

ECOCARDIOGRAFIA 2015

XVII Congresso Nazionale SIEC

MEDICINA INTERNA ED ECOCARDIOGRAFIA:

SINDROME METABOLICA

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Studi di Messina



Settore Operativo
Ricerca



Medicina Interna

Definire la sindrome metabolica

The definition of MS depends on which group of experts is doing the defining even if the risk for cardiovascular events remain significantly greater

Third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III). Final report. Circulation. 2002; 106: 3143–3421

Butler J, Rodondi N, Zhu Y, Figaro K, Fazio S, Vaughan DE, Satterfield S, Newman AB, Goodpaster B, Bauer DC, Holvoet P, Harris TB, de Rekeneire N, Rubin S, Ding J, Kritchevsky SB; Health ABC Study. Metabolic syndrome and the risk of cardiovascular disease in older adults. J Am Coll Cardiol. 2006 Apr 18;47(8):1595-602.

de Simone G, Devereux RB, Chinali M, Best LG, Lee ET, Galloway JM, Resnick HE. Prognostic Impact of Metabolic Syndrome by Different Definitions in a Population with High Prevalence of Obesity and Diabetes: The Strong Heart Study. Diabetes Care. 2007 Apr 17

Metabolic Syndrome

A cluster of metabolic risk factors for **CARDIOVASCULAR DISEASES** and **TYPE 2 DIABETES MELLITUS**.

The major components of metabolic syndrome X include

- ✓ excess **ABDOMINAL FAT**;
- ✓ atherogenic **DYSLIPIDEMIA**;
- ✓ **HYPERTENSION**;
- ✓ **HYPERGLYCEMIA**;
- ✓ **INSULIN RESISTANCE**;
- ✓ a proinflammatory state;
- ✓ prothrombotic (**THROMBOSIS**) state.

AHA/NHLBI/ADA Conference Proceedings, Circulation 2004; 109:551-556

Metabolic syndrome is a cluster of conditions (increased blood pressure, a high blood sugar level, excess body fat around the waist and abnormal cholesterol levels) that occur together, increasing your risk of heart disease, stroke and diabetes.



MS has been associated with worse in-hospital outcome higher risk of development of severe HF

Arnlov J, Lind L, Zethelius B, Andren B, Hales CN, Vessby B, Lithell H. Several factors associated with the insulin resistance syndrome are predictors of left ventricular systolic dysfunction in a male population after 20 years of follow-up. Am Heart J. 2001 Oct;142(4):720-4.

In a community-based sample of middle-aged men, metabolic syndrome was significant predictor of HF, independent of established risk factors for HF, during two decades of follow up

Zeller M, Steg PG, Ravisy J, Laurent Y, Janin-Manificat L, L'Huillier I, Beer JC, Oudot A, Rioufol G, Makki H, Farnier M, Rochette L, Verges B, Cottin Y; Observatoire des Infarctus de Cote-d'Or Survey Working Group. Prevalence and impact of metabolic syndrome on hospital outcomes in acute myocardial infarction. Arch Intern Med. 2005 May 23;165(10):1192-8.

Data from 5,579 subjects of the Third National Health and Nutrition Examination Survey (NHANES III), showed that patients with MS had nearly **twice the likelihood of self-reported HF**. Authors suggested that MS may serve as a surrogate indicator for the association between insulin resistance and HF

Ingelsson E, Arnlov J, Lind L, Sundstrom J. Metabolic syndrome and risk for heart failure in middle-aged men. Heart. 2006 Oct;92(10):1409-13

Metabolic syndrome and cardiac risk in symptomatic HF patients

in a study involving 865 patients with HF known that MS increases the risk of death

Wang TJ, Larson MG, Keyes MJ, Levy D, Benjamin EJ, Vasan RS. Association of plasma natriuretic peptide levels with metabolic risk factors in ambulatory individuals. Circulation. 2007 Mar 20;115(11):1345-53



Metabolic syndrome is associated with abnormal left ventricular diastolic function independent of left ventricular mass

Lisa de las Fuentes^{1,2*}, Angela L. Brown^{1,2}, Santhosh J. Mathews^{1,2}, Alan D. Waggoner^{1,2}, Pablo F. Soto^{2,3}, Robert J. Gropler^{2,3}, and Víctor G. Dávila-Román^{1,2}

607 soggetti ambulatoriali con normale frazione di eiezione

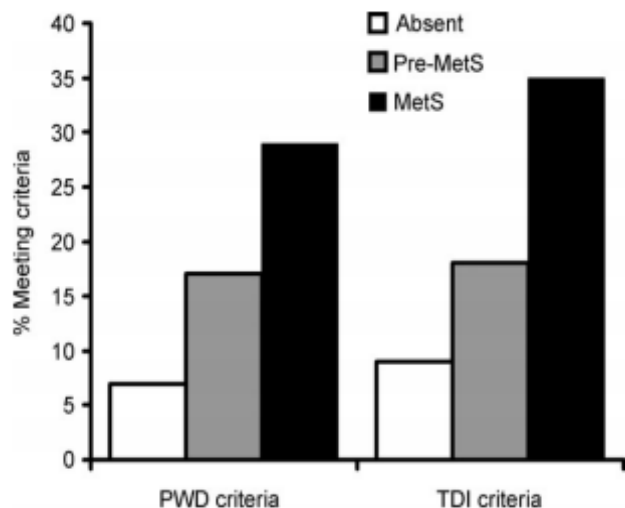


Figure 2 Prevalence of diastolic dysfunction by pulse-wave Doppler and tissue Doppler imaging criteria.

Table 3 Univariate and stepwise multiple variable analyses of E_m and E/A ratio for each component of the metabolic syndrome and covariates

Variable	$V_{e_{global}}$, cm/s			E/A Ratio		
	Univariate		Multiple variable	Univariate		Multiple variable
	r	P-value	P-value	r	P-value	P-value
Systolic BP	0.20	<0.0001		0.13	<0.0001	0.005
Diastolic BP	0.14	<0.0001	<0.0001	0.09	<0.0001	<0.0001
Triglyceride	0.04	<0.0001	0.01	0.03	<0.0001	
Glucose	0.04	<0.0001		0.02	0.0004	
Waist circumference	0.05	<0.0001	<0.0001	0.03	<0.0001	
HDL-C						0.02
MetS group	0.12	<0.0001		0.08	<0.0001	
Age	0.54	<0.0001	<0.0001	0.43	<0.0001	<0.0001
$LVM/Ht^{2.7}$	0.11	<0.0001	0.005	0.04	<0.0001	
$V_{e_{global}}$	0.42	<0.0001	<0.0001	0.18	<0.0001	<0.0001
Model r^2			0.75			0.50

BP, Blood pressure. Blank fields not significant.

