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ORIGINAL ARTICLE

M-MODE IN GRADE 3 DYSPNEIC PATIENTS ASSESSMENT

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ABSTRACT

Introduction/Objective Respiratory distress is a serious condition that can develop in the critically ill or those who have significant injuries. It is often fatal, and the risk of fatality increases with age and the severity of the illness. Therefore, an early diagnosis of the conditions that cause respiratory distress is an important factor. However, it is very challenging to make an accurate diagnosis in this domain. To clinically achieve higher accuracy during the diagnostic process, our study uses motion-mode (M-MODE) echo parameters. It aims to evaluate the accuracy of the M-MODE as a rapid assessment tool for grade 3 dyspneic patients in the Emergency Department when the physician is in a dilemma regarding the causes of respiratory distress.

Methods This is a retrospective observational study. The following parameters were taken into consideration: the mitral annular plane systolic excursion (MAPSE), the tricuspid annular plane systolic excursion (TAPSE), and the E-Point to Septal Separation (EPSS) for the admitted patients. The sensitivity, specificity, and accuracy of the M-mode model were analyzed, implementing the final diagnosis as the control. For analysis, this study considered 75 patients. The M-Mode parameter, along with the emergency physician clinical gestalt (M-Mode model), was compared with the final diagnosis at discharge or death of the patient.

Results For all patients, the mean values calculated for MAPSE, TAPSE, and EPSS were 13.463mm, 15.132 mm, and 9.4685 mm. The M-Mode model showed a sensitivity and specificity of 71.43 and 88.46%, respectively. The positive predictive value and negative predictive value were 92.11 and 62.16, respectively. The accuracy of the M-Mode model was 79.95%.

Conclusion The M-Mode Model can be utilized as a rapid assessment tool in the Emergency Department to initiate appropriate interventions in situations when a physician is in a dilemma regarding the cause of respiratory distress.

Keywords: M-mode echocardiography, mitral annular plane systolic excursion (MAPSE), tricuspid annular plane systolic excursion (TAPSE), E-Point to Septal Separation (EPSS).

INTRODUCTION

Dyspnea is the subjective experience of feeling unable to breathe comfortably, which may involve a strong desire for oxygen, a sensation of exertion when breathing, or a feeling of tightness in the chest [1]. Causes of dyspnea are various and can involve more than just the cardiovascular and respiratory systems [2,3]. Acute dyspnea is one of the main reasons for admission to the Emergency Department (ED). Physicians working in the ED often need to make a rapid diagnosis and devise a treatment plan based on limited clinical information [4] (**Figure 1**). Thus, the emergency physician (EP) is often forced to initiate treatment before the aetiology of the patient's respiratory distress can be clearly defined [5]. In diagnosing dyspnea, echocardiography has proven itself to be most helpful [6]. Echocardiography is increasingly recommended for the diagnosis and assessment of patients with severe cardiac disease, including heart failure (HF), where it provides information about myocardial structure, function, and valvular disease [7]. It can also identify causes of hemodynamic instability and quickly guide therapy. Its advantages are that it is a non-invasive risk-free method, capable of being performed serially, and in real-time [8].

For the diagnosis of heart disease, left ventricular and right ventricular function measurements are important parameters. Left ventricular (LV) longitudinal shortening plays an important role in cardiac pump function and can be evaluated by measuring the long axis M-mode-derived mitral annular plane systolic excursion (MAPSE) [9], also referred to as mitral annulus excursion (MAE). Other LV function parameters, such as EPSS [10], LV fractional shortening (FS), and transmitral propagation velocity can also be measured.

The right ventricular (RV) parameters that are measured are the tricuspid annular plane systolic excursion (TAPSE) [11,12], the subcostal echocardiographic assessment of tricuspid annulus kick (SEATAK) [13,14], RV outflow tract (RVOT) [15], FS motion of the ventricular septum (VS), RV wall thickness, and RVOT obstruction.

