Prognostic value of right ventricular function in acute heart failure with reduced ejection fraction

Valeur pronostique de la fonction ventriculaire droite dans l'insuffisance cardiaque aigue avec fraction d'éjection réduite

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Summary

Introduction: Several studies have demonstrated that right ventricular (RV) echocardiographic parameters predict prognosis in heart failure (HF), but none have specified their prognostic value in acute HF (AHF) with reduced ejection fraction ≤ 40%.

Aim: To demonstrate the prognostic value of RV echocardiographic parameters among patients with AHF and reduced ejection fraction ≤ 40%.

Methods: This was a prospective, descriptive, monocentric study conducted over a period of 24 months. We enrolled 56 patients who presented with AHF and a reduced LVEF ≤ 40%.

All patients included underwent an echocardiography study of the RV function: RV free wall strain (RVFWS), RV fractional area change (RV FAC), tricuspid annular plane systolic excursion and Peak systolic velocity of tricuspid annulus.

At the end of follow-up, cardiovascular mortality and rehospitalization rate for HF were studied.

Results: The average age of our population was 63 ±10 years. During follow-up, rehospitalization for HF and cardiovascular mortality were observed respectively in 57% and 20% of cases. In the multivariate analysis, only RVFWS with a cutoff value of -18.5% was an independent predictor for rehospitalization (95% CI 0.752-0.977; p=0.021). RV FAC with a cutoff value of 22.5% was an independent predictor for cardiovascular mortality (95% CI 1.019-2.673; p=0.042).

Conclusion: RVFWS and RV FAC seem to be strong predictors of prognosis in patients with AHF and reduced ejection fraction.

Keywords

Acute heart failure; cardiovascular mortality; rehospitalization; echocardiography

Résumé

Introduction : Plusieurs études ont démontré que les paramètres échocardiographiques du ventricule droit (VD) prédisent le pronostic dans l'insuffisance cardiaque (IC), mais aucune n'a spécifié leur valeur pronostique dans l'IC aigue (ICA) avec une fraction d'éjection réduite ≤ 40%.

Objectif : Démontrer la valeur pronostique des paramètres échocardiographiques du VD chez les patients présentant une ICA et une fraction d'éjection réduite ≤ 40%.

Méthodes : Il s'agissait d'une étude prospective, descriptive, monocentrique réalisée sur une période de 24 mois, incluant 56 patients présentant une ICA et une FEVG réduite ≤ 40%. Tous les patients ont eu une évaluation échocardiographique de la fonction VD : le strain de la paroi libre du VD (StrainVD), la fraction de raccourcissement du VD (FRVD), l'excursion systolique du plan annulaire tricuspidien et la vélocité systolique maximale de l'anneau tricuspidien.

À la fin du suivi, la mortalité cardiovasculaire et le taux de réhospitalisation pour IC ont été étudiés.

Résultats : L'âge moyen de notre population était de 63 ±10 ans. Au cours du suivi, la réhospitalisation pour IC et la mortalité cardiovasculaire ont été observées respectivement dans 57% et 20% des cas. En analyse multivariée, seul le Strain VD avec une valeur seuil de -18,5% était un prédicteur indépendant de réhospitalisation (IC 95% 0,752-0,977; p=0,021). La FRVD avec une valeur seuil de 22,5% était un prédicteur indépendant de la mortalité cardiovasculaire (IC 95% 1,019-2,673; p=0,042).

Conclusion : Le Strain VD et la FRVD semblent être de forts prédicteurs du pronostic chez les patients présentant une ICA avec une fraction d'éjection réduite.

Mots-clés

Insuffisance cardiaque aigue ; mortalité cardiovasculaire ; réhospitalisation ; échocardiographie

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INTRODUCTION

Heart failure (HF) is a serious condition spreading all around the world with an increasing prevalence[1]. In the US, 5.7 million people have HF and the projections expect that by 2030 more than 8 million people will have this condition with a 46% increase in prevalence[1]. The incidence of heart failure according to the National Tunisian Registry of Heart Failure (NATURE-HF) is 24% for patients aged ≥ 75years [2].

