CARDIO ROUNDS NEWSLETTER

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Dear Doctor,

Greetings from Micro Labs Limited. We are happy to bring you "Cardio rounds" which contains latest and interesting news in the field of Cardiology

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Comparison of ventricular and atrial functions between rheumatic patients and healthy controls using transthoracic echocardiograph

Rheumatoid arthritis (RA) is a common autoimmune inflammatory disease that affects approx. 1% of the global population. Interaction between genetic factors and environmental factors causes a cascade of immune reactions, leading to the formation of synovitis, joint damage, and structural bone damage.[1] Rheumatic diseases such as systemic lupus erythematosus (SLE), rheumatoid arthritis (RA), vasculitis, systemic sclerosis, and spondyloarthropathies can cause several comorbidities, of which cardiovascular complications is the most common one leading to mortality. Rheumatic diseases can affect pericardium, myocardium, and heart valves to the cardiac conduction system and vasculature.[2] Increased risk of cardiovascular disease in patients with Rheumatic diseases is independent to traditional cardiovascular risk factors.[1]

Norouzi etal aimed to compare the ventricular and atrial functions of rheumatic patients and healthy controls using transthoracic echocardiography (TTE). 64 patients with rheumatic diseases and sexmatched healthy controls who all underwent detailed history-taking and TTE were enrolled. Echocardiographic parameters were analysed and compared between rheumatic patients and healthy controls. Transthoracic echocardiography showed significant differences in many echocardiographic parameters. Compared to the controls group, left ventricular end-diastolic diameter, left ventricular end-systolic diameter, right atrium area, inferior vena cava diameter, and systolic pulmonary artery pressure were significantly higher in patients with rheumatic diseases. It was also observed that Right ventricular septal strain, right ventricular free wall strain, average longitudinal right ventricular strain, tricuspid annular plane systolic excursion, right ventricular systolic myocardial velocity, and right ventricular fractional area change were decreased in inflammatory rheumatic patients.

	All rheumatic diseases			SLE ($n=30$)			Systemic sclerosis ($n=21$)			Rheumatoid arthritis ($n=10$)		
	HC ($n=64$)	Cases ($n=64$)	*P* value	HC	SLE	*p* value	HC	SSc	*p* value	HC	RA	*p* value
LVEF (%)	55.16 ± 0.88	53.91 ± 6.00	0.104	55.17 ± 0.91	54.33 ± 2.54	0.099	55.24 ± 1.09	55.00 ± 2.24	0.663	55.00 ± 0.00	54.50 ± 1.58	0.331
LVEDD (mm)	40.03 ± 3.35	47.23 ± 3.82	< 0.001	39.57 ± 3.45	47.03 ± 4.13	< 0.001	39.48 ± 2.66	46.95 ± 3.58	< 0.001	41.90 ± 3.76	48.20 ± 3.05	0.001
LVESD (mm)	23.27 ± 4.84	30.86 ± 4.90	< 0.001	23.10 ± 4.55	30.37 ± 5.23	< 0.001	22.19 ± 4.66	29.52 ± 3.43	< 0.001	25.30 ± 5.62	33.50 ± 3.92	0.001
RVEDD (mm)	28.05 ± 1.69	28.66 ± 2.69	0.128	27.90 ± 1.71	28.37 ± 3.00	0.463	28.00 ± 1.55	28.38 ± 2.08	0.505	28.30 ± 2.06	29.00 ± 1.83	0.431
RA area (cm^2)	11.41 ± 1.90	13.07 ± 2.85	< 0.001	11.50 ± 1.80	13.17 ± 3.42	0.022	11.62 ± 2.29	12.67 ± 2.35	0.152	11.10 ± 1.45	13.05 ± 2.17	0.029
RV septal strain (%)	21.05 ± 2.11	16.33 ± 4.00	< 0.001	20.83 ± 2.35	16.03 ± 4.31	< 0.001	20.67 ± 1.93	15.90 ± 2.93	< 0.001	22.00 ± 1.49	17.40 ± 4.95	0.017
RV free wall strain (%)	26.47 ± 2.59	23.23 ± 4.14	< 0.001	26.73 ± 1.87	23.07 ± 4.00	< 0.001	26.19 ± 1.89	22.57 ± 3.70	< 0.001	25.80 ± 4.76	24.30 ± 4.52	0.479
Average longitudinal RV strain (%)	24.09 ± 2.08	19.31 ± 3.68	< 0.001	24.10 ± 1.99	19.03 ± 3.52	< 0.001	23.48 ± 1.89	18.67 ± 3.10	< 0.001	24.80 ± 2.25	20.70 ± 4.57	0.020
TAPSE (mm)	25.61 ± 1.53	21.70 ± 2.99	< 0.001	25.77 ± 1.28	21.77 ± 2.49	< 0.001	25.62 ± 1.53	22.33 ± 2.94	< 0.001	25.10 ± 2.28	20.90 ± 3.32	0.004
RV systolic myocardial velocity (cm/s)	15.86 ± 1.48	12.73 ± 2.30	< 0.001	15.97 ± 1.40	12.70 ± 2.31	< 0.001	16.00 ± 1.34	13.05 ± 2.06	< 0.001	15.10 ± 2.02	12.50 ± 1.51	0.004
RV fractional area change (%)	37.83 ± 3.13	29.53 ± 7.18	< 0.001	37.67 ± 2.93	29.44 ± 7.37	< 0.001	37.14 ± 3.18	27.42 ± 6.41	< 0.001	38.80 ± 3.22	32.30 ± 4.42	0.001
IVC diameter (mm)	12.06 ± 2.14	15.03 ± 3.18	< 0.001	11.67 ± 2.12	15.07 ± 2.91	< 0.001	12.48 ± 2.46	15.52 ± 3.38	0.002	12.00 ± 1.33	13.30 ± 2.11	0.120
SPAP	19.19 ± 1.92	30.61 ± 8.51	< 0.001	19.17 ± 1.58	30.43 ± 9.84	< 0.001	18.90 ± 2.00	31.81 ± 7.42	< 0.001	20.20 ± 2.62	27.80 ± 5.10	0.001