Different echocardiography modes can be used to analyse those parameters: standard two-dimensional echocardiography, M-mode echocardiography, A-mode echocardiography, B-mode echocardiography, and Doppler echocardiography [16-18]. While the M-mode denotes motion-based ultrasonographic imaging, the A-mode represents amplitude-based imaging, the B-mode signifies brightness-based imaging, and Doppler echocardiography permits evaluation of blood flow velocity characteristics within the heart and great vessels. The M-mode echocardiography has a sharp axial resolution and a high sampling frequency compared to the slower 2-D scanning rate, which allows small, rapidly moving structures to be discerned and accurately correlated with time relative to the echocardiography.

OBJECTIVE

Our study aims to determine the usefulness of the M-MODE as a rapid assessment tool in the ED for assessing grade 3 dyspneic patients to initiate appropriate treatment in situations when the physician has a dilemma regarding the cause of respiratory distress.

MATERIALS AND METHODS

This observational study was conducted in the ED of a tertiary care centre from January 2019 to December 2019. Patients between 18 and 85 years of age, presenting with Medical Research Council (MRC) grade 3 dyspnea and a respiratory rate (RR) of more than 24 bpm, were included in the study. Patients who experienced psychogenic hyperventilation, co-morbidities of congenital heart disease or valvular heart disease, and traumatic causes of respiratory distress were excluded from the study. The primary treating doctor was in charge of gathering the data regarding the final diagnosis from the discharge summary.

The patients were evaluated in the Emergency Room by the attending emergency physician relying on the M-mode model, and the findings were tabulated on an Excel sheet.

The data for initial assessment and M-Mode parameters viz. MAPSE, TAPSE and EPSS were obtained from the initial assessment sheet and 2D Echo was performed at the bedside in the Emergency Department respectively. The cumulative initial impression by the emergency physician, taking into account the clinical findings and the M-mode parameters, was tabulated as the M-mode model impression.

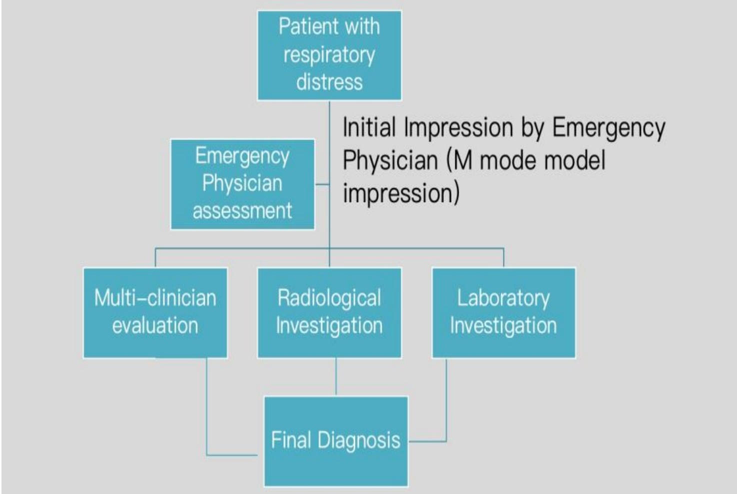

Figure 1 The study flow framework

In this study, the MAPSE and EPSS measurements were taken from the left ventricular systolic function, and the TAPSE measurement was taken from the right ventricular systolic function, which is explained in the below subsection.

MAPSE

Mitral Annular Plane Systolic Excursion (MAPSE) is a reliable marker for LV systolic function. Although MAPSE has been used as a prognostic factor for major cardiac events in patients, its application was quickly eclipsed by the introduction of Doppler imaging. MAPSE can be useful in urgent clinical decision-making settings for critical care and anaesthesia because of its limited dependence on image quality, easy acquisition, and accuracy in the prediction of LV function. Here, MAPSE is obtained by using the standard apical 4-chamber view transthoracic echocardiography (TTE). Generally, the MAPSE value is 10mm, which indicates a preserved left ventricular ejection fraction.

TAPSE

Tricuspid Annular Plane Systolic Excursion (TAPSE) is commonly recommended for estimating the right ventricular systolic function. TAPSE is simple to perform, has reproducible results, and is less dependent on optimal image quality than other measurements. It does not require complex calculations. TAPSE is measured using M-mode echocardiography in the apical four-chamber view to generate an image. The TAPSE value of less than 16mm is considered normal.

