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ASSESSMENT OF RV DYSFUNCTION AND LVEF IN HEART FAILURE PATIENTS USING SPECKLE TRACKING ECHOCARDIOGRAPHY

Cardiology

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ABSTRACT

Background: RV dysfunction is well known prognostic marker of morbidity and mortality in all forms of heart failure independent of LV function. In this study we used newer modality of speckle tracking echocardiography to diagnose RV dysfunction and study its correlation with various categories of heart failure namely HFpef, HFmef and Hfref **Aims:** To study the correlation between RV dysfunction and LVEF **Methods:** In a single hospital based cross sectional study we studied 99 patients of clinical heart failure and classified them in 3 groups according to LVEF [< 40%, 40-49% and > 50%] and calculated RV dysfunction using STE on Philips cvx machine using dedicated Tomtec software for calculating RV strain. RV dysfunction was defined as RV free wall GLS < 19 and RV 6 segment GLS < 24. LVEF was calculated with modified Simpson method. NT ProBNP levels more than 150 pg/ml were considered abnormal. Patients with chronic obstructive pulmonary disease, organic valvular heart disease, rhythm other than sinus rhythm, history of pulmonary embolism, respiratory failure, congenital heart disease were excluded. **Results:** The mean (SD) of LVEF (%) in the RV Dysfunction group was 42.51 (12.04) and without RV Dysfunction group was 48.39 (9.67). 43.3% of the patients with RV Dysfunction had LVEF <40%. 26.9% of the patients with RV Dysfunction had LVEF: 40-49%. 29.9% of the patients with RV Dysfunction had LVEF: ≥50%. The difference was significant between HFref and HFmef patients [p=0.01] and HFref and HFpef patients [p=0.04] but not between HFmef and HFpef patients. **Conclusion:** RV dysfunction significantly increases in patients with LVEF < 40%

KEYWORDS

RV right ventricle, LV left ventricle, STE speckle tracking echocardiography, EF ejection fraction

INTRODUCTION :

Myocardial deformation imaging by 2D-speckle-tracking echocardiography has improved our understanding of mechanisms of myocardial dysfunction, and global longitudinal strain (GLS) has emerged as an accurate sensitive method to noninvasively assess myocardial function .[1,2,3] STE analyses LV deformation by tracking cardiac motion from image intensities. It tracks features like image contours and image texture, speckled pattern of the myocardium when imaged by ultrasound. Strain is defined as the change in the length of tissue normalized to its original length ([L-L0]/L0), and strain rate describes the rate at which this change occurs, representing the time-derivative of strain. And RV dysfunction is an established marker of poor prognosis ,we intend to measure its incidence in heart failure population using STE and its incidence in three subgroups of heart failure namely HFpef ,HFmef and HFref.

METHODS :

In a single hospital based cross sectional study 99 patients aged >18 years who were either admitted with a primary diagnosis of heart failure or attended cardiology OPD at JNMCH,AMU ALIGARH for management of heart failure within 6 months of an episode of decompensated or hypertensive heart failure. Heart failure was diagnosed based on symptoms with or without signs of HF,elevated natriuretic peptides (BNP ≥35 pg/mL or NTproBNP≥ 125 pg/mL) ,(left atrial enlargement (>34 mL/m2) , diastolic dysfunction (E/e' > 13 and a mean e' septal and lateral wall <9 cm/s) . These Patients were studied and classified in 3 groups according to LVEF [HFref with EF< 40%, HFmef with EF 40-49% and HFpef EF > 50%] and RV dysfunction was diagnosed using STE on Philips cvx machine using dedicated Tomtec software for calculating RV strain. RV dysfunction was defined as RV free wall GLS < 19 and RV 6 segment GLS < 24. LVEF was calculated with modified Simpson method. All patients were examined while in the left lateral position Standard views for two-dimensional and M-mode were used for tissue Doppler image (TDI).[4] Measurements were obtained according to the recommendations of the American Society of Echocardiography for assessment of RV systolic function NT ProBNP levels more than 125 pg/ml were considered abnormal. Chi-squared test was used to explore the association between 'RV Dysfunction' and 'LVEF'. Patients with chronic obstructive pulmonary disease, organic valvular heart disease, rhythm other than sinus rhythm, history of pulmonary embolism, respiratory failure, congenital heart disease were excluded.