Enormous therapeutic progress has been made leading to a significant improvement in prognosis of patients with chronic heart failure [3]. No equivalent therapeutic advancement has been found for acute heart failure (AHF) [4], explaining poor prognosis of these patients [5].

In AHF, several parameters (clinical, biological and echocardiographic) have been proposed to help identify patients with the most severe prognosis in order to improve outcomes [6-8].

Several studies have demonstrated that right ventricular (RV) echocardiographic parameters predict prognosis in heart failure (HF), but none have specified their prognostic value in AHF with reduced ejection fraction ≤40%.

The aim of this study was to demonstrate the prognostic value of RV echocardiographic parameters among patients with AHF and reduced ejection fraction ≤40%.

METHODS

Study design and patient enrollment

This was a prospective, descriptive, monocentric study carried out in the cardiology department of the Interior Security Forces Hospital La Marsa, conducted from February 2020 to June 2022. We enrolled 56 patients who presented with AHF and reduced left ventricular ejection fraction (LVEF).

Patients with chronic heart failure or with moderately impaired or preserved LVEF were not included as well as patients with cardiac implantable electronic devices.

Patients lost to follow-up were excluded from our study.

Clinical and biological evaluation

AHF was defined according to 2021 ESC guidelines for the diagnostic and treatment of acute and chronic heart failure by a “rapid or gradual onset of symptoms and/or signs of HF, severe enough for the patient to seek urgent medical attention, leading to an unplanned hospital admission or an emergency department visit [3].

Reduced LVEF was defined by LVEF<=40% according to 2021 ESC guidelines [3].

Age, gender, cardiovascular risk factors, comorbidities were collected. Systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) were measured.

We classified patients according to initial clinical presentation: Right-sided AHF, Left-sided AHF or global decompensation.

All patients underwent a biological assessment comprising a determination of hemoglobin (Hb), CRP and serum creatinine.

Echocardiographic evaluation

All patients included underwent a transthoracic echocardiography (TTE) using a Philips EPIQ 7C echocardiography. All echocardiography examinations were performed by the same operator. An instantaneous and continuous electrocardiographic tracing took place simultaneously with the echocardiographic examination.

All measurements were performed following the recommendations of the American Association of Echocardiography and the European Association of Cardiovascular Imaging (ASE/EACVI) [9].

Left ventricular (LV) parameters

LVEF was measured following the simpson biplane method.

The LV diastolic diameter was acquired in the parasternal long-axis view perpendicular to the LV long axis at the level of the mitral valve leaflet by M-mode tracing.

Left atrial (LA) volume was calculated using the disk summation technique of volumetric measurements of the blood-tissue interface tracings on the apical four- and two-chamber views, at end-systole. LA volume was indexed to the body surface area.

Right ventricular (RV) parameters

Basal RV linear dimension was measured in the RV-focused view in the basal one third of the RV at end-diastole.

Tricuspid annular plane systolic excursion (TAPSE) was obtained by M-mode in the apical view. The cursor was positioned in the lateral tricuspid annulus and the displacement of the annulus between end-diastole and peak systole was measured (Figure1).

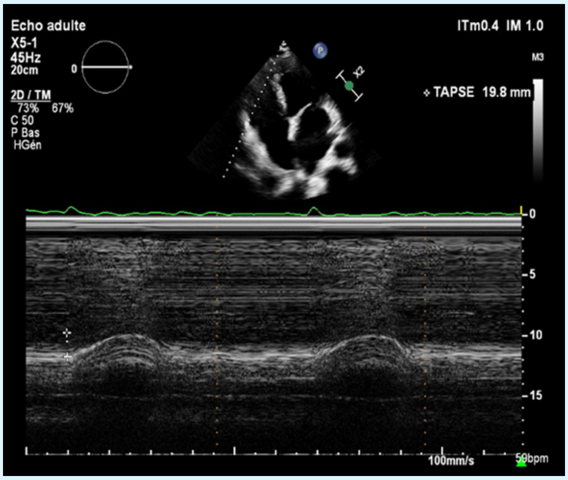

Figure 1 . Measurement of tricuspid annular plane systolic excursion (TAPSE) by calculating the difference in right ventricular basal motion from peak systole to end-diastole