Data are represented as mean ± standard deviation for continuous variables

HC healthy control, *SLE* systemic lupus erythematosus, *SSc* systemic sclerosis, *RA* rheumatoid arthritis, *LVEF* left ventricular ejection fraction, *LVEDD* left ventricular end-diastolic diameter, *LVESD* left ventricular end-systolic diameter, *RVEDD* right ventricular end-diastolic diameter, *RA* right atrium, *RV* right ventricle, *TAPSE* tricuspid annular plane systolic excursion, *IVC* inferior vena cava, *SPAP* systolic pulmonary artery pressure

Figure 1:Echocardiography results

CONCLUSION: In patients with rheumatic disease, Cardiac involvement should be taken into consideration as there may be silent changes affecting the overall prognosis of patients. Transthoracic echocardiography is the best option that helps in diagnosing and making a treatment plan for cardiovascular complications in such patients.

References

1. Bakhoum SW, Ashour ZA, Mohammed MS, WadieFawzy M. Left ventricular function and left atrial volumes in rheumatoid arthritis patients: Subclinical cardiac involvement and relation to seropositivity. The Egyptian Rheumatologist. 2021 Jan 1;43(1):41-5
2. Norouzi S, Khalaji A, Namazi M, Rezaei SS, Behnoush AH, Masoumi M. Ventricular and atrial function assessment with transthoracic echocardiography in patients with rheumatic inflammatory disease. The Egyptian Heart Journal. 2022 Dec;74(1):1-6.

Assessment of ventricular interaction with Exercise cardiovascular magnetic resonance from a diagnostic or therapeutic perspective

Direct force transmission between right and left ventricles, originates from the cross-talk brought about by the interventricular septum, shared myocardial fibres, and enclosing pericardium.[1] ventricular-ventricular interaction is defined as the impact that the function, geometry, and events in one ventricle have on the other.[2] Ventricular interactions are dynamic and can be seen throughout the cardiac cycle. In mediating ventricular interactions, interventricular septum plays an important role, thus, ventricular interdependence can be easily examined by evaluating the septal motion through cardiac imaging.[1] Although the physiology of ventricular interactions between the left and right ventricle are studied, but there are less data demonstrating the imaging of ventricular-ventricular interactions.[2]Ventricular interdependence has mainly been analysed in the context of right ventricular pressure or volume overload. Increased role of ventricular interdependence in patients with heart failure is observed [1]