EPSS

In echocardiography, the mitral valve E-point to septal separation (EPSS) is a straightforward approach that roughly corresponds to the status of the left ventricular (LV) function. When the left ventricle relaxes during diastole, blood rushes through the mitral valve, swinging open the anterior mitral valve leaflet toward the inter-ventricular septum. In the early stages of diastolic filling, the anterior mitral valve reaches a point of maximum excursion and, as such, comes closest to the ventricular septum (E-point). The distance in space separating the anterior mitral valve leaflet from the septal wall is referred to as the E-point septal separation or EPSS. EPSS can be thought of most simply as an estimation of left ventricle contractility and ejection fraction.

STATISTICAL ANALYSIS (table 1)

The data was collected on an Excel spreadsheet. The statistical analysis was performed using IBM SPSS software, version 23.0. To describe the data descriptive statistics frequency analysis, the percentage analysis was used for categorical variables, and the mean and S.D. were used for continuous variables. The Receiver Operator Characteristic (ROC) curve analysis was used to find the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) in comparison with the M-Mode model and final diagnosis. There was no loss of follow-up for any of the patients that were included.

RESULTS

For analysis, this study considered 75 patients, 46 of which were male and 29 female. The M-Mode model identified 38 patients with cardiogenic and 37 patients with non-cardiogenic causes of respiratory distress, whereas the final diagnosis declared 49 patients with cardiogenic and 26 with non-cardiogenic causes of respiratory distress. In this study, all the subjects were followed up until the time of discharge or death to obtain the final diagnosis.

Table 1 presents the statistical analysis of M-mode parameters regarding age, encompassing mean, median, mode, standard deviation (SD), range, minimum, and maximum values. The age range considered is between 18 and 75 years. The calculated mean values for MAPSE, TAPSE, and EPSS are 13.463 mm, 15.132 mm, and 9.4685 mm, respectively. TAPSE exhibits a range of 18.8, MAPSE of 15.6, and EPSS of 30.56. The maximum age recorded is 85, corresponding to TAPSE, MAPSE, and EPSS values of 20.0, 17.0, and 32.20, respectively. On the other end, the minimum age is 18, associated with TAPSE, MAPSE, and EPSS measurements of 1.2, 1.4, and 1.64, respectively.

Table 1 Statistical analysis

Statistical Parameters		Age	TAPSE	MAPSE	EPSS
N	Valid	75	75	75	75
Mean		53	15.132	12.023	9.4685
Median		55	16.000	13.000	6.0000
Mode		55	18.0	14.0	6.00
SD		19	4.3035	3.7777	7.04289
Range		67	18.8	15.6	30.56
Minimum		18	1.2	1.4	1.64
Maximum		85	20.0	17.0	32.20

M-mode parameters

Table 2 presents M-mode parameters in correlation with the cardiac and non-cardiac causes of dyspnea.

Table 2 M-mode parameters in correlation with the cardiac and non-cardiac causes of dyspnea

TAPSE	MAPSE	EPSS	Clinical Impression	M Mode diagnosis	Final Diagnosis
7	7.4	6.9	Cardiogenic	Cardiogenic	Cardiogenic
7	14	7	Cardiogenic	Cardiogenic	Cardiogenic
15	12	11.3	Cardiogenic	Cardiogenic	Cardiogenic
9	14	7	Cardiogenic	Cardiogenic	Cardiogenic
13	7	22	Cardiogenic	Cardiogenic	Cardiogenic
14	9	24.7	Cardiogenic	Cardiogenic	Cardiogenic
18	8.2	20	Non-cardiogenic	Cardiogenic	Cardiogenic
18	7	15	Non-cardiogenic	Cardiogenic	Cardiogenic
15	10	22.4	Cardiogenic	Cardiogenic	Cardiogenic
18	5.3	32.2	Non-cardiogenic	Cardiogenic	Cardiogenic
17	7.5	13	Non-cardiogenic	Cardiogenic	Cardiogenic
15	4.4	26.7	Cardiogenic	Cardiogenic	Cardiogenic