RV fractional area change (RV FAC) was calculated after measuring the end-diastolic area (EDA) and the end-systolic area (ESA) of the RV in the RV-focused view using the formula (RV FAC (%) = 100 × (EDA - ESA)/EDA) (Figure2).

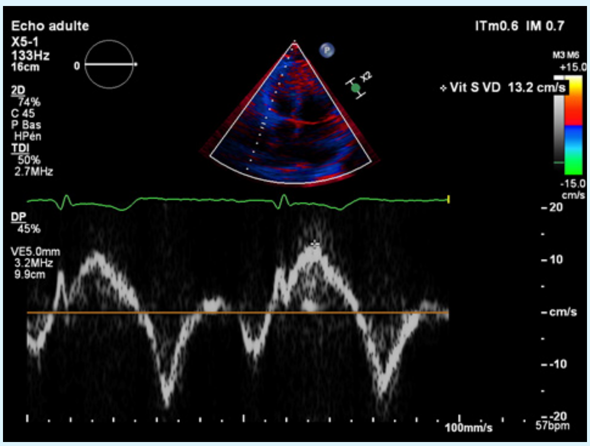

Figure 2. Measurement Peak systolic velocity of tricuspid annulus (RV S') by DTI-mode in the apical view

RV free wall strain (RVFWS), was performed using dedicated LV strain on the RV and averaging the apical, middle and basal strain of the RV free wall.

Peak systolic velocity of tricuspid annulus (RV S') was measured by DTI-mode in the apical view. The cursor was positioned in the lateral tricuspid annulus and the peak systolic velocity was calculated (Figure 2).

All clinical, biological and echocardiographic data were evaluated during the first 48 hours of hospitalization.

Follow-up and Endpoints

Mean follow-up was 24±6 months.

At the end of follow-up, 24-months cardiovascular mortality and rehospitalization rate for HF were studied according to medical records.

Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics 26 software.

We calculated percentages for qualitative variables, and means, medians and standard deviations for quantitative variables and determined the extreme values.

Comparisons of 2 means on independent series were carried out using the Student's t test for independent series, and in case of small numbers by the non-parametric Mann and Whitney test.

Comparisons of percentages on independent series were carried out using the Pearson chi-square test.

We conducted a multivariate analysis using binary logistic regression.

The determination of threshold values of the studied parameters was done by analyzing their receiver operating characteristic (ROC) curves with comparison of the areas under the curve (AUC) using the Delong method.

The significance level was set at 0.05.

Legal and ethical aspects

We obtained the oral consent of all the patients included in our study.

Confidentiality of medical records was respected during data collection and analysis.

We have no conflict of interest to declare.

RESULTS

The average age of our population was 63 ±10 years with extremes of 41 to 88 years. A male predominance was noted: 49 male patients (87.5%) and 7 female patients (12.5%), with a sex ratio of 7. Diabetes and smoking were the most common risk factors (71% and 70%, respectively). Ischemic heart disease was the most frequent underlying heart disease (43%) while 21% of heart diseases were of undetermined origin.

The baseline characteristics of the study population are reported in (Table1).