Claeys M etal aimed to study and compare the ventricular interaction during exercise in patients with heart failure with preserved ejection fraction (HFpEF) and patients with chronic thromboembolic pulmonary hypertension (CTEPH) with healthy volunteers. Forty-six participants were enrolled, of which 10 are included in controls, 19 patients in chronic thromboembolic pulmonary hypertension group, and 17 patients in preserved ejection fraction patients underwent cardiac magnetic resonance imaging during exercise. Ventricular interaction was evaluated through analysis of the septal curvature (SC) of a mid-ventricular short-axis slice at end-diastole, end-systole, and early-diastole (fig 2)

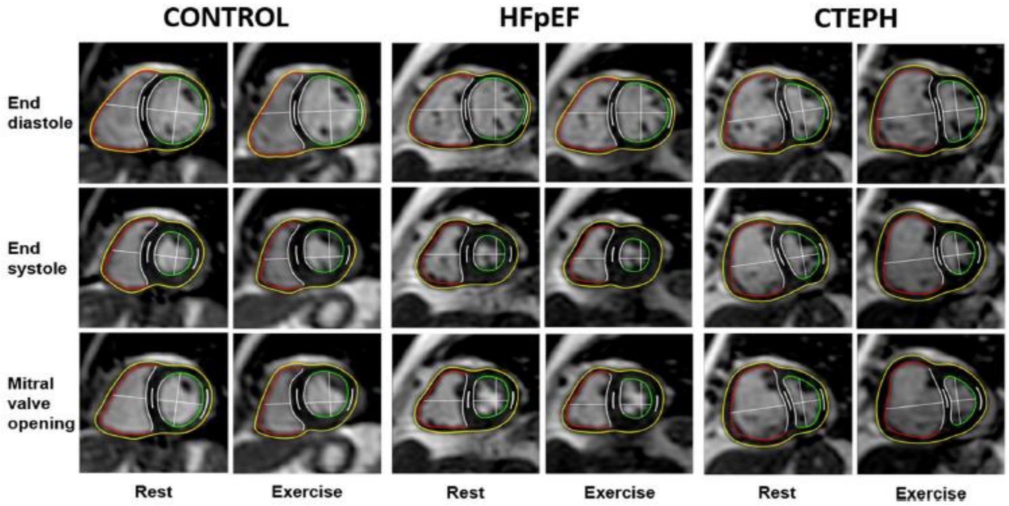

Figure 2: Illustrative mid-ventricular slice of control subject (A), HFpEF (B), and CTEPH (C) patient at ED (upper row), ES (middle row), MVO (lower row) both at rest (left column) and exercise (right column) with traced epicardial (yellow), RV endocardial (red), and LV endocardial (green) border

Exercise amplified ventricular interaction was found in patients with chronic thromboembolic pulmonary hypertension and to a lesser extent in patients with preserved ejection fraction. In early-diastole, adverse interaction was most profound and most pronounced in chronic thromboembolic pulmonary hypertension patients due to a disproportionate increase right ventricular afterload and diastolic pericardial restraint during exercise. Inspiration enhanced diastolic interdependence was found in patients with chronic thromboembolic pulmonary hypertension and preserved ejection fraction. During rest and exercise, septal curvature was strongly correlated with right ventricular volumes and pulmonary artery pressures

This study concluded that Exercise amplifies adverse right–left ventricular interactions in patients with chronic thromboembolic pulmonary hypertension and in isolated post-capillary patients with preserved ejection fraction. Analysing ventricular interaction with exercise cardiac magnetic resonance might be valuable option from a diagnostic or therapeutic perspective

References

1. Claeys M,etal. Dynamic aspects of ventricular interaction during exercise in HFpEF and in pre-capillary pulmonary hypertension. ESC Heart Failure. 2022 Nov 24
2. Friedberg MK. Imaging Right-Left Ventricular Interactions. JACC Cardiovasc Imaging. 2018 May;11(5):755-771

Impact of location and size of myocardial infarction in the morphology and function of the left atrium: Cardiovascular Magnetic Resonance Feature Tracking Study

After acute myocardial infarction, impairment of left ventricular systolic and diastolic function is observed. There is also a possibility of left atrial (LA) dysfunction. However, Impairment in the function of LA is related to myocardial fibrosis in left ventricular infarction and diastolic filling transferring stress from the left ventricle (LV) to left atrial. Function of left atrium is to regulate the left ventricular filling and to maintain the normal heart volume through the LA reservoir, conduit and booster pump function. Though, Percutaneous coronary intervention (PCI) has found to improve outcomes in MI patient, due to poor prognosis some patients still suffer adverse cardiovascular events, such as arrhythmias and heart failure. After PCI, during the period of recovery from myocardial. infarction, the infarct area gradually decreases, producing a degree of LA and LV recovery. Later, Necrotic tissue begins to get absorbed after 1–2 weeks of acute MI and fibrosis occurs, forming a scar within 6–8 weeks. After healing from the injury, final infarct size represents replacement fibrosis.

