

Diastolic Function Assessment by Echocardiography at Dhulikhel Hospital

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ABSTRACT

Introduction

Diastolic dysfunction (DD) is understood as impaired Left ventricular relaxation. Echocardiography is the key in diagnosis. In 2016 recommendation by American Society of Echocardiography (ASE) and the European Association of Cardiovascular Imaging (EACVI) was updated. In our country we do not have a general consensus. Diastolic dysfunction is reported on the basis of E/A ratio of mitral flow, that has the chance of missing a lot of patients with pseudo-normalization. This study carried out to look at importance of evaluation of other parameters to diagnose a patient with diastolic dysfunction.

Methods

It is a retrospective cross-sectional descriptive study. Echocardiography report from the year 2018 and 2019 was collected from database and the patients with diagnosis of Diastolic dysfunction were selected. Patient profile and the echocardiographic parameter were recorded. Echocardiography was reported according to 2016 ASE and EACVI update.

Results

Total of 1982 patients selected for analysis. E/A < 0.8 was seen in 702 (35.4%) patients, E/A 0.8-2.0 was seen in 1136 (57.3%) patients and E/A > 2.0 was found in 144 (7.3%) patients. The most common finding being E/e' 1470 (74.2%) of patients followed by TR velocity > 2.8m/s 1422 (71.7%), Septal e' velocity < 7 cm/s or Lateral e' velocity < 10 cm/s 1334 (67.3%) and LA area > 20 cm² 1286 (64.8%) respectively.

Conclusions

Diastolic dysfunction should be evaluated using all the parameters recommended by 2016 ASE and EACVI guideline update. Measurement of only E/A ratio has a chance of missing large number of patient with DD.

Keywords: Diastolic dysfunction; echocardiographic assessment, E/A ratio, E/e' average, e' velocity.

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INTRODUCTION

Heart failure (HF) is a major worldwide public health problem.¹ Diastolic dysfunction (DD) is understood as impaired LV relaxation with elevated filling pressures and can be assessed noninvasively by Echocardiography.^{2,3} 2009 AHA guideline on evaluation of DD required assessment of many parameters.⁴ Therefore in 2016 new recommendation by American Society of Echocardiography (ASE) and the European Association of Cardiovascular Imaging (EACVI) was updated which suggests measuring average E/e' (ratio of MV E Vmax/ tissue Doppler early myocardial relaxation velocity) > 14 , Septal e' velocity < 7 cm/s or Lateral e' velocity < 10 cm/s, TR(tricuspid regurgitation) velocity > 2.8 m/s, LA(left Atrium) volume index > 34 ml/m². If more than 50% finding than it is considered as DD.⁵

In Contrast, in our country, most DD are diagnosed solely based on E/A ratio, which may lead to missing patients with pseudo-normalization. This study highlights the importance of assessing additional parameters.

METHODS

It is a retrospective cross-sectional descriptive study. Echocardiography report from the year 2018 and 2019 was collected from database and the patients with diagnosis of DD were included. Along with DD if any patient had reduced EF $< 50\%$, Mitral Valve disease or atrial fibrillation then they were excluded from the study. Patient profile and the echocardiographic parameter were recorded. Out of total of 5841 records of echocardiographic report DD was

reported in 2742. When records with findings of LVEF $< 50\%$, Mitral Valve disease and AF were excluded 2362 remained for review. Out of these 380 reports had some missing data, so were also excluded. Total of 1982 reports were selected for analysis. Instead of LA volume index, LA area of more than 20 cm² was considered as enlarged LA.⁶ Echocardiography was done using Phillips EPIQ 7 machine available at Dhulikhel hospital, and by either of two cardiologist and according to the 2016 new recommendation by ASE and the EACVI update.⁵ Record of year 2018 and 2019 was selected because data was available in database. Year 2020 and 2021 was affected by Covid 19 so there was inconsistency in echocardiography indications and reporting. Record of year 2022 was excluded because there were more doctors performing echocardiography, chance of uniformity was less.

RESULTS

Out of total of 1982 patients the maximum number of patients were in the age group 60-69 years as shown in table 1.0. Hypertensive patients were 1342 (67.7 %), Diabetes was seen in 854 (43.1%) patients. E/A < 0.8 was seen in 702(35.4%) patients, E/A 0.8- 2.0 was seen in 1136 (57.3%) patients and E/A > 2.0 was found in 144(7.3%) patients. Distribution of patients with other echocardiographic parameters are given in table 4.0. The most common finding being E/e' 1470 (74.2%) of patients followed by TR velocity > 2.8 m/s 1422 (71.7%), Septal e' velocity < 7 cm/s or Lateral e' velocity < 10 cm/s 1334 (67.3%) and LA area > 20 cm² 1286 (64.8%) respectively.

Table 1. Distribution according to age and Sex.

