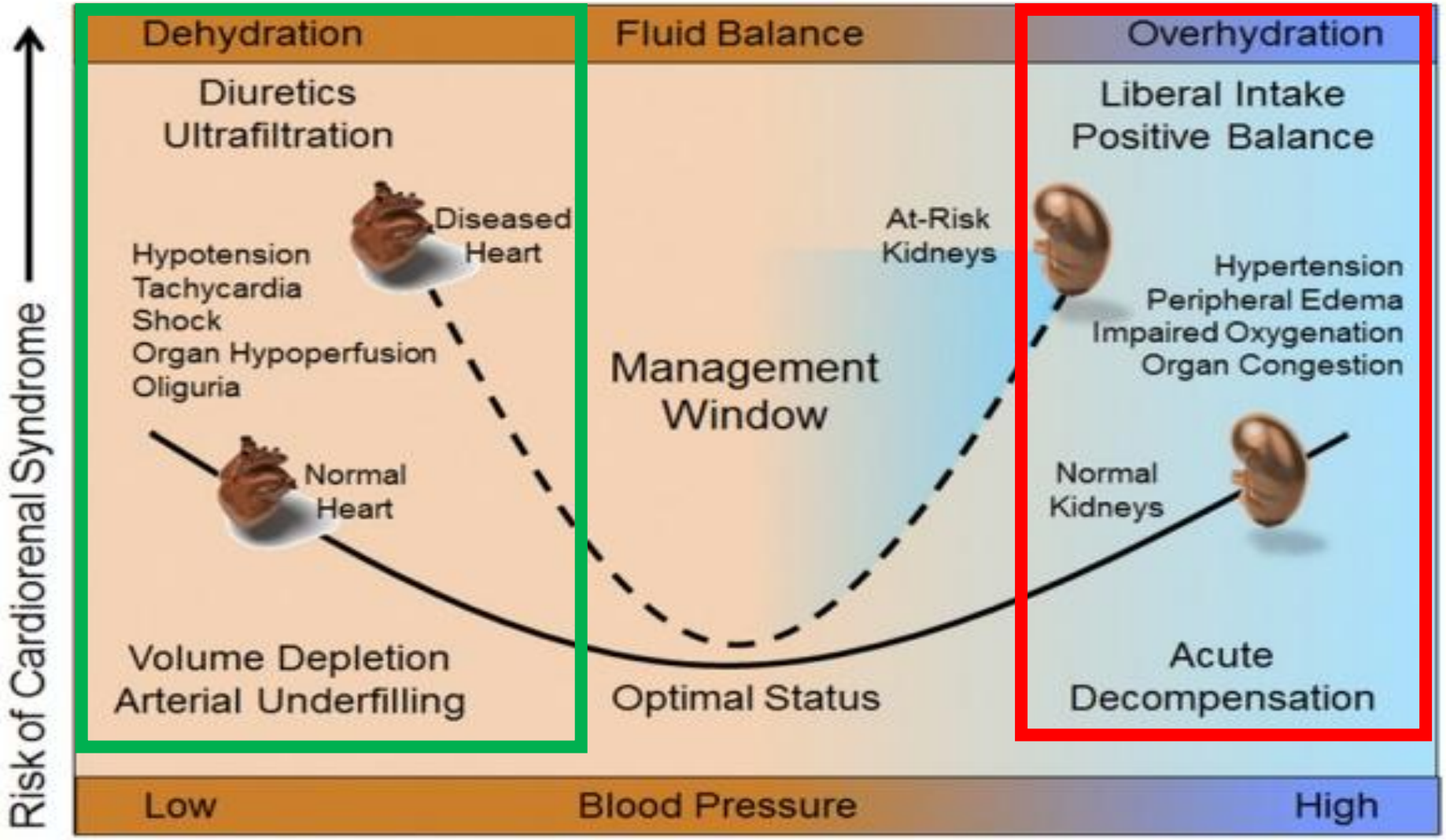
Cardiorenal Syndrome Type 1

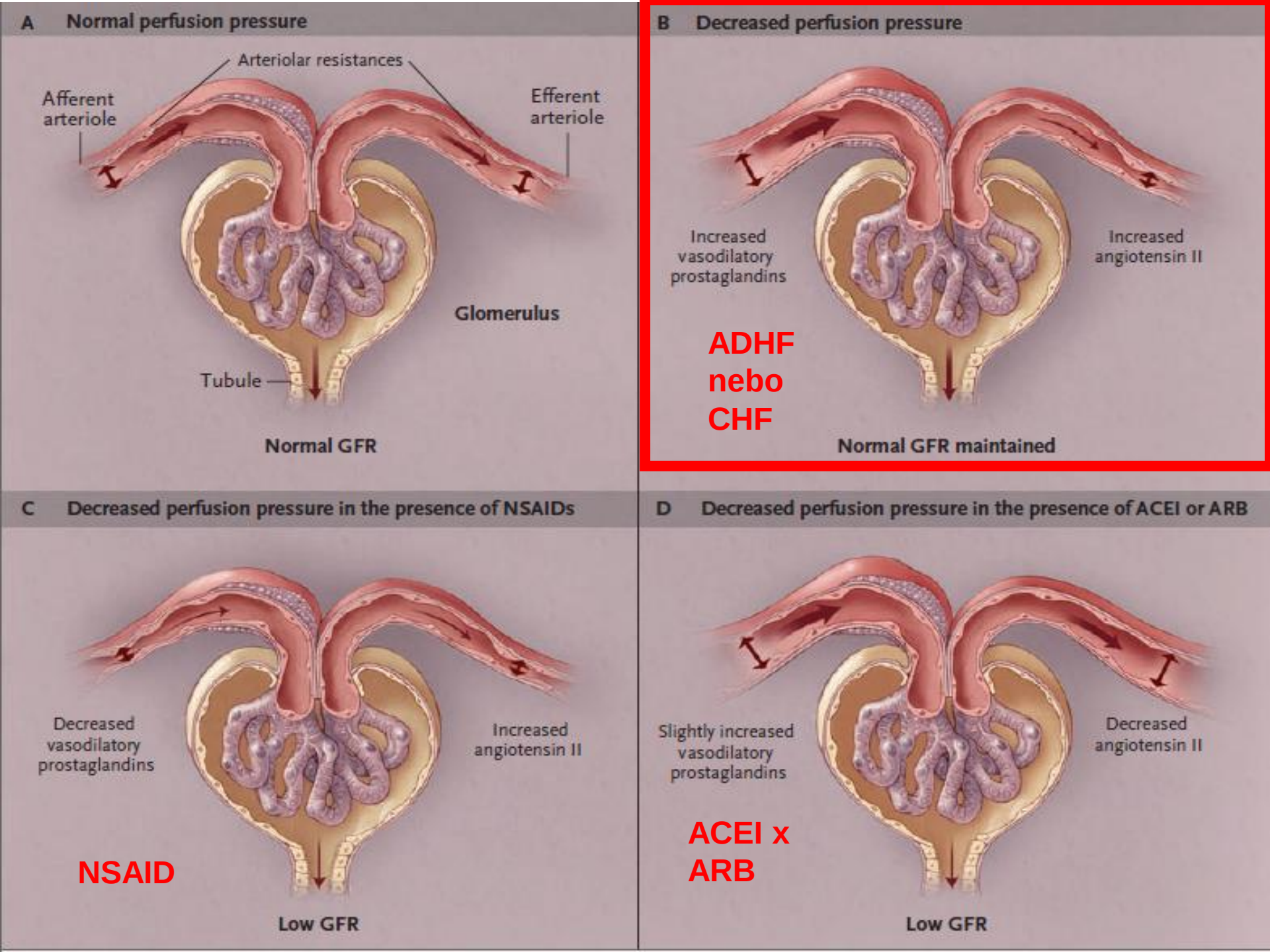
(J Am Coll Cardiol 2012;60:1031–42) © 2012

Pathophysiological Crosstalk Leading to Combined Heart and Kidney Dysfunction in the Setting of Acutely Decompensated Heart Failure

Claudio Ronco, MD,*† Mariantonietta Cicoira, MD,‡ Peter A. McCullough, MD, MPH§‖¶#

Volumové a tlakové „okno“ u pacientů s CRS 1

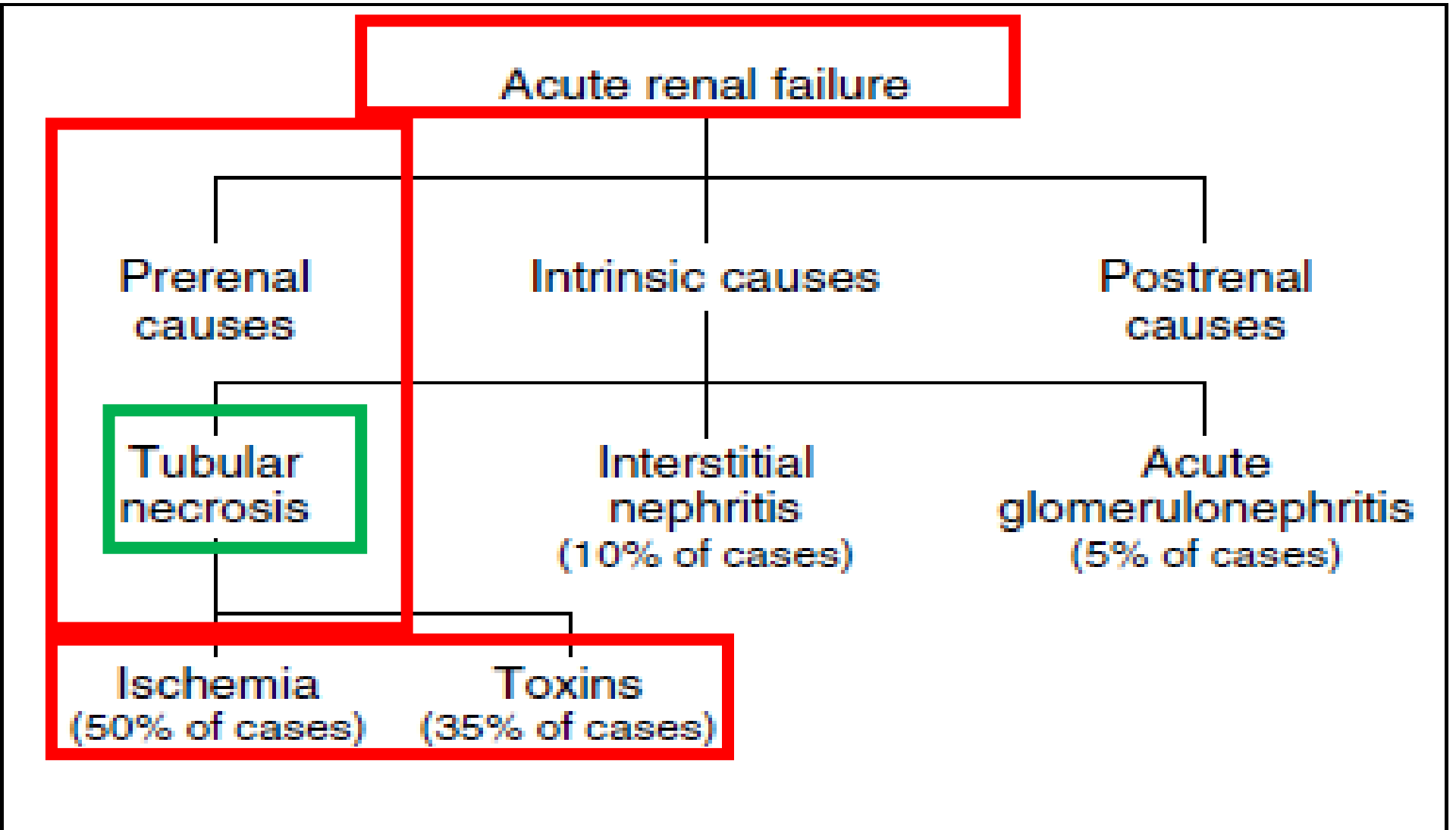



A Normal perfusion pressure
Arteriolar resistances
Afferent arteriole
Efferent arteriole
Glomerulus
Tubule
Normal GFR
B Decreased perfusion pressure
Increased vasodilatory prostaglandins
Increased angiotensin II
ADHF nebo CHF
Normal GFR maintained
C Decreased perfusion pressure in the presence of NSAIDs
Decreased vasodilatory prostaglandins
Increased angiotensin II
NSAID
Low GFR
D Decreased perfusion pressure in the presence of ACEI or ARB
Slightly increased vasodilatory prostaglandins
Decreased angiotensin II
ACEI x ARB
Low GFR

ACUTE RENAL FAILURE

RAVI THADHANI, M.D., MANUEL PASCUAL, M.D., AND JOSEPH V. BONVENTRE, M.D., PH.D.

THE NEW ENGLAND JOURNAL OF MEDICINE May 30, 1996

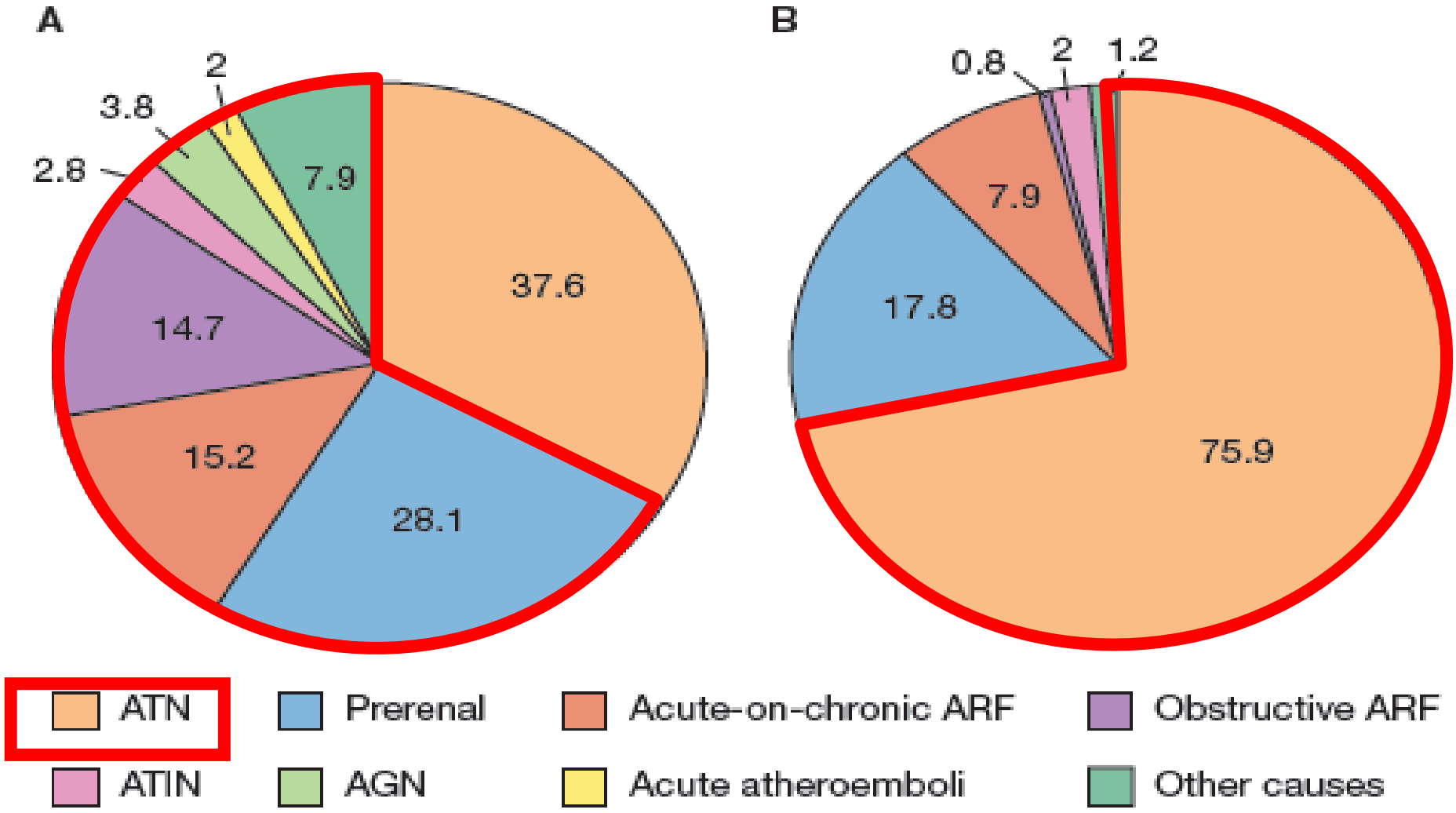


The changing epidemiology of acute renal failure

Norbert Lameire*, Wim Van Biesen and Raymond Vanholder

Received 16 August 2005 **Accepted** 27 January 2006
www.nature.com/clinicalpractice
doi:10.1038/ncpneph0218

