

Combined Measurements of Cardiac Troponin T and Brain Natriuretic Peptide in Patients with Congestive Heart Failure

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Background

▣ Cardiac troponin T (cTnT) is widely used a diagnostic value for acute coronary syndrome (ACS).

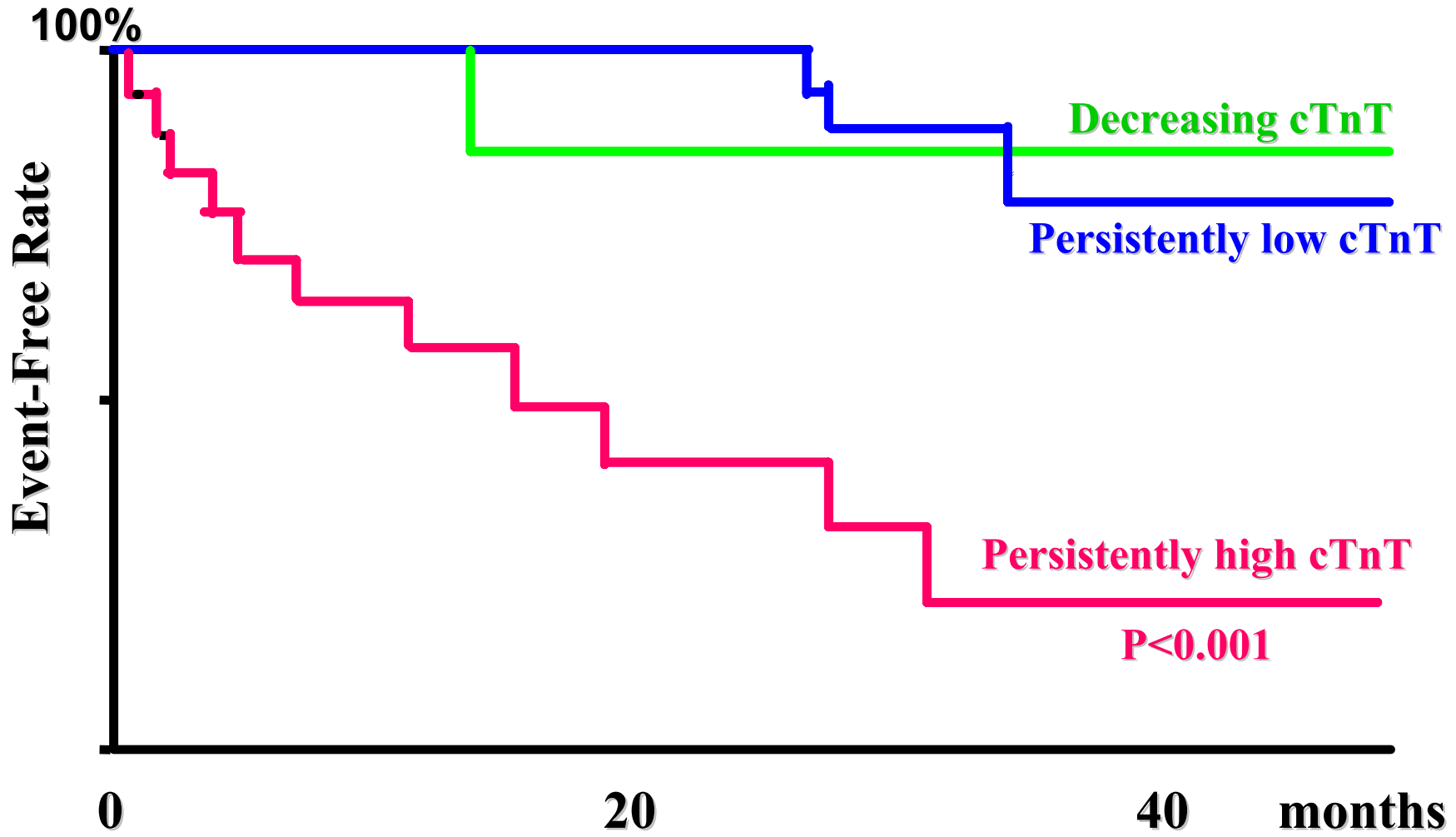
▣ We have recently reported that cTnT concentration predicts poor prognosis in dilated cardiomyopathy (DCM).