Table 1. Facteurs prédictifs d'une FEVG basse en analyse multivariée

Variables	General population
Age (Years)	63 ± 10
Gender Male/Female (n %)	49 (87)/7 (12)
Hypertension (n %)	24 (42)
Diabetes (n %)	40 (70)
Dyslipidemia (n %)	26 (46)
Smoking (n %)	40 (70)
BMI (Kg/cm^2)	26 ± 8
Obesity (n %)	22 (39)
Body surface (m^2)	1,9 [1,8-2,1]
SBP (mmHg)	120 [106-140]
DBP (mmHg)	70 [60-80]
HR (beats per minute)	100 [85-110]
Global HF (%)	29 (51)
Left-sided AHF (%)	52 (91)
Right-sided AHF (%)	33 (58)
Serum creatinine (umol/L)	132 ± 146
CRP (mg/L)	28 ± 45
Hemoglobin level (g/dL)	13 ± 2
LVEF (%)	27 [20-34]
LVEDD (mm)	63 ± 6
LA volume indexed (ml/m^2)	60 ± 23
Basal RV linear dimension (mm)	42 ± 7
RVFWS (%)	-12 [-21_-10]
TAPSE (mm)	17 ± 4
RV Fractional Area Change (n %)	9,2 [7-12]
RV S' (cm/s)	9,2 ± 3

SBP= systolic blood pressure; DBP= diastolic blood pressure; HR= Heart rate; AHF=acute heart failure ; CRP=c-reactive protein; LVEF=left ventricular ejection fraction; LVEDD= Left ventricular end-diastolic diameter; LA=left atrial; RV=right ventricle; RVFWS=Right ventricular free wall strain; TAPSE= Tricuspid annular plane systolic excursion; RV S'= Peak systolic velocity of tricuspid annulus

Follow-up

Rehospitalization for heart failure

During follow-up rehospitalization for heart failure was observed in 57% of cases with an average delay of 11 months.

The comparison of the clinical, biological and ultrasound characteristics is mentioned in table 2.

Table 2. Univariate analysis of the clinical, biological and echocardiographic parameters of patients who were rehospitalized

Variables	Rehospitalization +	Rehospitalization -	p-value
Age (Years)	66 ± 9	59 ± 10	0.012
Gender Male/Female (n %)	26 (81) /6 (19)	23 (96) / 1 (4)	0.102
Hypertension (n %)	12 (37)	12 (50)	0.419
Diabetes (n %)	23 (72)	17 (71)	0.932
Dyslipidemia (n %)	14 (44)	12 (50)	0.788
Smoking (n %)	19 (59)	19 (79)	0.091
BMI (Kg/cm^2)	27 ±4	28 ± 5	0.194
Obesity (n %)	11 (34)	11 (45)	0.385
Body surface (m^2)	1.9 ± 0.1	2 ± 0.2	0.280
SBP (mmHg)	120 [106-140]	125 [102-147]	0.463
DBP (mmHg)	70 [60-80]	80 [70-80]	0.464
HR (beats per minute)	98 ± 18	99 ± 19	0.835
Global HF (%)	16 (50)	11 (46)	0.157
Left-sided AHF (%)	29 (90)	23 (96)	0.454
Right-sided AHF (%)	19 (59)	14 (58)	0.938
Serum creatinine (umol/L)	86 [76-110]	92 [73-140]	0.683
CRP (mg/L)	15 [4-21]	10 [5-16]	0.358
Hemoglobin level (g/dL)	12.9 ± 2	12.8 ± 2.7	0.443
LVEF (%)	27 ± 7	27 ± 6	0.958
LVEDD (mm)	62 ± 8	64 ± 4	0.081
LA volume indexed (ml/m^2)	56 [46-72]	57 [50-68]	0.405
Basal RV linear dimension (mm)	43 ± 7	41 ± 5	0.969
RVFWS (%)	-10 [-17_-8]	-18 [-25_-11]	0.001
TAPSE (mm)	15 ± 4	19 ± 3	0.001
RV Fractional Area Change (n %)	27 ± 8	34 ± 10	0.014
RV S' (cm/s)	8.4 ± 1.2	11 ± 2.8	0.002

SBP= systolic blood pressure; DBP= diastolic blood pressure; HR= Heart rate; AHF=acute heart failure ; CRP=c-reactive protein; LVEF=left ventricular ejection fraction; LVEDD= Left ventricular end-diastolic diameter; LA=left atrial; RV=right ventricle; RVFWS=Right ventricular free wall strain; TAPSE= Tricuspid annular plane systolic excursion; RV S'= Peak systolic velocity of tricuspid annulus

All parameters for which the univariate analysis had p values < 0.05 were entered into the multivariate analysis (Table 3).