Preclinical Left Ventricular Diastolic Dysfunction in Metabolic Syndrome



Nir Ayalon, MD^a, Deepa M. Gopal, MD, MS^a, Deirdre M. Mooney, MD, MPH^a,
Juliana S. Simonetti, MD^b, Jason R. Grossman, MD^c, Aeshita Dwivedi, MD^c, Courtney Donohue, BA^a,
Alejandro J. Perez, RCS^a, Jill Downing, MD, MPH^a, Noyan Gokce, MD^a, Edward J. Miller, MD, PhD^a,
Chang-seng Liang, MD, PhD^a, Caroline M. Apovian, MD^b, Wilson S. Colucci, MD^a,
and Jennifer E. Ho, MD^{a,*}

(Am J Cardiol 2014;114)

Studio condotto su 110 pazienti ambulatoriali

**Preclinical Left Ventricular Diastolic Dysfunction
in Metabolic Syndrome**



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and Jennifer E. Ho, MD^{a,*}

The association of metabolic syndrome with echocardiographic measures

	Age- and Gender-Adjusted		Age-, Gender-, Blood Pressure- and BMI-Adjusted		Age-, Gender-, Blood Pressure-, BMI, and LV Mass-Adjusted	
	β Estimate (s.e.)	p Value	β Estimate (s.e.)	p Value	β Estimate (s.e.)	p Value
Left atrial dimension	5.0 (0.8)	<0.001	3.5 (1.4)	0.01	3.5 (1.4)	0.01
Left ventricular end diastolic dimension	-0.6 (1.1)	0.55				
Left ventricular end systolic dimension	-0.1 (0.9)	0.89				
Posterior wall thickness	2.2 (0.3)	<0.001	0.8 (0.5)	0.11		
Interventricular septal thickness	2.5 (0.3)	<0.001	1.1 (0.5)	0.02	1.2 (0.4)	0.001
Relative wall thickness	0.10 (0.02)	<0.001	0.07 (0.03)	0.01	0.07 (0.03)	0.01
Left ventricular mass/height ^{2.7}	11.2 (2.0)	<0.001	-1.2 (2.8)	0.66		
Left ventricular ejection fraction (%)	-0.1 (1.2)	0.90				
E (cm/s)	6.4 (3.6)	0.08	-1.9 (5.6)	0.73		
A (cm/s)	21.0 (3.3)	<0.001	12.1 (5.2)	0.02	11.9 (5.2)	0.02
E/A ratio	-0.4 (0.1)	<0.001	-0.4 (0.1)	0.002	-0.4 (0.1)	0.002
Deceleration time (ms)	-3.3 (10.2)	0.75				
Mean e' (cm/s)	-2.2 (0.4)	<0.001	-1.7 (0.7)	0.015	-1.8 (0.7)	0.01
E/mean e'	2.2 (0.5)	<0.001	0.8 (0.8)	0.32		

β estimate represents the change in echocardiographic measure in the presence versus absence of metabolic syndrome.

ORIGINAL INVESTIGATION

Open Access

Diastolic dysfunction in the diabetic *continuum*: association with insulin resistance, metabolic syndrome and type 2 diabetes

Ricardo Fontes-Carvalho^{1,2,3*}, Ricardo Ladeiras-Lopes^{2,3}, Paulo Bettencourt^{4,5}, Adelino Leite-Moreira^{3,6} and Ana Azevedo^{1,7}

Within a population-based study (EPIPorto), a total of 1063 individuals aged ≥ 45 years (38% male, 61.2 ± 9.6 years) were evaluated. Diastolic function was assessed by echocardiography, using tissue Doppler analysis (E' velocity and E/E' ratio) according to the latest consensus guidelines. Insulin resistance was assessed using the Homeostasis Model Assessment of Insulin Resistance (HOMA-IR) score.

ORIGINAL INVESTIGATION

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Diastolic dysfunction in the diabetic continuum: association with insulin resistance, metabolic syndrome and type 2 diabetes

Ricardo Fontes-Carvalho^{1,2,3*}, Ricardo Ladeiras-Lopes^{2,3}, Paulo Bettencourt^{4,5}, Adelino Leite-Moreira^{3,6} and Ana Azevedo^{1,7}

Table 3 Crude and adjusted odds ratios for the presence of any grade of diastolic dysfunction according to quartiles of insulin resistance and metabolic syndrome status

	Prevalence of LVDD n (%)	Crude OR (95% CI)	Adjusted OR* (95% CI)
Insulin resistance			
(HOMA-IR score)			
Quartile 1	35 (14.9%)	Reference	Reference
Quartile 2	42 (18.6%)	1.30 (0.80-2.13)	1.08 (0.63-1.86)
Quartile 3	70 (29.3%)	2.37 (1.50-3.73)	1.88 (1.12-3.14)
Quartile 4	89 (30.6%)	2.52 (1.63-3.90)	1.82 (1.09-3.03)
No Metabolic Syndrome (n = 571)	93 (16.3%)	Reference	Reference
Metabolic Syndrome without T2DM (n = 331)	108 (32.6%)	2.54 (1.85-3.50)	1.62 (1.12-2.36)
Metabolic Syndrome with T2DM (n = 123)	45 (36.6%)	3.04 (1.98-4.67)	1.78 (1.09-2.91)

T2DM: type 2 diabetes mellitus; LVDD: left ventricular diastolic dysfunction; HOMA-IR - Homeostasis Model Assessment of Insulin Resistance; OR (95% CI) - odds ratio with 95% confidence interval.

*Variables included in the model: age (continuous), sex, systolic blood pressure (continuous) and body mass index (continuous).

Does the metabolic syndrome impact left-ventricular mechanics? A two-dimensional speckle tracking study.

Tadic M, Cuspidi C, Majstorovic A, Pencic B, Backovic S, Ivanovic B, Scepanovic R, Martinov J, Kocijancic V, Celic V.

This cross-sectional study included 95 untreated patients with metabolic syndrome and 65 controls similar by sex and age.

Does the metabolic syndrome impact left-ventricular mechanics? A two-dimensional speckle tracking study.

2DE global longitudinal and circumferential strain was significantly decreased in the metabolic syndrome group

2DE global radial strain was similar between the observed groups.

The increasing number of the metabolic syndrome criteria induces progressive reduction of the left-ventricular longitudinal strain from the individuals with no metabolic syndrome risk factors to the individuals with five metabolic syndrome criteria.

Impact of metabolic syndrome traits on cardiovascular function: should the Adult Treatment Panel III definition be further stratified?

Antonini-Canterin, Francesco^a; Mateescu, Anca D.^a; Vriza, Olga^b; La Carrubba, Salvatore^c; Di Bello, Vitantonio^d; Carerj, Scipione^e; Zito, Concetta^e; Sparacino, Lina^a; Uşurelu, Cătălin^a; Ticulescu, Răzvan^a; Ginghină, Carmen^f; Nicolosi, Gian L.^g; Popescu, Bogdan A.^f

We studied by echocardiography and carotid ultrasound 435 asymptomatic patients with metabolic syndrome.

Carotid stiffness index (β) was measured using a high-resolution echo-tracking system.

Patients with metabolic syndrome were divided into two groups: metabolic syndrome with three traits (Gr.1) and metabolic syndrome with four or five traits (Gr. 2).

Impact of different ATP III traits of metabolic syndrome on cardiac remodeling and function

Characteristics	No MS (N=457)	MS 3 (N=231)	MS 4-5 (N=204)	P-value
^a LV mass, g/m ^{2.7}	52.5±12.9	54.2±10.8	58.8±11.5	<0.001
^a LVEDV, ml/ m ^{2.7}	28.7±6.3	28.2±5.3	29.3±5.7	0.127
^a LVESV, ml/m ^{2.7}	9.7±3.4	9.5±2.9	9.9±3.5	0.336
^a LVEF, %	62.4±5.0	61.9±4.3	61.3±5.3	0.036
^a LA volume, ml/m ^{2.7}	9.9±3.6	10.7±3.5	12.6±10.5	<0.001
^a E/E'	8.0±2.5	8.3±2.7	9.2±3.0	<0.001

^aData are reported as: mean±SD. LVEDV, LV end-diastolic volume; LVESV, LV end-systolic volume; LA, left atrium; LVEF, LV ejection fraction.

JOURNAL OF CARDIOVASCULAR MEDICINE

LV mass index correlated with hypertension ($p < .001$), hyperglycemia ($p = .02$) and central obesity ($p < .001$).

LVEDV index correlated with hypertriglyceridemia ($p = .011$) and central obesity ($p < .001$).

LVESV index correlated only with central obesity ($p < .001$).

