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AN OVERVIEW OF THE GUIDELINES FROM THE BRITISH SOCIETY OF ECHOCARDIOGRAPHY 2020: WHAT'S NEW?

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Abstract. *An overview of the guidelines from the British Society of Echocardiography 2020: what's new? Babkina T.M., Smyrnova G.S., Polishchuk O.V., Hladka L.Yu. Quantitative assessment of cavities and heart function is the most common task of echocardiography (EchoCG). It is difficult to overestimate the importance of standardizing EchoCG measurements, because their results influence clinical decisions. In January 2015, the American Society of Echocardiography and the European Association of Cardiovascular Imaging, published an update Recommendations for Cardiac Chamber Quantification by Echocardiography. Since then, the results of new research*

using obtained prospective data, on the basis of which in February 2020 the British Society of Echocardiography (BSE) released a new guide. The authors of the recommendations set the goal of creating a simple, practical reference document and guide for everyday use that encourage the holistic interpretation of measurements (no single number should define normality or pathology). Based on these data, we considered the rational component of the updated recommendations, focused on important conceptual changes in the assessment of heart structure and function, provided new terminology for left ventricular function and left atrial size, and a new approach in assessing aortic root, right heart and left atrium. The BSE recommends obtain left ventricular dimensions from the parasternal long-axis window preferentially using 2D imaging. Aortic dimensions should be obtained using the “inner-edge to inner-edge” technique in end-diastole. The BSE suggests that for those EchoCG labs that currently use the “leading-edge to leading-edge” technique, it is reasonable to continue doing so for continuity and consistency.

Реферат. Обзор рекомендаций Британского общества эхокардиографии 2020: что нового? Бабкина Т.М., Смирнова А.С., Полищук Е.В., Гладка Л.Ю. Количественная оценка полостей и функции сердца является наиболее частой задачей эхокардиографии (ЭхоКГ). Достаточно сложно переоценить важность стандартизации ЭхоКГ измерений, поскольку их результаты влияют на принятие клинических решений. В январе 2015 года Американское эхокардиографическое общество совместно с Европейской ассоциацией по сердечно-сосудистой визуализации опубликовало обновление рекомендаций по количественной оценке структуры и функции камер сердца. С того момента были получены результаты новых исследований с использованием проспективных данных, на основании которых в конце февраля 2020 г. Британское общество эхокардиографии выпустило в свет новое руководство. Авторами рекомендаций была поставлена цель создания простого, легкого для повседневного использования руководства, которое поощряет целостность интерпретации измерений (ни одно число, по мнению ученых, не должно определять норму или патологию). Основываясь на этих данных, мы рассмотрели рациональную составляющую обновленных рекомендаций, акцентировали внимание на важных концептуальных изменениях в оценке структуры и функции сердца, предоставили новую терминологию для функции левого желудочка и размера левого предсердия, а также новый подход в оценке корня аорты, правого сердца и левого предсердия. Так, авторы руководства 2020 для получения корректного линейного размера левого желудочка (ЛЖ) рекомендуют производить запись изображения с парастеральной позиции по длинной оси ЛЖ в В-режиме. Согласно рекомендациям 2020, для получения размеров аорты рекомендуется выполнять запись изображения с парастеральной позиции по длинной оси в конце диастолы с помощью методики «от внутреннего края к внутреннему краю». При этом авторы добавляют: для ЭхоКГ лабораторий, использующих технику «от верхнего края до верхнего края», надо продолжить ее выполнение с целью соблюдения последовательности и преемственности.

The introduction of new highly informative research methods into medical practice is closely connected with the development of technical progress. In the last decades of its existence, ultrasound imaging of the heart has gone from images in one-dimensional M-modal scan to three-dimensional reconstruction in real time, which revolutionized the diagnosis of cardiovascular disease and opened wide prospects for their recognition [1]. Undoubtedly, quantitative assessment of cavities and heart function is the most common task of echocardiography (EchoCG). It is quite difficult to overestimate the importance of standardization of echocardiography measurements, as their results influence clinical decision-making. In January 2015, the American Society of Echocardiography (ASE), together with the European Association of Cardiovascular Imaging (EACVI), published an update on guidelines for quantifying the structure and function of heart chambers [5]. Since then, the results of new studies have been obtained using prospective data, on the basis of which at the end of February 2020 the British Society of Echocardiography (BSE) released a new guide [3]. The authors of the recommendations set the goal of

creating a simple, easy-to-use guide that encourages the integrity of the interpretation of measurements (no number, according to scientists, should determine the norm or pathology).