10	9.4	32	Cardiogenic	Cardiogenic	Cardiogenic
8	13	8	Cardiogenic	Cardiogenic	Cardiogenic
15	8	15	Cardiogenic	Cardiogenic	Cardiogenic
17	9.4	18.1	Cardiogenic	Cardiogenic	Cardiogenic
16	8	10	Non-cardiogenic	Cardiogenic	Cardiogenic
10	5.4	15.4	Cardiogenic	Cardiogenic	Cardiogenic
13	10	12	Non-cardiogenic	Cardiogenic	Cardiogenic
13	16	6	Cardiogenic	Cardiogenic	Cardiogenic
1.2	7.6	14	Cardiogenic	Cardiogenic	Cardiogenic
1.6	8	10	Cardiogenic	Cardiogenic	Cardiogenic
1.6	8	21.2	Cardiogenic	Cardiogenic	Cardiogenic
12	9	11	Non-cardiogenic	Cardiogenic	Cardiogenic
1.5	10	24	Cardiogenic	Cardiogenic	Cardiogenic
17	14	13	Non-cardiogenic	Cardiogenic	Cardiogenic
18	14	6	Non-cardiogenic	Non-cardiogenic	Cardiogenic
18	10	6	Non-cardiogenic	Cardiogenic	Cardiogenic
18	14	6	Non-cardiogenic	Non-cardiogenic	Cardiogenic
18	16	6	Non-cardiogenic	Non-cardiogenic	Cardiogenic
18	14	6	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
18	13	5	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
18	17	6	Non-cardiogenic	Non-cardiogenic	Cardiogenic
15	13	6	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
19	120	5.4	Non-cardiogenic	Cardiogenic	Non-cardiogenic
18	16	3	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
18	16	2	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
15	15.1	5.3	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
17	17	4	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
20	16	3	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
16	13	6	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
18	14	5	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
18	13	6	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
20	16	4	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
20	14	6	Non-cardiogenic	Non-cardiogenic	Cardiogenic
16	14	5	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
16	17	3	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
15	13	6	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
18	17	4	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
15	14	10	Non-cardiogenic	Cardiogenic	Cardiogenic
16	16	6	Non-cardiogenic	Non-cardiogenic	Cardiogenic
15	13	5	Cardiogenic	Non-cardiogenic	Cardiogenic
14	13	4	Non-cardiogenic	Cardiogenic	Non-cardiogenic
18	14	2	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
18	14	5	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
18	16	6	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
19	16	3	Cardiogenic	Non-cardiogenic	Non-cardiogenic
19	16	4	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
19	14	5	Cardiogenic	Non-cardiogenic	Cardiogenic
17	16	5	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic

18	14	6	Non-cardiogenic	Non-cardiogenic	Non-cardiogenic
18	16	5	Cardiogenic	Non-cardiogenic	Cardiogenic
16	17	4	Non-cardiogenic	Non-cardiogenic	Cardiogenic
17	14	6	Non-cardiogenic	Non-cardiogenic	Cardiogenic
16	16.8	10	Non-cardiogenic	Cardiogenic	Non-cardiogenic
16	12.4	8	Non-cardiogenic	Cardiogenic	Cardiogenic
15	13	7	Cardiogenic	Non-cardiogenic	Cardiogenic
15	8	13.4	Cardiogenic	Cardiogenic	Cardiogenic
15	7	17	Cardiogenic	Cardiogenic	Cardiogenic
16	4.6	1.64	Non-cardiogenic	Cardiogenic	Cardiogenic
16	6.2	10	Non-cardiogenic	Cardiogenic	Cardiogenic
15	8.6	17	Non-cardiogenic	Cardiogenic	Cardiogenic
15	12	5.6	Cardiogenic	Cardiogenic	Cardiogenic
16	1.4	6	Cardiogenic	Non-cardiogenic	Cardiogenic
15	13	6	Cardiogenic	Non-cardiogenic	Cardiogenic

Performance Analysis

Figure 2 shows the clinical impression analysis of patients with cardiogenic vs non-cardiogenic causes of respiratory distress at the time of patient presentation. The frequency is shown in the form of a graph. The frequency value for the patients with cardiogenic causes is 28, and for the patients with non-cardiogenic causes 47, with a total count of 75. Percentage-wise, the percentage of patients with cardiogenic causes is 37.3%, and the percentage of patients with non-cardiogenic causes is 62.7%.