Podíl různých typů AKI u pacientů přijatých na běžné oddělení a JIP

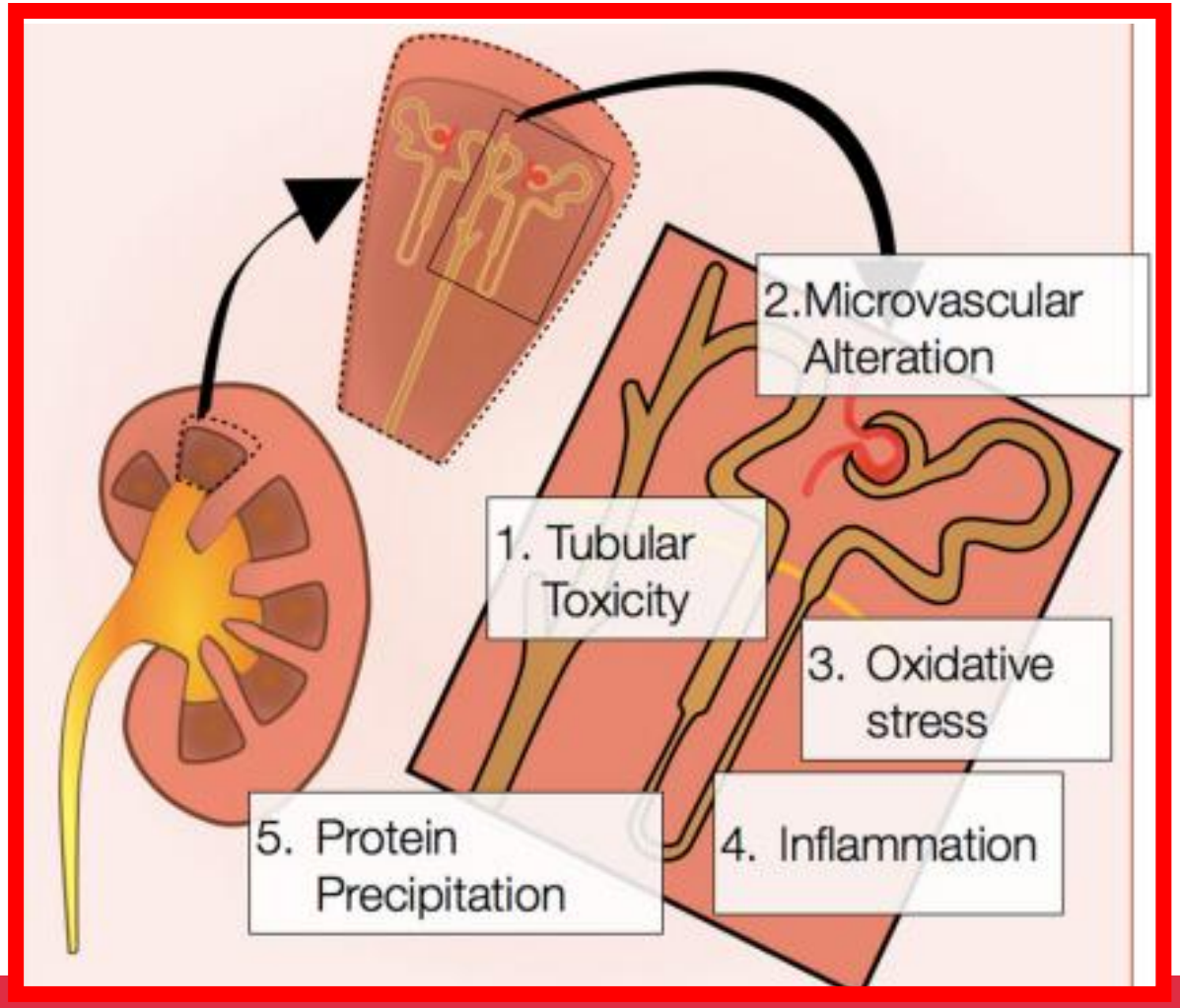


Contrast-induced nephropathy in invasive cardiology

Swiss Med Wkly. 2012;142:w13608

Incidence, pathophysiology, diagnosis, prevention and prognosis

Tilman Perrin, Eric Descombes, Stéphane Cook

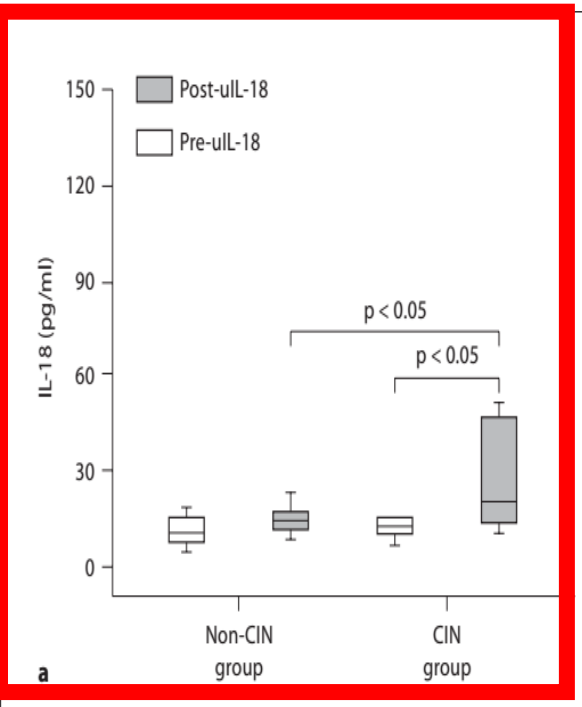


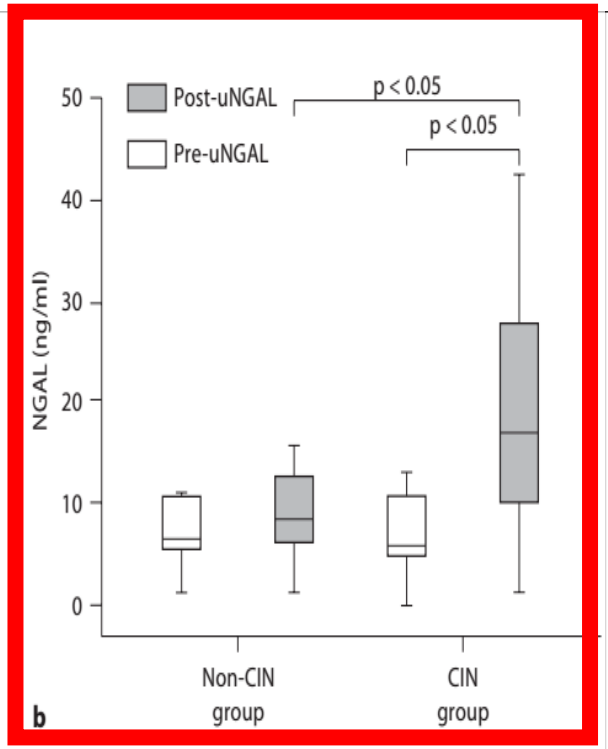
Urinary IL-18 and NGAL as Early Predictive Biomarkers in Contrast-Induced Nephropathy after Coronary Angiography

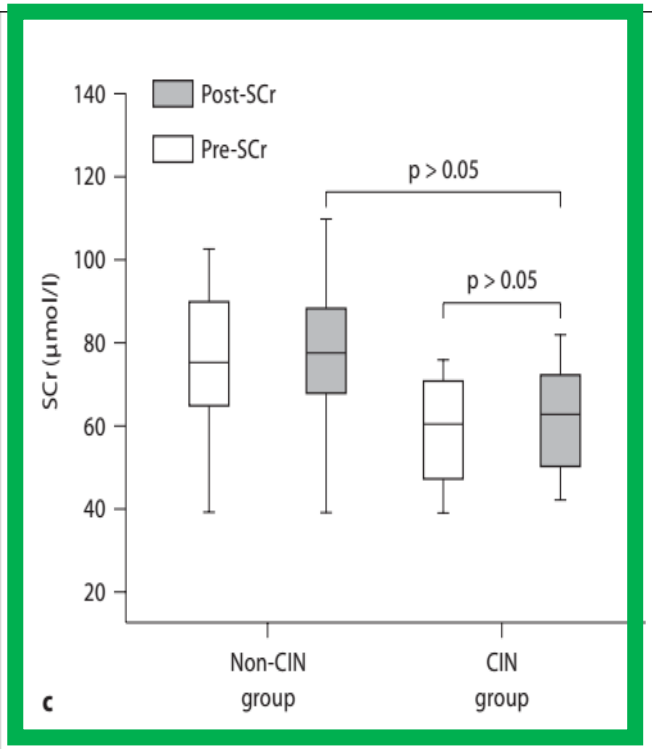
Nephron Clin Pract 2008;108:c176–c181

Wang Ling[a] Ni Zhaohui[a] He Ben[b] Gu Leyi[a] Liu Jianping[b] Dai Huili[a] Qian Jiaqi[a]

Močový IL-18 a NGAL a Skreat před a 24 hodin po koronarografii u pacientů s kontrastovou nefropatií odpověď sérového kreatininu méně výrazná a opožděná







Urinary Biomarkers at the Time of AKI Diagnosis as Predictors of Progression of AKI among Patients with Acute Cardiorenal Syndrome

Clin J Am Soc Nephrol 11: 1536–1544, 2016

Chunbo Chen,[*†] *Xiaobing Yang,*[*] *Ying Lei,*[*] *Yan Zha,*[*] *Huafeng Liu,*[§] *Changsheng Ma,*[‖] *Jianwei Tian,*[*] *Pingyan Chen,*[*] *Tiecheng Yang,*[¶] *and Fan Fan Hou*[*]

Močový angiotensinogen – nejlepší prediktor progrese AKI u akutního kardiorenálního syndromu

Table 3. Biomarkers for predicting AKI progression: multivariate logistic regression analyses

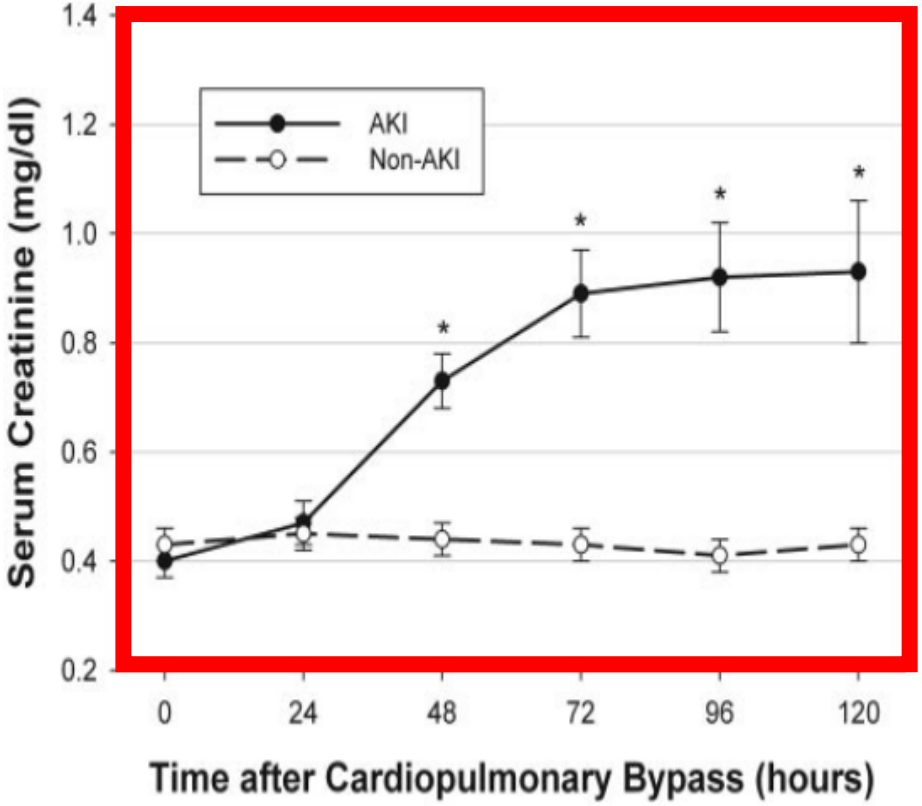
Biomarker	Cut Points	*N*	AKI Progression (%)	Unadjusted OR (95% CI)	*P* Value	Adjusted OR[a] (95% CI)	*P* Value
SCr, mg/dl							
Low (T1)	0.8–1.4	70	14.3	1 (referent)	0.04	1 (referent)	0.21
Medium (T2)	1.5–2.0	72	23.6	1.9 (0.8 to 4.3)		2.3 (0.8 to 6.6)	
High (T3)	>2.0	71	32.4	2.9 (1.2 to 6.6)		2.9 (0.8 to 10.5)	
uAGT, μg/g Cr							
Low (T1)	0.04–27.3	71	7.0	1 (referent)	<0.001	1 (referent)	<0.001
Medium (T2)	27.4–146.4	71	19.7	3.2 (1.1 to 9.5)		3.7 (1.1 to 12.1)	
High (T3)	>146.4	71	43.7	10.2 (3.7 to 28.4)		10.8 (3.4 to 34.7)	
uNGAL, μg/g Cr							
Low (T1)	0.2–47.4	71	9.9	1 (referent)	<0.001	1 (referent)	0.01
Medium (T2)	47.5–185.4	71	21.1	2.4 (0.9 to 6.4)		2.0 (0.7 to 5.7)	
High (T3)	>185.4	71	39.4	5.9 (2.4 to 14.8)		4.7 (1.7 to 13.4)	
uIL-18, ng/g Cr							
Low (T1)	1.2–38.5	70	14.3	1 (referent)	<0.001	1 (referent)	0.004
Medium (T2)	38.6–224.4	72	11.1	0.8 (0.3 to 2.0)		0.8 (0.3 to 2.3)	
High (T3)	>224.4	71	45.1	4.9 (2.2 to 11.1)		3.6 (1.4 to 9.5)	

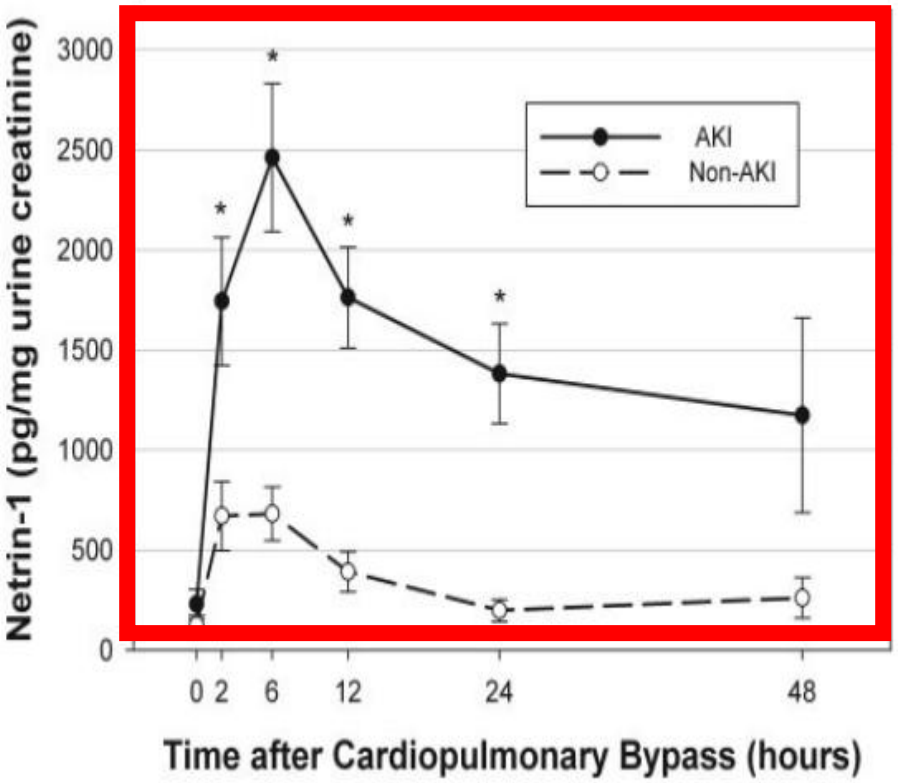
Urinary Netrin-1 Is an Early Predictive Biomarker of Acute Kidney Injury after Cardiac Surgery

Clin J Am Soc Nephrol 5: 395–401, 2010

Ganesan Ramesh,* Catherine D. Krawczeski,† Jessica G. Woo,‡ Yu Wang,‡ and Prasad Devarajan§

Netrin-1 stoupá časně v průběhu srdeční operace





Chronic kidney disease after acute kidney injury: a systematic review and meta-analysis

Steven G. Coca[1,2,3], Swathi Singanamala[1,3] and Chirag R. Parikh[1,2]

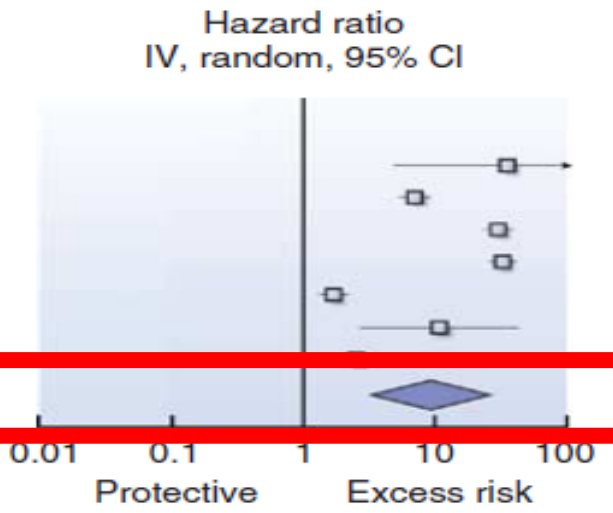
Kidney International (2012) **81,** 442–448

Pacienti s AKI mají ve srovnání s pacienty bez AKI ↑ riziko CKD a CKD5

a

Study or subgroup	Weight (%)	Hazard ratio IV, random, 95% CI
Weiss *et al.* (13)	10.0	32.79 (4.30–249.77)
Amdur *et al.* (22)	15.5	6.64 (5.05–8.74)
Lo *et al.* (11)	15.5	28.08 (21.01–37.53)
James *et al.* (16)	15.6	29.99 (24.32–36.99)
James *et al.* (15,23)	15.5	1.60 (1.20–2.14)
Ando *et al.* (19)	12.4	9.91 (2.48–39.63)
Total (95% CI)	100.0	8.82 (3.05–25.48)

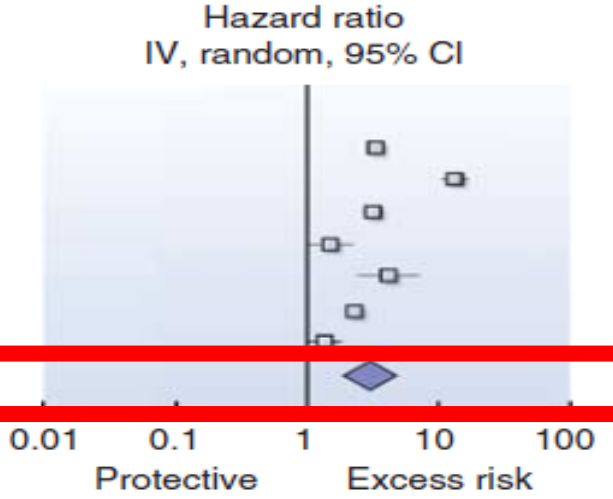
Heterogeneity: $\tau^2 = 1.87$; $\chi^2 = 446.89$, d.f. = 6 ($P < 0.00001$); $I^2 = 99\%$. Test for overall effect: $Z = 4.02$ ($P < 0.0001$)



b

Study or subgroup	Weight (%)	Hazard ratio IV, random, 95% CI
Newsome *et al.* (14)	15.0	3.26 (2.87–3.70)
Ishani *et al.* (20)	14.8	12.99 (10.57–15.96)
Wald *et al.* (17)	14.9	3.22 (2.70–3.85)
Hsu *et al.* (10)	13.5	1.47 (0.95–2.28)
James *et al.* (15,23)	12.5	4.15 (2.32–7.41)
Lafrance *et al.* (18)	15.0	2.33 (2.08–2.61)
Choi *et al.* (12)	14.4	1.37 (1.02–1.84)
Total (95% CI)	100.0	3.10 (1.91–5.03)

Heterogeneity: $\tau^2 = 0.40$; $\chi^2 = 252.85$, d.f. = 6 ($P < 0.00001$); $I^2 = 98\%$. Test for overall effect: $Z = 4.58$ ($P < 0.00001$)