Sato Y, Taniguchi R, et al Circulation 2001;103:369-374.

▣ Here, to clarify whether this value also a predictive factor for prognosis of chronic congestive heart failure (CHF), we evaluated cTnT together with brain natriuretic peptide (BNP) in patients with CHF with various etiologies other than ACS.

cTnT in Dilated Cardiomyopathy

(cardiac event = cardiac death or rehospitalization for worsening heart failure)



Sato Y, Taniguchi R, et al Circulation 2001;103:369-374.

Methods

cTnT and BNP were measured simultaneously in 190 patients with CHF (mean age 66.3 ± 1.1 years; 116 men) at baseline, in 137 patients of all, at baseline and Day 30 after admission (mean period 31.8 ± 1.9 days).

They are followed for 436 ± 26 days.

Endpoints were defined as cardiac events including sudden cardiac death, and death or rehospitalization due to CHF.

Baseline characteristics (n=190)

Underlying disease	DCM (n=41)	Ischemic (n=40)	Valvular or congenital disease (n=53)	Hypertension (n=16)	HCM (n=22)
Age	63.1±2.1	66.4±2.1	63.8±1.8	68.1±3.3	66.0±2.8
LVEF (%)	34.9±2.0	38.8±2.0	62.6±1.8	58.9±3.2	68.0±2.7

Comparison of NYHA functional class with cTnT and BNP (n=190)

NYHA class	I N=41	II N=70	III N=48	IV N=31
BNP (pg/ml)	140.2±82.3	248.8±63.0	670.3±76.1	1009.6±94.7
cTnT (ng/ml)	0.085±0.033	0.070±0.014	0.040±0.012	0.050±0.011

Baseline concentrations of cTnT and BNP(n=190)

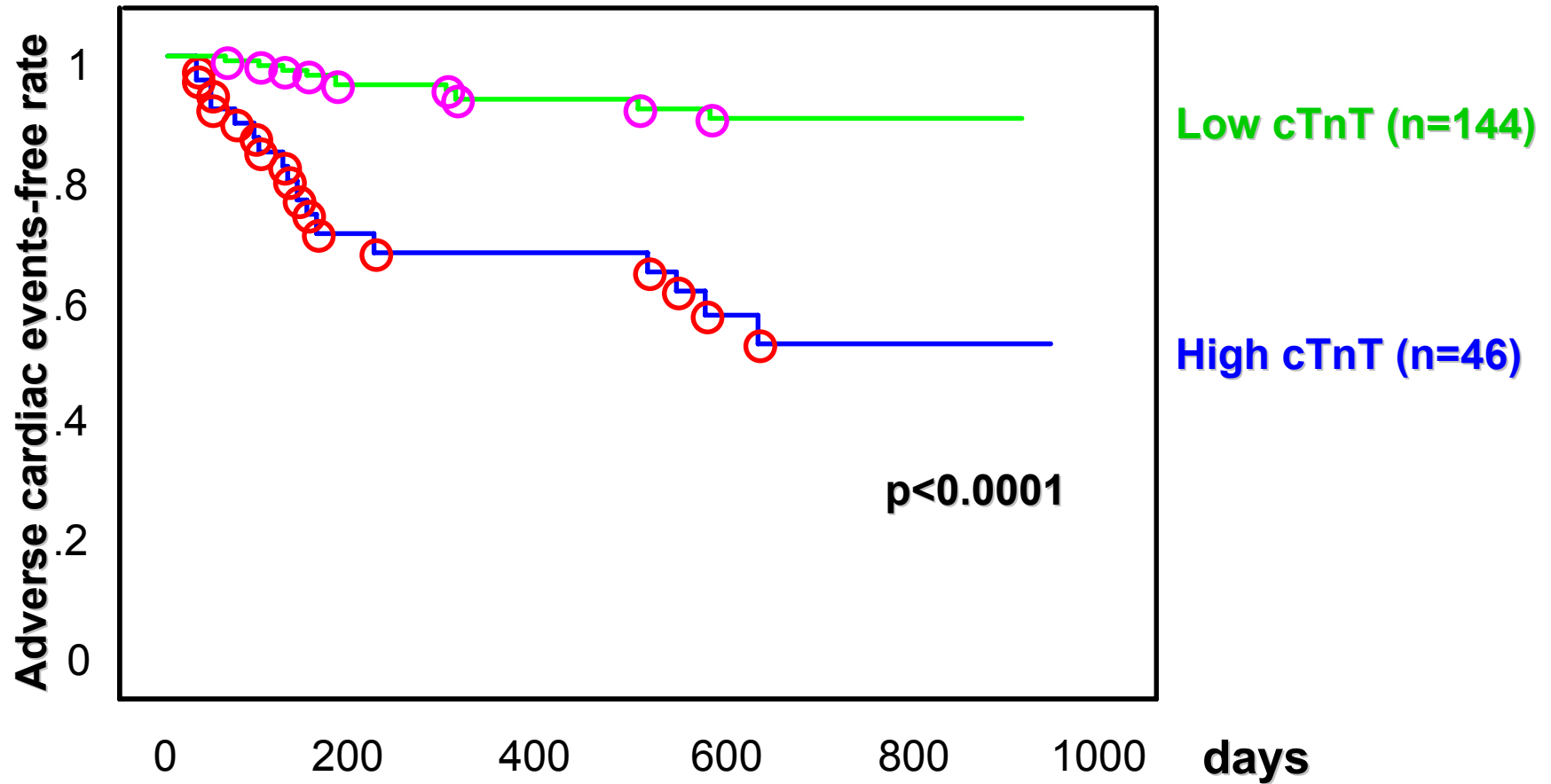
Underlying disease	DCM (n=41)	Ischemic (n=40)	Valvular or congenital (n=53)	Hypertension (n=16)	HCM (n=22)
CK (IU/L)	89.4±6.6	87.1±6.7	85.6±5.8	86.4±10.6	104.9±9.0
BNP (pg/ml)	593.0±94.7	606.2±95.8	341.5±83.2	343.6±151.5	354.6±129.2
cTnT ≥0.02 ng/ml N(%) of pts	8/41 (20)	17/40 (43)	11/53 (21)	7/16 (44)	2/22 (9)
mean cTnT (ng/ml)	0.039±0.017	0.069±0.012	0.039±0.014	0.051±0.018	0.035±0.034