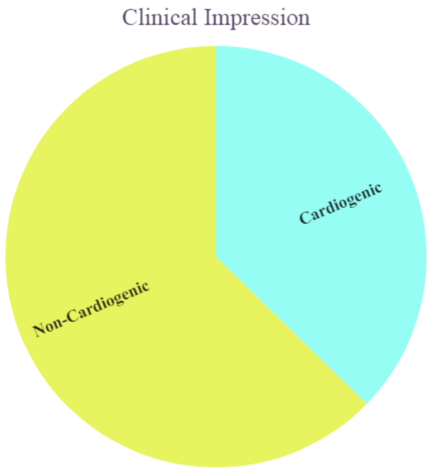

Figure 2 Clinical impression analysis

Figure 3 shows the frequency percentage of the M-mode diagnosis of cardiogenic vs non-cardiogenic causes of respiratory distress. The M-mode diagnosis uncovered 50.7% of patients with cardiogenic causes and 49.3% with non-cardiogenic causes.

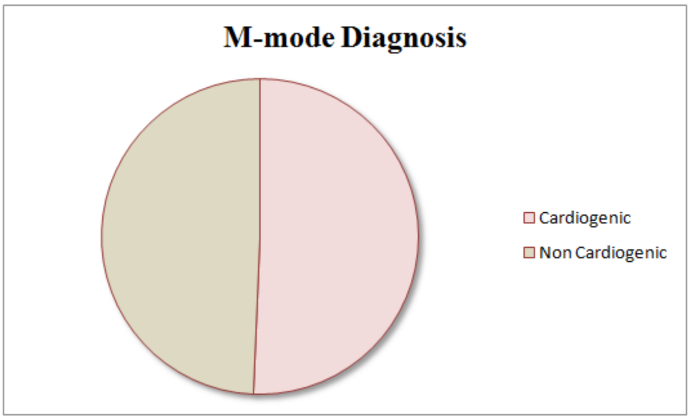

Figure 3: Analysis of the output of the M-mode model diagnosis

Figure 4 analyzes the final diagnosis. At the end of their treatment, 65.3% of the patients were thought to have been affected by cardiogenic disease, and 34.7% were not.

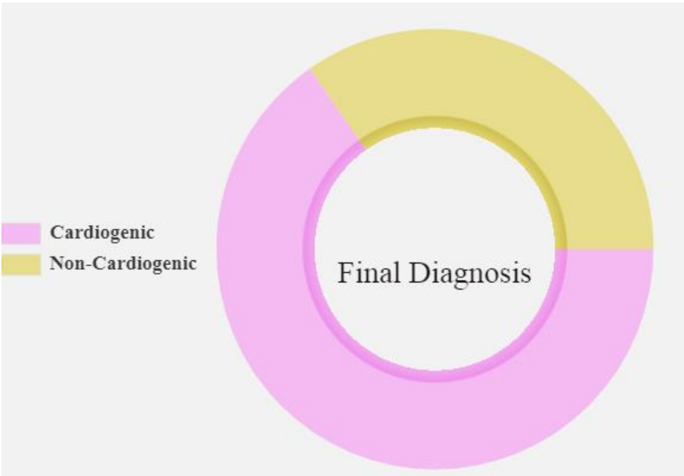

Figure 4: Final diagnosis analysis

COMPARATIVE ANALYSIS

The M-mode model diagnosis was compared with the final diagnosis, and the parameters of accuracy like sensitivity, specificity, PPV, and NPV were calculated. The M-Mode model showed a sensitivity and specificity of 71.43 and 88.46%, respectively. The positive predictive value and negative predictive value were 92.11 and 62.16, respectively. The accuracy of the M-Mode model was 79.95% (**figure 5**).