Age (years)	Male	Female	Total
40-49	93(4.7%)	94(4.7%)	187 (9.4%)
50-59	332 (16.8%)	304(15.3%)	636 (32.1%)
60-69	348 (17.6%)	370 (18.7%)	718 (36.2%)
≥ 70	228 (11.5%)	213 (10.7%)	441 (22.3%)

Table 2. Distribution of patient according to Hypertension and Diabetes Mellitus.	
HTN	1342 (67.7%)
DM	854 (43.1%)
Both HTN and DM	691(34.9%)

Table 3. Distribution of patient according to E/A ratio.	
< 0.8	702 (35.4%)
1.8 – 2.0	1136 (57.3%)
>2.0	144 (7.3%)

Table 4. Distribution of patient according to different echocardiographic parameters.	
Average E/e' > 14	1470 (74.2%)
Septal e' < 7 cm /s or lateral e' <10 cm/s	1334(67.3%)
TR velocity > 2.8 m/s.	1422(71.7%)
LA area > 20 cm ²	1286 (64.8%)

DISCUSSION

This study evaluated DD using 2016 recommendations of ASE and EACVI and found that almost 33.9 % (1982 out of 5841) patient had DD with preserved systolic function. In one of the study done in Nepal out of total echocardiography performed 31.8 % had DD which is similar to our study though the study does not mention whether 2016 guideline was used or not.⁷

Sanchis et al. did DD assessment initially with 2009 recommendation followed by 2016 recommendation and compared finding with brain natriuretic(BNP) levels, heart failure diagnosis and cardiovascular outcome and concluded that 2016 guidelines were more accurate.⁸ Similarly Lancellotti P et al. did Euro-Filling study and concluded that 2016

recommendations are fairly reliable and clinically useful and superior to 2009 recommendation for estimating left ventricular end diastolic pressure.⁹ Arno A et al. found that ASE/EACVI recommendation for DD had an accuracy of 73% to correlate with pulmonary capillary wedge pressure (PCWP).¹⁰ We applied the 2016 guideline and parameters were measured in standard protocol.

Alena Shantshila et al did E-ECHOES study and compared ethnicity and DD in subjects of African-Caribbean and South Asian origins in England and found that south Asians had higher prevalence of DD. South Asian ethnicity was associated with higher LA diameter index, and higher E/e' ratio. They studied prevalence of DD in hypertensive patient and found it be 73%.¹¹ This study found E/e' ratio to be the most common finding, though LA area was less common than other echocardiographic parameter. Our study did not look into prevalence of DD in hypertensive patient but we found that among those who had DD 67.7% were hypertensive.

In a survey on evaluation of left ventricular DD done by Marta Sitges et al. who collected information from 93 different centers from Europe found that in a patient with preserved EF most centers 84% reported on DD routinely but only 53 centers described mitral annulus e' and E/e' ratio.¹² This study found that 380 out of 2362 (16.1%) had missing data on those who were reported to have DD. We had described DD on 2016 guideline parameters on 83.9% of patients. According to the survey different methods were applied to report LA size. Diameter or area was described in 24% of centers and majority of centers (84%) reported indexed size. In our study we reported LA size as area but it was non-indexed.

Mukesh laddha et did an echocardiographic

assessment of cardiac dysfunction in end stage renal disease patient in India and found DD denoted by E/A ratio less than 0.75 or more than 1.8 in 61.4% of patients.¹³ In our study when we looked at patient with diastolic dysfunction E/A ratio less than 0.8 was found in 35.4% of patients and E/A ratio more than or equal to 2 in 7.3% of patients. The difference is probably due specific group of patients in their study and also slight variation in criteria used.

Two studies on diastolic dysfunction from Nepal was found. One by Laudari S et al on diastolic dysfunction on hypertensive patients using 2009 guideline and the other by Adhikaree A. et al on echocardiographic assessment of DD in patients with atrial Fibrillation so we were not able make comparison with this study.^{14,15}

Most of the echocardiography report from our country where DD is mentioned has descriptions of E/A ratio and LA size (mostly reported as non-indexed diameter). In our study we found that out of all the patient who met 2016 recommendation criteria for DD only 702 (35.4%) had E/A ratio less than 0.8. So if DD is reported only based on E/A ratio then there is chance of missing almost 65% of cases who may have pseudo-normalization. If LA size is

also included then there is less chance of missing pseudo-normalization as we found 64.8% had increase in LA size. According to Henein MY et al a simple observation of E/A ratio and LA size can give rough impression of DD which is similar to our finding, but however other parameters should be looked into.¹⁶

Limitation

In this study we could not get data on those patient with indeterminate finding i.e. those with fulfilling two criteria out of four according to 2016 ASE and EACVI guideline. Further evaluation is required for these group of patients.

CONCLUSIONS

In conclusion this study emphasizes the importance of adopting comprehensive guidelines such as the 2016 ASE and EACVI recommendations and considering multiple echocardiographic parameters including E/e' ratio and LA size, for an accurate diagnosis of diastolic dysfunction. Relying solely on the E/A ratio may result in under diagnosis of DD cases with pseudo-normalization. Standardized reporting practices are essential for the assessment and management of DD in clinical setting.

Conflict of interest: None

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