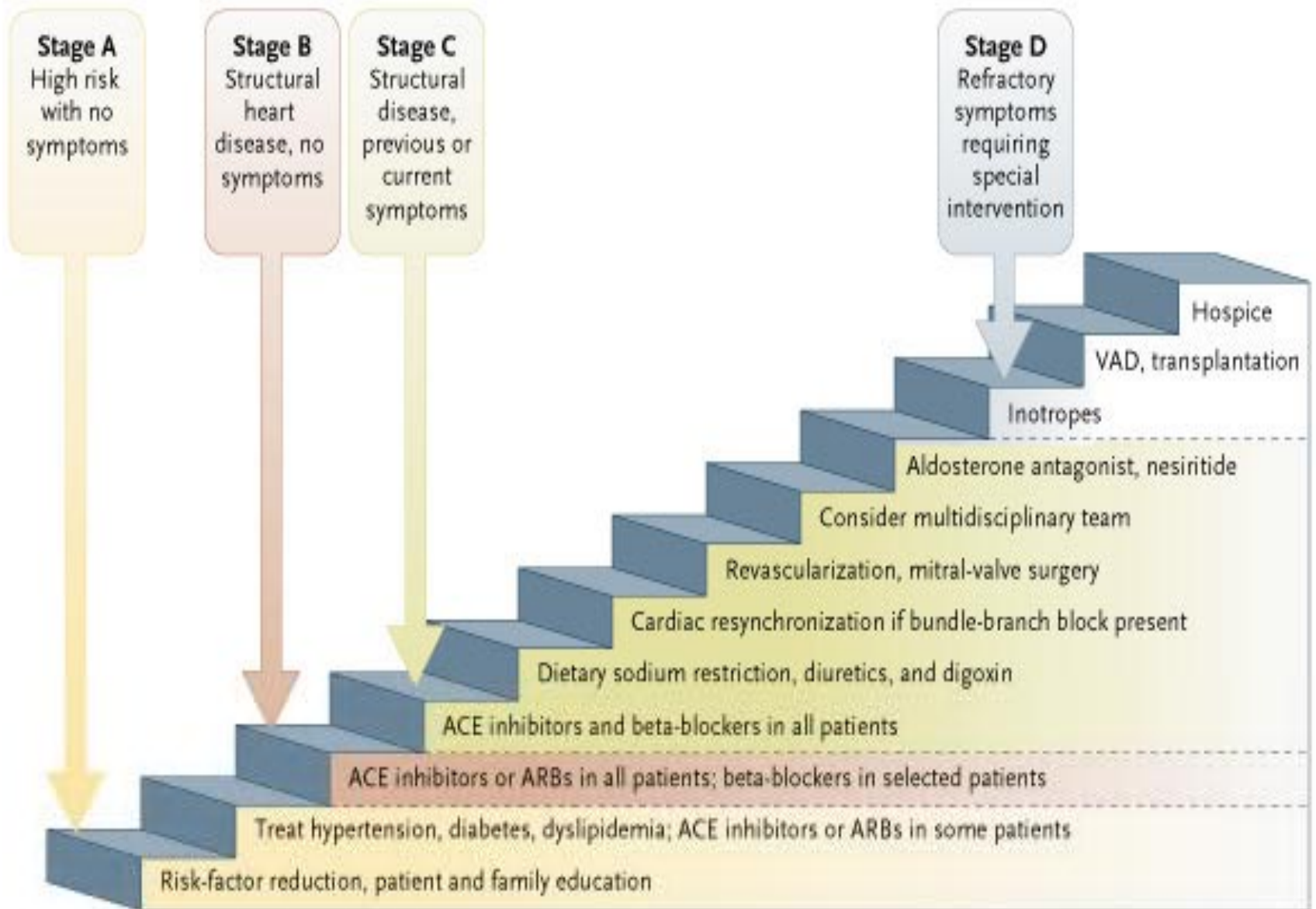
E/E' ratio correlated with hypertension ($p = .02$)

LA volume index correlated with central obesity ($p < .001$).

DISFUNZIONE DEL VENTRICOLO
SINISTRO (Sistolico e diastolico)

The diagram consists of two overlapping ovals on a dark blue background. The larger, upper oval is light orange and contains the text 'DISFUNZIONE DEL VENTRICOLO SINISTRO (Sistolico e diastolico)'. The smaller, lower oval is a darker red-orange and contains the text 'SCOMPENSO CARDIACO'. The two ovals overlap in the lower-middle section.

SCOMPENSO CARDIACO





DAVES (Disfunzione Asintomatica del VEntricolo Sinistro)

Pazienti screenati: **16600**

Pazienti arruolati: **6672**

Role of electrocardiography and echocardiography in prevention and predicting outcome of subjects at increased risk of heart failure. Bello VD, Carrubba SL, Antonini-Canterin F, Salvo GD, Caso P, Canna GL, Erlicher A, Badano L, Romano MF, Zito C, Vrizz O, Conte L, Carerj S; on behalf of the Research Group of the Italian Society of Cardiovascular Echography (SIEC), Milan, Italy. Eur J Prev Cardiol. 2013

The prognostic value of early left ventricular longitudinal systolic dysfunction in asymptomatic subjects with cardiovascular risk factors.

Di Salvo G, Di Bello V, Salustri A, Antonini-Canterin F, La Carrubba S, Materazzo C, Badano L, Caso P, Pezzano A, Calabrò R, Carerj S; Research Group of the Italian Society of Cardiovascular Echography. Clin Cardiol. 2011

Early left ventricular longitudinal systolic dysfunction and cardiovascular risk factors in 1,371 asymptomatic subjects with normal ejection fraction: a tissue Doppler study.

Di Salvo G, Di Bello V, Salustri A, Antonini-Canterin F, La Carrubba S, Materazzo C, Badano L, Caso P, Pezzano A, Calabrò R, Carerj S; Research Group of the Italian Society of Cardiovascular Echography (SIEC). Echocardiography. 2011

The incremental prognostic value of echocardiography in asymptomatic stage a heart failure. Carerj S, La Carrubba S, Antonini-Canterin F, Di Salvo G, Erlicher A, Liguori E, Monte I, Badano L, Pezzano A, Caso P, Pinto F, Di Bello V; Research Group of the Italian Society of Cardiovascular Echography. J Am Soc Echocardiogr. 2010

The DAVES (Disfunzione Asintomatica VEntricolare Sinistra) study by the Italian Society of Cardiovascular Echography: rationale and design.

Carerj S, Penco M, La Carrubba S, Salustri A, Erlicher A, Pezzano A; Investigators of the DAVES Study. J Cardiovasc Med (Hagerstown). 2006

The Incremental Prognostic Value of Echocardiography in Asymptomatic Stage A Heart Failure

Scipione Carerj, MD, Salvatore La Carrubba, MD, Francesco Antonini-Canterin, MD, Giovanni Di Salvo, MD, Andrea Erlicher, MD, Enrico Liguori, MD, Ines Monte, MD, Luigi Badano, MD, Antonio Pezzano, MD, Pio Caso, MD, Fausto Pinto, MD, and Vitantonio Di Bello, MD, on behalf of the Research Group of the Italian Society of Cardiovascular Echography, *Messina, Palermo, Pordenone, Naples, Bolzano, Sorrento, Catania, Udine, Milan, and Pisa, Italy; Lisbon, Portugal*

Objective: This multicenter study consisted of echocardiographic examination of subjects with stage A heart failure (HF) with cardiovascular risk factors and normal electrocardiogram and clinical examination results to (a) define whether stage A subjects with risk factors are really free of functional or structural cardiac abnormalities and (b) assess the impact of the presence of risk factors and incremental value of echocardiographic parameters in the prediction of progression of HF or in the development of cardiovascular events.