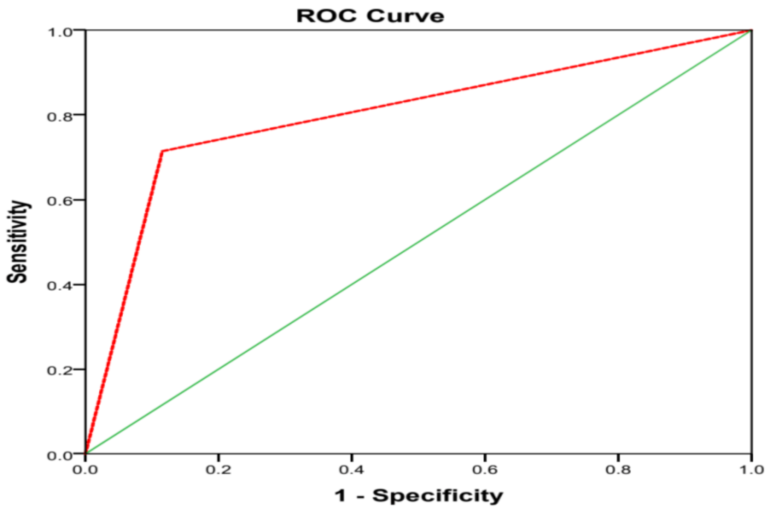

Figure 5: ROC curve analysis of the M-mode echocardiography

Table 3 shows the area under the curve of the presented study. Here, the area is 0.799 and the standard error is 0.54. In this, the term 'a' denotes the non-parametric assumption. Then, the asymptotic sig is 0005, and the term b indicates the null hypothesis. The lower bound and upper bound confidence intervals of the AUC are 0.694 and 0.905.

Table 3 AUC analysis

Area	Standard error [a]	Asymptotic Sig [b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.799	0.54	0.0005	0.694	0.905

DISCUSSION

Dyspnea, or shortness of breath, is a common symptom encountered in emergency departments (EDs). The broad range of potential underlying conditions necessitates timely and accurate diagnostic approaches. Echocardiography with M-mode has emerged as a valuable tool for rapid assessment, aiding in early diagnosis and management by providing a one-dimensional view of the cardiac structures [4]. In this discussion, we explore the role of M-mode USG in evaluating dyspnea, caused by cardiac or non-cardiac conditions, and its credibility in comparison to the patient's final diagnosis.

As illustrated in the results of this study, with the sensitivity being 71.43% and the specificity being 88.46%, it is interesting to note that the positive predictive value is 92.1%. That means that for a patient with a high pretest probability for cardiogenic dyspnea, there is a 92.1% chance that the M-mode diagnosis will show a positive result. Further studies regarding the implementation of M-mode for diagnosing cardiac vs. non-cardiac dyspnea must be done to solidify the use of M-mode USG in clinical practice. Additionally, exploring the limitations and potential sources of error in M-mode USG could provide valuable insights into improving its accuracy and reliability as a diagnostic tool for dyspnea. Overall, the promising results of this study suggest that M-mode USG has the potential to play a significant role in the evaluation and management of patients presenting with dyspnea, particularly in distinguishing between cardiac and non-cardiac causes. Further research and validation studies are warranted to confirm these findings and establish M-mode USG as a valuable tool in the diagnostic workup of dyspnea.

Although no other studies are exploring M-mode and grade 3 dyspnea yet, a few noteworthy studies relevant to the topic were reviewed, and the salient findings have been described as follows: Ikuo Hashimoto and Kazuhiro Watanabe evaluated the left ventricular (LV) function in patients with Kawasaki disease (KD) during the acute phase [19].