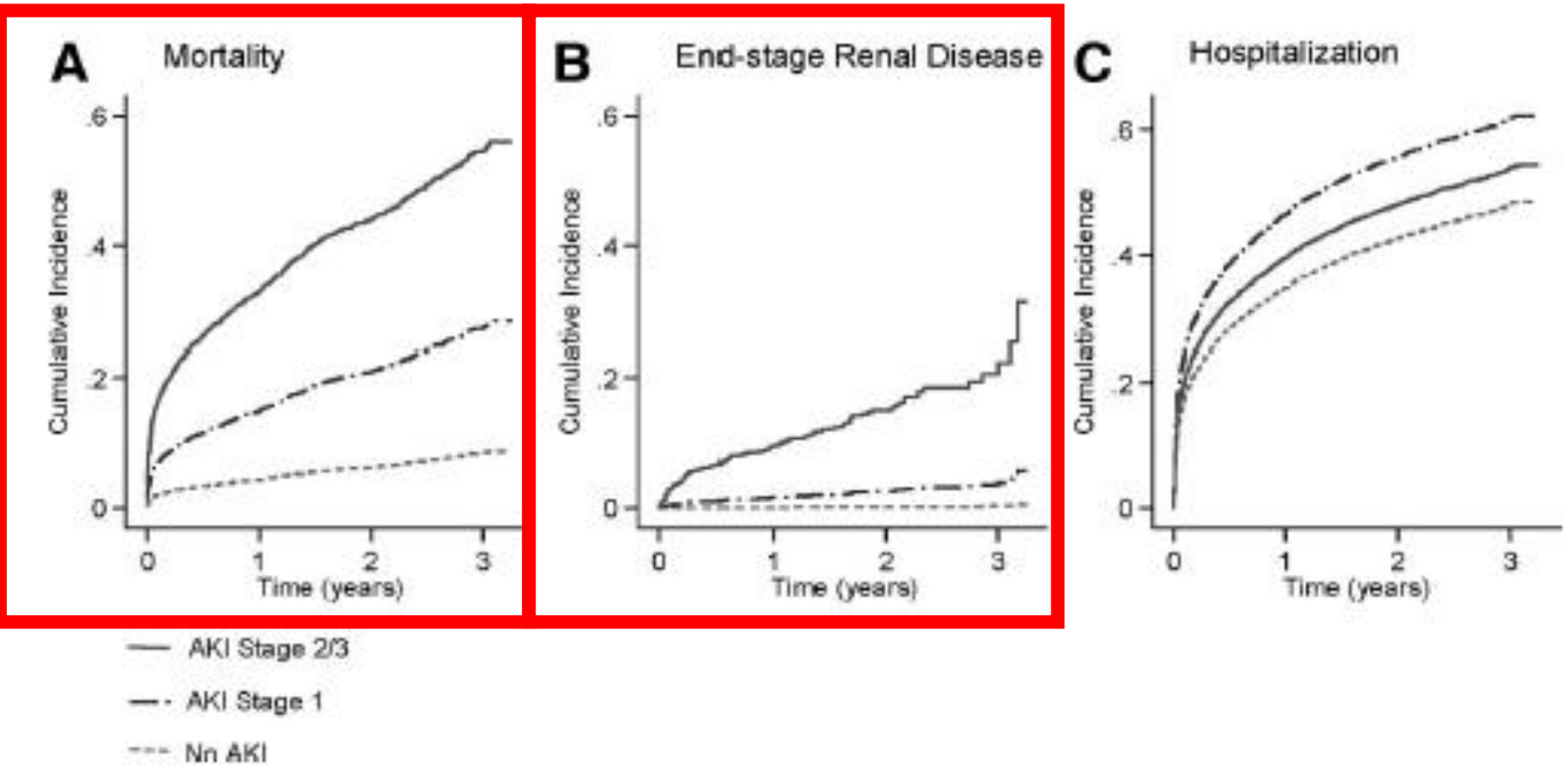


Associations Between Acute Kidney Injury and Cardiovascular and Renal Outcomes After Coronary Angiography

Matthew T. James, MD; William A. Ghali, MD, MPH; Merril L. Knudtson, MD; Pietro Ravani, MD, PhD; Marcello Tonelli, MD, SM; Peter Faris, PhD; Neesh Pannu, MD, MSc; Braden J. Manns, MD, MSc; Scott W. Klarenbach, MD, MSc; Brenda R. Hemmelgarn, MD, PhD; for the Alberta Provincial Project for Outcome Assessment in Coronary Heart Disease (APPROACH) Investigators

Circulation. 2011;123:409-416.

AKI po koronární angiografii ↑ mortalitu (2x) a riziko CKD5 (4x) - studie APPROACH

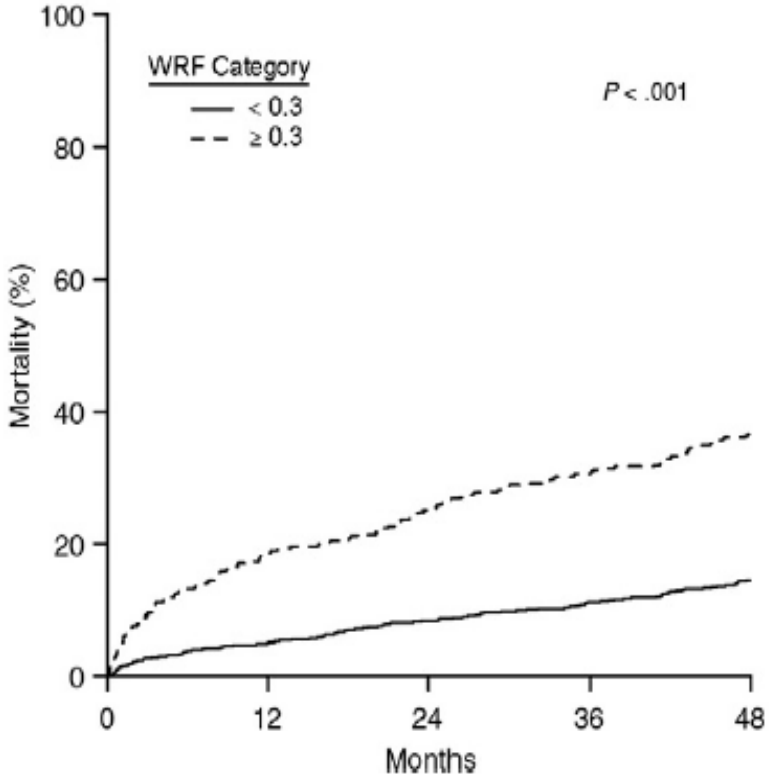


The prognostic importance of worsening renal function during an acute myocardial infarction on long-term mortality

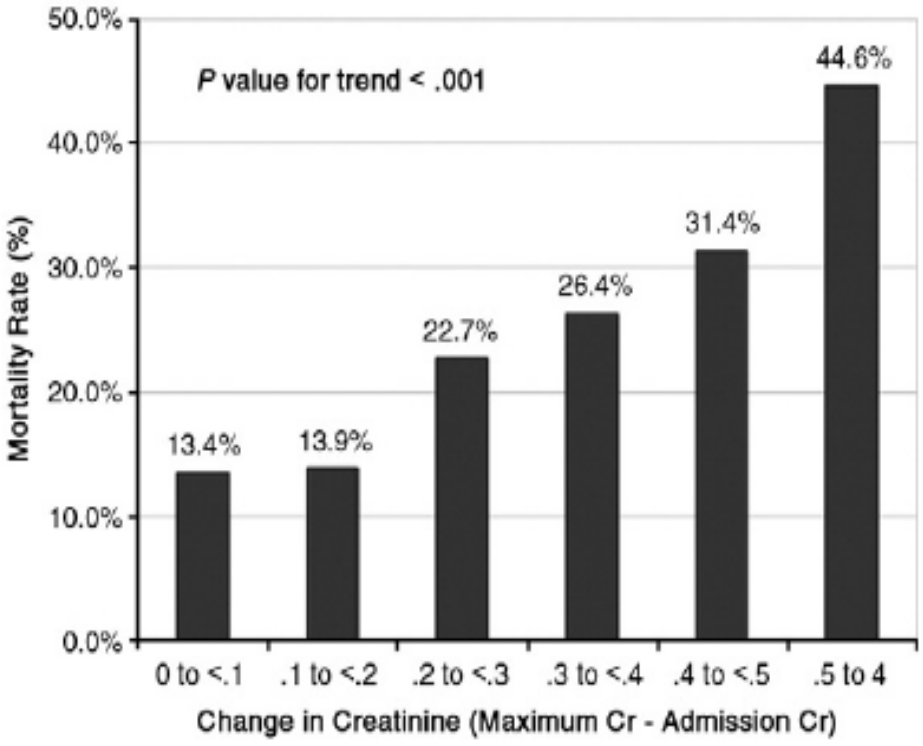
Am Heart J 2010;160:1065-71

Amit P. Amin, MD,[a] John A. Spertus, MD, MPH,[a] Kimberly J. Reid, MS,[a] Xiao Lan, MS,[a] Donna M. Buchanan, PhD,[a] Carole Decker, PhD,[a] and Frederick A. Masoudi, MD, MSPH[b,c,d] *Kansas City, MO; and Denver and Aurora, CO*

Zhoršení renální funkce (↑ Skreat o 30 μmol/l) po AIM prediktorem dlouhodobé (4-leté) prognózy pacientů v rozsáhlé multicentrické studii PREMIER (2098 pacientů)



Kaplan-Meier survival estimates by WRF.



Relationship of change in creatinine with observed mortality.

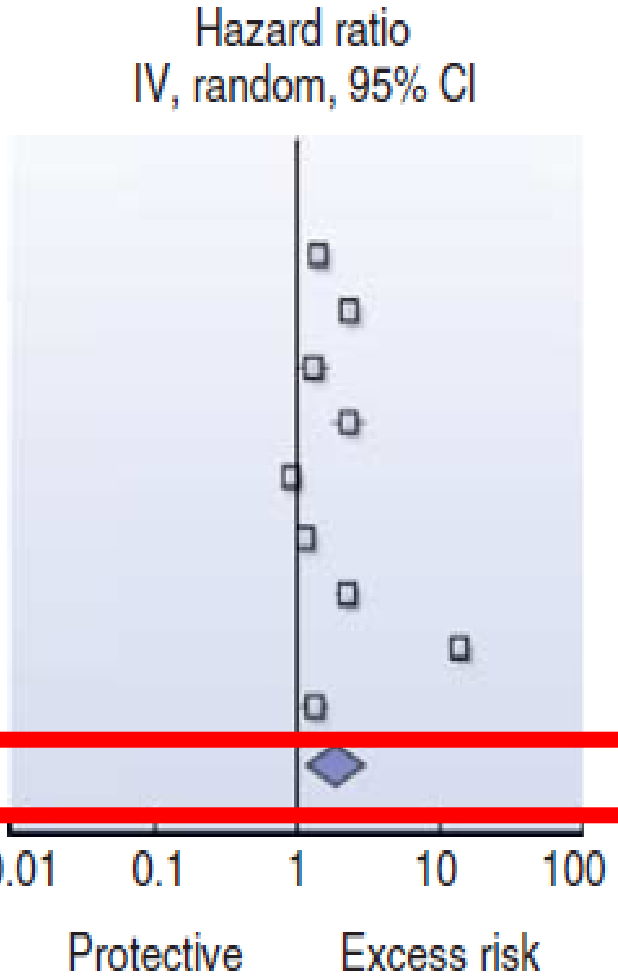
Chronic kidney disease after acute kidney injury: a systematic review and meta-analysis

Steven G. Coca[1,2,3], Swathi Singanamala[1,3] and Chirag R. Parikh[1,2]

Kidney International (2012) **81,** 442–448

Pacienti s AKI mají vyšší mortalitu

Study or subgroup	Weight (%)	Hazard ratio IV, random, 95% CI
Newsome *et al.* (14)	11.2	1.39 (1.35–1.43)
Ishani *et al.* (20)	11.2	2.38 (2.31–2.46)
Hsu *et al.* (10)	10.9	1.30 (1.03–1.64)
Lo *et al.* (11)	10.8	2.30 (1.76–2.99)
Wald *et al.* (17)	11.2	0.95 (0.89–1.02)
Choi *et al.* (12)	11.2	1.20 (1.13–1.28)
Lafrance *et al.* (18)	11.1	2.32 (2.04–2.63)
James *et al.* (16)	11.2	12.99 (12.08–13.96)
Ishani *et al.* (21)	11.1	1.38 (1.20–1.59)
Total (95% CI)	100.0	1.98 (1.26–3.11)



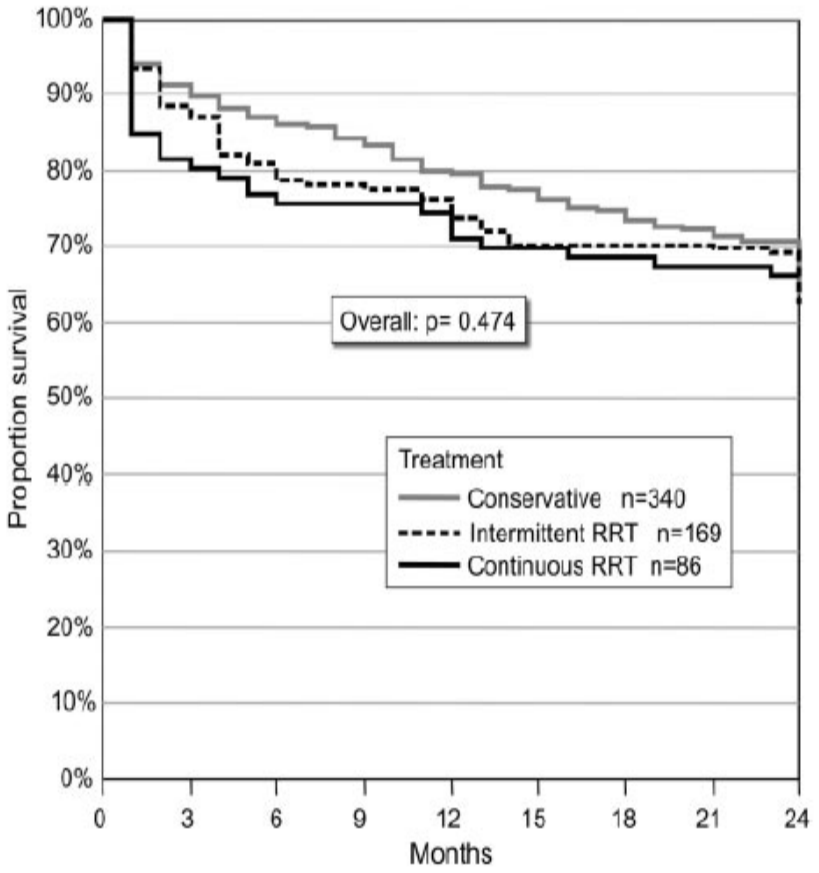
Heterogeneity: $\tau^2 = 0.47$; $\chi^2 = 4001.87$, d.f. = 8 ($P < 0.00001$); $I^2 = 100\%$. Test for overall effect: $Z = 2.96$ ($P < 0.003$)

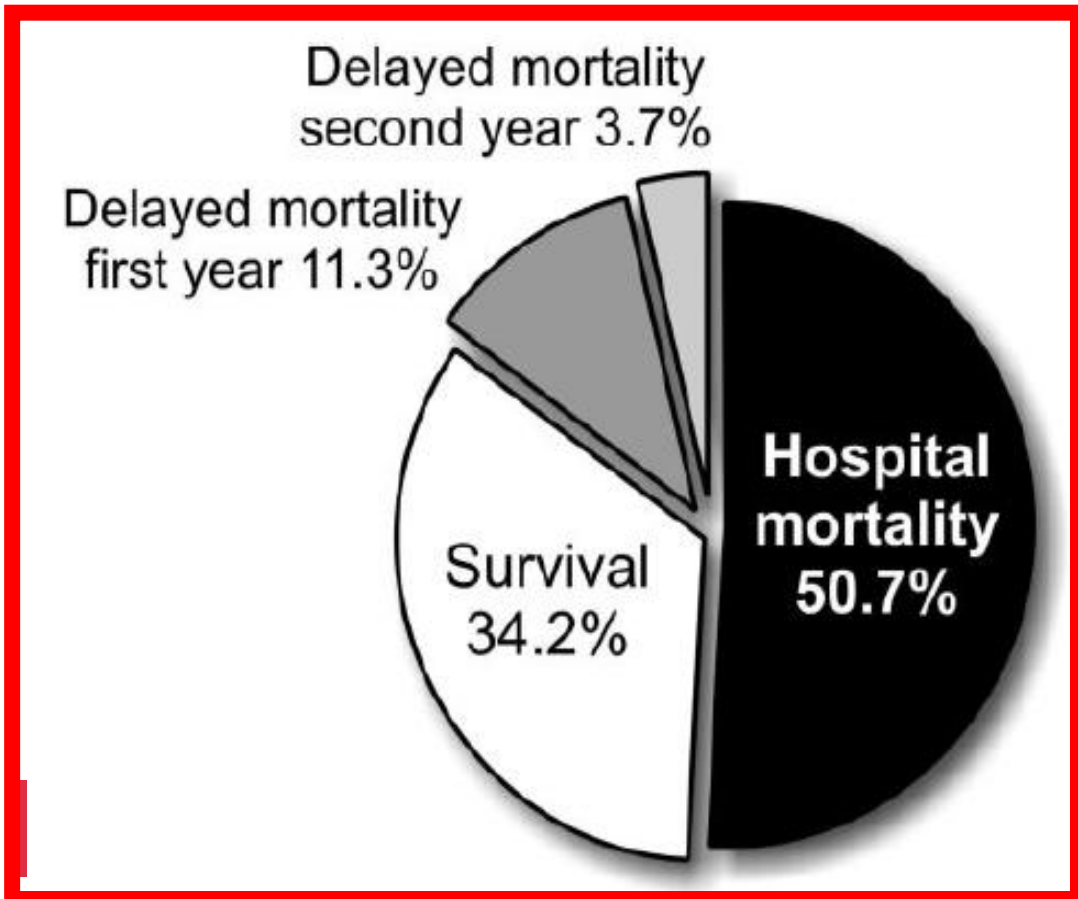
Outcome of Acute Kidney Injury with Different Treatment Options: Long-Term Follow-up

Clin J Am Soc Nephrol 5: 1755–1762, 2010.