It is known that in order to obtain the reference interval of any EchoCG parameter, it is necessary to study the population of healthy individuals devoid of obvious cardiovascular diseases. In addition, it is desirable to exclude from the statistical analysis individuals who have risk factors for cardiovascular pathology, because it may affect the results of the study.

The authors of the new guide faced the task of constructing a representative sample, because it is representativeness that determines the extent to which it is possible to generalize the results of the study with the involvement of a certain sample to the entire population from which it was collected. In view of this, according to the authors, the analysis should include data from prospective studies obtained from standardized echocardiographic protocols. Herewith, in ideal conditions EchoCG images should be sent to the central independent laboratory for processing. This meticulous approach to the methodology of the study and the need for new guidance is explained by the fact that the

recommendations of ASE/EACVI 2015 included in the analysis the data of several large studies, which did not guarantee the unification of the methodology. In addition, the population in a number of studies included in the analysis was ethnically heterogeneous and, therefore, may not be fully applicable to members of the Caucasian race, in particular the British. Given the objectives, the reference values of the BSE 2020 recommendations were obtained from the database of the European project NORRE [2].

The authors emphasize that the reference values of any echocardiogram parameter proposed in the manual should be distinguished from the concept of "normal values". Thus, when establishing the reference range, mathematical and statistical approaches are used, according to which the values of research results of 95% of healthy people fall into this interval. Thus, in the remaining 5% of healthy individuals, the values of the analyzed indicators are outside the range. The 2020 recommendations emphasize that any value that is outside the reference range should be interpreted in a clinical context, rather than hastily included in the deviation section. In addition, the value in the reference interval does not always reflect the norm, as the range of many values is quite wide. When the echocardiogram parameter is outside the reference interval, the authors recommend the use of gradation by severity in the case of its clinical significance.

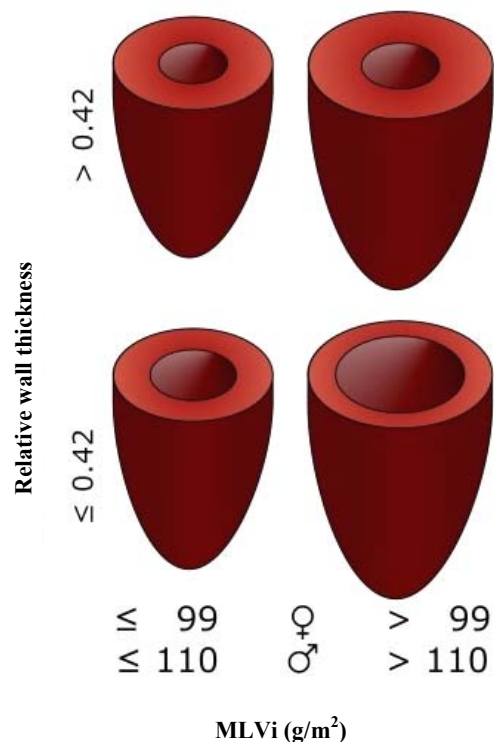
As a rule, many echocardiographic parameters vary depending on gender, ethnicity, age, height and weight. This difference leads to the creation of cumbersome reference tables that complicate the work of the doctor. The recommendations of BSE 2020 include the necessary and justified from a practical point of view number of variables that vary [4]. As is known, today it is customary to index echocardiographic parameters according to total body area (TBA). However, if for the volume of the left atrium (LA) such an approach, according to many studies, is considered appropriate, for other parameters – no. Thus, the authors of the 2020 recommendations decided to include in the indexed values only those parameters that have clinically sound indications.