RESULTS :

43.3% of the patients had RV Dysfunction in the group1 with LVEF: <40%. 26.9% of the patients had RV Dysfunction in the group2 with LVEF: 40-49%. 29.9% of the paticnts had RV Dysfunction in the group3 with LVEF: ≥50%. [figure1]. The mean (SD) of RV GLS (%) in the LVEF: <40% group was 17.39 (4.45). The mean (SD) of RV GLS (%) in the LVEF: 40-49% group was 20.03 (3.24). The mean (SD) of RV GLS (%) in the LVEF: ≥50% group was 18.81 (4.39). The median (IQR) of RV GLS (%) in the LVEF: <40% group was 17 (15-20). The median (IQR) of RV GLS (%) in the LVEF: 40-49% group was 20 (17-23). The median (IQR) of RV GLS (%) in the LVEF: ≥50% group was 19 (17-22).

Table 1

LVEF	RV Dysfunction			Chi-Squared Test	
	Yes	No	Total	$\chi 2$	P Value
<40%	29 (43.3%)	4 (12.9%)	33 (33.7%)	8.901	0.012
40-49%	18 (26.9%)	14 (45.2%)	32 (32.7%)		
≥50%	20 (29.9%)	13 (41.9%)	33 (33.7%)		
Total	67 (100.0%)	31 (100.0%)	98 (100.0%)		

LVEF	Adjusted P Values
<40% vs. 40-49%	0.017
<40% vs. ≥50%	0.034
40-49% vs. ≥50%	0.804

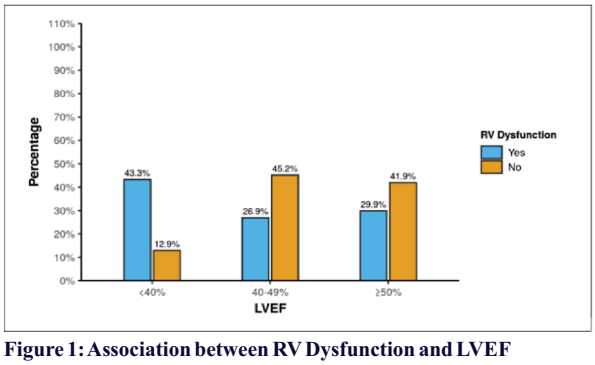

Figure 1: Association between RV Dysfunction and LVEF

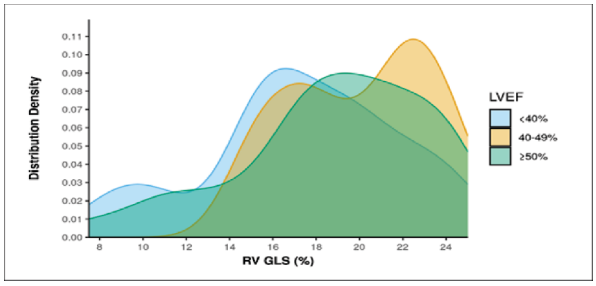

Figure 2: Association Between LVEF and RV GLS (%)

DISCUSSION:

In many similar studies using RV strain to diagnose RV dysfunction its incidence range from 40-60% depending upon cutoffs used.[5,6] Incidence of RV dysfunction in the present study was 68% in overall patient population ,in the sub group analysis it was 43% ingroup 1 with LVEF < 40% which was significantly higher compared to both group 2 [26%] and group 3 [29%] p value 0.01 and 0.03 respectively ,although RV dysfunction was more in group 2 compared to group 3 it was not statistically significant p =0.8.This shows that incidence of RV dysfunction increases significantly in heart failure with reduced ejection fraction and that patients with heart failure with ejection fraction more than 40% tend to have similar picture in terms of right heart dysfunction and therefore may behave differently in terms of clinical outcome and therapeutic intervention.[7,8]

CONCLUSION :

RV function by strain analysis is a direct measurement of intrinsic RV myocardial deformation along the longitudinal plane, which is less affected by loading conditions and geometric assumptions than traditional parameters, RV longitudinal strain still lacks clear standardization and validation, with consequent limitations in its implementation in clinical routine But still routine RV strain analysis along with other parameters of RV evaluation should be done heart failure patients for better stratification of prognosis and therapeutic intervention.

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