The investigation uses the MAPSE z-scores, which were calculated based on the standard MAPSE data. The MAPSE z-score decreased in the acute phase (median value, -1.4) and increased in the convalescent phase (median value, 0.18; P<0.0001). However, there was no significant difference in the MAPSE z-score between patients in the convalescent phase and the control patients (0.18 vs. 0.02, P = 0.199). The MAPSE z-score was a useful index to evaluate LV function, and the cutoff value of -0.9 was an indicator to judge LV dysfunction in patients with acute-phase KD. These findings suggest that monitoring MAPSE z-scores can be valuable in assessing left ventricular function in patients with acute-phase KD. The increase in MAPSE z-scores during the convalescent phase indicates an improvement in cardiac function over time. Additionally, the comparison with control patients highlights the importance of utilizing the MAPSE z-score as a tool for early detection of left ventricular dysfunction in patients with KD. Overall, maintaining a cutoff value of -0.9 for the MAPSE z-score can aid in timely intervention and management of cardiac complications in this patient population. Another study by Yazdan Ghandi et al. looked at both full-term and early-term babies and calculated TAPSE and MAPSE at the lateral and septal (LAT/SEP) mitral [20]. The study groups were divided into three classes based on birth age: two preterm groups, 30–33 weeks and 34–37 weeks, and one full-term group, 38–40 weeks. The study included 21 full-term neonates and 31 preterm neonates. The mean LAT MAPSE was 0.63±0.11 cm for gestational age (GA) of 30–33 weeks, 0.76±0.03 cm for GA of 34–36 weeks, and 0.84±0.08 cm for GA of 37–40 weeks; the mean SEP MAPSE was 0.39±0.14 cm, 0.51±0.06 cm, and 0.65±0.09 cm, respectively; and the mean TAPSE was 0.47±0.13 cm, 0.62±0.07 cm, and 0.88 ± 0.15 cm, respectively. These findings suggest that there is a gradual increase in left atrial longitudinal function, and septal and tricuspid annular plane systolic excursion (MAPSE) with advancing gestational age. The full-term neonates demonstrated significantly higher MAPSE values compared to preterm neonates in all three parameters measured. This indicates that cardiac function in neonates improves as they approach full-term gestation. Further research is needed to explore the clinical implications of these findings and whether they have any long-term effects on cardiovascular health. Kai O. Hensel et al. looked at how reproducible M-mode and B-mode acquired mitral annular plane systolic excursion (MAPSE) was between observers and how it changed depending on the quality of the echocardiogram images in children [21]. The investigation analyzed 284 transthoracic echocardiograms performed on consecutive normotensive children without structural heart disease (mean age 12.6±3.1 years, 50.4% female). Overall, MAPSE measurements were highly reproducible with only minor bias. Both inter- and intra-observer reliability were significantly better for M-mode-derived MAPSE (P=0.235). However, the study also found that the reproducibility of B-mode-derived MAPSE was still acceptable, with a slight decrease in reliability compared to M-mode. The researchers noted that echocardiographic image quality did have an impact on the reproducibility of MAPSE measurements, with clearer images resulting in more consistent results. Despite this, overall, the study concluded that both M-mode and B-mode are reliable methods for assessing MAPSE in children without structural heart disease.

Hongmin Zhang et al. intended to investigate the relationship between the TAPSE and central venous pressure (CVP) in mechanically ventilated critically ill patients [22]. From October 1 to December 31, 2017, patients admitted to the intensive care unit with CVP monitoring and controlled mechanical ventilation were screened for enrollment. Many heart-related measurements were gathered, such as the TAPSE, MAPSE, LVEF, and internal diameter of the inferior vena cava (dIVC). In addition, blood flow measurements, such as the CVP, were also recorded. The TAPSE was inversely correlated with the CVP in mechanically ventilated critically ill patients who had an LVEF of less than 55%. This suggests that lower TAPSE values may be indicative of higher CVP levels in this subset of patients. Additionally, the MAPSE and dIVC did not show any significant correlation with CVP levels in this study. These findings highlight the importance of monitoring TAPSE as a potential marker for hemodynamic instability in mechanically ventilated patients with impaired cardiac function. Further research is needed to explore the clinical implications of these correlations and potential interventions to optimize patient outcomes.

To find out how much the right and left ventricles depend on each other, Steven R. Bruhl et al. compared their systolic functions directly using echocardiographic markers to show the functions of the right and left ventricles [23]. The study prospectively evaluated '51' healthy participants (mean age, 41±17 years) by echocardiography. In addition, the standard measurement was measured by M-mode and pulsedwave Doppler-issue echocardiography and further evaluated for variance across age, gender, and body surface area. The result analysis showed good surrogates of systolic-ventricular relationships and interdependence. Parameters such as MAPSE and TAPSE were used to compare the interventricular function. The study found that both MAPSE and TAPSE were reliable indicators of interventricular function, with no significant variation across age, gender, or body surface area. These parameters provided valuable information about the systolic function of both the right and left ventricles. Overall, the use of echocardiographic surrogates proved to be an effective method for assessing ventricular systolic function in healthy individuals.