It is noted that the proposed BSE reference tables should be used with caution in three cohorts of patients: non-Caucasian ethnic groups, athletes and pregnant women. Thus, in people of Afro-Caribbean origin, myocardial mass may be slightly higher than in Caucasians. Therefore, a slight increase in left ventricular mass (LV) in this cohort should be interpreted in the light of the clinical picture. In

addition, people in East Asia and India tend to have a decrease in LV volume.

What's new in the BSE 2020 recommendations?

The authors of the guide of 2020 do not recommend using the M-mode to obtain a linear LV size in routine practice. To obtain the correct linear size of the left ventricle, the image must be recorded from the parasternal position along the long axis of the left ventricle in B-mode. Calculation of LV myocardial mass is recommended to be performed using linear measurements in B-mode with indexation to TBA. As in the ASE/EACVI recommendations of 2015, the authors of this manual note that estimating LV indexed mass and LV relative wall thickness (RWT)) is useful for determining LV geometry. Calculation of LV RWT according to the formula $(SWTd + PWTd) / EDD$, where SWTd is septum wall thickness during diastole; PWTd – posterior wall thickness during diastole; EDD – end-diastolic dimension of the left ventricle, allows to differentiate the increase in left ventricular mass into concentric (left ventricular $RWT \geq 0.42$) and eccentric (left ventricular $RWT \leq 0.42$) hypertrophy, as well as to identify concentric LV remodeling (normal MM of LV at increased RWT of $LV \geq 0.42$) (Fig.).



Geometry of the left ventricle

At the same time it is necessary to pay attention to the changed reference intervals for the linear sizes of LV and the weight of LV offered by BSE in 2020 (Table 1).

The approach to estimating LV volumes has not changed: they should be obtained from the apical four- and two-chamber positions using the B-mode by the Simpson method. The changed reference intervals for LV volumes proposed by BSE in 2020 are shown in Table 2.

The LV ejection fraction (EF) is still recommended to be calculated in B-mode by the Simpson biplane method. In this case, the reference values of LV EF for both men and women in accordance with the proposed recommendations are equal (Table 3).

The authors explain this by the fact that, despite the statistical differences in the values of EF depending on gender, the absolute difference in indicators is extremely small to be considered clinically significant. In addition, in the BSE 2020 guidance, a pronounced disorder of LV EF is considered to be a decrease of <35%, while in the ASE/EACVI recommendations of 2015 – <30%. The authors of the recommendations start from the concepts of "mild" and "moderate" reduction of LV EF, replacing them with the terms "borderline reduction" and "disorder". It is emphasized that these reference intervals are not applicable to the EF values obtained in the 3D mode.

Table 1

Linear dimensions and mass of the left ventricle

	Norm	Mild increase	Moderate increase	Pronounced increase
Males				
EDD (mm)	37-56	57-61	61-65	>65
ESD (mm)	22-41	41-45	46-50	>50
SWTd (mm)	6-12	-	-	-
PWTd (mm)	6-12	-	-	-
MLVi (g/m ²)	40-110	111-127	128-145	>145
MLV (g)	72-219	-	-	-
Females				
EDD (mm)	35-51	52-55	56-59	>59
ESD (mm)	20-37	38-42	43-46	>46
SWTd (mm)	5-11	-	-	-
PWTd (mm)	6-12	-	-	-
MLVi (g/m ²)	33-99	98-115	116-131	>131
MLV (g)	51-173	-	-	-

Notes: EDD - end-diastolic dimension; ESD - end-systolic dimension; SWT – septum wall thickness during diastole; PWTd - posterior wall thickness of left ventricle during diastole; MLVi - mass of left ventricle with indexation to body surface area; MLV – mass of left ventricle.

The approach to the assessment of LV volume has not changed: it should be obtained from the apical four- and two-chamber position using the B-mode by the method of Simpson and indexed to TBA. Reference limits of LA volume are the same for both men and women in accordance with the

proposed recommendations, as the difference in the dimension of LA in men and women is leveled after indexation to TBA (Table 4). The authors do not recommend routine use of linear LA dimensions except in some clinical situations.