Sindrome metabolica e DAVES



Asymptomatic Left Ventricular Dysfunction and Metabolic Syndrome: Results from an Italian Multicenter Study

Salvatore La Carrubba¹, Maria Chiara Todaro², Concetta Zito², Francesco Antonini-Canterin³, Ines Paola Monte⁴, Pio Caso⁵, Paolo Colonna⁶, Cesare de Gregorio², Antonio Pezzano⁷, Frank Benedetto⁸, Giovanni Di Salvo⁵, Scipione Carerj², Vitantonio Di Bello⁹

6422 pazienti

Table 1: Study population characteristics

	Metabolic syndrome		Overall	P
	Group A no MS	Group B MS		
	N (%)	N (%)		
Female	2,798 (47.8)	260 (45.9)	3,058 (47.6)	0.202
Male	3,057 (52.2)	307 (54.1)	3,364 (52.4)	
Diabetes	395 (6.7)	334 (58.9)	729 (11.4)	<0.001
Hypertension	2,905 (49.6)	552 (97.4)	3,457 (53.8)	<0.001
Dyslipidemia	1,556 (26.6)	496 (87.5)	2,052 (32)	<0.001
Obesity	575 (9.8)	387 (68.3)	962 (15)	<0.001
Smokers	1,173 (20)	106 (18.7)	1,279 (19.9)	0.241
Family history of cardiovascular disease	1,858 (31.7)	228 (40.2)	2,086 (32.5)	<0.001
Previous Myocardial infarction	493 (8.4)	95 (16.8)	588 (9.2)	<0.001
Angina	249 (4.3)	57 (10.1)	306 (4.8)	<0.001
Atrial Fibrillation	248 (4.2)	19 (3.4)	267 (4.2)	0.186
Stroke	77 (1.3)	14 (2.5)	91 (1.4)	0.028
Transient Ischemic cerebrovasculopathy	59 (1)	10 (1.8)	69 (1.1)	0.080

Group A = No metabolic syndrome; Group B = Metabolic syndrome

Table 3: Systolic left ventricular dysfunction (LVD) in the two groups

	Patients <i>n</i> 6175 (96% total population)	
LV Systolic function	Group A <i>n</i> 5630	Group B <i>n</i> 545
Normal EF <i>n</i> (%)	5022 (89,2)	477 (87,5)
Low EF <i>n</i> (%)	608 (10,8)	68 (12,5)

P < 0.0001

Table 4: Diastolic left ventricular dysfunction (LVD) in the two groups

	Patients <i>n</i> 3936 (61.3% of total population)	
LV diastolic function	Group A <i>n</i> 3566 (%)	Group B <i>n</i> 370 (%)
Normal	2379 (66.7)	201 (54.3%)
Abnormal	1187 (33,3)	169 (45,7)

P < 0.0001

Table 5: Logistic regression: Predictors of systolic LVD

	OR (CI 95%)	P value
Age	1.01 (1.01-1.02)	<0.001
Gender (m)	2.20 (1.85-2.61)	<0.001
MS	1.45 (1.13-1.86)	0.001

Table 6: Logistic regression: predictors of diastolic LVD

	OR (CI 95%)	P value
Age	1.06 (1.05-1.07)	<0.001
Gender (m)	1.10 (0.95-1.27)	0.17
MS	1.44 (1.15-1.81)	0.001

Valore prognostico
dell'ecocardiografia e della
sindrome metabolica in pazienti
asintomatici per scompenso
cardiaco

Popolazione

Studio multicentrico (19)

Pazienti con almeno un fattore di rischio tradizionale
(Ipertensione, Fumo, Familiarità per malattie CV, Diabete,
Dislipidemia, Obesità)

Sottoposti ad Ecocardiogramma transtoracico

1920 pazienti selezionati

ECOCARDIOGRAMMA TRANSTORACICO

Misure

Funzione sistolica

Funzione diastolica

Follow-up

Primary events

Secondary events

Valore incrementale della disfunzione diastolica
e della sindrome metabolica

Primary events

Morte per causa cardiaca

Infarto del miocardio

Rivascolarizzazione

Eventi cerebrovascolari (Ictus)