An M. Van Berendoncks,* Monique M. Elseviers,† and Robert L. Lins‡ for the SHARF Study Group

Pacienti s AKI mají vyšší pozdní mortalitu (< 2 roky po propuštění) bez ohledu na způsob léčby





Acute Kidney Injury in Cardiorenal Syndrome Type 1 Patients: A Systematic Review and Meta-Analysis

Cardiorenal Med 2016;6:116–128

Wim Vandenberghe[a] Sofie Gevaert[b] John A. Kellum[d, e] Sean M. Bagshaw[f]
Harlinde Peperstraete[a] Ingrid Herck[a] Johan Decruyenaere[a] Eric A.J. Hoste[a, c, e]

Mortalita vyšší ještě rok po AKI, výrazně vyšší u pacientů, kteří byli dialyzováni

Table 4. Outcomes of CRS-1 according to the definition of AKI

	Period	All definitions	Studies/ Patients	AKI	Studies/ Patients	WRF	Studies/ Patients	RRT	Studies/ Patients
Mortality	28 days	4.90 (3.68–6.52)	33/56,860	5.14 (3.81–6.94)	24/35,227	5.19 (2.78–9.70)	12/51,805	9.16 (2.71–30.98)	5/6,556
	1 year	2.08 (1.27–3.42)	9/13,723						
	≥5 years	1.90 (1.50–2.41)	3/31,108						
LOS_{ICU}	28 days	1.46 (0.52–2.39)	10/10,855	1.37 (0.41–2.33)	9/10,758	3.00(0.04–5.96)	1/97	10.63(3.51–17.74)	3/5,799
LOS_{hosp}	28 days	3.51 (1.78–5.24)	13/8,733	3.94 (1.74–6.15)	8/6,649	2.65 (0.75–4.54)	5/2,084	20.20 (12.17–28.23)	3/6,045

Acute Kidney Injury in Cardiorenal Syndrome Type 1 Patients: A Systematic Review and Meta-Analysis

Cardiorenal Med 2016;6:116–128

Wim Vandenberghe[a] Sofie Gevaert[b] John A. Kellum[d, e] Sean M. Bagshaw[f]
Harlinde Peperstraete[a] Ingrid Herck[a] Johan Decruyenaere[a] Eric A.J. Hoste[a, c, e]

Mortalita, délka hospitalizace a délka hospitalizace na JIP roste se stupněm AKI

Table 5 Outcomes of CRS-1 according to the severity of AKI when defined as AKI

	Risk/stage1	Studies/ Patients	Injury/stage2	Studies/ Patients	Loss/stage 3	Studies/ Patients
Mortality	3.45 (2.25–5.31)	16/53,066	9.57 (6.31–14.50)	13/39,644	20.37 (13.19–31.48)	12/38,575
LOS_{ICU}	0.99 (0.65–1.33)	8/16,348	2.22 (0.89–3.55)	7/12,479	8.32(3.39–13.24)	7/12,479
LOS_{hosp}	3.51 (2.63–4.39	10/17,713	8.32 (5.87–10.78)	9/13,844	18.41 (14.74–22.09)	9/13,844

Acute Kidney Injury in Cardiorenal Syndrome Type 1 Patients: A Systematic Review and Meta-Analysis

Cardiorenal Med 2016;6:116–128

Wim Vandenberghe[a] Sofie Gevaert[b] John A. Kellum[d, e] Sean M. Bagshaw[f]
Harlinde Peperstraete[a] Ingrid Herck[a] Johan Decruyenaere[a] Eric A.J. Hoste[a, c, e]

Riziko AKI nejvyšší u pacientů s akutním srdečním selháním
(ve srovnání s pacienty s akutní koronární příhodou a po srdeční operaci)

Table 3 Occurrence rate of AKI according to the 3 stages of AKI and subclasses of CRS-1

	Risk/stage 1, %	Studies/ patients	Injury/stage 2, %	Studies/ patients	Failure/stage 3, %	Studies/ patients
CRS-1	17.9 (9.1–24.0)	27/99,561	4.4 (3.5–6.9)	28/101,442	3.6 (1.9–5.3)	17/99,561
AHF	34.2 (27.6–39.6)	5/2,797	11.7 (10.4–18.6)	5/2,797	9.1 (5.7–9.3)	5/2797
ACS	9.2 (8.2–9.6)	5/5,763	4.3 (3.7–4.5)	5/5,763	3.2 (1.0–3.8)	5/5763
CS	17.9 (9.6–22.0)	19/93,858	4.4 (3.5–5.6)	19/93,858	3.5 (1.9–4.5)	19/93,858

Data are presented as proportions and interquartile ranges. AKI = AKI defined by the RIFLE, AKIN or KDIGO classifications.

Acute Kidney Injury in Cardiorenal Syndrome Type 1 Patients: A Systematic Review and Meta-Analysis

Cardiorenal Med 2016;6:116–128

Wim Vandenberghe[a] Sofie Gevaert[b] John A. Kellum[d, e] Sean M. Bagshaw[f]
Harlinde Peperstraete[a] Ingrid Herck[a] Johan Decruyenaere[a] Eric A.J. Hoste[a, c, e]

Mortalita nejvyšší u pacientů s AKI po srdeční operaci

Table 6 Mortality, LOS_{ICU} and LOS_{hosp} in the subtypes of CRS-1 according to the definition of AKI

Outcome	Sub-group	AKI	Studies/ Patients	WRF	Studies/ Patients	RRT	Studies/ Patients
Mortality	AHF	2.89 (2.14–3.89)	5/4,018	2.37 (1.65–3.38)	8/5,050		
	ACS	3.53 (2.04–6.10)	3/5,088	16.95 (12.00–23.93)	2/4,621	2.72 (1.52–4.88)	1/97
	CS	7.51 (5.58–10.11)	16/26,121	17.11 (9.53–30.73)	2/42,134	7.55 (1.28–44.39)	4/5,605
LOS_{ICU}	AHF	0.35 (–0.80–1.51)	3/2,119	3.00 (0.04–5.96)	1/97		
	ACS	2.00 (1.88–2.12)	1/3,210				
	CS	1.68 (0.38–2.97)	5/5,429			10.63 (3.51–17.74)	3/5,799
LOS_{hosp}	AHF	5.79 (1.21–10.37)	4/2,172	2.65 (0.75–4.54)	5/2,084		
	ACS	2.08 (1.01–3.15)	1/236				
	CS	3.56 (–1.05–8.16)	4/4,241			20.20 (12.17–28.23)	3/6,045

Urinary IL-18 and NGAL as Early Predictive Biomarkers in Contrast-Induced Nephropathy after Coronary Angiography

Nephron Clin Pract 2008;108:c176–c181

Wang Ling[a] Ni Zhaohui[a] He Ben[b] Gu Leyi[a] Liu Jianping[b] Dai Huili[a] Qian Jiaqi[a]

Močový IL-18 predikoval pozdní KV příhody

Table 3. Biomarkers for later cardiac events

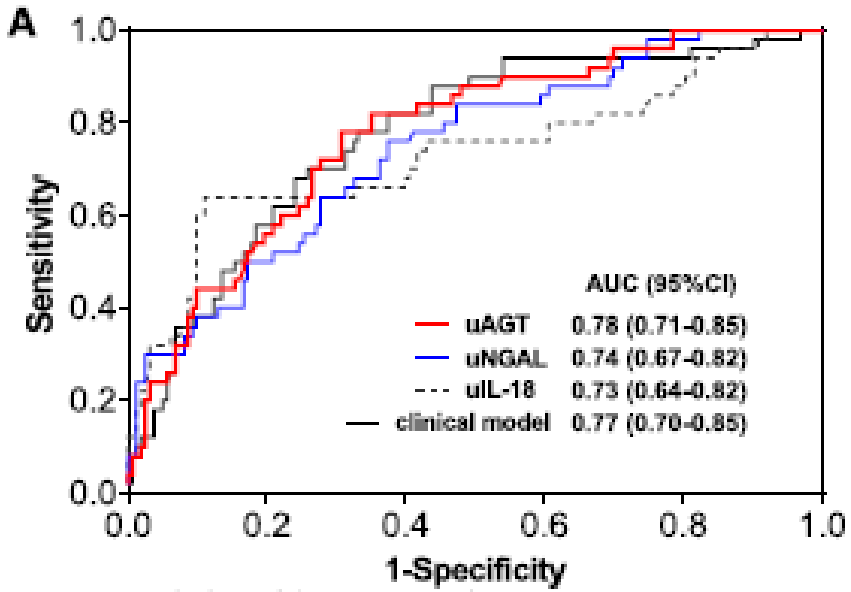
Variable	Relative risk	95% CI	p
Urinary IL-18[a]	2.09	1.15–3.77	0.001
Urinary NGAL[a]	1.44	0.34–6.20	1.000
SCr (48 h)[a]	1.517	0.78–1.78	1.000

Urinary Biomarkers at the Time of AKI Diagnosis as Predictors of Progression of AKI among Patients with Acute Cardiorenal Syndrome

Clin J Am Soc Nephrol 11: 1536–1544, 2016

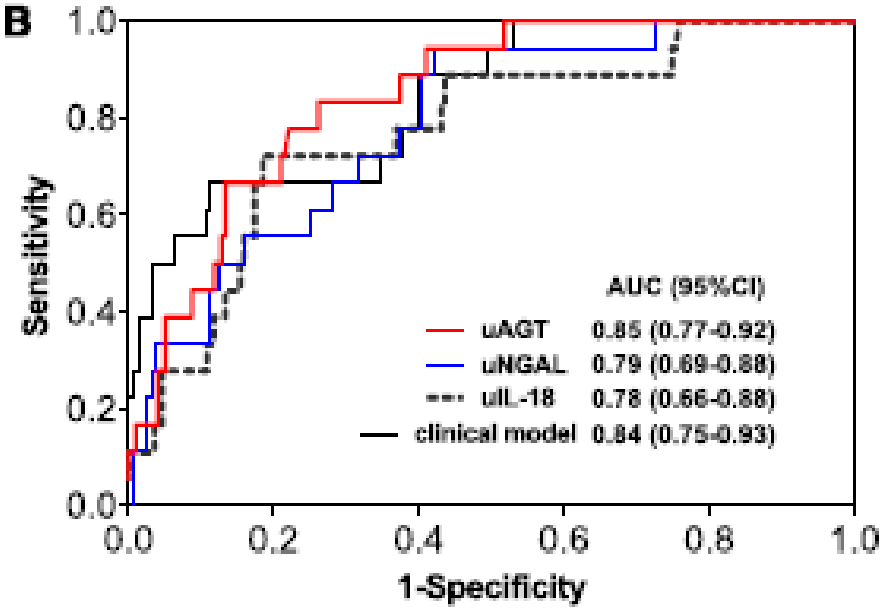
Chunbo Chen,† Xiaobing Yang,* Ying Lei,* Yan Zha,‡ Huafeng Liu,§ Changsheng Ma,‖ Jianwei Tian,* Pingyan Chen,* Tiecheng Yang,¶ and Fan Fan Hou**

Močový angiotensinogen nejlepší prediktor letálního AKI



Prediction of AKI progression

Marker	Best cutoff	Sensitivity	Specificity
uAGT, μg/g Cr	90.5	0.78	0.69
uNGAL, μg/g Cr	84.0	0.76	0.63
uIL-18, ng/g Cr	649.7	0.64	0.89



Prediction of AKI progression with death

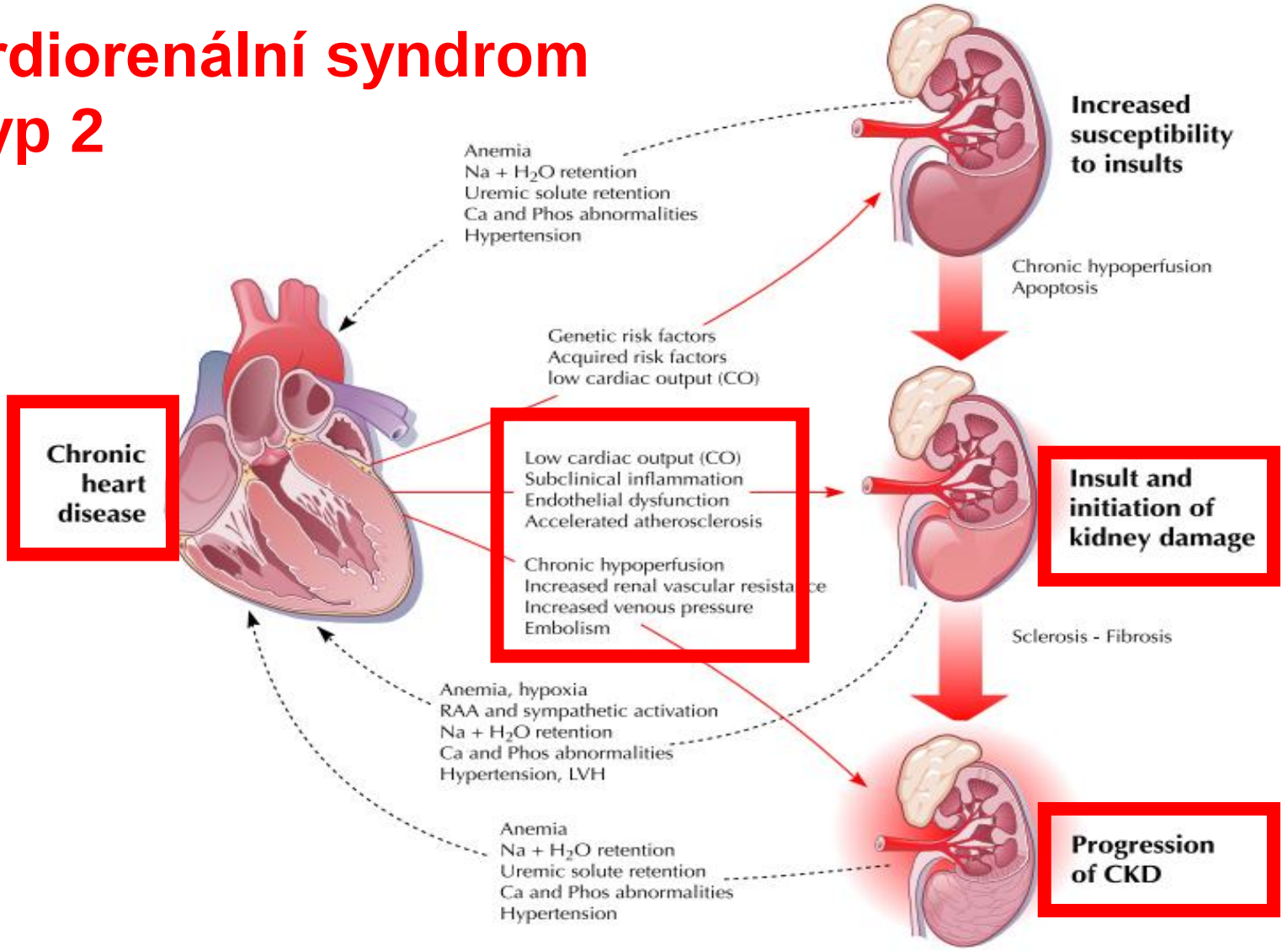
Marker	Best cutoff	Sensitivity	Specificity
uAGT, μg/g Cr	162.9	0.83	0.74
uNGAL, μg/g Cr	90.7	0.89	0.59
uIL-18, ng/g Cr	724.9	0.66	0.83

Cardiorenal Syndrome

(J Am Coll Cardiol 2008;52:1527–39) © 2008

Claudio Ronco, MD,* Mikko Haapio, MD,† Andrew A. House, MSc, MD,‡ Nagesh Anavekar, MD,§ Rinaldo Bellomo, MD¶

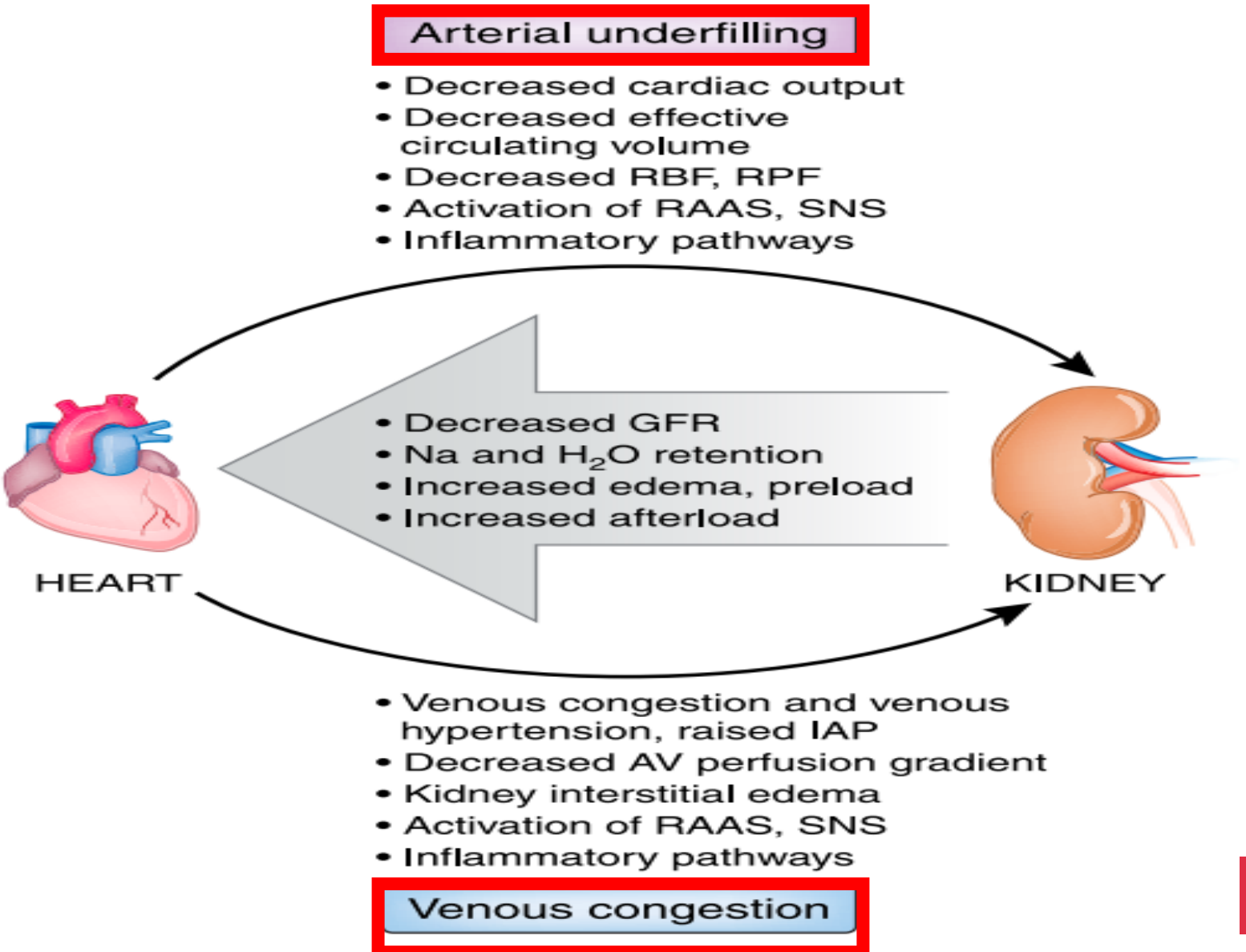
Kardiorenální syndrom - typ 2



Cardiorenal Syndrome: New Developments in the Understanding and Pharmacologic Management

Andrew A. House

Clin J Am Soc Nephrol 8: 1808–1815, 2013.



Current and Potential Therapeutic Strategies for Hemodynamic Cardiorenal Syndrome

Cardiorenal Med 2016;6:83–98

Yoshitsugu Obi[a, c] Taehee Kim[a, c, f] Csaba P. Kovesdy[d] Alpesh N. Amin[b]
Kamyar Kalantar-Zadeh[a, c, e]

Table 1. Pharmacologic and non-pharmacologic regimens for CRS discussed in this review

	Dose/frequency	Adverse effects	Special consideration
Pharmacologic regimens			
Loop diuretics	*Intravenous:* Starting 2.5 times dose of chronic oral dose followed by boluses at intervals of 6–8 h or continuous infusion. If urine output is <1 ml/kg/h, double as necessary to a maximum of 80–160 mg/h.	Electrolyte disturbances, arrhythmias, hearing impairment, tinnitus, hematologic disorders, dermatologic diseases, tubulointerstitial nephritis.	Need serial assessments and dose adjustments based on symptoms, urine output and volume status.
Dopamine	*Intravenous:* 5–15 μg/kg/min (increased systemic vascular resistance at >10 μg/kg/min).	Tachyarrhythmias, headache, nausea, cardiac ischemia, tissue necrosis.	Drug interaction with MAO-I.
Dobutamine	*Intravenous:* 2.5–20 μg/kg/min (decreased systemic vascular resistance at <5 μg/kg/min).	Hypertension, hypotension, tachyarrhythmias, headache, nausea, fever, hypersensitivity.	Drug interaction with MAO-I; contraindication for sulfite allergy.
Levosimendan	*Intravenous:* 6–24 μg/kg over 10 min followed by a continuous infusion of 0.05–0.2 μg/kg/min, adjusted according to response.	Hypotension, headache, nausea, arrhythmias.	Avoid use with other vasodilators; not currently available in the U.S.

