Acta Scientific Clinical Case Reports

Volume 2 Issue 12 December 2021

Mini Review

Diagnostic, Prognostic and Therapeutic Role of Echocardiography in Young Patients with Arterial Hypertension

Disharee Das[1] and Arnab Banerjee[2]*

[1]Associate Consultant, Cradle Fertility Centre, Joka, Kolkata, India

2Associate Consultant, Interventional Cardiology, Apollo Multispeciality Hospitals, Kolkata, India

***Corresponding Author:** Arnab Banerjee, Associate Consultant, Interventional Cardiology, Apollo Multispeciality Hospitals, Kolkata, India.

Received: October 26, 2021

Published: November 30, 2021

Abstract

Hypertension in young patients is diagnosed quite frequently. In most cases, a definite cause is not found. Various conditions can be the cause of secondary hypertension in young patients. Echocardiography is currently not a necessary modality of investigation for diagnosis of hypertension in young patients. But this non-invasive and easily available mode of imaging holds promise in the future, both in terms of diagnosis, and therapeutic and prognostic evaluation of patients with hypertension. Newer modalities of echocardiography can help in the diagnosis of end-organ damage much earlier than previously used techniques. This article explores the possibilities of echocardiogram in the management of hypertension in young patients.

Keywords: Hypertension; Echocardiography; Echocardiogram

Introduction

At a time when a deadly pandemic is scourging the human race like nothing else in the last 100 years, it is difficult to concentrate upon anything else. Still, we must never forget about our duties and responsibilities. We must not forget to care for the patients who are not suffering from corona virus disease but need our care nevertheless. It is by winning these small battles that we will ultimately win the bigger war.

Hypertension is one of the most common long-term diseases that afflict human beings. More than 1 billion people suffer from hypertension worldwide of which about 80% are from the developing countries. It is a major risk factor for cardiovascular disease including myocardial infarction, heart failure, atrial fibrillation (AF), aortic dissection, peripheral arterial disease and stroke and cognitive decline. In recent times it has been seen that more and more young people below the age of 30 are being diagnosed with hypertension. Echocardiography is not the primary mode of investigation in hypertension and is mainly used as an adjunctive for assessing end-organ damage [1]. We shall be reviewing the various utilities of Echocardiography in young patients with hypertension.

Causes of hypertension in the young

Even in young patients the most common cause of hypertension is primary or idiopathic. Primary aldosteronism, pheochromocytoma, Cushing syndrome, renovascular disease, hyperthyroidism, coarctation of the aorta, Takayasu arteritis and drug-induced hypertension make up most of the secondary causes. Apart from that, in pregnant mothers, pre-eclampsia and eclampsia are important causes of hypertension. A detailed physical examination followed by blood and urine analysis and some imaging studies will be necessary in most cases.

Role of echocardiography

Diagnosis, classification and prognosis

Apart from a few causes of secondary hypertension like coarctation of aorta (CoA), echocardiography is usually not required for the diagnosis of hypertension. But after the diagnosis is confirmed,

it is usually prudent to do a baseline echocardiography to assess the extent of end-organ damage, the burden of uncontrolled hypertension and the severity of the disease [2].

Echocardiography is recommended in hypertension when a structural or ischaemic heart disease is suspected, or the patient is suffering from heart failure or a refining of the cardiovascular risk is required.

The parameters that are needed to be seen during an echocardiographic study along with their normal values are enumerated in table 1. Speckle tracking echocardiography with assessment of LV global longitudinal strain (LVGLS), radial strain and circumferential strain is the new hot cake in the field of non-invasive cardiology. The importance of LVGLS lies in the fact that it can diagnose subclinical LV dysfunction much before it is manifested in other parameters such as reduced LV Ejection fraction (LVEF) and LV dilatation.

Hypertensive heart disease has been classified by the echocardiographic findings. It ranges from mild asymptomatic disease to heart failure (Table 2).