Edema polmonare acuto

Secondary events

Ospedalizzazione per Scompenso Cardiaco

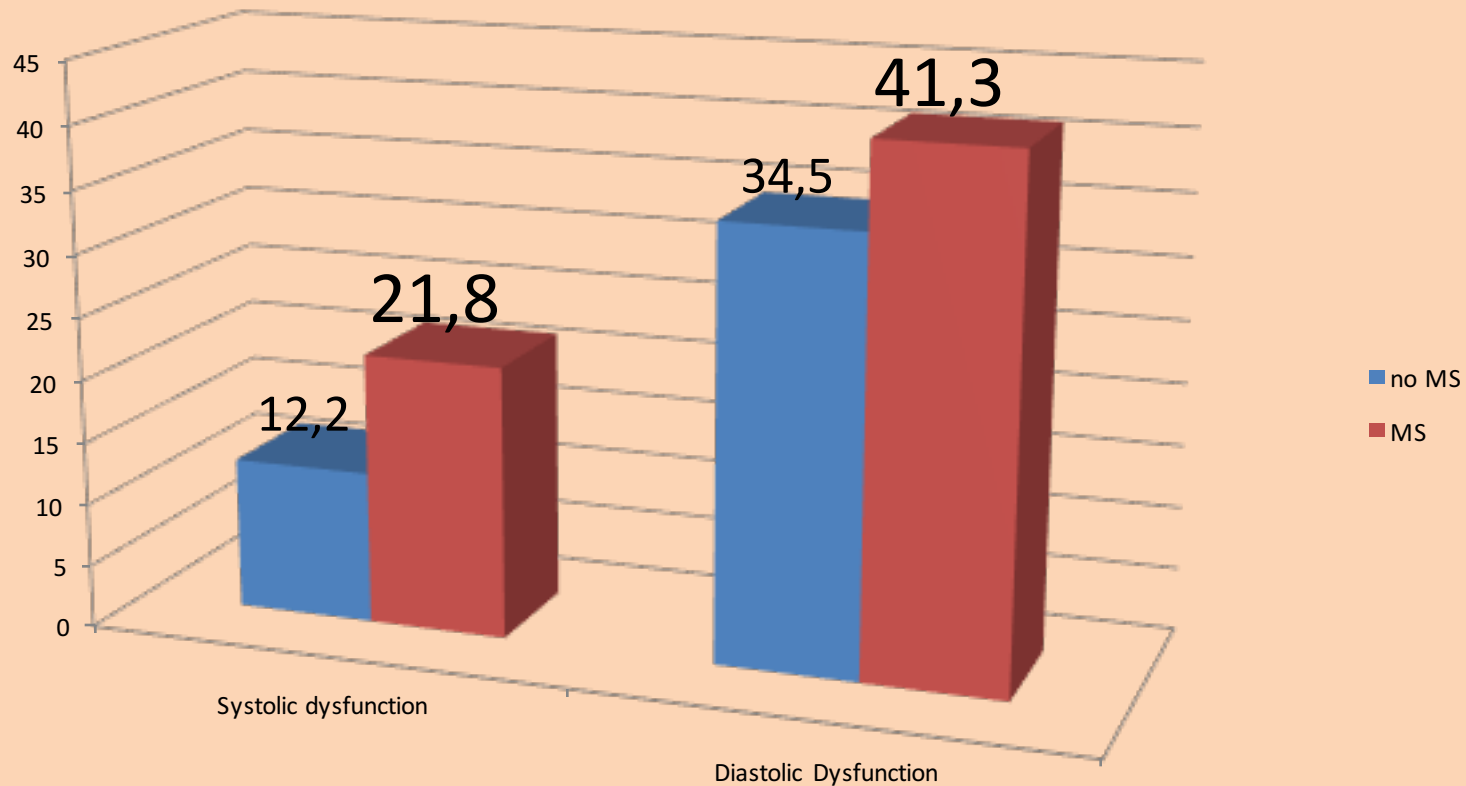
Cambiamento classe funzionale NYHA

	No sindrome metabolica	Sindrome metabolic a	Total	RR (CI 95%)	p
ECG patologico	402 (24.2)	89 (34)	491 (25.6)	1.61 (1.22-2.12)	0.001
IVS (ECG)	53 (3.2)	16 (6.1)	69 (3.6)	1.970 (1.108-3.500)	0.021
Segni ischemia (ECG)	170 (10.3)	40 (15.3)	210 (10.9)	1.577 (1.087 - 2.288)	0.016
Progresso IMA	220 (13.3)	70 (26. 7)	290 (15.1)	2.383 (1.751-3.24)	<0.001
Angina	118 (7.1)	27 (10.3)	145 (7.6)	1.499 (0.97-2.33)	0.071
rivascolarizzazione	177 (10.7)	50 (19.1)	227 (11.8)	1.97 (1.40-2. 79)	<0.001
Eventi cerebrovascolari pregressi	4 (0.2)	1 (0.4)	5 (0.3)	1.584 (0.18-14.2)	0.681
fumo	439 (26.5)	56 (21.4)	495 (25.8)	.755 (0.55-1.03)	0.080
familiarità	663 (40.0)	98 (37.4)	761 (39.6)	.897 (0.68-1.17)	.427
Diabete	161 (9.7)	144 (55.0)	305 (15.9)	11.347 (8.47-15.2)	<0.001
Ipertensione	978 (59)	250 (95.4)	1228 (64)	14.485 (8.05-26.0)	<0.001
Dislipidemia	550 (33.2)	225 (85.9)	775 (40.4)	12.251 (8.5-17.6)	<0.001
Obesità	262 (15.8)	204 (77.9)	466 (24.3)	18.741 (13.6-25.8)	<0.001
BBSx	23 (1.4)	8 (3.1)	31 (1.6)	2.239 (0.99-5.06)	0.053
Donne	921 (55.5)	159 (60.7)	1080(56.3)	.810 (0.6-1.06)	0.120
Female	737 (44.5)	103 (39.3)	840 (43.8)		
Total	1658	262	1920		

Echo parameters

	No MS	Sindrome metabolica	Total	p
Diametro TD VSx	50 (46-54)	51 (48-55)	50 (46-54)	<0.001
Diam. Ts VSx	31 (28-35)	33 (29-37)	31 (28-35)	<0.001
Volume Diast VSx	93 (72-119)	104 (79.2-130.7)	95 (73-121)	0.001
Volume Sist. VSx	34 (26-48)	41 (30-55)	35 (26-50)	<0.001
SIV	10 (9-12)	12 (10-13)	11 (9-12)	<0.001
PPw	10 (9-11)	11 (9-12)	10 (9-11)	<0.001
Diametro AS	38 (33-42)	40 (36-45)	38 (34-42)	<0.001
Area AS	17 (14-20)	18 (15-21)	17 (14-20)	<0.001
BMI	25.3 (23.1-28)	30.7 (27.6-32.9)	25.9 (23.4-29)	<0.001
FE (%)	61.7 (55.8-67.5)	59 (51-66)	61.4 (55.4-67.4)	<0.001
E/A	0.9 (0.75-01.22)	0.8 (0.71-1.1)	0.9 (0.74-1.21)	0.001
MASSA i	100 (82-119)	110 (91.8-131.1)	101.2 (83-121)	<0.001

	No MS	Sindrome Metabolic	RR	CI 95%	
Disfunzione sistolica (n=1876)	198 (12.2)	55 (21.8)	253 (13.5)	2.011 (1.44-2.80)	0.000
Disfunzione diastolica (n=1395)	419 (34.5)	74 (41.3)	493 (35.3)	1.3 (0.97-1.85)	0.073



Analisi multivariata. Variabile dipendente:
Disfunzione sistolica (EF < 50%)

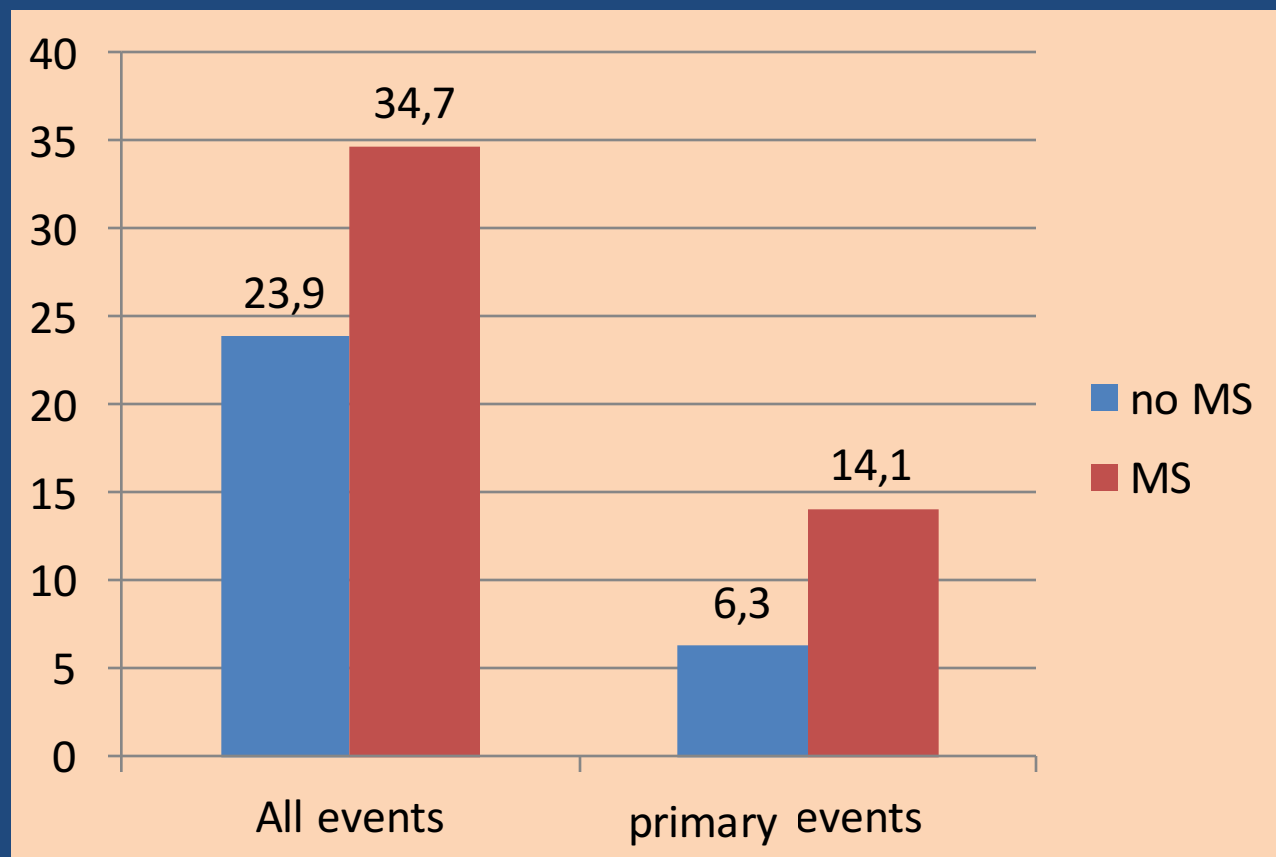
	OR (CI 95%)	
Metabolic Syndrome	1.92 (1.36-2.7)	<0.001
Age	1.0 (0.99-1.01)	0.39
gender	0.37 (0.27-0.49)	<0.001

FOLLOW UP

(durata media 22 ± 10 mesi
range 1-60 mesi).