Table 2

Volumes of the left ventricle

	Norm	Mild increase	Moderate increase	Pronounced increase
Males				
EDVi (ml/m ²)	30-79	80-91	92-103	>103
ESVi (ml/m ²)	9-31	32-36	37-42	>42
EDV (ml)	53-156	-	-	-
ESV (ml)	15-62	-	-	-
Females				
EDVi (ml/m ²)	29-70	71-81	82-91	>91
ESVi (ml/m ²)	8-27	28-32	33-37	>37
EDV (ml)	46-121	-	-	-
ESV (ml)	13-47	-	-	-

Notes: EDV - end-diastolic volume; ESV - end-systolic volume; EDVi - end-diastolic volume with indexation to body surface area; ESVi - end-systolic volume with indexation to body surface area.

For the first time, BSE recommends routine use of indexed right ventricular end-diastolic area (RV) and indexed right atrial area (RA) to assess right heart. The authors of the recommendations talk about the need for additional measurement of the linear dimensions of the right ventricle (basal

transverse dimension and diameter of the external tract of the RV). The 2020 guide updates the reference limits for the linear dimensions of RA, which differ from the ASE/EACVI recommendations of 2015 (Table 5).

Table 3

Left ventricular ejection fraction

	Norm	Borderline reduction	Disorder	Pronounced disorder
LV EF for men and women (%)	≥55	50-54	49-36	<35

Note. LV EF – left ventricular ejection fraction.

Table 4

Volume of the left atrium

	Norm	Borderline zone	Dilatation
LA volume index in men and women (ml/m ²)	<34	34-38	>38

Note. LA - left atrium.

Table 5

Parameters of the right heart

Males	Norm
Index of end-diastolic surface of RV (cm ² /m ²)	≤13.6
Index of RA surface (cm ² /m ²)	≤11
Proximal diameter of ET RV (mm)	22-44
Distal diameter of ET RV (mm)	16-29
Basal diameter of RV (mm)	26-47
Average diameter of RV (mm)	19-42
Longitudinal diameter of RV (mm)	55-87
Surface of RA (cm ²)	≤22
Fractional change in surface of RV (%)	≥30
Females	Norm
Index of end-diastolic surface of RV (cm ² /m ²)	≤12.6
Index of RA surface (cm ² /m ²)	≤11
Proximal diameter of ET RV (mm)	20-42
Distal diameter of ET RV (mm)	14-28
Basal diameter of RV (mm)	22-43
Average diameter of RV (mm)	17-35
Longitudinal diameter of RV (mm)	51-80
Surface of RA (cm ²)	≤19
Fractional change in surface of RV (%)	≥35

Notes: RA - right atrium; EV - right ventricle; ET RV - excretory tract of right ventricle.

According to the recommendations of 2020, in order to obtain the dimension of the aorta, it is necessary to record the image from the parasternal position along the long axis of the left ventricle. Indexation of parameters should be performed in ascending order at the end of diastole using the

"inner-edge to inner-edge" technique. At the same time, the authors add: for those EchoCG- laboratories that use the "leading-edge to leading-edge" technique, it is necessary to continue doing so for continuity and consistency. Updated reference limits of linear aortic dimensions are presented in Table 6.

Table 6

Normal indexed aortic root dimensions according to "inner-edge to inner-edge" technique

	Males	Females
Valsalva sinuses (mm/m)	14.8-23.2	14.1-22.1
Sinotubular transition (mm/m)	12.6-19.8	12.2-19.4
Ascending aorta (mm/m)	12.6-21.4	12.3-21.1

Note. The measurement of the proximal part of the ascending aorta is performed 1 cm above the sinotubular junction.

CONCLUSIONS

Thus, the BSE 2020 recommendations present updated reference intervals of EchoCG parameters obtained during prospective studies that can be used in everyday practice by physicians in Europe. As repeatedly mentioned, any meaning that beyond the

reference range should be interpreted in a clinical context and not hastily included in the section on abnormalities.

Conflict of interest. The authors declare no conflict of interest.

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