Parameter	Normal value	Remarks/Prognostic Implications
Left ventricular hypertrophy (LVH): concentric or eccentric	No Hypertrophy	LVH denotes poorly controlled hypertension and increased risk of morbidity and mortality [3]
LV mass and geometry: concentric or eccentric hypertrophy, 3D echocardiography [4]	No hypertrophy	Increased LV mass and hypertrophy denotes poorly controlled hypertension and increased risk of morbidity and mortality; eccentric hypertrophy may be due to dilatation as a sequelae of Ischaemic Heart Disease (IHD)
LV systolic function; LV Ejection Fraction (EF) (Simpson's biplane method)	>55%	Low ejection fraction may imply sequelae of IHD and/or Heart Failure with Reduced Ejection Fraction (HFrEF) and portends poor prognosis [5]
LV Global Longitudinal Strain (LVGLS); Speckle tracking Echocardiography; Radial strain, circumferential strain	LVGLS: -18% to -22%; Can detect subclinical LV dysfunction not detected by EF [6]	Reduced LVGLS or circumferential strain may imply sequelae of IHD and/or Heart Failure with Reduced Ejection Fraction (HFrEF) and portends poor prognosis [7]
Regional Wall Motion Abnormality (RWMA)	No RWMA	Denotes IHD and portends poor prognosis, urgent intervention is required
Mitral E velocity, Deceleration time, A velocity	E/A>1	These parameters can classify the degrees of diastolic dysfunction and help diagnose Heart Failure with preserved Ejection Fraction (HFpEF) [8]
Tissue Doppler: Mitral Annular e prime velocity	Lateral >10cm/s Medial >8cm/s [9]	These parameters can classify the degrees of diastolic dysfunction and help diagnose Heart Failure with preserved Ejection Fraction (HFpEF)
E/e prime	Less than 8 [10]	>15 denotes severe diastolic dysfunction
LA Size	<4 cm in males <3.8 cm in females	Increased LA size denotes uncontrolled hypertension, increased LV End Diastolic Pressure (LVEDP), a/w metabolic syndrome and is a harbinger of poor prognosis [11]
LA volume	Less than 28 ml/m^2	Volumes more than 34 ml/m^2 portends poor prognosis and increased risk of heart failure, AF, stroke and death [12]
Pulmonary Artery Systolic Pressure (PASP)	Less than 30 mmHg at rest, less than 40 during exercise.	Increased PASP may indicate increased LA pressure from increased LVEDP and LV failure [13].

Table 1: Echocardiographic assessment of hypertension in young.

Class I:	Subclinical diastolic dysfunction by echocardiography without left ventricular hypertrophy (LVH) Asymptomatic patients with abnormal left ventricular relaxation/stiffness by Doppler echocardiography, a common finding in hypertensive individuals >65 years
Class II: IIA: IIB:	Left ventricular hypertrophy (LVH) with normal functional capacity (NYHA Class I) with abnormal functional capacity (NYHA Class ≥ II)
Class III:	Heart failure with preserved ejection fraction (HFpEF)
Class IV:	Heart failure with reduced ejection fraction (HFrEF)

Table 2: Classification of Hypertensive Heart Disease [14].

Therapeutic implications

Echocardiography plays and important part in the therapeutics of hypertension. Coarctation of Aorta needs a particular line of management, either surgical or catheter-based correction of the defect. In other cases of hypertension, echocardiography will guide to a more tailored management.

LVH denotes poor control of hypertension and warrants stricter control of blood pressure. Low ejection fraction or diastolic dysfunction [15] with symptoms and signs of heart failure will require treatment of fluid overload, and other heart failure management along with control of hypertension [16]. RWMA indicates ischaemic heart disease and may need angiography with subsequent revascularisation if that particular myocardial segment is viable. Very poor LVEF may require tapering of the blood pressure medications in view of the frequently lowered BP in this subset of patients. Increased LA size and volume or decreased LA function signals to poor hypertensive control and/or LV dysfunction leading to increased LVEDP, which will again warrant a thorough assessment and more stringent control of hypertension. Lifestyle modifications are necessary and smoking cessation and strict glycaemic control in hypertensive patients are of paramount importance.

Conclusion

Echocardiography is currently not a dominant diagnostic modality in young patients with hypertension. But prognostically and therapeutically it plays a major role, particularly when hypertension is associated with structural or ischaemic heart disease. Various parameters in the echocardiographic assessment of a hypertensive heart signifies increased risk of major cardiovascular adverse events (MACE) in these patients and leads to the possibility of better blood pressure control and reduction in subsequent mortality and morbidity. With rapid development of echocardiographic techniques, the role of this non-invasive radiation free modality in the diagnosis, treatment and prognostic classification of hypertension is expected to increase.