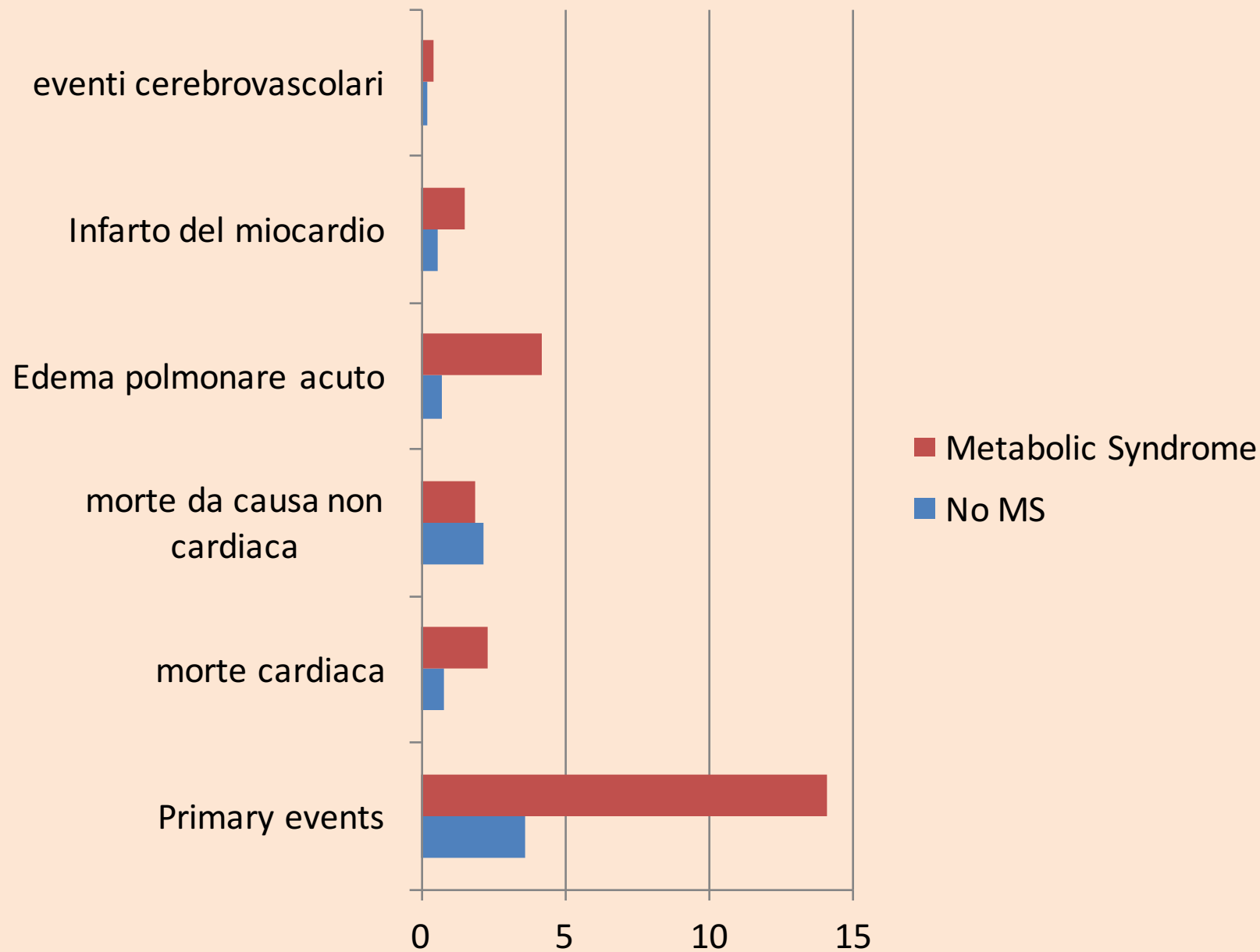
Sindrome metabolica ed eventi

	No MS	Metabolic Syndrome	Total	RR (CI 95%)	p
Tutti gli eventi	396 (23.9)	91 (34.7)	487 (25.4)	1,696 (1,28 -2,24)	0,000
Primary events	105 (6.3)	37 (14.1)	142 (7.4)	2,432 (1.63-3.63)	0,000