Current and Potential Therapeutic Strategies for Hemodynamic Cardiorenal Syndrome

Cardiorenal Med 2016;6:83–98

Yoshitsugu Obi[a, c] Taehee Kim[a, c, f] Csaba P. Kovesdy[d] Alpesh N. Amin[b]
Kamyar Kalantar-Zadeh[a, c, e]

Table 1. Pharmacologic and non-pharmacologic regimens for CRS discussed in this review

	Dose/frequency	Adverse effects	Special consideration
Tolvaptan	*Oral:* 15 mg once daily; after at least 24 h, may be increased to 30 mg once daily to a maximum of 60 mg once daily titrating at 24-hour intervals.	Hepatotoxicity, hypernatremia, hypersensitivity, nausea, weakness, fever, anorexia.	Do not use for more than 30 days due to the risk of hepatotoxicity; do not use with strong CYP3A inhibitors; monitor closely for rate of serum sodium increase and neurological status.
Nesiritide	*Intravenous:* 2 μg/kg (bolus optional) followed by continuous infusion at 0.01 μg/kg/min.	Hypotension, rise in serum creatinine, headache, nausea, hypersensitivity.	Blood pressure should be closely monitored; hypotensive effects may last for several hours.
Sacubitril/valsartan	*Oral:* Start with 49/51 mg (sacubitril/valsartan) twice daily. Double the dose after 2–4 weeks, as tolerated by the patient.	Hypotension, hyperkalemia, cough, dizziness, renal failure.	Do not use with an angiotensin-converting enzyme inhibitor; do not use with aliskiren in patients with diabetes; avoid use with an angiotensin receptor blocker.

Current and Potential Therapeutic Strategies for Hemodynamic Cardiorenal Syndrome

Cardiorenal Med 2016;6:83–98

Yoshitsugu Obi[a, c] Taehee Kim[a, c, f] Csaba P. Kovesdy[d] Alpesh N. Amin[b]
Kamyar Kalantar-Zadeh[a, c, e]

Table 1. Pharmacologic and non-pharmacologic regimens for CRS discussed in this review

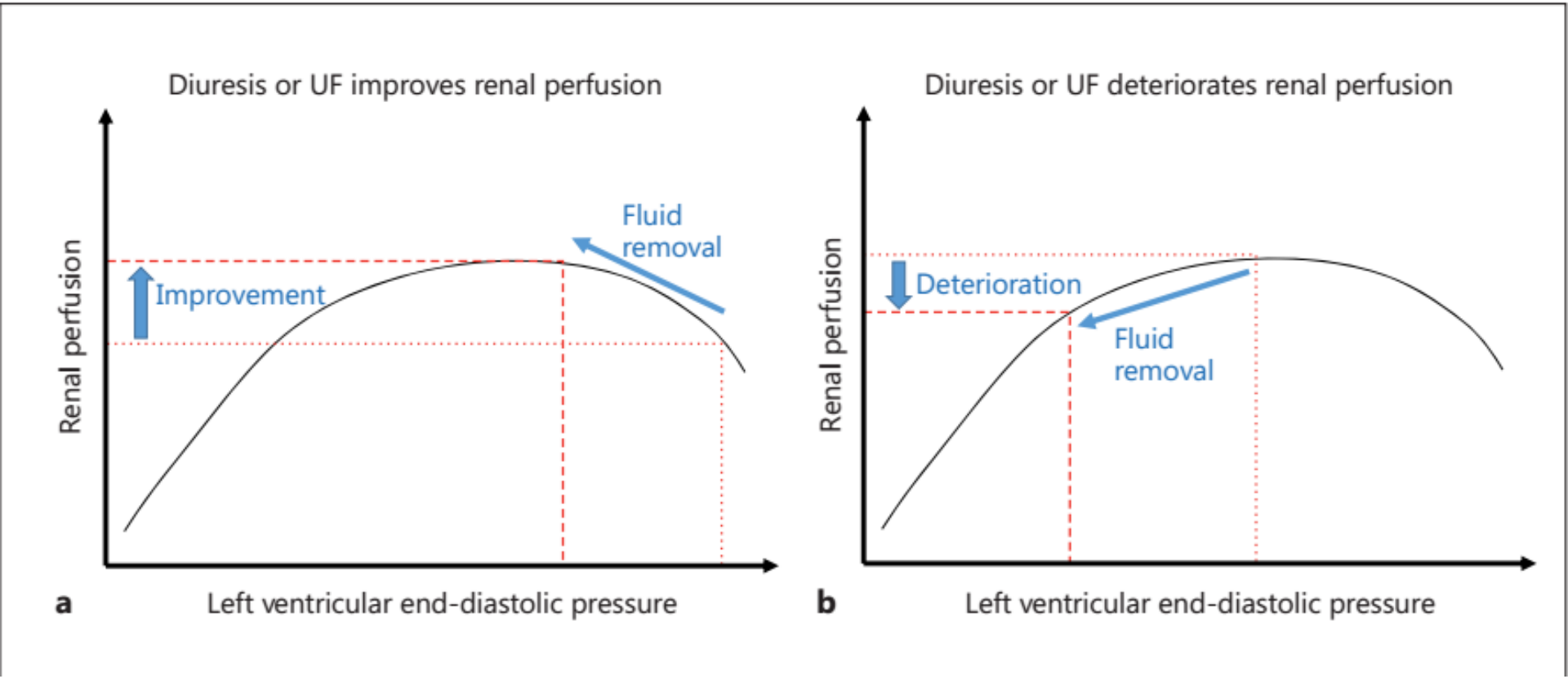
	Dose/frequency	Adverse effects	Special consideration
Non-pharmacologic regimens			
RRT (UF, intermittent HD, sustained low-efficiency dialysis, continuous HD, peritoneal dialysis	Indicated when refractory to medical therapy.	Volume depletion, hypotension, hypokalemia and/or hypophosphatemia (HD).	Consultation with a nephrologist is appropriate before initiation.
Fluid and sodium restriction	<1.5 to 2.0 g/day of sodium, <1.5 to 2.0 l/day of water.	Hypotension, hyponatremia, RAAS activation?	Individualize based on serum sodium level and diuretic resistance.

Current and Potential Therapeutic Strategies for Hemodynamic Cardiorenal Syndrome

Cardiorenal Med 2016;6:83–98

Yoshitsugu Obi[a, c] Taehee Kim[a, c, f] Csaba P. Kovesdy[d] Alpesh N. Amin[b]
Kamyar Kalantar-Zadeh[a, c, e]

Diuretická (nebo dialyzační) ultrafiltrace renální perfuze

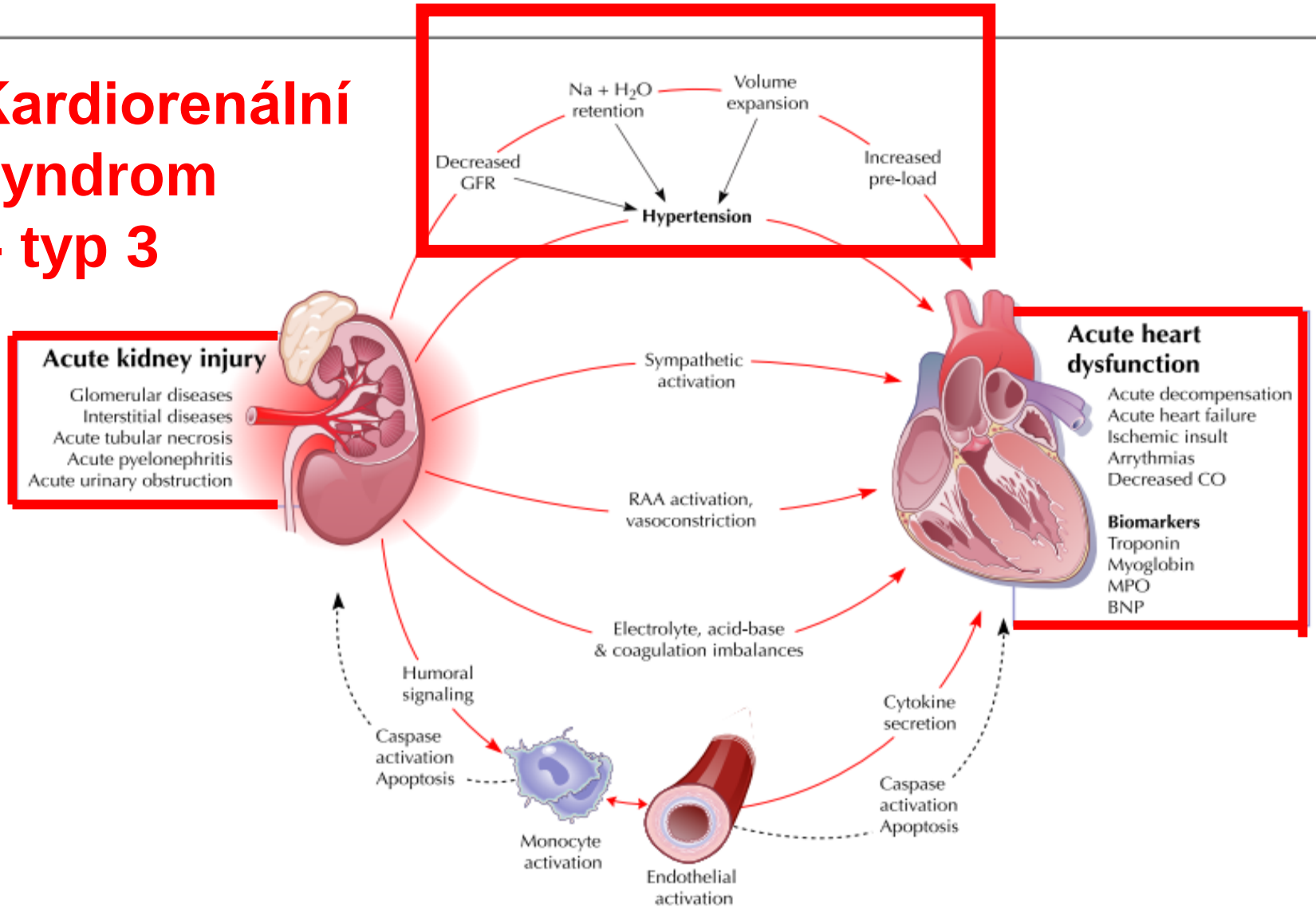


Cardiorenal Syndrome

(J Am Coll Cardiol 2008;52:1527–39) © 2008

Claudio Ronco, MD,* Mikko Haapio, MD,† Andrew A. House, MSc, MD,‡ Nagesh Anavekar, MD,§ Rinaldo Bellomo, MD¶

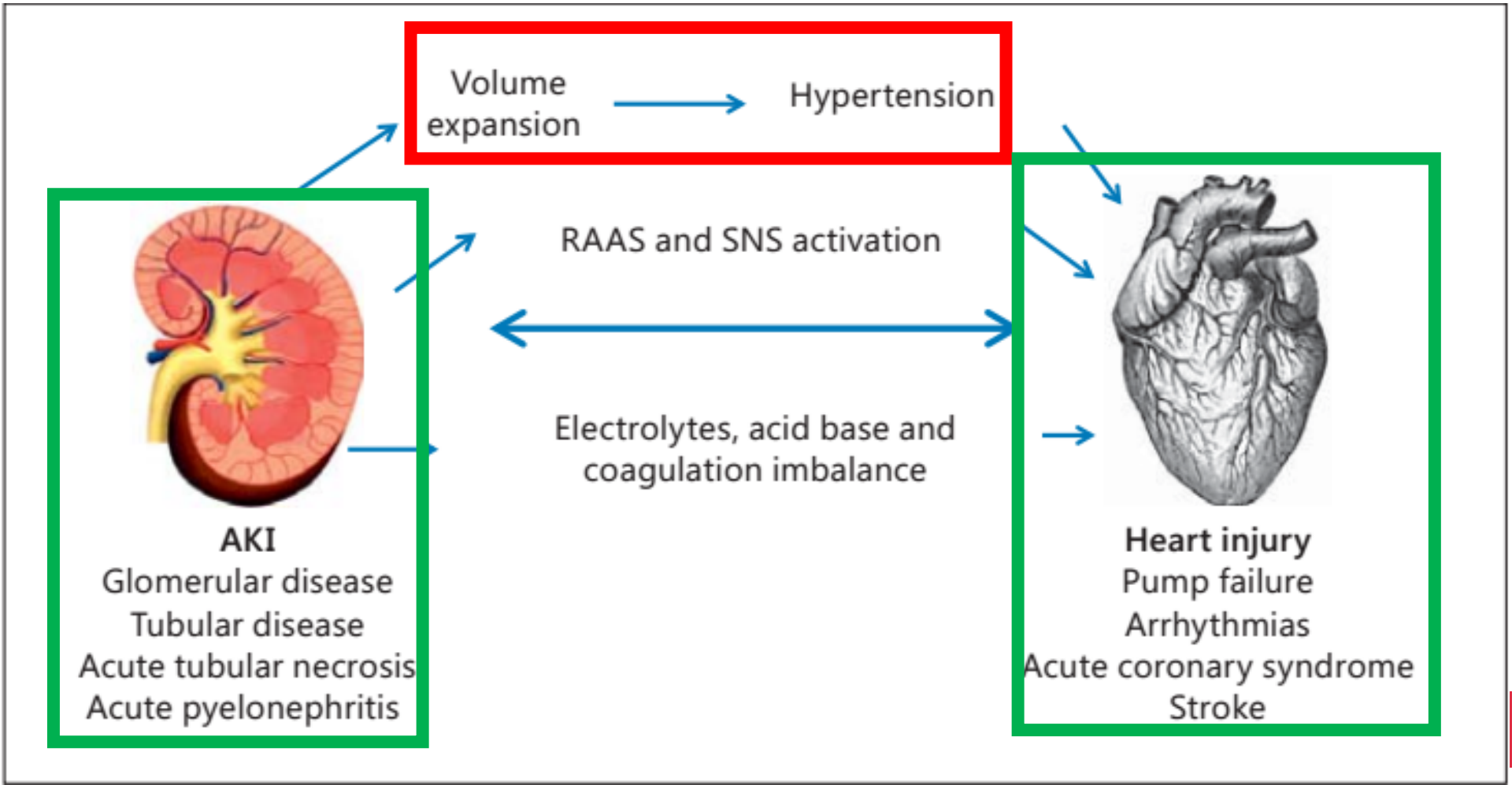
Kardiorenální syndrom - typ 3



Cardiorenal Syndrome in Western Countries: Epidemiology, Diagnosis and Management Approaches

Kidney Dis 2016;2:151–163

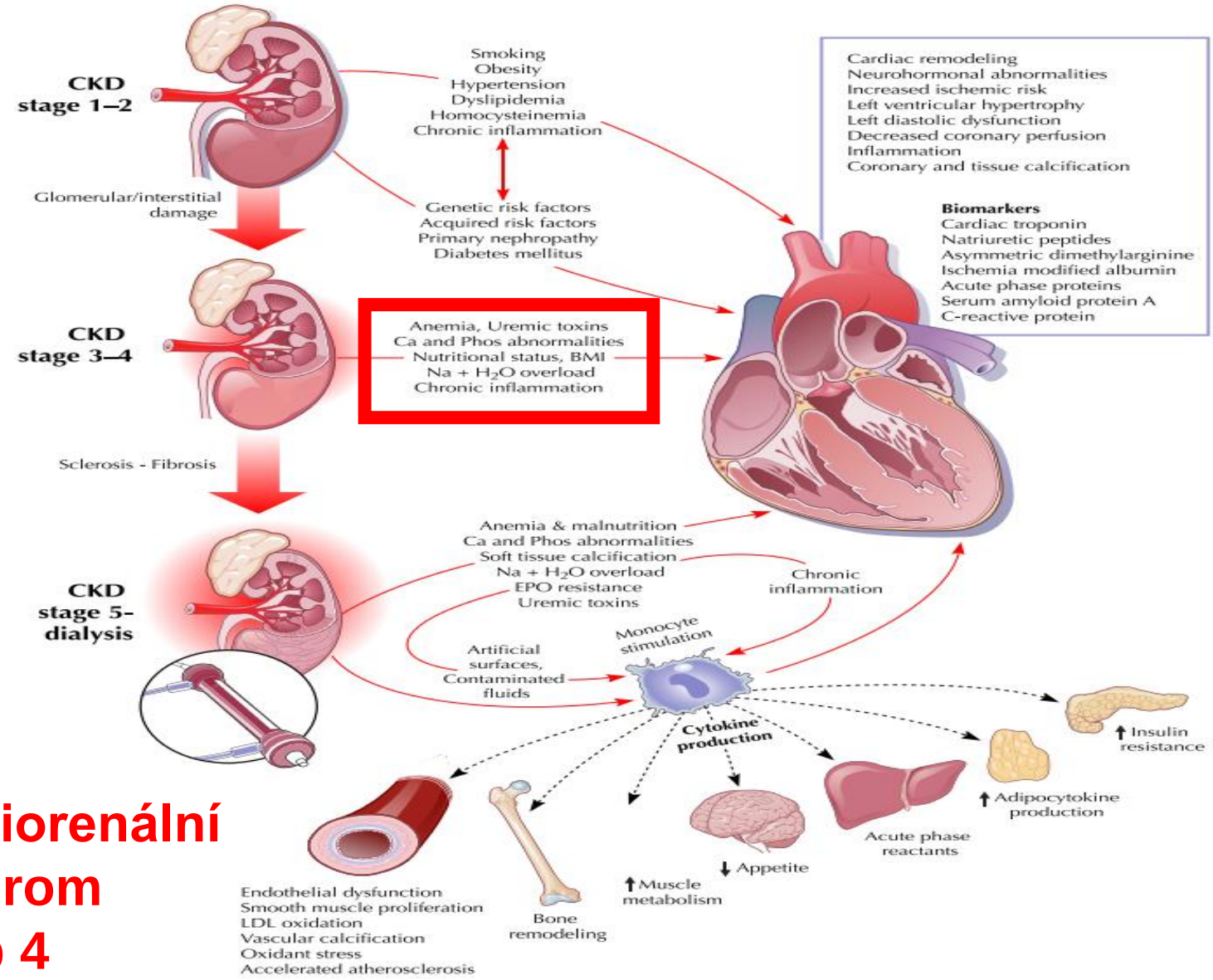
Claudio Ronco[a] Luca Di Lullo[b]