Table 3. Binary logistic regression analyzes for rehospitalizations for HF

	P	OR	95% CI	
			LB	UB
Age	0.063	0.935	0.870	1.004
RVFWS	0.021	0.857	0.752	0.977
TAPSE	0.50	1.204	0.982	1.636
RV Fractional Area Change	0.272	0.946	0.858	1.045
RV S'	0.351	1.135	0.870	1.479

RVFWS=Right ventricular free wall strain; TAPSE=Tricuspid annular plane systolic excursion; RV S'= Peak systolic velocity of tricuspid annulus; CI=confidence interval; LB= lower bound; UB= upper bound; OR=odds Ratio

Only RVFWS (95% CI 0.752-0.977; p=0.021) was found to be significantly associated with rehospitalization for heart failure after multivariate analysis and, therefore, was an independent predictor of rehospitalization for heart failure in patients presenting with acute heart failure with a reduced LVEF <=40%.

The performance analysis of echocardiographic parameters (TAPSE, RV S', RV fractional area change and RVFWS) to predict rehospitalizations for HF is illustrated in Figure 3.

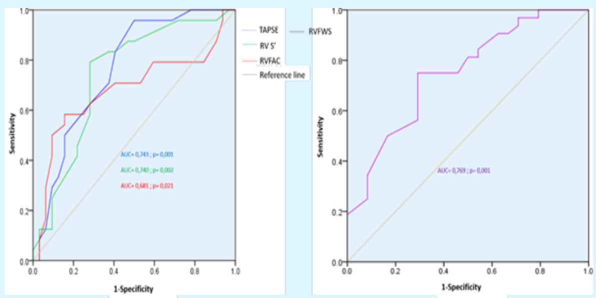

Figure 3. ROC curves of echocardiographic parameters (TAPSE, RV S', RV FAC and RVFWS) to predict rehospitalizations for HF

AUC= area under the curve; TAPSE=Tricuspid annular plane systolic excursion; RV S'= Peak systolic velocity of tricuspid annulus; RV FAC=RV Fractional Area Change; RVFWS=Right ventricular free wall strain

The analysis of the area under the curve (AUC) of the echocardiographic parameters (TAPSE, RV S', RV FAC and RVFWS) showed similar performance with a superiority of the RVFWS compared to the TAPSE, RV S' and RV FAC to predict rehospitalizations for heart failure (AUC=0.769, p=0.001).

Analysis of the ROC curve of the RV strain identified a threshold value of -18.5% to predict rehospitalizations for HF with a sensitivity (Se) of 87.5% and a specificity (Sp) of 50%.

Cardiovascular mortality

Cardiovascular mortality was observed in 20% of the cases with an average delay of 9 months.

The comparison of the clinical, biological and echocardiographic characteristics is mentioned in table 4.

Table 4. Univariate analysis of the clinical, biological and echocardiographic parameters to assess the cardiovascular mortality of patients