This retrospective study aimed to investigate the effect of location and size of previous myocardial infarction (MI) on LA function using Cardiovascular magnetic resonance feature tracking. 129 participants were enrolled, where 42 patients were already diagnosed with anterior MI and 42 as non-anterior MI and 47 as healthy controls. Late-gadolinium enhancement (LGE) imaging was used to locate the infarct and its size and were assigned and quantified. Function of LA was evaluated using CMR-FT in 2- and 4-chamber cine images, including LA reservoir, conduit and booster pump function.

Result of this study has found that Anterior MI patients had impaired LA reservoir function, conduit function and booster pump function when compared with controls. (fig 3) At the same time, Non-anterior MI patients had impaired LA strain but preserved LAEFs. No significant difference in the LA morphology and function between the anterior and non-anterior wall groups were observed.

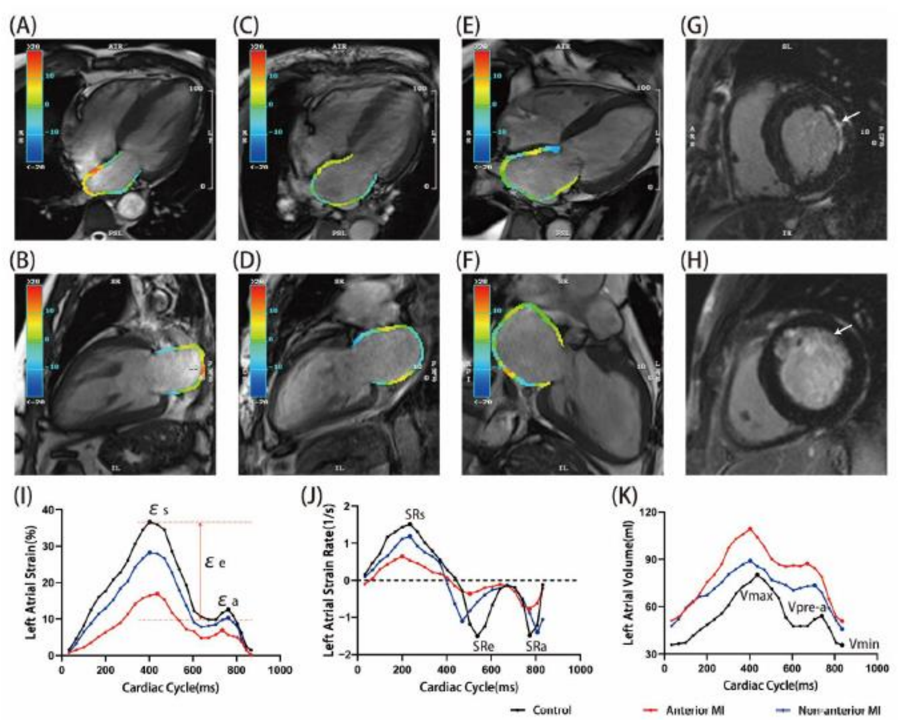

Fig:3 Typical examples of control ((**A**,**B**) and black line), non-anterior MI ((**C**,**D**,**G**) and blue line) and anterior MI ((**E**,**F**,**H**) and red line). (**A**,**C**,**E**) 4-chamber view of LA systolic phase, (**B**,**D**,**F**) 2-chamber view of LA systolic phase (the LA color varies strain parameters). (**G**) = lateral MI, (**H**) =anterior MI. (**I**–**K**) Curves showing LA strain, strain rate and volume in 25 phases, respectively.

According to the Stratification analysis, LA volumes and LAEFs were unchanged in patients with MI size _< 15% compared with controls. Increased LAVI pre-a, LAVI min and reduced LA total emptying fraction, and LAAEF were found in patients with MI size > 15% compared with the MI size _< 15% group.

