

SEVERE HYPERHYDRATION PREDICTS DEVELOPMENT OF ACUTE KIDNEY INJURY IN PATIENTS WITH DECOMPENSATED HEART FAILURE

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Background and Objective

- Patients with acute decompensated heart failure (ADHF) are usually admitted with severe systemic congestion^{1,2}
- Volume overload is the known main driver for morbidity, mortality and readmission to the hospital¹
- Acute kidney injury (AKI) is the common complication among patients with ADHF and occurs up to 70% of this population²
- Bioimpedance vector analysis (BIVA) is a non-invasive, accurate technique for hydration status evaluation^{3,4}
- The aim of the study was to determine the hydration status in patients with ADHF by BIVA and to evaluate the association of fluid status with AKI, short-term and long-term outcomes

Inclusion criteria

- Patients hospitalized with ADHF
- Age 45-80 years

Methods

- Detection and classification of AKI:
 - ✓ KDIGO Guidelines 2012⁵
- Assessment of hydration status by BIVA:
 - ✓ Resistance (50kHz), standardized by height (R/h)
 - ✓ Reactance (50kHz), standardized by height (Xc/h)
 - ✓ Less R/h and Xc/h marks more hydration

¹ Adams K., Fonarow G.C., Emerman C. et al. Am. Heart. J. – 2005; 149:209-216.

² Ronco C., Cicoira M., McCullough P.A. J Am Coll Cardiol 2012; 60: 1031-42

³ Piccoli A., Nigrelli S., Caberlotto A. et al. Am. J. Clin. Nutr. - 1995; 61: 269-70

⁴ Ronco C., Costanzo M.R., Bellomo R. et al. Contrib Nephrology. 2011; vol. 164.

⁵ KDIGO Clinical practice guideline for acute kidney injury. Kidney Int. 2012; 2(1): 1-141

AKI criteria

- Increase in SCr ≥ 0.3 mg/dl (≥ 26.5 $\mu\text{mol/l}$) within 48 hours; or
- Increase in SCr ≥ 1.5 times baseline within the prior 7 days

Study population (n=183)

Parameters	Value
Male, n (%)	125 (68.3)
Age, years (M SD)	68.9 \pm 9.4
Arterial hypertension, n (%)	159 (86.9)
Ischemic heart disease, n (%)	102 (55.7)
Myocardial infarction, n (%)	97 (53)
Diabetes mellitus, n (%)	66 (36.1)
Known chronic kidney disease, n (%)	103 (56.3)
Ejection fraction, %	44 \pm 15

Results

- 87% of patients were overhydrated and 64% of them had severe hyperhydration, assessing by BIVA (Fig. 1)
- 41% of patients developed AKI (Fig. 2)
- Severe hyperhydration was diagnosed in 72% of patients with AKI and 44% of patients without AKI ($\chi^2=13.6$, $p<0.001$).
- The patients with AKI demonstrated higher volume overload compared with patients without worsening of renal function: lower levels of both R/h and Xc/h (Fig. 3)
- Level of Xc/h <20.8 Om/m (odds ratio 7.3; 95% confidential interval 3.8-14.3) was determined to be significant and independent factor for development of AKI
- Patients with AKI and poor outcomes (30-days mortality and re-hospitalization for 6 month) compared with patients without these conditions had lower levels of R/h and Xc/h (more marked hydration) (Fig. 4)
- Patients with AKI compared with patients without CRS had more marked clinical presentation of systemic congestion: orthopnea, acrocyanosis, jugular venous distension, hepatomegaly, higher respiratory rate on admission (25.3 vs 23.3 per minute, $p<0.01$), higher Borg dyspnea index (8.4 \pm 2.0 vs 7.6 \pm 1.6, $p<0.01$), but there were found no difference between EF and blood pressure levels (Fig. 5)