Variables	Mortalité +	Mortalité -	Valeur de P
	66 ± 9	59 ± 10	0.012
Age (Years)	67 ± 11	62 ± 9	0.159
Gender Male/Female (n %)	10 (91) /1 (9)	39 (86) / 6 (13)	0.703
Hypertension (n %)	5 (45)	19 (42)	0.846
Diabetes (n %)	8 (72)	32 (71)	0.932
Dyslipidemia (n %)	4 (36)	22 (49)	0.455
Smoking (n %)	8 (72)	30 (70)	0.848
BMI (Kg/cm^2)	27 ±4	28 ± 5	0.821
Obesity (n %)	3 (27)	19 (42)	0.363
Body surface (m^2)	1.9 ± 0.1	1.9 ± 0.2	0.490
SBP (mmHg)	135 [100-160]	120 [110-140]	0.293
DBP (mmHg)	75 [60-100]	70 [60-80]	0.804
HR (beats per minute)	100 ± 20	98 ± 18	0.835
Global HF (%)	6 (54)	23 (51)	0.857
Left-sided AHF (%)	10 (91)	42 (93)	0.754
Right-sided AHF (%)	7 (63)	26 (57)	0.838
Serum creatinine (umol/L)	125 [84-373]	84 [74-110]	0.087
CRP (mg/L)	14.5 [6-160]	12 [4-19]	0.005
Hemoglobin level (g/dL)	12.6 ± 2	12.9 ± 2.3	0.694
LVEF (%)	25 ± 8	28 ± 7	0.240
LVEDD (mm)	64 ± 6	63 ± 6	0.602
LA volume indexed (ml/m^2	61 [47-73]	56 [46-70]	0.004
Basal RV linear dimension (mm)	43 ± 7	42 ± 6	0.575
RVFWS (%)	-9 [-11_-8]	-16 [-22_-10]	0.003
TAPSE (mm)	13 ± 4	17 ± 3	0.009
RV Fractional Area Change (n %)	19 ± 3	33 ± 9	<0.001
RV S' (cm/s)	7 ± 1.3	10 ± 3	0.001

SBP= systolic blood pressure; DBP= diastolic blood pressure; HR= Heart rate; AHF=acute heart failure ; CRP=c-reactive protein; LVEF=left ventricular ejection fraction; LVEDD= Left ventricular end-diastolic diameter; LA=left atrial; RV=right ventricle; RVFWS=Right ventricular free wall strain; TAPSE= Tricuspid annular plane systolic excursion; RV S'= Peak systolic velocity of tricuspid annulus

All parameters for which the univariate analysis had p values < 0.05 were entered into the multivariate analysis (Table 5).

Table 4. Binary logistic regression analyzes for rehospitalizations for HF

	P	OR	95% CI	
			LB	UB
CRP	0.100	0.959	0.912	1.008
LA volume indexed	0.107	0.955	0.794	1.023
RVFWS	0.849	0.956	0.602	1.518
TAPSE	0.266	1.232	0.853	1.778
RV Fractional Area Change	0.042	1.649	1.019	2.673
RV S'	0.933	0.970	0.482	1.955

CRP= c-reactive protein; LA=left atrial; RVFWS=Right ventricular free wall strain; TAPSE=Tricuspid annular plane systolic excursion; RV= right ventricle; RV S'= Peak systolic velocity of tricuspid annulus; CI=confidence interval; LB= lower bound; UB= upper bound; OR=odds Ratio

Only RVFAC (95% CI 1.019-2.673; p=0.042) was found to be significantly associated with cardiovascular mortality after multivariate analysis and, therefore, was an independent predictor of cardiovascular mortality in patients presenting with acute heart with a reduced LVEF ≤ 40%.

The performance analysis of echocardiographic parameters (TAPSE, RV S', RV fractional area change and RVFWS) to predict cardiovascular mortality is illustrated in Figure 4.

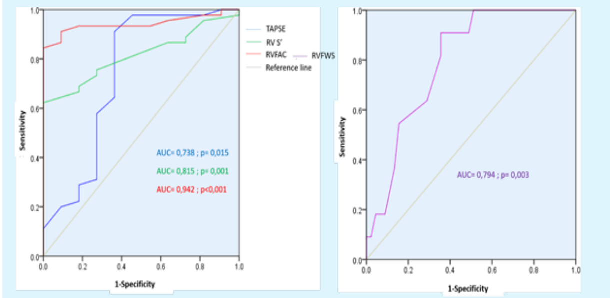

Figure 4. ROC curves of echocardiographic parameters (TAPSE, RV S', RV FAC and RVFWS) to predict cardiovascular mortality.

