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ORIGINAL ARTICLE / ОРИГИНАЛНИ РАД

Current echocardiography practice in Serbia – a national survey by the Echocardiographic Society of Serbia

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SUMMARY

Introduction/Objective The purpose of the Echocardiographic Society of Serbia (ECHOS) national survey was to assess current echocardiography practice in Serbia, the availability of different echocardiographic techniques and self-perceived need for improvement at personal and institutional level.

Methods A survey comprising 20 questions about demographics, numbers and distribution of echocardiographic equipment and techniques, image acquisition and reporting standards as well as future educational preferences was sent to all ECHOS members via email.

Results A total of 106 members (42%) answered the survey. Echocardiographic examinations are most frequently performed by cardiologists and internal medicine specialists. Transesophageal echocardiography (TOE), stress echocardiography (SECHO) and speckle tracking echocardiography (SpTE) are available in approximately 20% of centers, three-dimensional echocardiography in 11%, while contrast echocardiography is practiced in only two centers. Less than a third of respondents always attach electrocardiographic electrodes and archive examinations. Almost all respondents (96%), always evaluate both systolic and diastolic function of the left ventricle (LV), although systolic LV function is frequently assessed (55%) using non-standard methods. The newer echocardiographic machines are more often available at university than non-university centers (87 *versus* 44%, $p < 0.01$). SECHO was perceived as the most needed technique at the institutional level, while SpTE and TOE were most often reported personal aspirations of the respondents.

Conclusion Advanced techniques, SECHO and TOE are needed but rarely performed outside the university hospitals in Serbia. In order to achieve a better adherence to standards of practice in echocardiography, the development of national guidelines and personal and laboratory accreditation seem warranted.

Keywords: echocardiography; survey; Serbia

INTRODUCTION

Echocardiography is a cornerstone clinical tool used for the diagnosis, treatment, and follow up of patients with cardiovascular diseases [1]. It is the most frequently used imaging modality in a clinical cardiology [2]. Furthermore, the need for using echocardiography not only by cardiologists, but also by non-cardiologists, is rising [3, 4, 5]. In Serbia, echocardiography was implemented shortly after its introduction at the world stage and it has been used extensively ever since. Notwithstanding the long history of availability and widespread use of echocardiography, at the moment, there are no national guidelines for practice and implementation of echocardiography in Serbia. In addition, there is neither individual nor laboratory accreditation at the national level and the current echocardiography standards in Serbia are largely unknown.

The mission of the Echocardiographic society of Serbia (ECHOS) is to foster development of echocardiography by promoting and advocating personal and institutional high standards of practice, education and research in the field of echocardiography in Serbia. Setting up the national standards and guidelines for clinical practice, education, and training is an important step towards optimal use, quality improvement, and modern practice of echocardiography. However, a complete lack of data on the usage, international guideline implementation, and educational needs in echocardiography in Serbia is a serious challenge.

In order to adequately address the educational needs in echocardiography, and to develop the national recommendations and standards, ECHOS conducted a survey to demonstrate the current state of echocardiography practice in Serbia.

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METHODS

The survey was conducted by the ECHOS Scientific Initiatives, Membership, and affiliations Committees from June 6 to August 16, 2019. A questionnaire comprising 20 questions about demographics, numbers and distribution of echocardiographic equipment and techniques, image acquisition and reporting standards as well as educational preferences was sent to all ECHOS members (a total of 254 members at the time of conducting the survey) via email. The data were gathered and analyzed using commercially available software PASW Statistics, version 18, (SPSS Inc., Chicago, IL, USA). Categorical data were summarized by proportions and compared using a Fisher's exact test. All statistical tests were two-tailed, and a p-value < 0.05 was considered significant.

We confirm that we have read the Journal's position on issues involving ethical publication and affirm that this work is consistent with those guidelines.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. All ECHOS members received the survey and accompanying cover letter stating the intention of academic publication of the obtained data.

RESULTS

Overall, 106 ECHOS members (42%) from all regions of Serbia, including Kosovo and Metohija, answered the survey. The majority of respondents (42%) were affiliated with university hospitals, 29% were employed in general hospitals, 20% in private cardiology practices, and 9% in community health centers. Respondents' general characteristics are summarized in Table 1. Most respondents were female, older than 35 years, with more than 10 years of experience in echocardiography. In Serbia, echocardiography is performed almost exclusively by physicians while echo sonographers are currently employed in only one echocardiography laboratory. Physicians performing echocardiography have different educational backgrounds and are at different levels of training. In the vast majority of centers, echocardiography was performed by cardiologists (92%), followed by residents or fellows (24%; only at university centers) and internal medicine specialists (22%). Only 4% of respondents reported that radiologists (2%), anesthesiologists (1%) and emergency medicine specialists (1%) also perform echocardiographic examinations at their centers. Expectedly, transthoracic echocardiography (TTE) was available in all centers, but almost 65% of responders refer their patients for further evaluation to expert centers. Other echocardiographic techniques, both standard and advanced, were significantly less distributed among cardiology centers in Serbia (Table 1). The introduction of stress echocardiography (SECHO) and transesophageal echocardiography (TOE) to the existing echocardiographic armamentarium was considered the most needed improvement of the respondents' centers. Respondents' personal educational preferences were strain echocardiography, SECHO, and TOE. Contrast echocardiography was the least available but also the least desired technique, both at personal and institutional level (Table 1).