Follow up samples after one month for treatment (n=137)

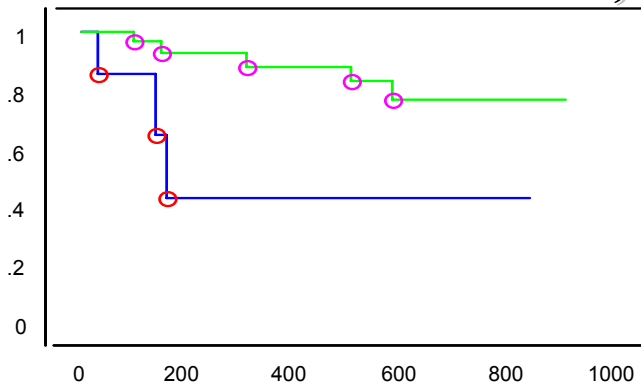
Underlying disease	DCM (n=36)	Ischemic (n=33)	Valvular or congenital (n=28)	Hypertension(n=13)	HCM (n=16)
BASELINE					
BNP (pg/ml)	662.0±113.0	691.3±118.1	456.5±128.1	403.0±188.0	418.0±169.5
cTnT≥0.02ng/ml n(%) of patients	8/36 (22)	16/33 (48)	8/28 (29)	6/13 (46)	2/16 (13)
Concentration (ng/ml)	0.039±0.018	0.072±0.013	0.045±0.018	0.048±0.020	0.035±0.007
FOLLOW-UP					
BNP (pg/ml)	257.2±59.4 *	310.6±62.0 *	274.6±67.4 *	186.7±98.9 **	265.6±89.1 ***
cTnT≥0.02ng/ml n(%) of patients	7/36 (19)	13/33 (39)	7/28 (25)	5/13 (38)	3/16 (19)
Concentration (ng/ml)	0.044±0.010	0.044±0.007	0.036±0.010	0.036±0.012	0.033±0.015

*p<0.0001, **p<0.005, ***p<0.05 vs baseline

Low versus high cTnT concentrations and adverse cardiac events-free rate in the entire group (n=190)