Figure 1. Hydration status in patients with ADHF

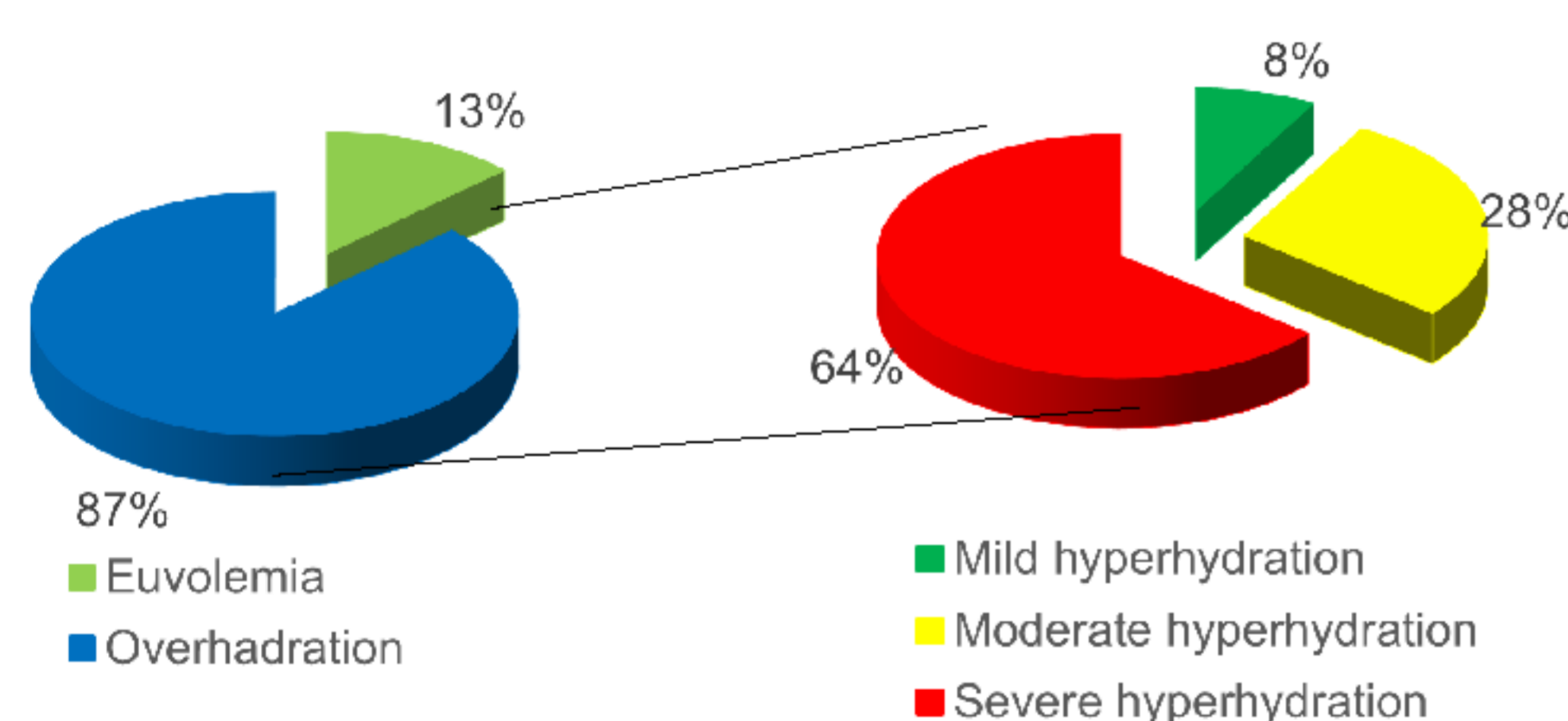


Figure 2. Prevalence of AKI in patients with ADHF

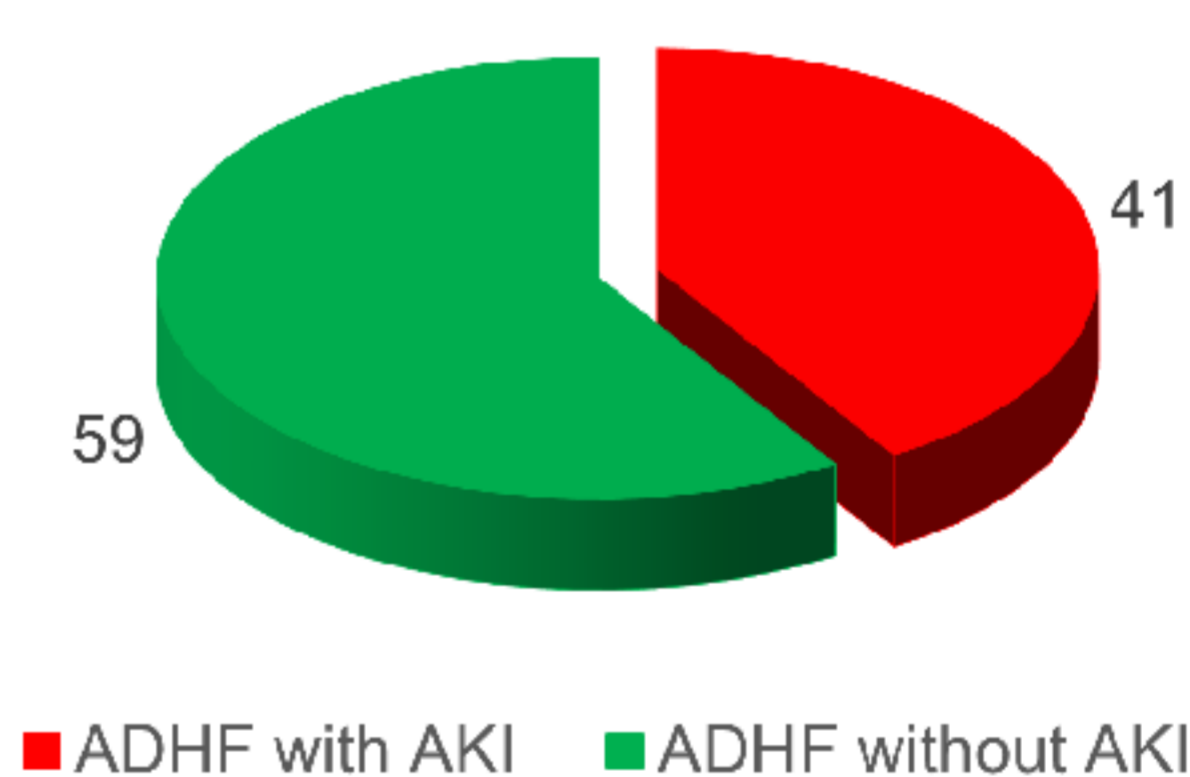


Figure 3. Bioelectrical parameters of hydration status according to presence of AKI