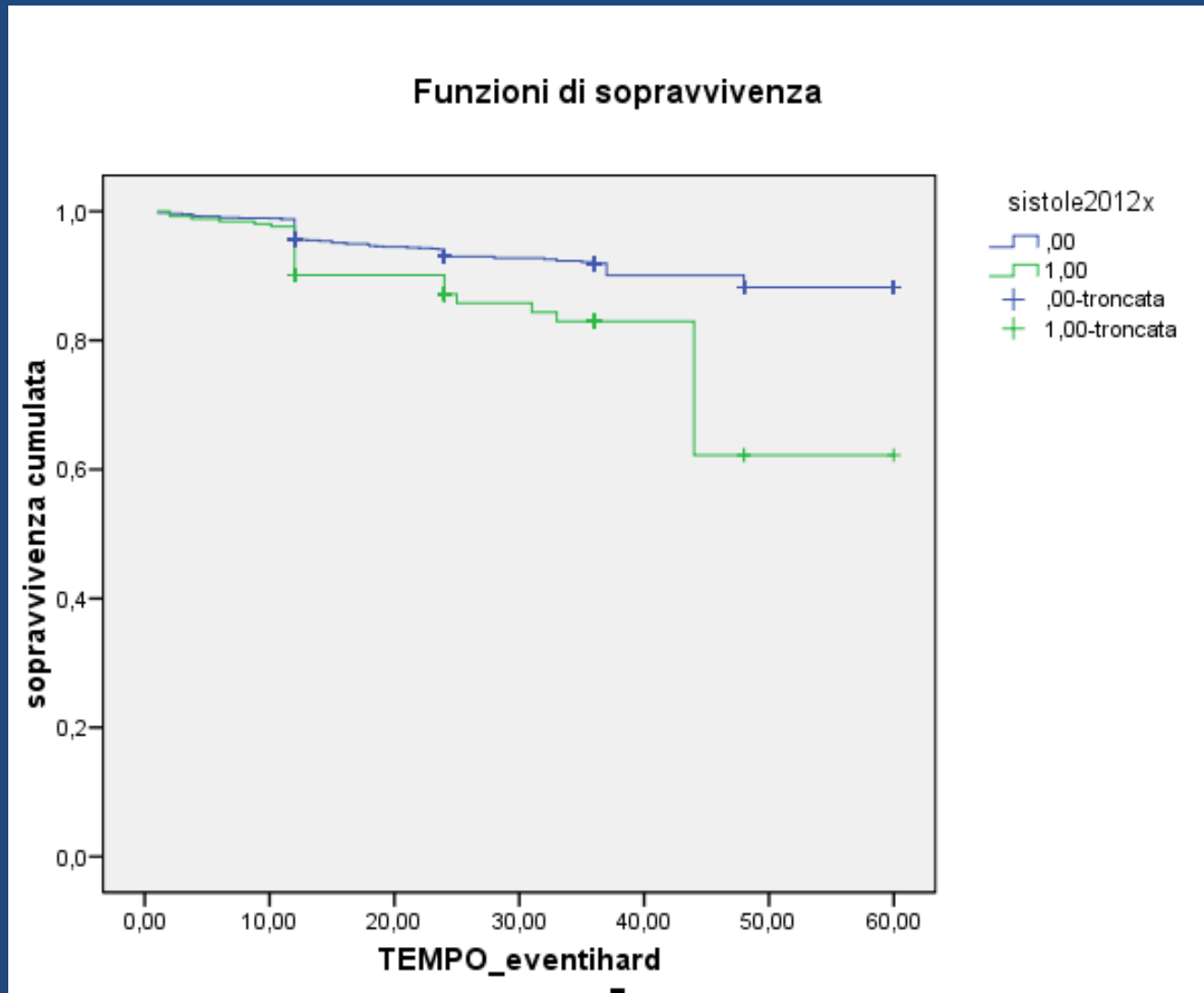


Sindrome metabolica ed eventi

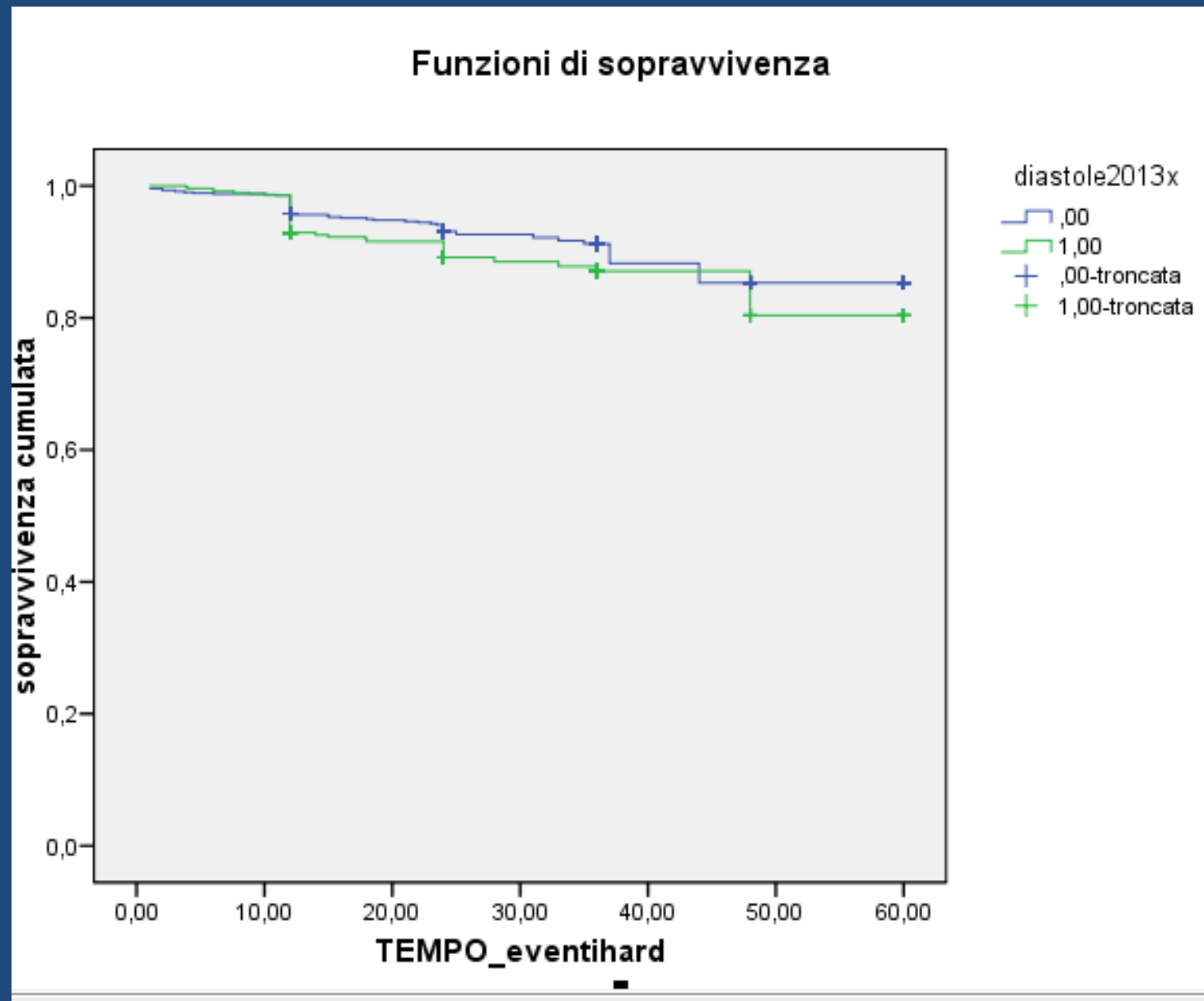
	No MS	Metabolic Syndrome	Total	RR (CI 95%)	p
Primary events	105 (6.3)	37 (14.1)	142 (7.4)	2,432 (1.63-3.63)	0,000
Morte per causa cardiaca	14 (0.8)	6 (2.3)	20 (1)	2,752 (1.05-7.23)	0,040
Edema polmonare acuto	11 (0.7)	11(4.2)	22 (1.1)	6,56 (2.81-15.29)	0,000
Infarto del miocardio	10 (0.6)	4 (1.5)	14 (0.7)	2,55 (0.79-8.21)	0,115
Eventi cerebrovasc.	4 (0.2)	1 (0.4)	5 (0.3)	1,58 (0.18-14.23)	0,681



Primary events e disfunzione sistolica (p0.001)

