



Prevalence and prognostic significance of cardiorenal anemic syndrome in patients with acute cardiovascular diseases

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Background and Objective

Anemia is common and associated with adverse outcomes in patients with chronic kidney disease (CKD). Many factors contribute to declining hemoglobin as CKD progresses, but impaired production of erythropoietin by failing kidneys is a central cause. Hcpidin-mediated iron restriction also contributes to anemia by down regulating both intestinal iron absorption and release of stored iron for erythropoiesis. The relationship among anemia, renal dysfunction, left ventricular ejection fraction, and outcomes of patients hospitalized for acute decompensated heart failure is unclear. Anemia and chronic kidney disease are common in patients with heart failure (HF) and are associated with adverse outcomes. ¹

Purpose: The aim of this study was to evaluate and to study the prevalence and prognostic significance of cardiorenal of anemia in patients with acute cardiovascular diseases.

1. Atkinson MA, Warady BA. *Pediatr Nephrol.* 2017 Apr 15. doi: 10.1007/s00467-017-3663-y.

Methods

- We examined 430 patients.
- Anemia was diagnosed according to WHO criteria at the level of hemoglobin below 130 g/l in men and less than 120 g/l in women, iron deficiency anemia (IDA) - based on the study of indicators of iron metabolism and anemia of chronic disease (ACD) - in anemic patients with absence of iron deficiency, B12 and folic acid.
- A condition where a patient with cardiovascular disease revealed anemia and CKD, regarded as cardiorenal anemic syndrome (CRAS).

Table 1. Prevalence of cardiovascular-anemic syndrome in patients with cardiovascular pathology

	Stable CHF (n=421)	AD CHF (n=278)	ACS nST (n=288)	AD CHF+ACS nST (n=566)
Anemia on admission, n (%)	122 (28,5)**	113 (40,7)	73 (25,3) ³	186 (32,9)
Anemia at discharge, n (%)	-	86 (30,9)	68 (23,6)	154 (27,2)
CKD, n (%)	213 (50,6)	125 (45)	134 (46,5)	259 (45,8)
CRAS, n (%)	87 (20,7)#	71 (25,5)	39 (13,5) ³	110 (19,4)

^{3p} <0.001 - the reliability of the differences between the groups AD CHF and ACS nST
** p <0,01-reliability of differences between stable CHF and AD CHF groups #p <0,05-reliability of differences between stable CHF and ACS nST groups

Index	AD CHF (n=278)		ACS nST (n=288)		AD CHF+ACS nST (n=566)	
	Frequency Anemia, n	Hb g/l	Frequency Anemia, n	Hb g/l	Frequency Anemia, n	Hb g/l
SCr, μmol/L	0,325 (<0,001)	-0,250 (<0,001)	0,131 (0,03)	-0,056 (0,4)	0,243 (<0,001)	-0,158 (<0,001)
GFR _{CKD-EPI} , ml/min/1,73 m ²	-0,295 (<0,001)	0,324 (<0,001)	-0,181 (<0,01)	0,197 (<0,001)	-0,245 (<0,001)	0,261 (<0,001)

Table 2. Correlation of indicators of kidney function and anemia in acute cardiovascular diseases. R-ranked Spearman correlation coefficient.