Cardiorenal Syndrome

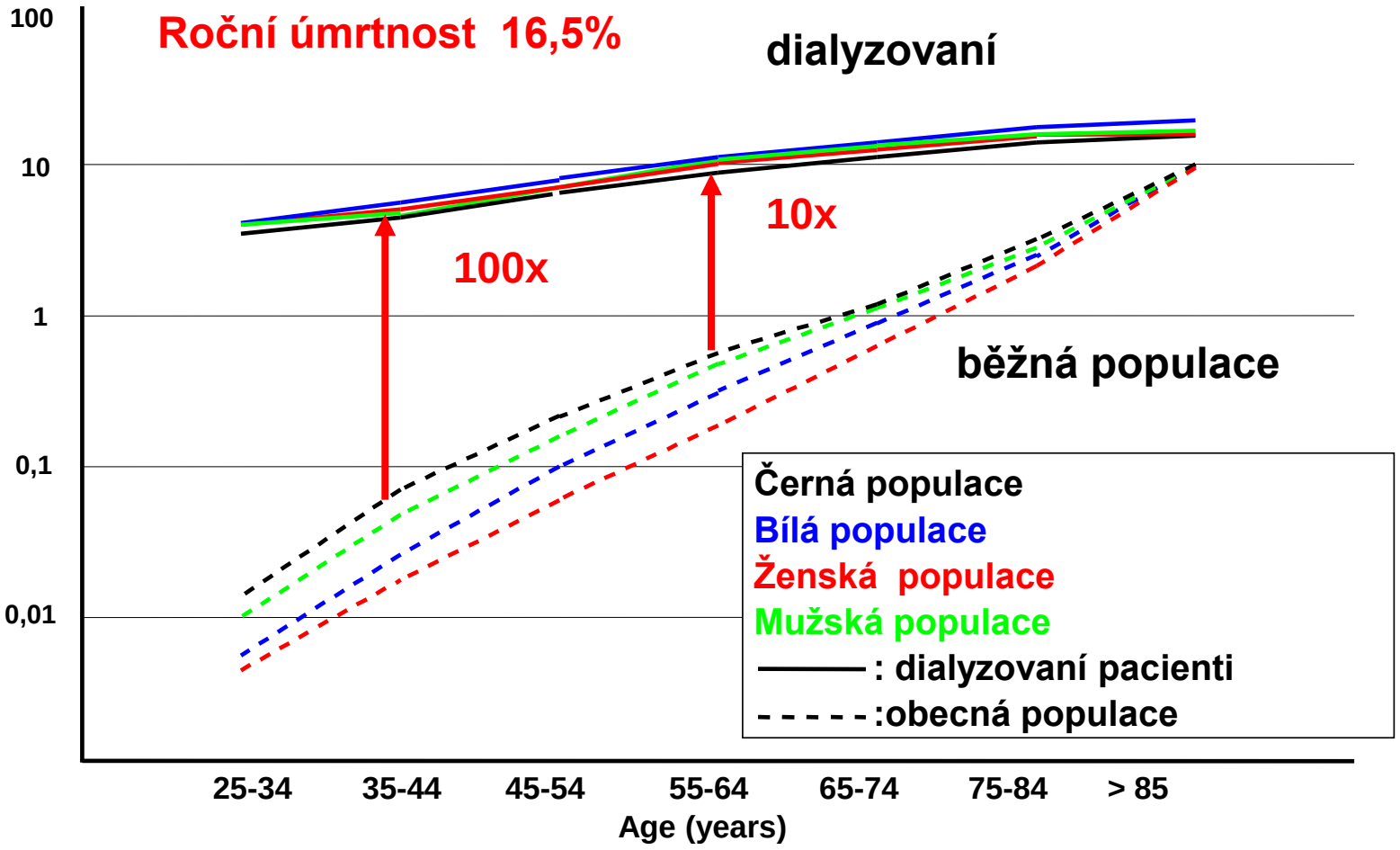
(J Am Coll Cardiol 2008;52:1527–39) © 2008

Claudio Ronco, MD,* Mikko Haapio, MD,† Andrew A. House, MSc, MD,‡ Nagesh Anavekar, MD,§ Rinaldo Bellomo, MD¶



Kardiorenální syndrom - typ 4

Roční KV mortalita u CKD5 (%)



17 Foley RN et al. AJKD 1998.

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 SEPTEMBER 23, 2004 VOL. 351 NO. 13

Relation between Renal Dysfunction and Cardiovascular Outcomes after Myocardial Infarction

Nagesh S. Anavekar, M.D., John J.V. McMurray, M.D., Eric J. Velazquez, M.D., Scott D. Solomon, M.D., Lars Kober, M.D., D.Sc., Jean-Lucien Rouleau, M.D., Harvey D. White, D.Sc., Rolf Nordlander, M.D., Aldo Maggioni, M.D., Kenneth Dickstein, M.D., Steven Zelenkofske, D.O., Jeffrey D. Leimberger, Ph.D., Robert M. Califf, M.D., and Marc A. Pfeffer, M.D., Ph.D.

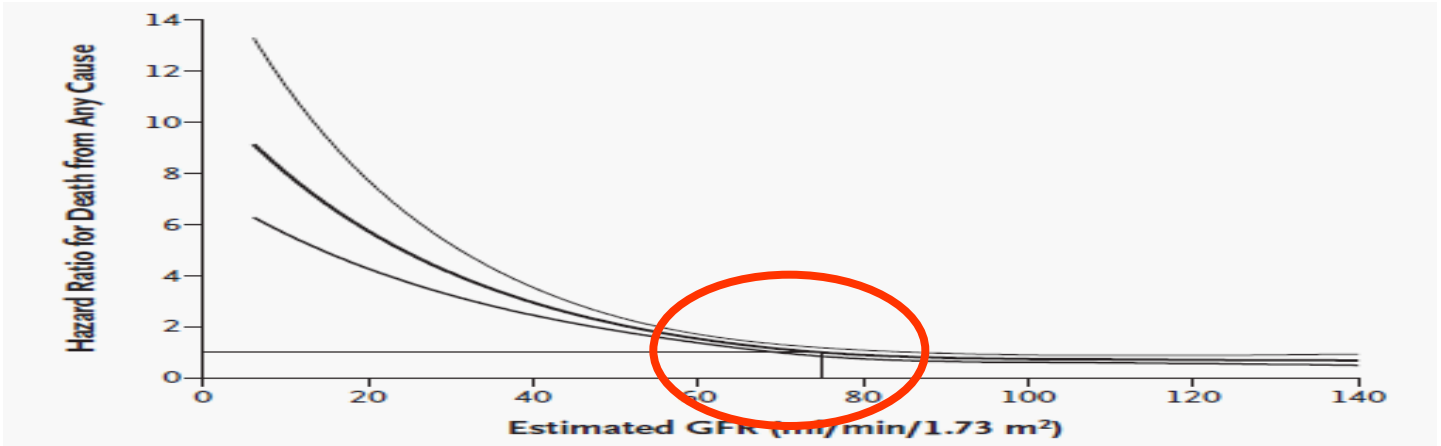


Figure 4. Unadjusted Hazard Ratio for Death from Any Cause, According to the Estimated GFR at Baseline.

The estimated hazard ratio (middle curve) is shown with the 95 percent confidence limits (upper and lower curves).

Table 2. Hazard Ratios for Death and Composite Outcomes According to the Estimated GFR and Creatinine Levels at Baseline.*

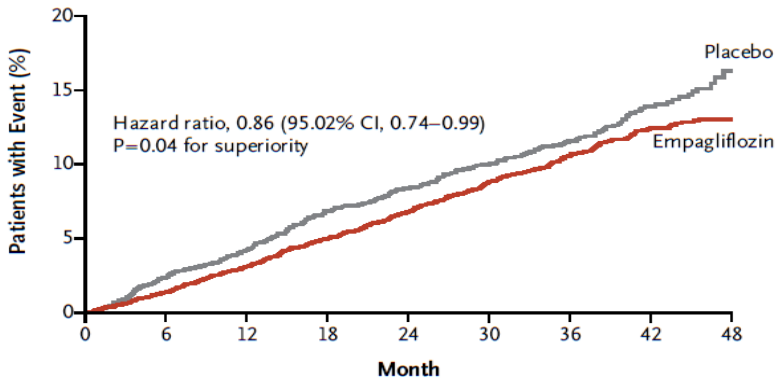
Outcome	GFR, <45.0 ml/min/1.73 m²; Creatinine, 1.7±0.4 mg/dl (N=1644)	GFR, 45.0–59.9 ml/min/1.73 m²; Creatinine, 1.3±0.2 mg/dl (N=3218)	GFR, 60.0–74.9 ml/min/1.73 m²; Creatinine, 1.1±0.1 mg/dl (N=4105)	GFR, >75.0 ml/min/1.73 m²; Creatinine 0.9±0.1 mg/dl (N=5560)
Death (%)	45.5	28.9	20.5	14.1
Unadjusted hazard ratio (95% CI)	3.78 (3.39–4.21)	2.29 (2.07–2.53)	1.42 (1.28–1.58)	1.0†
Adjusted hazard ratio (95% CI)‡	1.70 (1.50–1.93)	1.38 (1.24–1.54)	1.14 (1.02–1.27)	
Composite end point (%)§	59.9	44.1	34.3	26.5
Unadjusted hazard ratio (95% CI)	2.94 (2.7–3.2)	1.92 (1.78–2.08)	1.33 (1.23–1.44)	1.0†
Adjusted hazard ratio (95% CI)‡	1.49 (1.35–1.65)	1.26 (1.16–1.37)	1.10 (1.02–1.19)	

Empagliflozin, Cardiovascular Outcomes, and Mortality in Type 2 Diabetes

Bernard Zinman, M.D., Christoph Wanner, M.D., John M. Lachin, Sc.D., David Fitchett, M.D., Erich Bluhmki, Ph.D., Stefan Hante
N Engl J Med 2015;373:2117-28.

Ve studii EMPA-REG Outcome ↓ empagliflozin KV morbitidu, KV a celkovou mortalitu i hospitalizace pro srdeční selhání

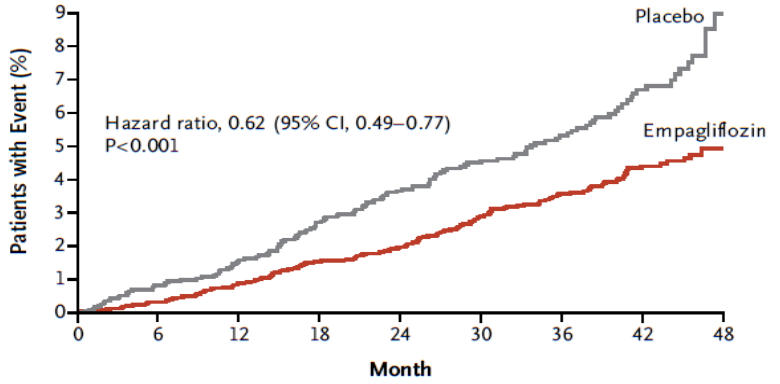
A Primary Outcome



No. at Risk

Empagliflozin	4687	4580	4455	4328	3851	2821	2359	1534	370
Placebo	2333	2256	2194	2112	1875	1380	1161	741	166

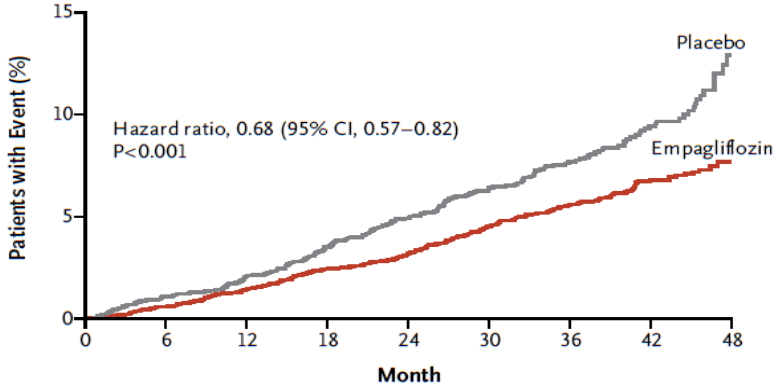
B Death from Cardiovascular Causes



No. at Risk

Empagliflozin	4687	4651	4608	4556	4128	3079	2617	1722	414
Placebo	2333	2303	2280	2243	2012	1503	1281	825	177

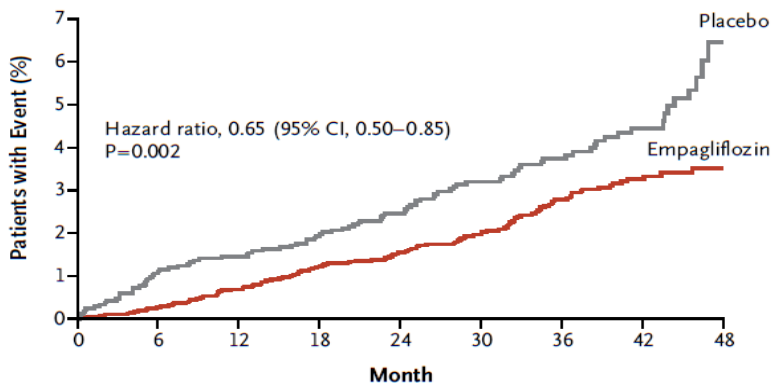
C Death from Any Cause



No. at Risk

Empagliflozin	4687	4651	4608	4556	4128	3079	2617	1722	414
Placebo	2333	2303	2280	2243	2012	1503	1281	825	177

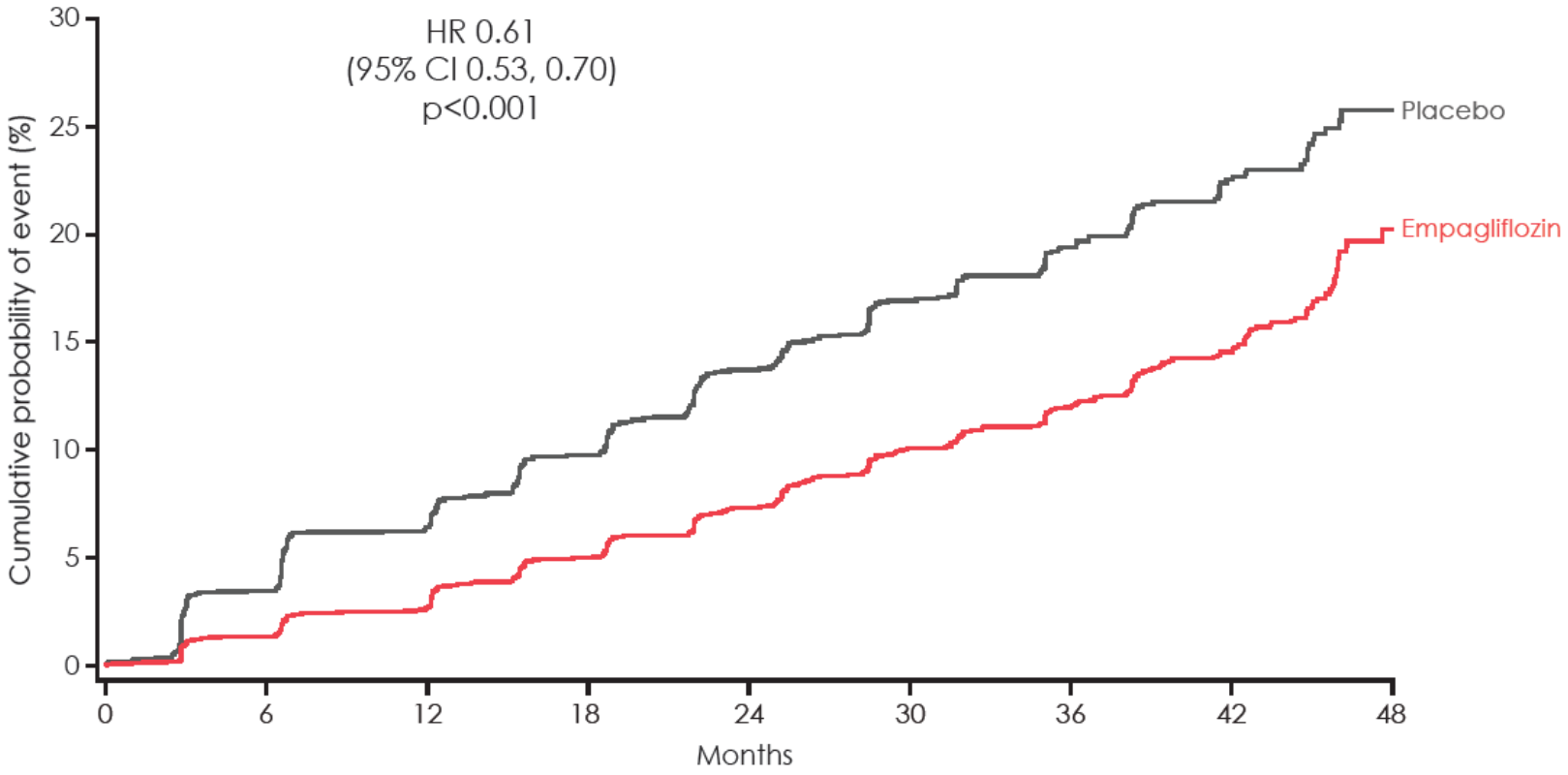
D Hospitalization for Heart Failure



No. at Risk

Empagliflozin	4687	4614	4523	4427	3988	2950	2487	1634	395
Placebo	2333	2271	2226	2173	1932	1424	1202	775	168

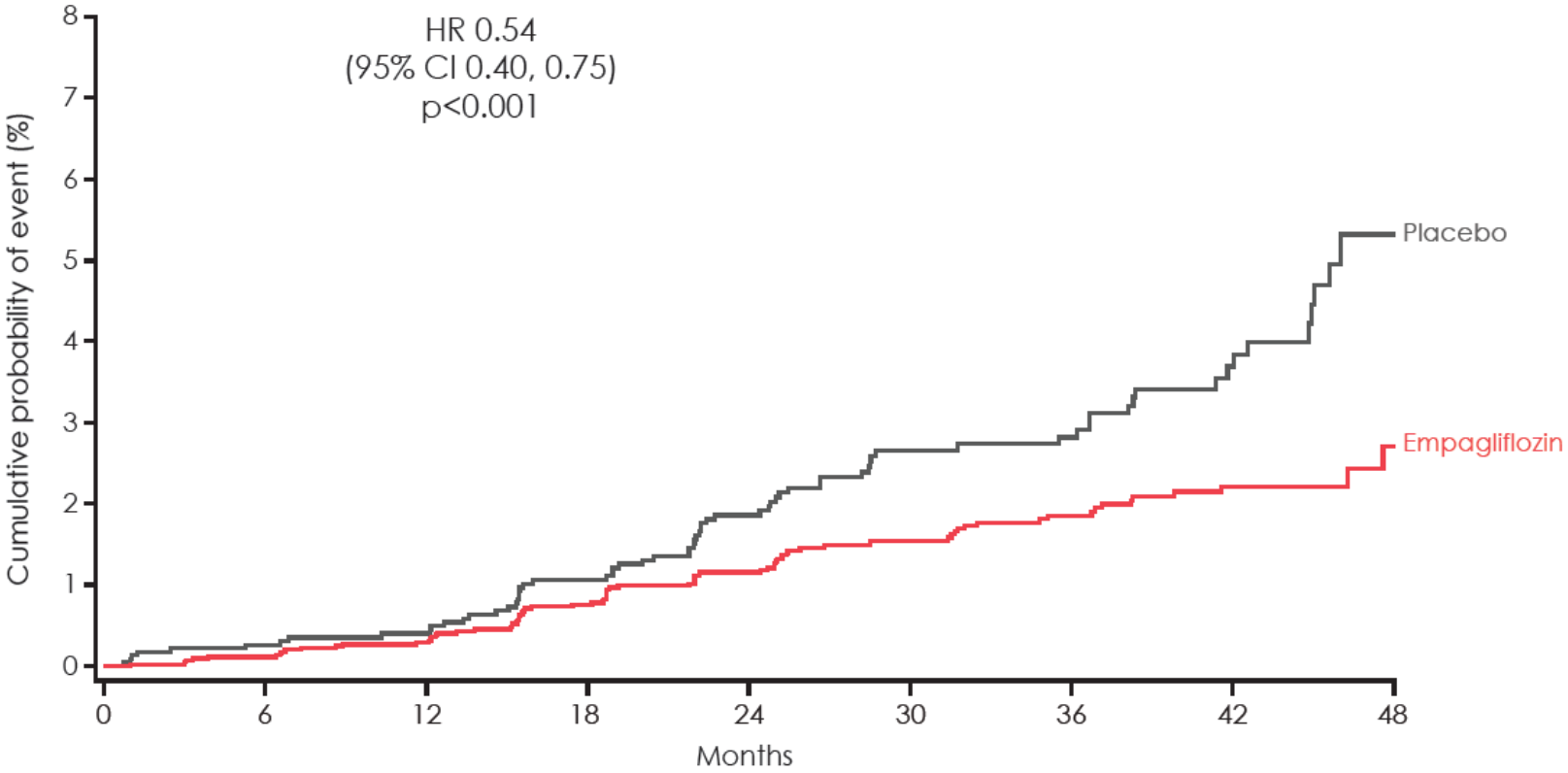
Nově vzniklá nebo zhoršující se nefropatie



No. of patients									
Empagliflozin	4124	3994	3848	3669	3171	2279	1887	1219	290
Placebo	2061	1946	1836	1703	1433	1016	833	521	106

Kaplan-Meier estimate. Patients treated with at least one dose of study drug. Hazard ratios are based on Cox regression analyses. HR, hazard ratio; CI, confidence interval.