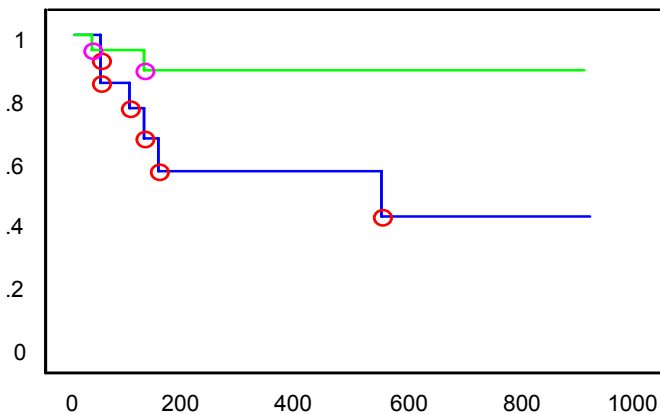
Adverse cardiac event-free rates and cTnT in DCM, ischemic heart disease, and valvular or congenital disease



Dilated cardiomyopathy (n=41)

Low cTnT (n=33)

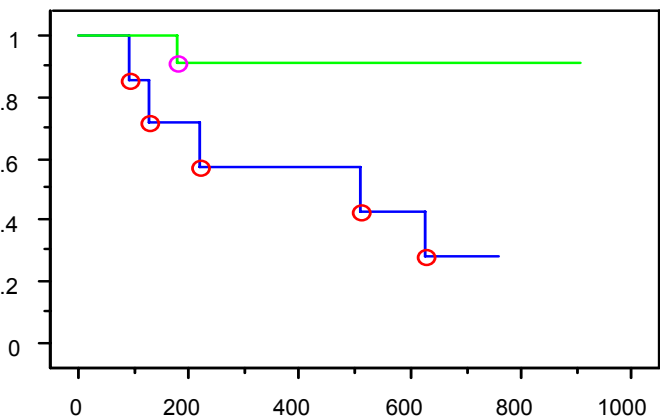
High cTnT (n=8), p<0.05



Ischemic heart disease (n=40)

Low cTnT (n=23)

High cTnT (n=17), p<0.05



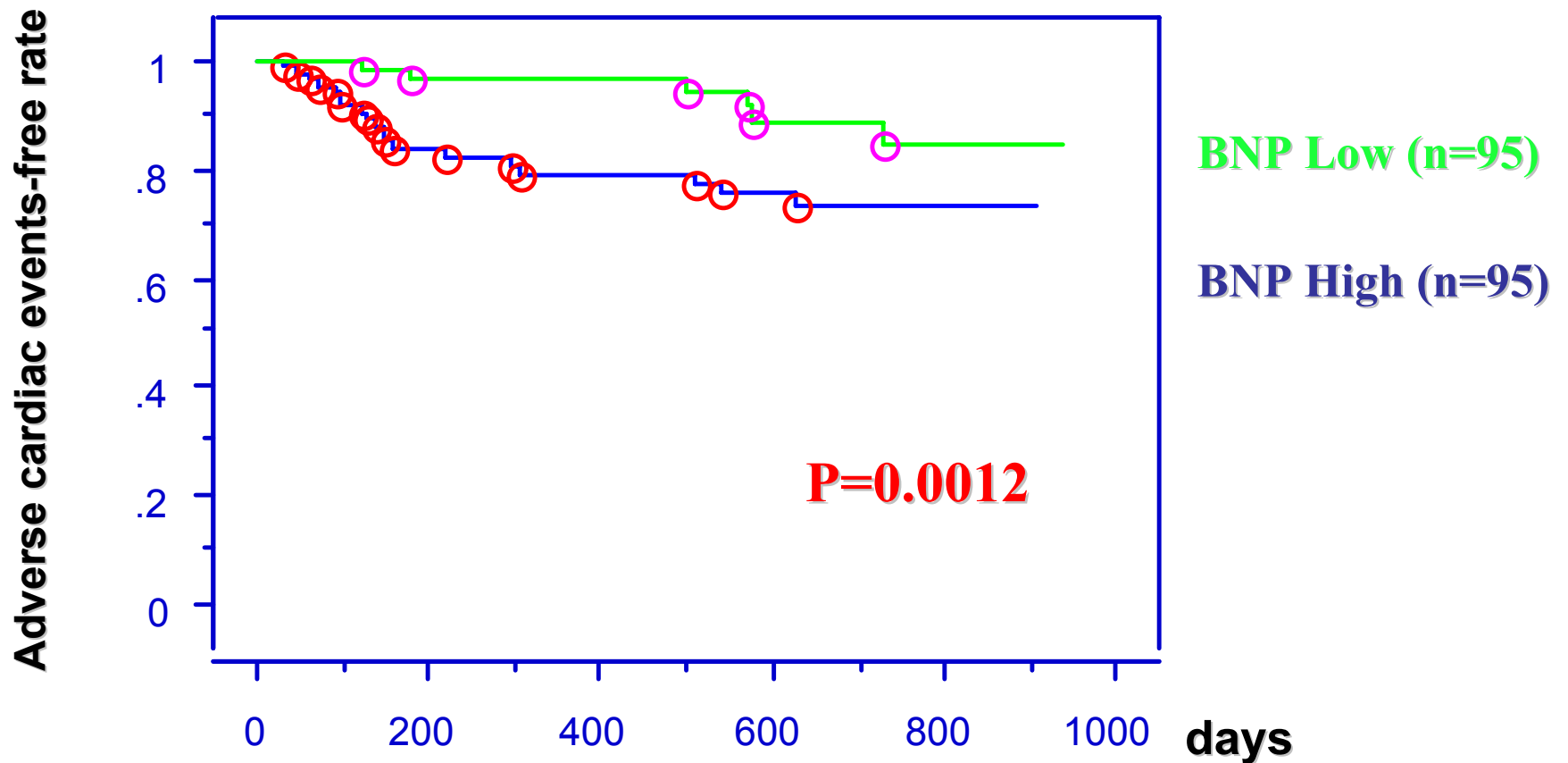
Valvular or congenital disease (n=53)