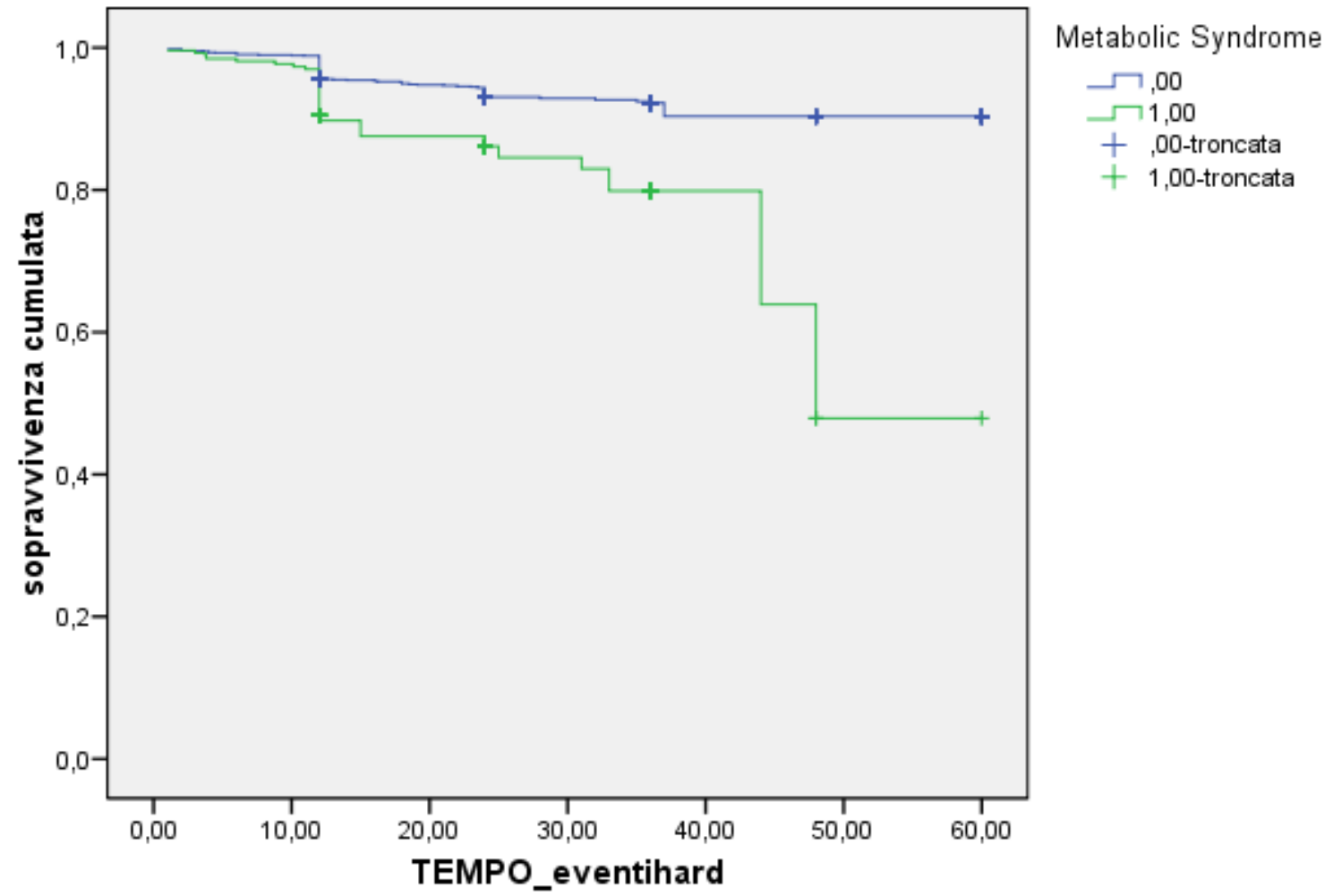


Primary events e disfunzione diastolica (p<0.018)



Primary events e sindrome metabolica (p<0.001)

Funzioni di sopravvivenza



Analisi multivariata: predittori “primary events”

	Odd Ratio(CI 95%)	p value
Sindrome metabolica	2,65 (1.67-4.18)	<0.001
Genere	0,72 (0.47-1.10)	0,14
Età	1,04 (1.02-1.06)	<0.001
Disfunzione diastolica	1,17 (0.77-1.77)	0,46
Disfunzione sistolica	2,10 (1.29-3.41)	0,002

Primary events (Cox regression)

	Hazard Ratio (CI 95%)	p
Disfunzione diastolica	1,17 (0.79-1.72)	0,429
Disfunzione sistolica	1,98 (1.27-3.09)	0,003
età	1,04 (1.02-1.05)	0,000
Genere	0,76 (0.51-1.14)	0,181
Sindrome Metabolica	2,49 (1.64-3.77)	0,000

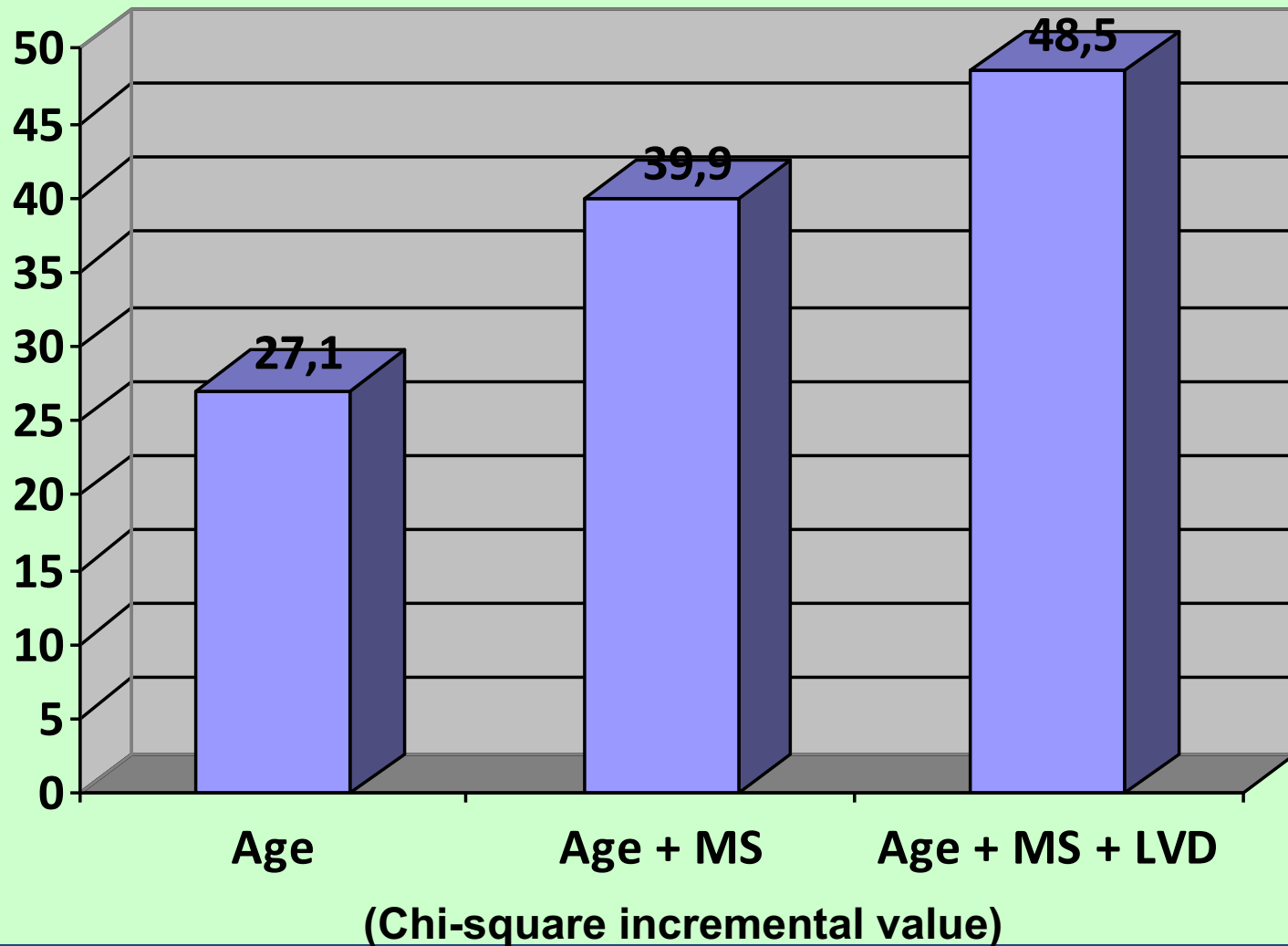
Logistic regression: predictors for All events

	Odd Ratio (CI 95%)	p
Metabolic Syndrome	1,89 (1.35-2.63)	0,000
gender	1,12 (0.88-1.44)	0,348
Age	1,01 (0.99-1.01)	0,124
Diastolic dysfunction	0,872 (0.67-1.13)	0,306
Systolic dysfunction	2,78 (2.00-3.86)	0,000

All events (primary and secondary) predictors – Cox regression

	Hazard Ratio (CI 95%)	P value
Diastolic dysfunction	0,91 (0.73-1.13)	0,37
Systolic dysfunction	2,04 (1.59-2.61)	<0.001
Age	1,01 (1.01-1.02)	0,012
gender	1,07 (0.87-1.32)	0,497
Metabolic syndrome	1,74 (1.35-2.25)	<0.001

Incremental value of MS and LVD as predictors of Hard events



Conclusioni

La disfunzione asintomatica del ventricolo sinistro (Sistolica e diastolica) è correlata alla sindrome metabolica.

l'Ecocardiografia ha un valore predittivo incrementale rispetto alla sola sindrome metabolica nel selezionare pazienti a maggior rischio di eventi

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- 1. [Early detection of regional and global left ventricular myocardial function using strain and strain-rate imaging in patients with metabolic syndrome.](#)

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- 2. [Does the metabolic syndrome impact left-ventricular mechanics? A two-dimensional speckle tracking study.](#)

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- 3. [Metabolic syndrome, strain, and reduced myocardial function: multi-ethnic study of atherosclerosis.](#)

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