Tvrdý“ renální endpoint
Zdvojnásobení sérového kreatininu, zahájení náhrady funkce ledvin nebo smrt v důsledku onemocnění ledvin



No. of patients									
Empagliflozin	4645	4500	4377	4241	3729	2715	2280	1496	360
Placebo	2323	2229	2146	2047	1771	1289	1079	680	144

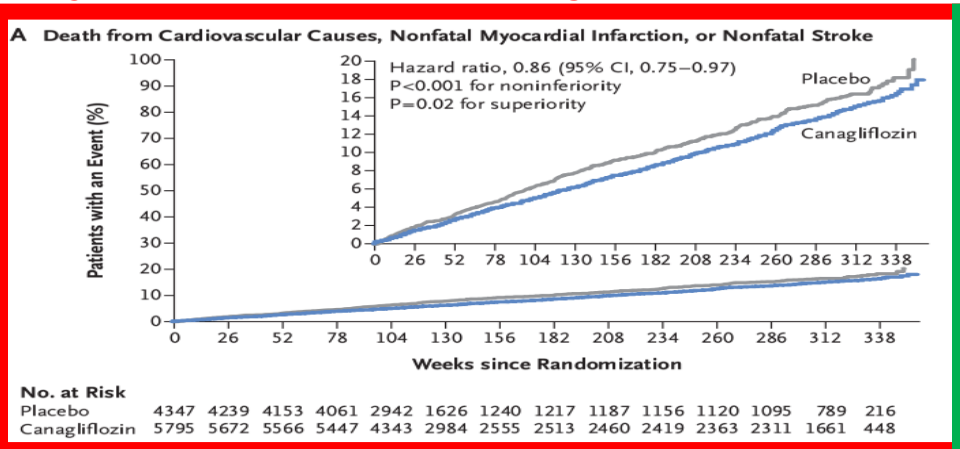
Kaplan-Meier estimates in patients treated with ≥1 dose of study drug. Hazard ratios are based on Cox regression analyses.

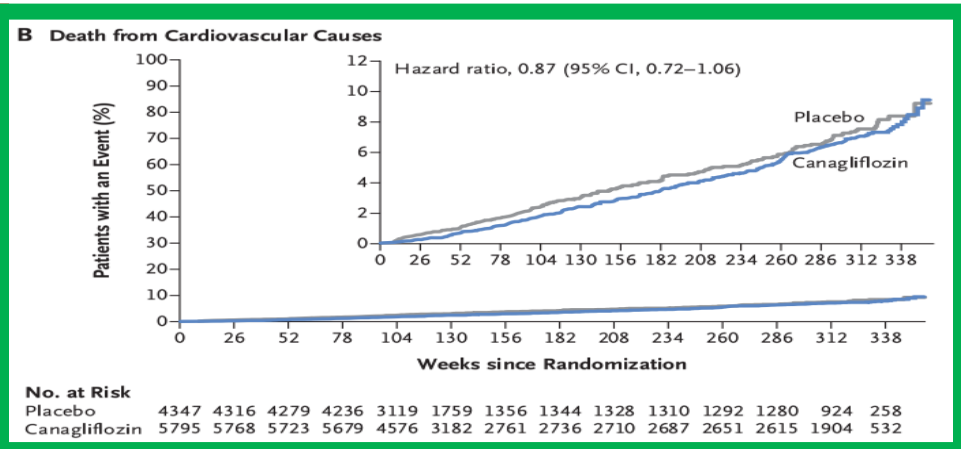
Canagliflozin and Cardiovascular and Renal Events in Type 2 Diabetes

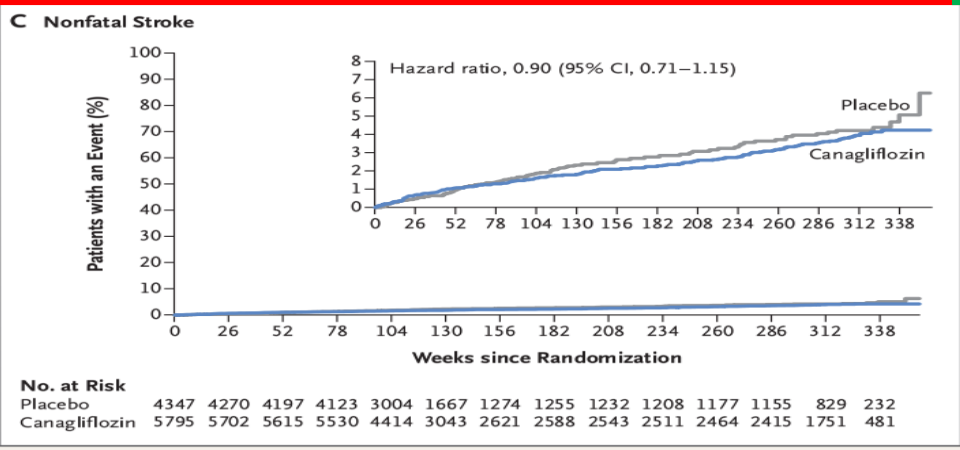
Bruce Neal, M.B., Ch.B., Ph.D., Vlado Perkovic, M.B., B.S., Ph.D., Kenneth W. Mahaffey, M.D., Dick de Zeeuw, M.D., Ph.D., Greg Fulcher, M.D., Ngozi Erondu, M.D., Ph.D., Wayne Shaw, D.S.L., Gordon Law, Ph.D., Mehul Desai, M.D., and David R. Matthews, D.Phil., B.M., B.Ch., for the CANVAS Program Collaborative Group*

Canagliflozin snížil primární endpoint, ale neměl významný vliv na jednotlivé komponenty včetně KV mortality

This article was published on June 12, 2017, at NEJM.org.







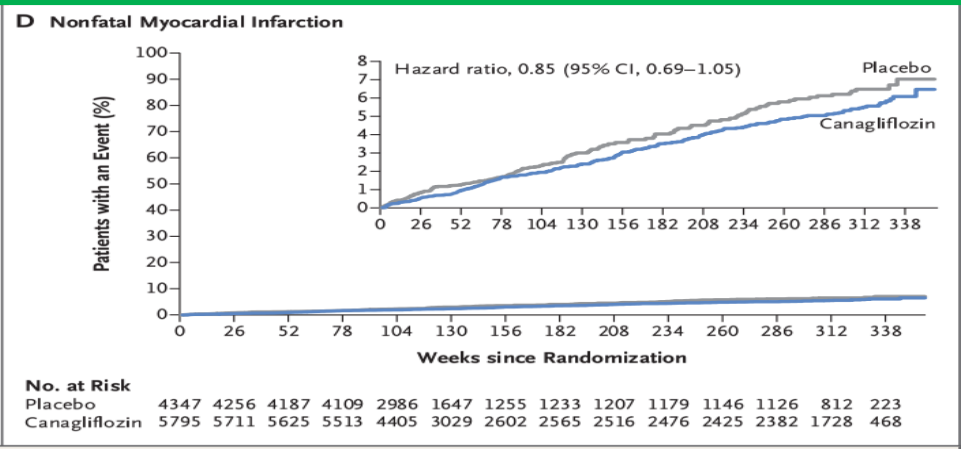


Figure 2. Cardiovascular Outcomes in the Integrated CANVAS Program.

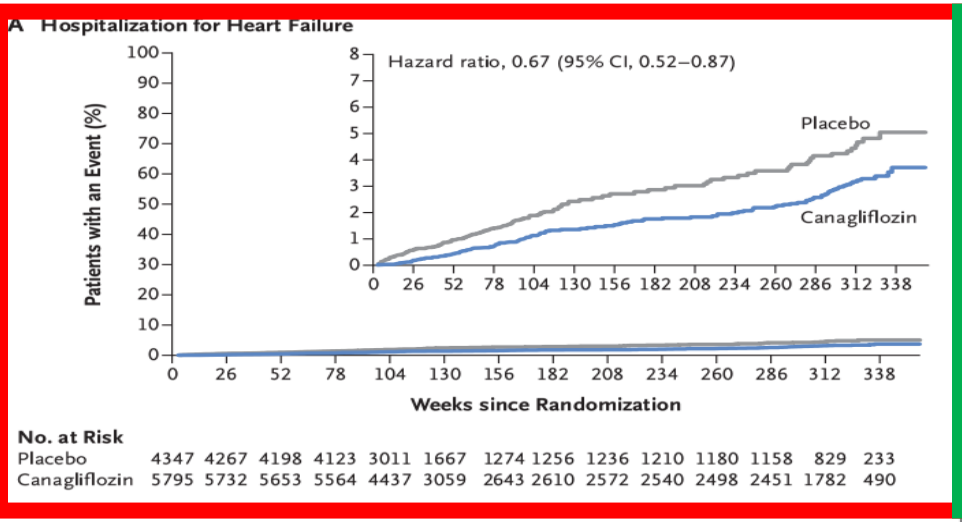
The primary outcome was a composite of death from cardiovascular causes, nonfatal myocardial infarction, or nonfatal stroke. The hazard ratios and 95% confidence intervals for the primary outcome and the components of the outcome were estimated with the use of Cox regression models with stratification according to trial and history of cardiovascular disease for all canagliflozin groups combined versus placebo. Analyses are based upon the full, integrated data set comprising all participants who underwent randomization. The inset in each panel shows the same data on an enlarged y axis.

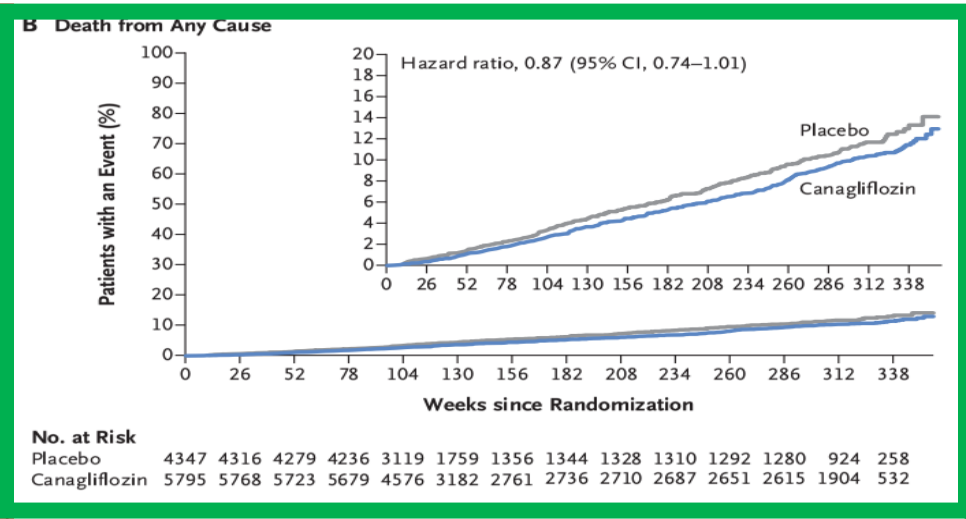
Canagliflozin and Cardiovascular and Renal Events in Type 2 Diabetes

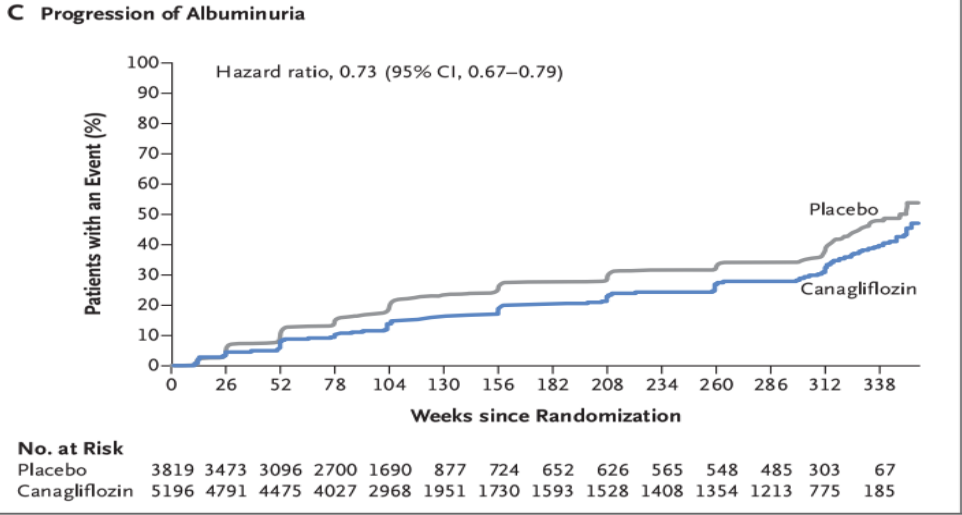
Bruce Neal, M.B., Ch.B., Ph.D., Vlado Perkovic, M.B., B.S., Ph.D., Kenneth W. Mahaffey, M.D., Dick de Zeeuw, M.D., Ph.D., Greg Fulcher, M.D., Ngozi Erondu, M.D., Ph.D., Wayne Shaw, D.S.L., Gordon Law, Ph.D., Mehul Desai, M.D., and David R. Matthews, D.Phil., B.M., B.Ch., for the CANVAS Program Collaborative Group*

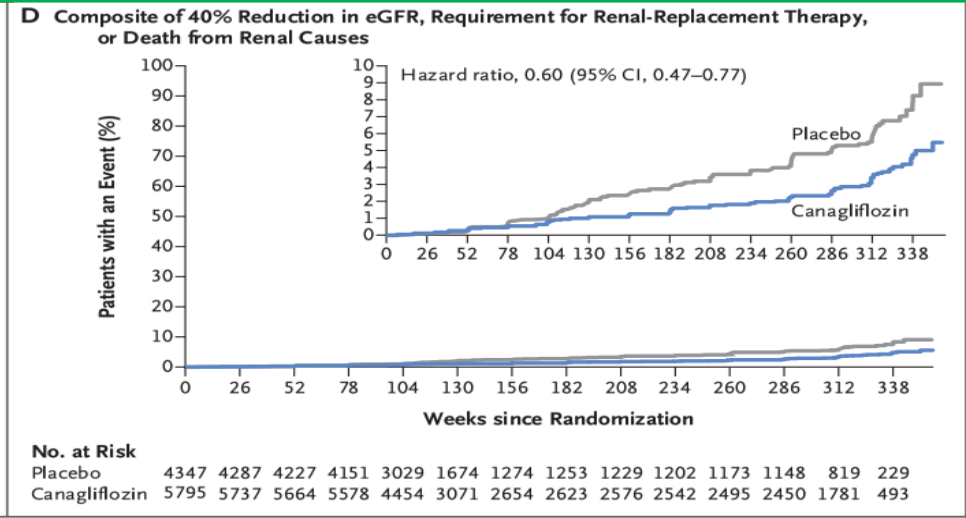
This article was published on June 12, 2017, at NEJM.org.