Huang et al. looked at how the left ventricular longitudinal strain (LVLS), the mitral annular plane systolic excursion (MAPSE), and the M-mode-derived fractional shortening are related [24]. A review of old transthoracic echocardiographic records was done and 80 studies were chosen that could be used to measure strain and M-mode in the apical 4-chamber view. The longitudinal wall fractional shortening (LWFS) was found by using both the standard M-mode (LWFS) and the curved anatomical M-mode (CAMMFS). Patients who were critically ill had their longitudinal wall fractional shortening (LWFS) measured to estimate their LVLS. It provided a fast and accurate prediction of the LVLS. The results showed a strong correlation between MAPSE, fractional shortening, and LWFS, indicating that these parameters are closely related when assessing cardiac function. The use of both standard M-mode and CAMMFS allowed for a more comprehensive evaluation of longitudinal wall function. By measuring LWFS in critically ill patients, healthcare providers were able to quickly estimate LVLS and make timely treatment decisions based on this important parameter. Overall, this study highlights the importance of utilizing multiple echocardiographic measurements to provide a more thorough assessment of cardiac function in patients.

To summarize the key results of our study with the primary objectives, the M-Mode model had comparable accuracy to the final diagnosis. The limitation of the study is the non-inclusion of BNP levels in the patients, which is considered to have a high sensitivity to identifying cardiac failure. No bias of any sort was identified throughout the study. The results obtained did not deviate significantly from the studies mentioned above. However, considering the sample size of 75, the M-Mode model requires further validation with a larger sample size, multicentric trials, and comparison with biomarkers.

CONCLUSION

The M-Mode Model can be used as a rapid assessment tool in the Emergency Department to initiate appropriate interventions in situations where the physician is in a dilemma regarding the causes of respiratory distress. Further, the study highlights the advantage of using parameters with low interobserver variability over using parameters with observer subjective findings.

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ORIGINALNI RAD

M-MOD ULTRAZVUK U EVALUACIJI DISPNOIČNIH PACIJENATA GRADUSA 3

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SAŽETAK

Uvod/Cilj Respiratorni distres je ozbiljno stanje, koje se može razviti kod kritično obolelih ili teško povređenih pacijenata. Ishod je često fatalan, a rizik od smrti raste sa godinama života i težinom bolesti. Postavljanje rane dijagnoze, kao i prepoznavanje stanja koja mogu dovesti do respiratornog distresa, je važan, ali istovremeno i veoma izazovan proces. Da bi se klinički postigla veća tačnost tokom dijagnostičkog procesa, naša studija koristi eho parametre u režimu pokreta (M-MODE). Cilj je da proceni tačnost ultrasonografskog M-MODE-a, kao alata 1. izbora, za brzu dijagnostiku pacijenata sa dispnejom 3. stepena (na hitnom prijemu), u diferencijalnoj dijagnozi respiratornog distresa.
Metodologija Sprovedena je retrospektivno opservaciona studija. Razmatrani su sledeći parametri: sistolno pomeranje ravni mitralnog prstena (MAPSE), sistolno pomeranje ravni trikuspidalnog prstena (TAPSE) i septalna separacija u E-tački (EPSS) za hospitalizovane pacijente. Analizirana je osetljivost, specifičnost i tačnost M-mode modela, pri čemu je konačna dijagnoza implementirana kao kontrola. Za analizu, ova studija je razmatrala 75 pacijenata. Parametar M-Mode, zajedno sa kliničkim geštaltom (opšti klinički utisak) lekara hitne pomoći (M-Mode model), upoređen je sa konačnom dijagnozom pri otpustu ili smrti pacijenta.
Rezultati Za sve pacijente, izračunate srednje vrednosti za MAPSE, TAPSE i EPSS bile su 13,463 mm, 15,132 mm i 9,4685 mm. M-Mode model je rezultirao osetljivošću od 71,43% i specifičnošću od 88,46%. Pozitivna prediktivna vrednost bila je 92,11, a negativna prediktivna vrednost 62,16. Tačnost M-Mode modela bila je 79,95%.
Zaključak M-Mode model, se može koristiti kao dijagnostičko sredstvo za brzu procenu na hitnim prijemima bolnica. Korišćenje ovog ultrasonografskog modela, bi olakšalo lekarima iniciranje tačnih postupaka, koji bi precizno utvrdili uzrok respiratornog distresa.

Ključne reči: M-mod ehokardiografija, sistolno pomeranje ravni mitralnog prstena (MAPSE), sistolno pomeranje ravni trikuspidalnog prstena (TAPSE), septalna separacija u E- tački (EPSS).