Low cTnT (n=42)

High cTnT (n=11), p<0.01

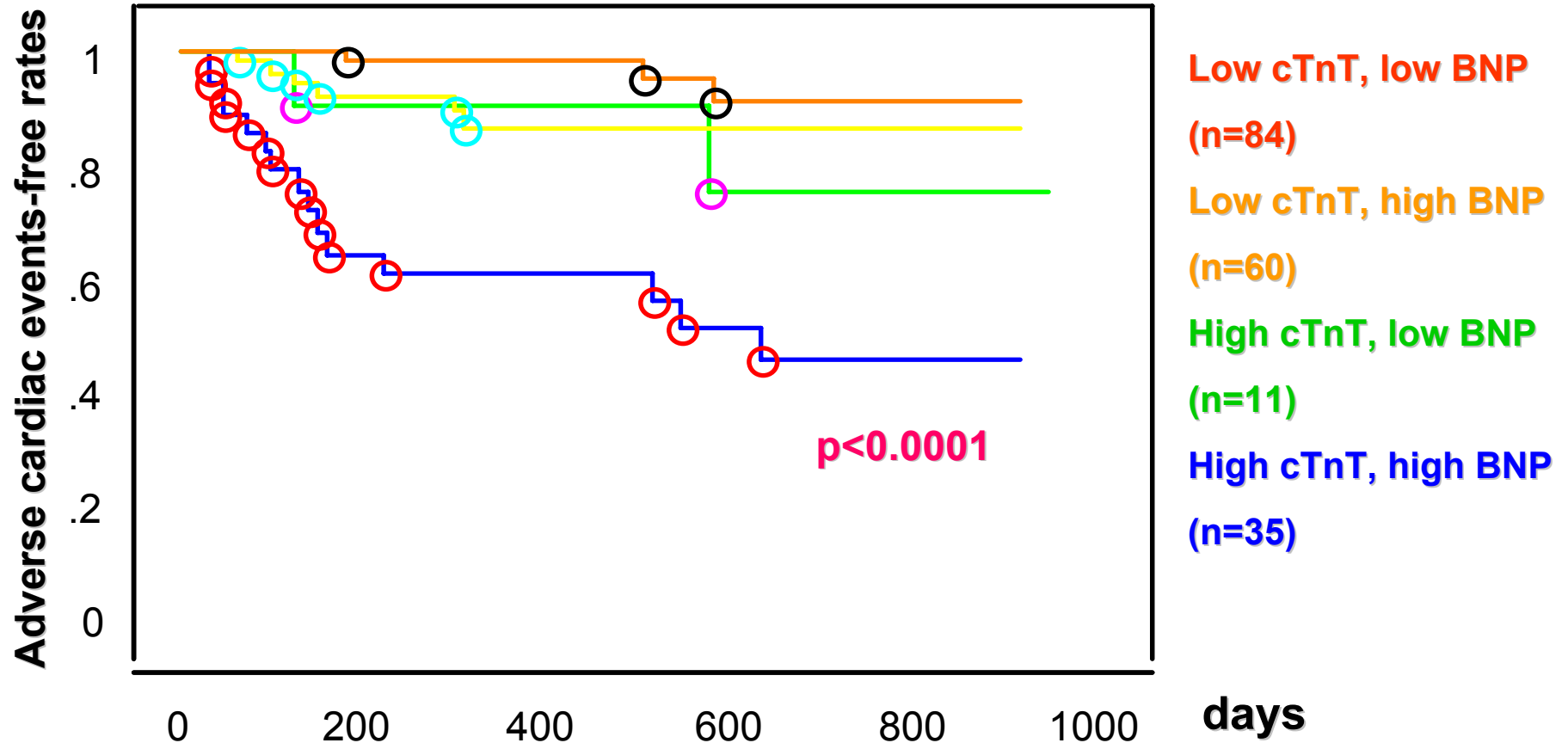
Low versus high BNP concentrations and adverse cardiac events-free rate in the entire group (n=190)