AUC= area under the curve; TAPSE= Tricuspid annular plane systolic excursion; RV S'=RV Tissue Doppler Imaging (TDI) tricuspid annular peak systolic wave velocity; RVFAC=RV Fractional Area Change; RVFWS=Right ventricular free wall strain

Analysis of the area under the curve (AUC) of the echocardiographic parameters (TAPSE, RV S', RVFAC and RVFWS) showed similar performance with superior RV FAC compared to TAPSE, RV S' and RVFWS to predict cardiovascular mortality (AUC=0.942, p<0.001).

Analysis of the ROC curve of the RV FAC identified a threshold value of 22.5% to predict cardiovascular mortality with a sensitivity of 90.9% and a specificity of 91%.

DISCUSSION

This prospective study carried out in the cardiology department of the Interior Security Forces Hospital La Marsa had enrolled 56 patients who presented with AHF and a reduced left ventricular ejection fraction (LVEF) and aimed to assess the prognostic value of RV echocardiographic parameters among patients with AHF and reduced ejection fraction.

The main findings of this study were:

- During follow-up, rehospitalization for HF and cardiovascular mortality were observed respectively in 57% and 20% of cases.
- All RV echocardiographic parameters studied (RVFWS, RVFAC, TAPSE and RV S') were predictive of rehospitalization for HF and cardiovascular mortality.
- Only RVFWS with a cutoff value of -18.5% (sensitivity of 87.5%; specificity of 50%) was an independent predictor for rehospitalization (95% CI 0.752-0.977; p=0.021).
- Only RV FAC with a cutoff value of 22.5% (sensitivity of 90.9%; specificity of 91%) was an independent predictor

for cardiovascular mortality (95% CI 1.019-2.673; p=0.042).

Prevalence of rehospitalization for HF and cardiovascular mortality in AHF

In this study, 24-month rehospitalization for HF and cardiovascular mortality were observed respectively in 57% and 20% of cases.

In the Nature HF register that included a total of 408 patient with AHF, 12-month rehospitalization was 7.4%, 12-month mortality and rehospitalization was 18.7%, in-hospital mortality was 3.3% and all-cause mortality was 22.8% [2]. This was a longitudinal, prospective and multicentric national registry with a 13-month period of follow-up.

In a study published by Park et al in 2018, a total of 1824 patient with AHF were included. Five-year all-cause mortality was 43.8% (799) [10]. Similarly, Palazzuoli et al, published a study in 2020 in which a total of 381 AHF patient were included; the follow-up period was 6 months; in-hospital death and rehospitalization were observed respectively in 19% and 25% of cases [11].

This inequality of rates can be explained by the difference in the follow-up periods (2 years for our study, 12 months for Nature HF, 5 years for Park et al and 6 months for Palazzuoli et al), in the timeframes when the studies were conducted (2020-2022 for our study, 2017-2018 for Nature HF, 2009-2016 for the Park et al study, 2012-2017 for the Palazzuoli study), in the medical treatment and in the baseline characteristics of the study population.

RV echocardiographic parameters

Several studies aimed to investigate the prognostic value of RV echocardiographic parameters and their impact on all-cause mortality. However, to our knowledge, this is the first study to assess the role of RV echocardiographic parameters in predicting rehospitalization alone in AHF.

RV strain

RV strain is an important parameter for estimating global and regional RV systolic function [9]. Park et al. demonstrated that RV global longitudinal strain (GLS) <12% (p<0.001 HR=1.405 CI [1.222-1.616]); RVGLS (per 1 % decrease) (p<0.001, CI [1.021-1.045], HR=1.033) was predictive of 5-year all-cause mortality in the univariate analysis. And that RVGLS (per 1 % decrease) was an independent predictor of 5-year all-cause mortality (p=0.014 HR=1.022, IC [1.004-1.040]). With a cutoff value of -12% [10].