Conclusion: Location of myocardial infarction doesn't affect the morphology and function of the left atrium. Patients having MI size > 15% shows more pronounced post-infarction LA remodelling and dysfunction compared to patients with MI size _< 15%

Reference: Zhang H, Tian Z, Huo H, Li H, Liu H, Hou Y, Dai X, Liu T, Jin S. Effect of Infarct Location and Size on Left Atrial Function: A Cardiovascular Magnetic Resonance Feature Tracking Study. Journal of Clinical Medicine. 2022 Nov 24;11(23):6938.

Consecutive spontaneous bilateral Carotid Artery Dissection requiring an intracranial stent with an interval of 4 years between the first and second carotid artery stenting: A CASE REPORT

Intimal defect and penetration of the blood flow between Extracranial internal carotid artery dissection (CAD) leads to separation of the arterial wall layers. Spontaneous and bilateral cases of CAD are relatively rare. Antiplatelet agents or anticoagulants are the treatment options that results in the healing of the dissected artery. However, some cases may require urgent carotid artery stenting (CAS) if the patient is refractory to medical therapy or hemodynamic infarction is imminent. In case of expansion of CAD to the petrous portion of internal carotid artery (ICA), carotid stent won't be able cover the length of the CAD.

However, Takano Y describes a case report of spontaneous bilateral CADs that occurred consecutively with a 4-year interval requiring an urgent CAS with carotid and intracranial stents.

A 54-year-old man with pre-existing hyperlipidaemic condition was presented with the chief complaint of transient weakness in the right upper and lower limbs and dysarthria. During admission, patient had almost no neurological deficit. Magnetic resonance imaging (MRI)-diffusion-weighted imaging (DWI) revealed no cerebral infarction while magnetic resonance angiography (MRA) showed severe stenosis of the left ICA and dissection of the ICA was diagnosed according to digital subtraction angiography (fig 4).

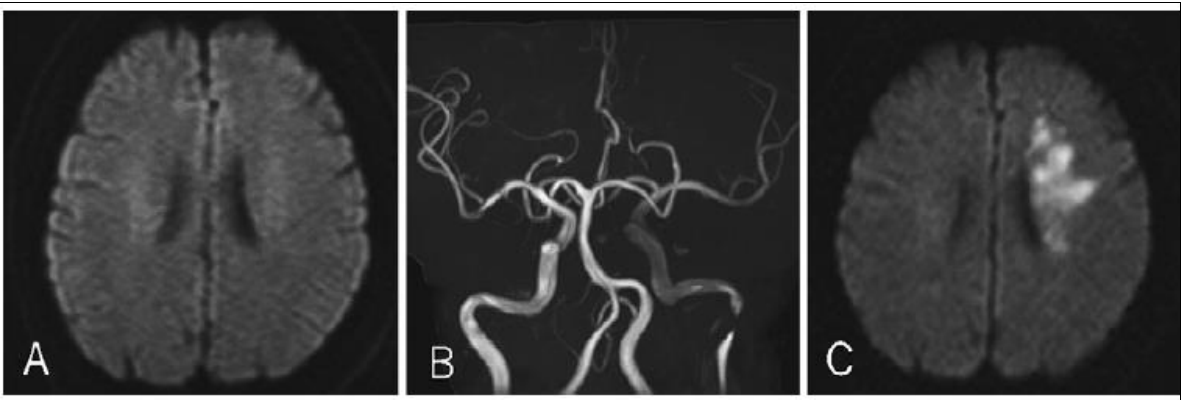

Fig 4: Initial findings before the first CAS treatment. Magnetic resonance imaging (MRI)-diffusion-weighted imaging (DWI) showed no cerebral infarction (A). Magnetic resonance angiography showed severe stenosis of the left internal carotid artery (B). MRI-DWI on the third day showed enlarged infarct centered on the watershed area

On 3rd day patient underwent CAS with carotid and intracranial stents for the left CAD due to exacerbation of symptoms under antithrombotic therapy and new stroke on magnetic resonance imaging (MRI). Patient got recovered and was discharged. However, After 4 years of the initial treatment, patient was re-admitted due to sudden headache, photophobia, and transient weakness of the left lower limb and was diagnosed with CAD on the contralateral side. Patient underwent CAS with carotid and intracranial stents due to progressive neurological deterioration under antithrombotic therapy. Patient responded to therapy and was clinically stable without any new infarctions on a follow-up MRI. Later, patient was discharged without neurological deficit

CONCLUSION: This case reported concluded that early revascularization with immediate stenting with carotid and intracranial stents in carotid artery dissection contributes to the prevention of extensive neurological damage resulting in a favourable outcome