BNP (Median 229.0 pg/dL), high BNP: BNP concentrations \geq median value
low BNP: BNP concentrations $<$ median value



Combined measurements of cTnT and BNP and adverse cardiac events-free rates (n=190)

BNP (Median 229.0 pg/dL), high BNP: BNP concentrations \geq median value
low BNP: BNP concentrations $<$ median value



Univariate and multivariate analysis of cardiac events (n=190)

Variable	Univariate			Multivariate		
	p value	Chi-square	Hazard Ratio (95%CI)	p value	Chi-square	Hazard Ratio (95%CI)
Age	0.1751	1.83	1.023 (0.990-1.058)	0.8416	0.04	1.003 (0.972-1.035)
LVEF	0.0009	11.1	0.961 (0.938-0.984)	0.0846	2.97	0.975 (0.947-1.004)
NYHA III or IV	0.0009	11.0	5.242 (1.976-13.910)	0.6099	0.26	1.339 (0.436-4.116)
cTnT \geq 0.01 ng/ml	<0.0001	19.7	6.269 (2.792-14.075)	0.0038	8.38	3.481 (1.496-8.100)
Log BNP	<0.0001	20.5	8.041 (3.263-19.818)	0.0306	4.67	3.102 (1.111-8.660)
creatinine	0.0006	11.8	3.784 (1.771-8.085)	0.0203	5.38	2.764 (1.171-6.524)

Combined cTnT and BNP in heart failure

Our hypothesis

	Low cTnT	High cTnT
Low BNP	No ongoing myocyte injury or myocardial overload	No myocardial overload in presence of subclinical myocyte injury
High BNP	Heart failure is present in the absence of ongoing myocyte injury	Heart failure and myocyte injury are both ongoing

Heart 2004;90:1110-1113

Combined measurements of cTnT and BNP

Summary

- 1. Elevated cTnT concentrations were found in 10-40% of patients with a variety of heart failure diseases.**
- 2. cTnT did not correlate with NYHA functional class.**
- 3. After 1 month of treatment, BNP decreased significantly. However most patients with elevated cTnT at baseline, had persistently elevated concentrations of cTnT.**
- 4. Patients with elevated cTnT had a worse prognosis than patients with a low cTnT.**
- 5. Patients with elevated concentrations of both cTnT and BNP had the poorest prognosis.**

Future applications of biochemical markers for myocyte injury in heart failure

- 1. Identification of myocyte injury at an early stage of disease, characterized by the presence of risk factors, such as hypertension, diabetes, hyperlipidemia etc. (metabolic syndrome, SAS)**
- 2. Therapeutic monitoring with bedside rapid assays in the setting of acute cardiac decompensation.**

We expect both cTnT and BNP to become standard tests in the management of congestive heart failure.