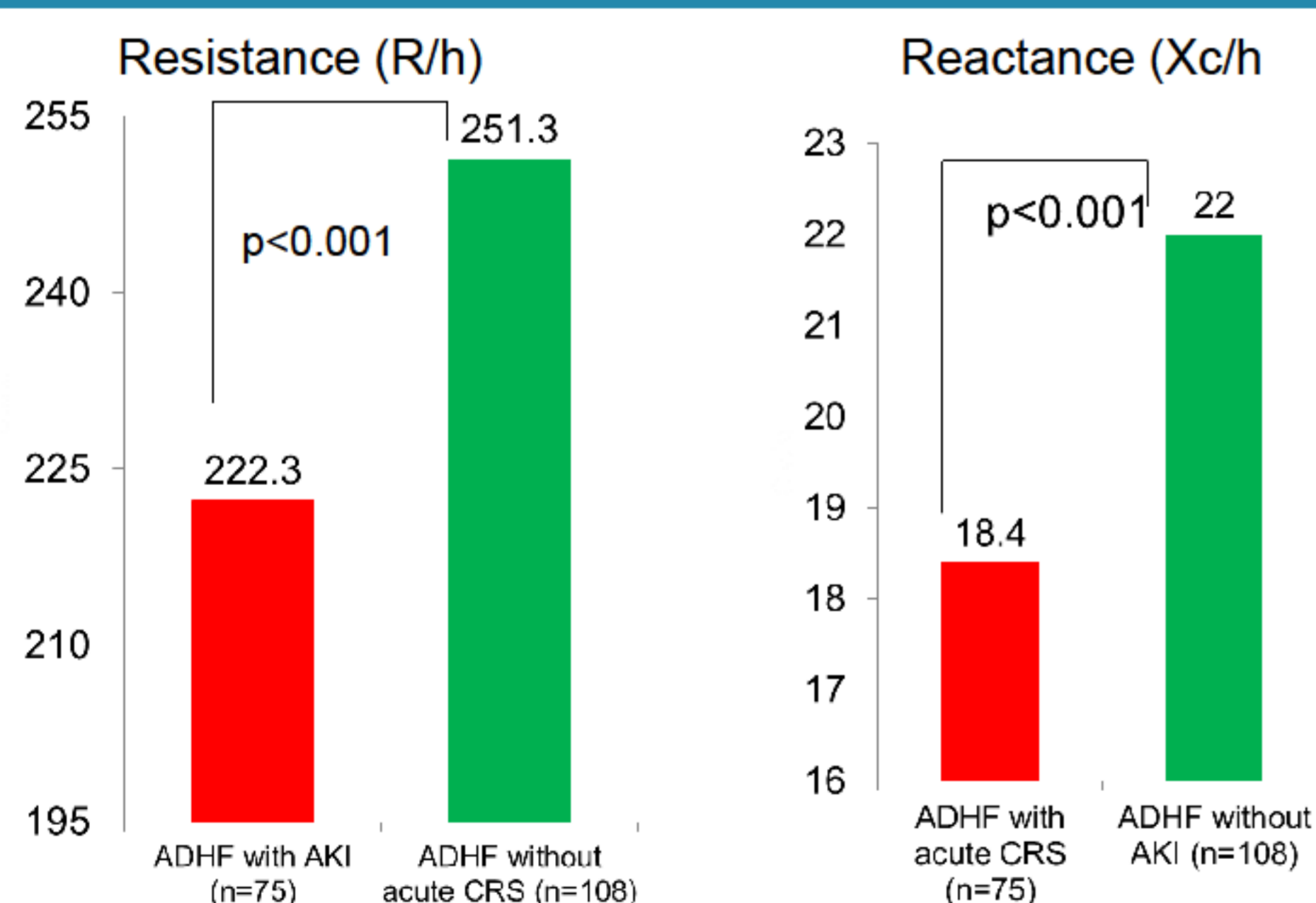


Figure 4. Bioelectrical parameters of hydration status according to presence of AKI and poor outcomes