Bibliography

1. Saito M., *et al.* "Prognostic implications of LV strain risk score in asymptomatic patients with hypertensive heart disease". *JACC Cardiovasc Imaging* 9.8 (2016): 911-921.
2. Koren MJ., *et al.* "Relation of left ventricular mass and geometry to morbidity and mortality in uncomplicated essential hypertension". *Annals of Internal Medicine* 114.5 (1991): 345-352.
3. Lang RM., *et al.* Chamber Quantification Writing G, American Society of Echocardiography's G, Standards C, European Association of E. "Recommendations for chamber quantification: A report from the American Society of Echocardiography's guidelines and standards committee and the chamber quantification writing group, developed in conjunction with the European association of echocardiography, a branch of the European society of cardiology". *The Journal of the American Society of Echocardiography* 18 (2005): 1440-1463.
4. Jung HO., *et al.* "Evaluation of midwall systolic function in left ventricular hypertrophy: a comparison of 3-dimensional versus 2-dimensional echocardiographic indices". *The Journal of the American Society of Echocardiography* 2006 19 (2006): 802-810.
5. Takeuchi M., *et al.* "Measurement of left ventricular mass by real-time three-dimensional echocardiography: validation against magnetic resonance and comparison with two-dimensional and m-mode measurements". *The Journal of the American Society of Echocardiography* 21 (2008): 1001-1005.

6. Oxborough D., *et al.* "Interpretation of two-dimensional and tissue doppler-derived strain (epsilon) and strain rate data: is there a need to normalize for individual variability in left ventricular morphology?" *European Journal of Echocardiography* 10 (2009): 677-682.

7. Kang SJ., *et al.* "Longitudinal strain and torsion assessed by two-dimensional speckle tracking correlate with the serum level of tissue inhibitor of matrix metalloproteinase-1, a marker of myocardial fibrosis, in patients with hypertension". *The Journal of the American Society of Echocardiography* 21 (2008): 907-911.

8. Sohn DW., *et al.* "Assessment of mitral annulus velocity by doppler tissue imaging in the evaluation of left ventricular diastolic function". *Journal of the American College of Cardiology* 30 (1997): 474-480.

9. Ommen SR., *et al.* "Clinical utility of Doppler echocardiography and tissue Doppler imaging in the estimation of left ventricular filling pressures: a comparative simultaneous doppler-catheterization study". *Circulation* 102 (2000): 1788-1794.

10. Nagueh SF., *et al.* "Doppler estimation of left ventricular filling pressure in sinus tachycardia. A new application of tissue doppler imaging". *Circulation* 98 (1998): 1644-1650.

11. Cuspidi C., *et al.* "Prevalence and correlates of left atrial enlargement in essential hypertension: Role of ventricular geometry and the metabolic syndrome: the evaluation of target organ damage in hypertension study". *Journal of Hypertension* 23 (2005): 875-882.

12. Tsang TS., *et al.* "Left atrial volume: important risk marker of incident atrial fibrillation in 1655 older men and women". *Mayo Clinic Proceedings* 76 (2001): 467-475.

13. Kitabatake A., *et al.* "Noninvasive evaluation of pulmonary hypertension by a pulsed Doppler technique". *Circulation* 68 (1983): 302-309.

14. Mann DL., *et al.* "Braunwald's heart disease: A textbook of cardiovascular medicine (Eleventh edition)". Philadelphia, PA: Elsevier/Saunders (2009).

15. Hogg K., *et al.* "Heart failure with preserved left ventricular systolic function epidemiology, clinical characteristics, and prognosis". *Journal of the American College of Cardiology* 43.3 (2004): 317-327.

16. Pierdomenico SD., *et al.* "Regression of echocardiographic left ventricular hypertrophy after 2 years of therapy reduces cardiovascular risk in patients with essential hypertension". *American Journal of Hypertension* 21.4 (2008): 464-470.

Volume 2 Issue 12 December 2021