Similarly Berrill et al. published a study in 2022, 418 patient with AHF were included. RV peak GLS was found to be predictive of 24-month all-cause mortality (p=0.021) with a cutoff value of -18.6% (Sensibility=88.3%, Specificity=22.5%) [6].

In our analysis, we used right ventricular free wall strain rather than right ventricular global strain to eliminate the influence of the septum and therefore of the left ventricule function on the right ventricular strain [12].

In our study, RVFWS was found to be predictive of 24-month cardiovascular mortality (p=0.003) similarly to Berrill et al. results.

Our study showed as well that RVFWS was predictive of 24-month rehospitalization (p=0.001) and that it was an independent predictor of rehospitalization for HF for patients with reduced LVEF (95% CI 0.752-0.977; p=0.021) with a cutoff value of -18.5% (Se=87.5%, Sp=50%). To our Knowledge, this result has been demonstrated for the first time.

RV FAC

This parameter allows us to estimate the global RV systolic function [9]. Berrill et al. showed that RV FAC was predictive of 24-month all-cause mortality (p=0.007) with a cutoff value of 38.2% (Sensibility=62%, Specificity=51%) [6].

Similarly, our study showed that RV FAC was predictive of 24-month cardiovascular mortality (p<0.001) and that it was an independent predictor of cardiovascular mortality (95% CI 1.019-2.673; p=0.042) with a cutoff value of 22.5% (Se=90.9%, Sp=91%).

Our study showed as well that RV FAC was predictive of 24-month rehospitalization (p=0.014). This result has been demonstrated for the first time to our knowledge.

TAPSE

TAPSE is a parameter reflecting RV longitudinal function but has been shown to correlate well with parameters estimating global RV systolic function [9].

Palazzuoli et al. showed that lower TAPSE was predictive of 6-month in-hospital death (17 [13-20] mm vs 19 [16-21] mm p=0.004) and that TAPSE<19mm (p<0.001 HR=2.37 IC [1.73-3.23]) was predictive of 6-month death or rehospitalization. Multivariate analysis showed that TAPSE<19mm was an independent predictor of 6-month events (p=0.004 HR=1.68 IC [1.18-2.38]) [11].

Berrill et al. showed that TAPSE was predictive of 24-month all-cause mortality (p=0.011), with a cutoff value of 16mm (Se=70.4%, Sp=43.7%) [6].

In our study TAPSE has been found to be predictive of 24-month cardiovascular mortality (p=0.009) similarly to Berrill et al. results.

In addition, our study showed that TAPSE was predictive of 24-month rehospitalization for HF (p=0.001). This result has also been demonstrated for the first time to our knowledge.

RV S'

In literature, RV S' prognostic value has not been clearly established in AHF.

Berrill et al. showed that it wasn't significantly predictive of 24-month all-cause mortality (p=0.17) with a cutoff value of 9cm/s [6].

In our cohort, RV S' was associated with 24-months rehospitalization for HF (p=0.002) and with 24-month cardiovascular mortality (p=0.001).

This difference can be explained by frequent measurement errors of this parameter. In fact, correct alignment of the cursor on the free right ventricular wall is required to obtain correct values, which is a problem in the acute phase where time to scan the patient is limited.

The results of our study confirmed the already proven importance of right ventricular echocardiographic parameters in predicting the prognosis in patients with heart failure.

In addition, it has proven their impact on rehospitalization for heart failure alone and on cardiovascular mortality in acute heart failure with a reduced LVEF.

CONCLUSION

RVFWS and RV FAC seem to be strong predictors of prognosis in patients with AHF and reduced ejection fraction.

A study showing the prognostic interest of right ventricular echocardiographic parameters on cardiovascular mortality and rehospitalization for heart failure in acute heart failure with preserved ejection fraction and with mildly reduced ejection fraction could be a good perspective for the future.

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