Canagliflozin snížil hospitalizace pro srdeční selhání, ale neovlivnil celkovou mortalitu









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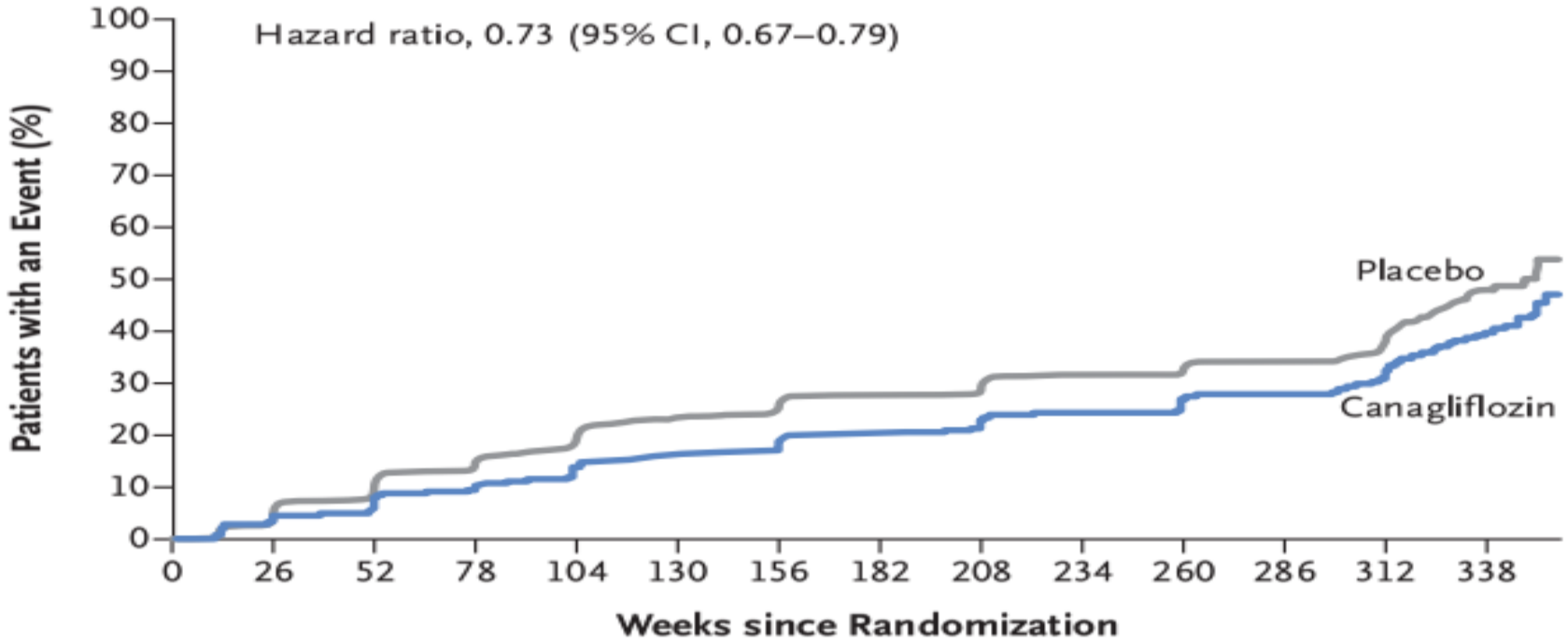
Canagliflozin snížil riziko progrese albuminurie

C Progression of Albuminuria



No. at Risk

Placebo	3819	3473	3096	2700	1690	877	724	652	626	565	548	485	303	67
Canagliflozin	5196	4791	4475	4027	2968	1951	1730	1593	1528	1408	1354	1213	775	185

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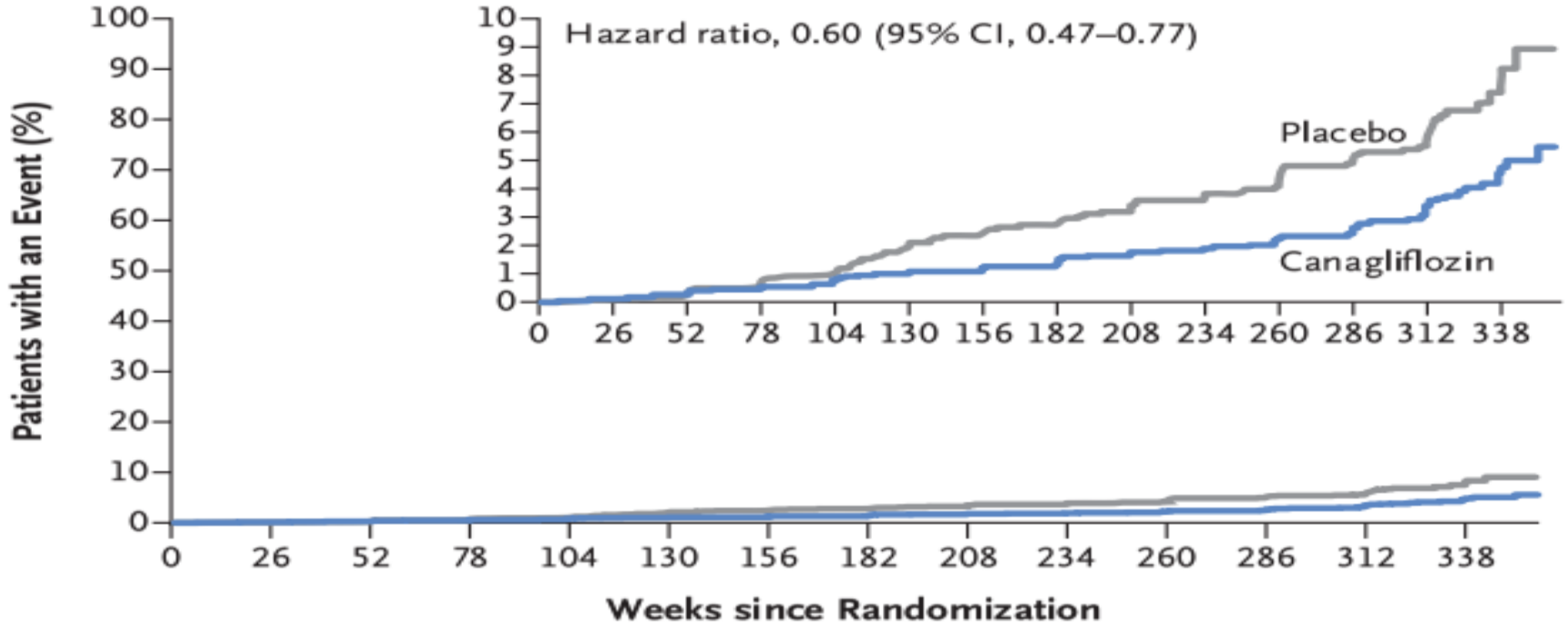
Canagliflozin snížil riziko snížení eGF o 40% nebo ESRD

D Composite of 40% Reduction in eGFR, Requirement for Renal-Replacement Therapy, or Death from Renal Causes



No. at Risk

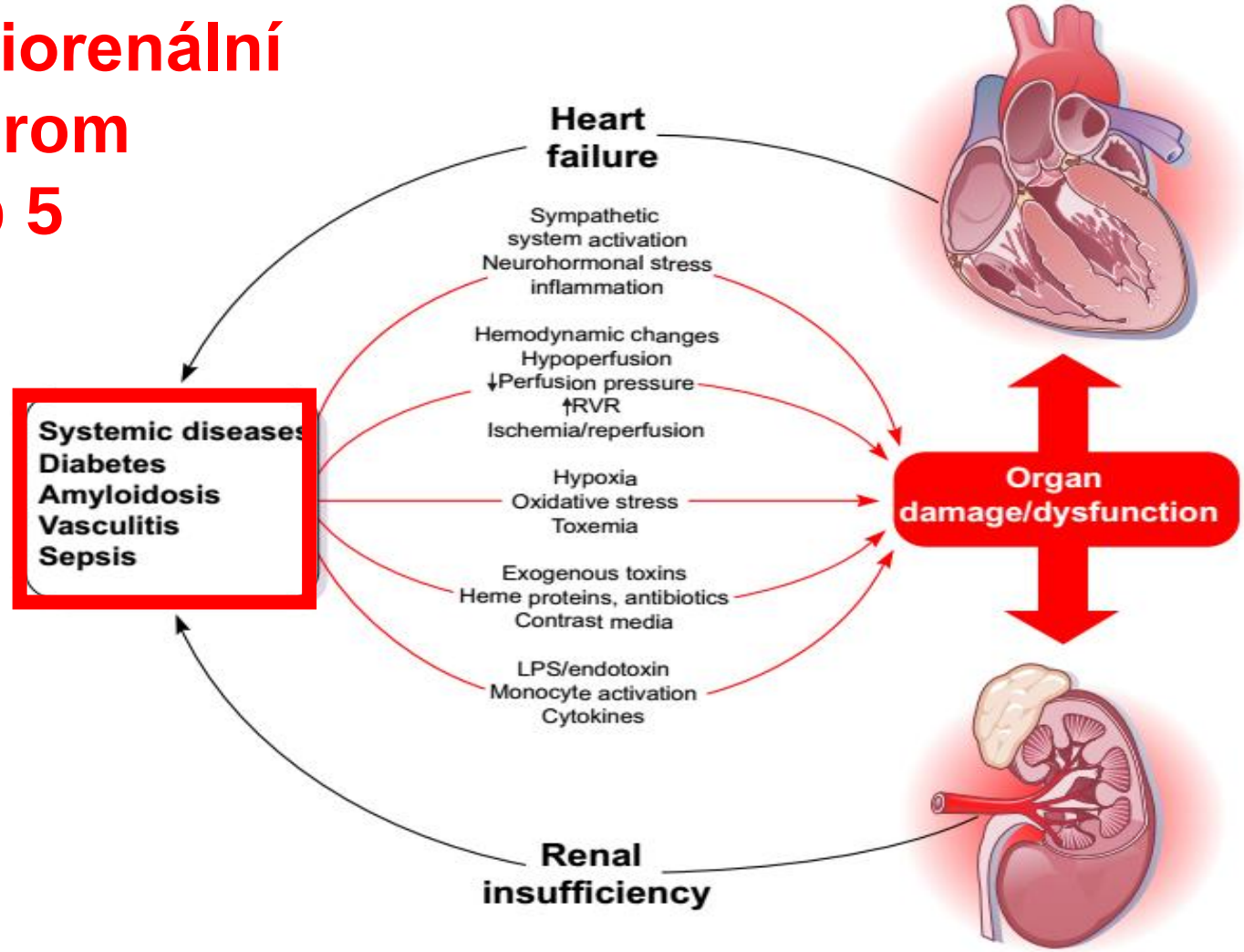
Placebo	4347	4287	4227	4151	3029	1674	1274	1253	1229	1202	1173	1148	819	229
Canagliflozin	5795	5737	5664	5578	4454	3071	2654	2623	2576	2542	2495	2450	1781	493

Cardiorenal Syndrome

(J Am Coll Cardiol 2008;52:1527–39) © 2008

Claudio Ronco, MD,* Mikko Haapio, MD,† Andrew A. House, MSc, MD,‡ Nagesh Anavekar, MD,§ Rinaldo Bellomo, MD¶

Kardiorenální syndrom - typ 5



Light-chain cardiac amyloidosis: strategies to promote early diagnosis and cardiac response

Martha Grogan,[1] Angela Dispenzieri,[2] Morie A Gertz[2]

Heart 2017;**103**:1065–1072

Table 2 Consensus criteria for organ involvement

Organ	Diagnostic criteria*
Kidney	24-hour urine protein >0.5 g/day, predominantly albumin
Heart	Mean LV wall thickness >12 mm in diastole on echocardiography (no other cardiac cause) Elevated NT-proBNP (>332 ng/L) in the absence of renal failure or atrial fibrillation
Liver	Hepatomegaly with total liver span >15 cm in the absence of heart failure or alkaline phosphatase >1.5 times institutional upper limit of normal
Nerve	Peripheral: symmetric lower extremity sensorimotor peripheral neuropathy Autonomic: gastric emptying disorder, pseudo-obstruction, postural hypotension, erectile dysfunction (males), voiding dysfunction unrelated to direct organ infiltration
Gastrointestinal tract	Direct biopsy verification with symptoms
Lung	Direct biopsy verification with symptoms or Radiographic pattern of interstitial infiltration
Soft tissue	Macroglossia Arthropathy Claudication, presumed vascular amyloid Skin lesions Myopathy by biopsy or pseudohypertrophy of muscle Lymphadenopathy (may be localised) Carpal tunnel syndrome

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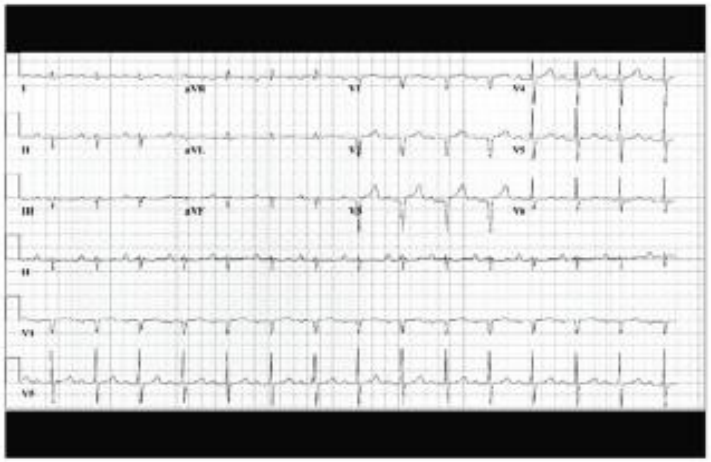
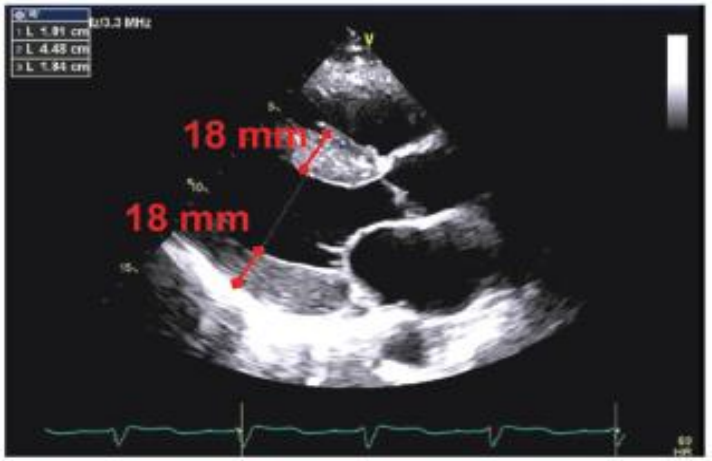
Relativně nízká voltáž EKG s těžkou hypertrofií LK a abnormalitami na MRI vyšetření

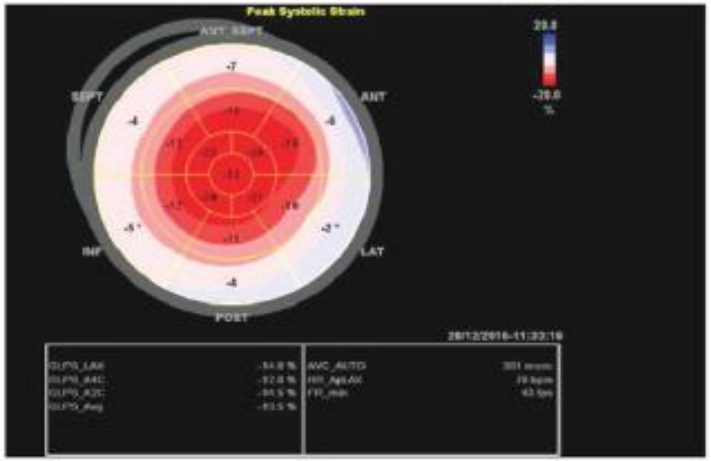
A ECG



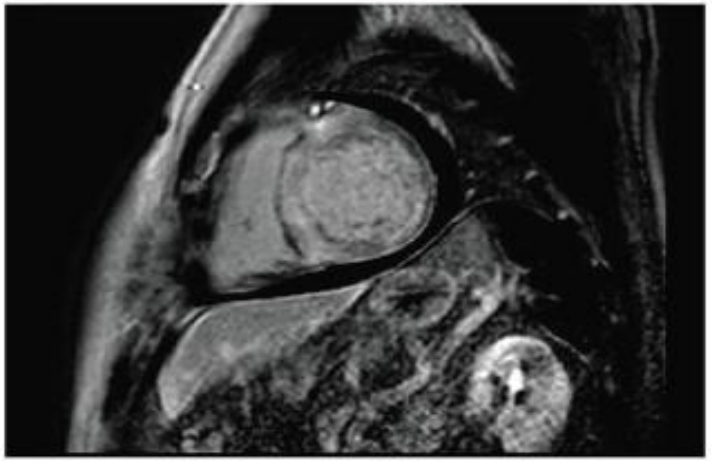
B ECHO



C Strain Rate Imaging



D CMR



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Infiltrace srdce amyloidovými fibrilami

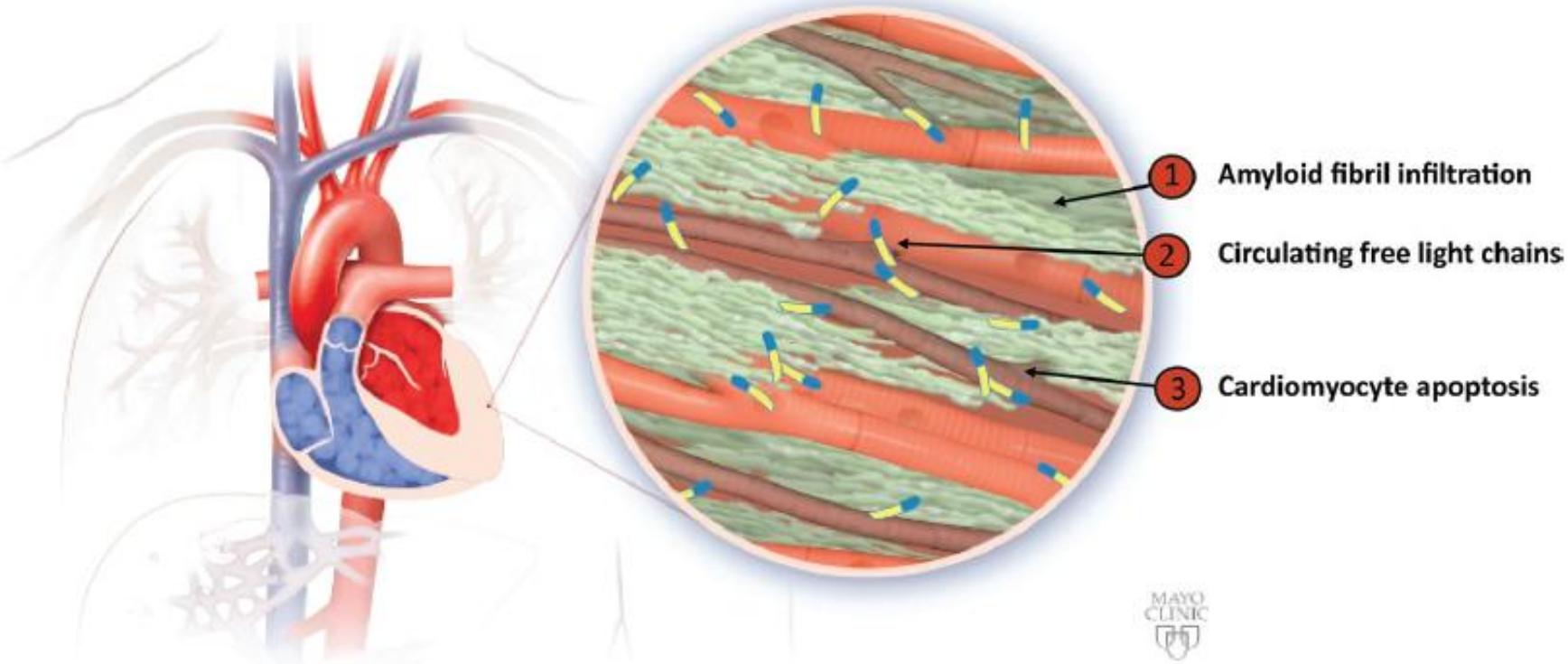

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Table 3 Treatments for patients with cardiac amyloid light chain (AL) amyloidosis and clinical outcome

Treatment	Mechanism of action	Clinical outcome
Plasma cell-directed therapies	Eliminate the production of amyloidogenic LC	Patients with advanced cardiac amyloidosis often die despite HR, whereas patients with less severe cardiac involvement may experience rapid improvement in cardiac biomarkers and cardiac function when FLC can be reduced by 50%–90%[7]
Cardiac support therapies and/or hear transplantation	Ameliorate symptoms of heart failure while patient is treated with other therapies or awaiting heart transplantation	Patients with isolated cardiac deposition of amyloid may respond best to transplantation, but these treatments are supportive and not disease modifying
Amyloid-directed therapies	Inhibit amyloid fibril formation or neutralise and clear circulating and deposited LC aggregates	Published clinical trial data have demonstrated cardiac and other organ responses with anti-LC[45] and anti-SAP[47] immunotherapy Preliminary data suggest a potential survival benefit of doxycycline

Závěry

1. Pacientů s CRS1 a CRS 2 přibývá – AKI a CKD mají nepříznivý vliv na prognózu pacientů
2. Postižení srdce u CKD5 (CRS4) má velmi závažnou prognózu
3. AL amyloidóza může být příčinou CRS5 – postižení srdce výrazně zhoršuje prognózu pacientů
4. Časná diagnostika a léčba by měla prognózu pacientů s CRS zlepšit