Results

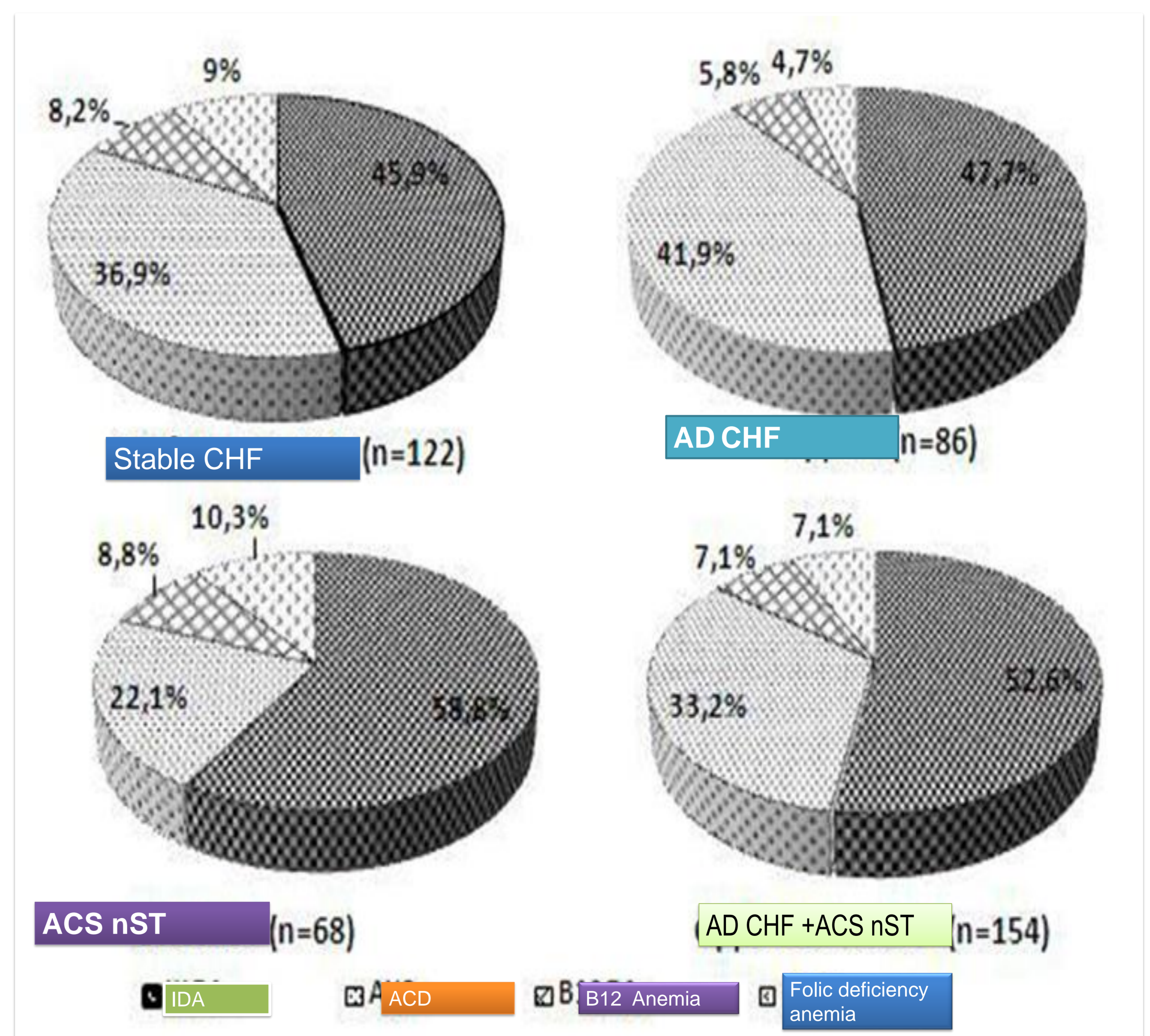
- The incidence of cardiorenal anemic syndrome (CRAS) was higher in patients with heart failure than in ACS non-ST elevation (20.7% vs. 13.5% with stable CHF and 25.5% versus 13.5% for AD CHF, p <0.05 and p <0.01 respectively). The incidence of anemia in patients with AD CHF at admission was significantly higher than in the other groups, however, after the stabilization of the patients at discharge it down and did not differ from that in stable CHF and ACS non-ST elevation. In most patients, anemia was due to iron deficiency (IDA), is less common anemia of chronic diseases (ACD). The prevalence of IDA and ACD did not differ in CHF group: with AD CHF 47.7% and 41.9%, with stable CHF - 45.9% and 36.9% respectively, and in patients with IDA ACS non-ST elevation more common: 58.8% vs. 22.1%, p <0.001. Deficiency of folic acid and B12, as the main cause of anemia, are much rarer.
- Among patients with CRAS with AD CHF dominated by men, and in the group ACS non-ST elevation had more women like in the presence of KRAS, and in his absence. Significant differences in age, depending on the availability of KRAS were found in patients with ACS non-ST elevation (78,5 ± 9,5 and 70,9 ± 12,1 years, p <0.001). Patients with KRAS often smoking and alcohol abuse in AD CHF group, they have often had a history of myocardial infarction (p <0.001), and a history of hospitalizations due to AD CHF over the past year more often present in patients with KRAS and ACS non-ST elevation (p <0.05). Patients with CRAS AKI often developed ACS non-ST elevation group (p <0.001) and were mainly community-acquired (p <0.01) and transient (p <0.001). The development of events at AHF ACS non-ST elevation as cases of readmission of patients with AD CHF groups during the 6 months after discharge with symptoms of decompensation often recorded with RED (p <0.001 and p <0.01, respectively). Hospital mortality was higher in the group ACS non-ST elevation in patients with CRAS (p <0.01), and in AD CHF group differences were not statistically