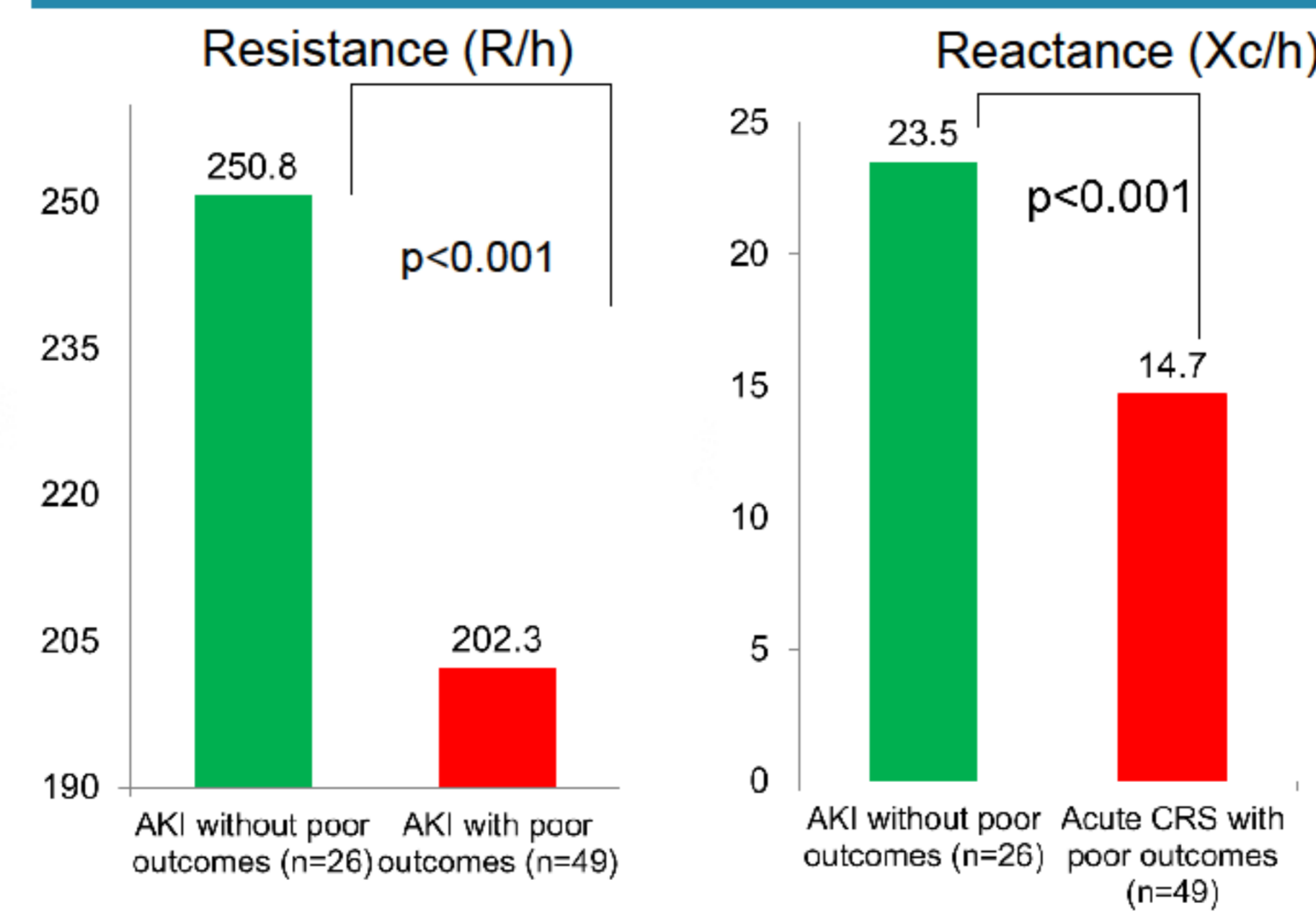
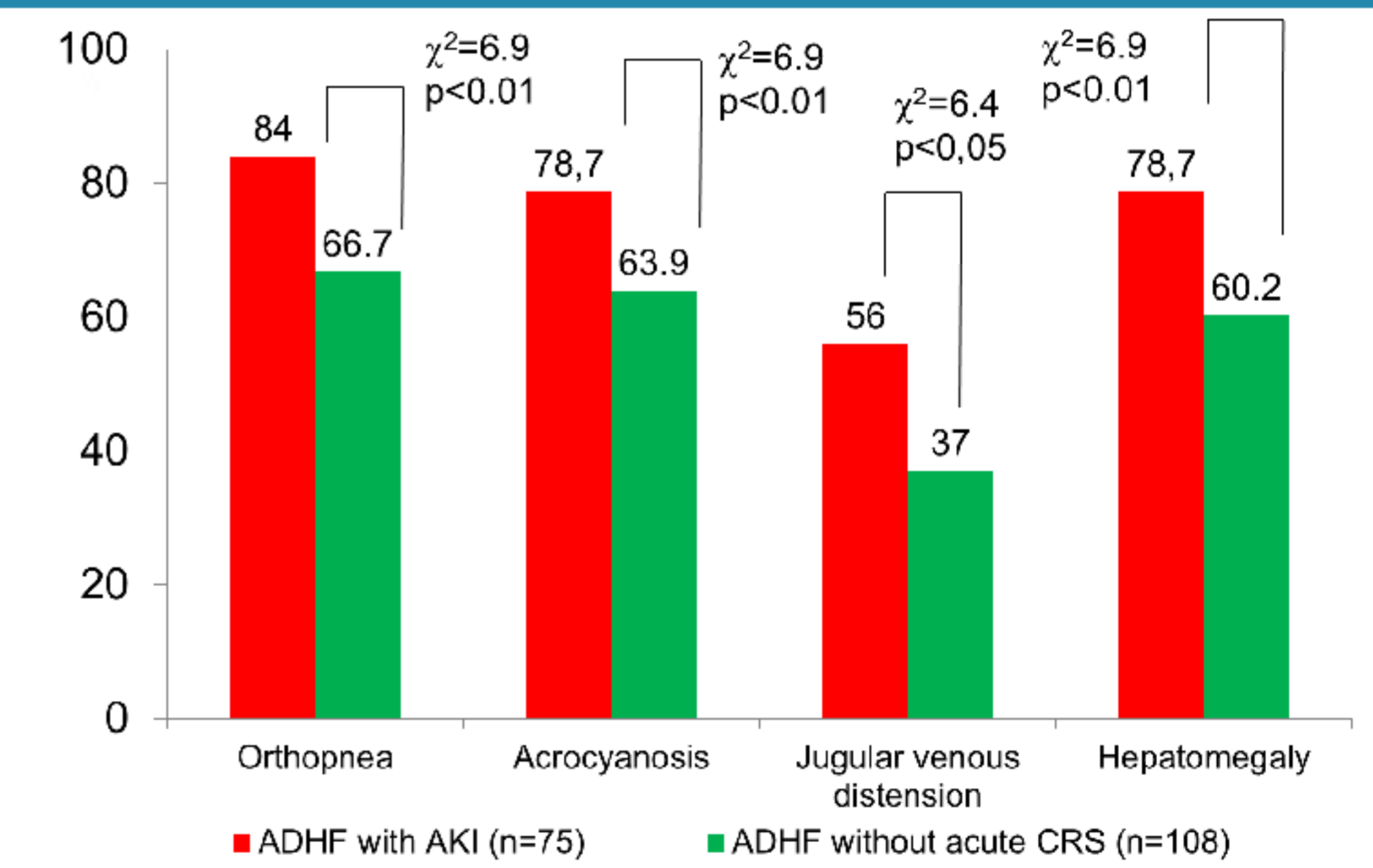


Figure 5. Clinical presentation of systemic congestion according to presence of acute CRS



Conclusions

- ✓ 87% of patients admitted to the hospital with ADHF diagnosed with overhydration. Severe hyperhydration more often occurs in patients with AKI
- ✓ Patients with AKI and worse outcomes had more severe hyperhydration compared with patients without renal deterioration
- ✓ Level of Xc/h <20.8 Om/m in ADHF patients is associated with higher risk of AKI development
- ✓ Evaluating hydration status by BIVA added useful information to standard clinical parameters and could help to determine the patient population with higher risk of development of AKI and its poor outcomes.

Disclosure: none