Figure 1. Comparative clinical and demographic characteristics of patients with acute cardiovascular pathology, depending on the presence of CRAS

Index	AD CHF (n=278)		ACS nST (n=288)		AD CHF+ ACS nST (n=566)	
	CRAS+ (n=71)	CRAS- (n=207)	CRAS+ (n=39)	CRAS- (n=249)	CRAS+ (n=110)	CRAS- (n=456)
sex (m/f), n (%)	50(70,4)/21(29,6)***	104(50)/103(50) ²	9(23,1)/30(76,9)***	96(38,6)/153(61,4)***	75(68,2)/35(31,8)***	200(43,9)/256(56,1)
Age, годы	71,7±9,2	69±10,4	78,5±9,5	70,9±12,1 ³	74,1±9,8	70,1±11,4
Smoking, n (%)	50(70,4)	83(40,1) ³	-	23(9,2)	50(45,5)	106(23,3)
Alcohol, n (%)	35(49,3)	50(24,2) ³	1(2,6)	15(6)	36(32,7)	65(14,3) ³
History AD CHF with hospitalizations, n(%)	53(74,6)	142(68,6)	20(51,3)	82(32,9) ¹	73(66,4)	224(49,1) ³
MI in history, n (%)	50(70,4)	81(3,1) ³	21(53,9)	101(40,6)	71(64,6)	182(39,9) ³
Angina pectoris, n(%)	40(56,3)	137(66,2)	12(30,8)	80(32,1)	52(47,3)	217(47,6)
A history of stroke, n(%)	8(11,3)	28(13,5)	9(23,1)	32(12,9)	17(15,5)	60(13,2)
AH, n (%)	67(94,4)	184(88,9)	38(97,4)	228(91,6)	105(95,5)	412(90,4)
AF, n (%)	18(25,4)	110(53,1) ³	9(23,1)	60(24,1)	27(24,6)	170(37,3)
Diabetes, n (%)	26(36,6)	66(31,9)	11(28,2)	56(22,5)	37(33,6)	122(26,8)
Obesity, n (%)	42(59,2)	113(54,6)	13(33,3)	76(30,5)	55(50)	189(41,4)
AD CHF/AHF, n (%)	71(100)	207(100)	22(56,4)	76(30,5) ²	93(84,6)	283(62,1) ³
MI, n (%)	-	-	27(69,2)	159(63,9)	27(24,6)	159(34,9)
Ns Angina pectoris, n (%)	-	-	12(30,8)	90(36,1)	12(10,9)	90(19,7)
SBP mm Hg	138±33,6	144±28,3	134±27,7	144±31,4	137±31,6	144±30
DBP, mm Hg	85,2±21,5	83,9±14,9	76,4±15,4	81,9±14,9	82,1±20	82,8±14,9
HR, min	83±19	91±20 ²	90±25	84±25	85±21	87±23

^{1p} <0,05, ^{2p} <0,01, ^{3p} <0,001 - reliability of differences between the groups CRAS + and CRAS -; * - reliability of differences within groups.

Figure 2. Etiology of anemia in cardiorenal anemia syndrome



Conclusions

The incidence of CRAS was higher in patients with CHF, AD CHF, AKI and ACS non ST elevation. Anemia was significantly influenced on hospital mortality, regospitalization and frequency of AHF.

Declaration of interest: nothing to declare