Table 1. Characteristics of respondents and summary of available and most needed echocardiographic techniques at personal and institutional level

Characteristic	%	
Age (years)		
< 35	7	
35–50	57	
> 50	36	
Sex (male/female)	35/65	
Experience in echocardiography (years)		
< 5	35	
5–10	17	
> 10	48	
Echocardiographic techniques available at the center		
Transthoracic echocardiography	100	
Transesophageal echocardiography	20	
Dobutamine stress echocardiography	22	
Exercise stress echocardiography	22	
Speckle tracking strain echocardiography	19	
Three-dimensional echocardiography	11	
Coronary flow reserve testing	8	
Agitated saline contrast study	32	
Contrast echocardiography	8	
Most desired/needed new techniques	Personal	Institutional
None	12	23
Transesophageal echocardiography	41	27
Dobutamine stress echocardiography	45	34
Exercise stress echocardiography	31	21
Speckle tracking strain echocardiography	48	26
Three-dimensional echocardiography	37	13
Coronary flow reserve testing	25	20
Agitated saline contrast study	12	7
Contrast echocardiography	16	13

Equipment, standard practice, and indications for echocardiography

Most common indications for echocardiography are cardiomyopathies (79%), coronary artery disease (76%), valvular heart diseases (70%), hypertension (63%), arrhythmias (58%), and pulmonary embolism (47%). There are significant variations among echocardiography laboratories in Serbia with regard to the equipment and standard echocardiography practice (Table 2). A daily workload ranges from up to five examinations (35% of respondents), 5–10 (34%) to more than 10 examinations (31%).

Most responders (59%) have 15–30 minutes to complete an echocardiographic study, 24% have less than 15 minutes, while 16% have approximately 30–45 minutes. Only one respondent (0.9%) usually has more than 45 minutes for examination.

Electrocardiographic (ECG) electrodes are attached to the patient during each echocardiographic examination by

Table 2. Characteristics of echocardiographic examinations and equipment

Characteristic	%
Number of examinations	
< 5 per week	9
< 5 per day	26
5–10 per day	34
> 10 per day	31
Average duration of examination	
< 15 minutes	24
15–30 minutes	59
30–45 minutes	16
> 45 minutes	1
The need for additional expertise/supervision	
Never	36
Sometimes	50
Often	14
ECG electrodes during examination	
Always	27
Sometimes	37
Never	36
Recording and archiving of examinations	
Always	39
Sometimes	41
Never	20
The age of the newest echocardiographic machine	
< 5 years	61
5–10 years	19
> 10 years	20

ECG – electrocardiography

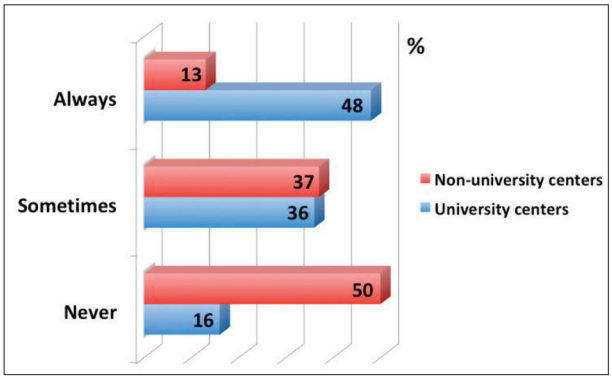

Figure 1. The practice of electrocardiographic electrodes attachment during echocardiographic examination in university *versus* non-university centers

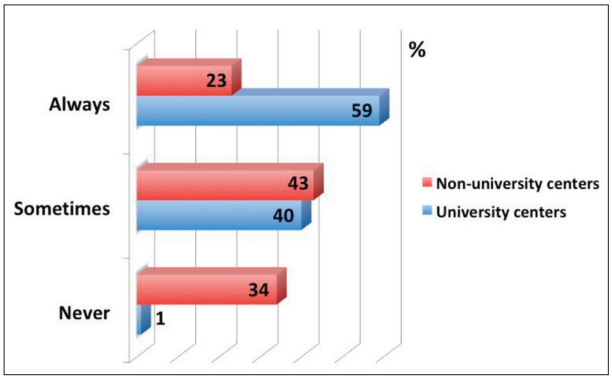

Figure 2. The practice of recording and archiving of echocardiographic examinations in university *versus* non-university centers

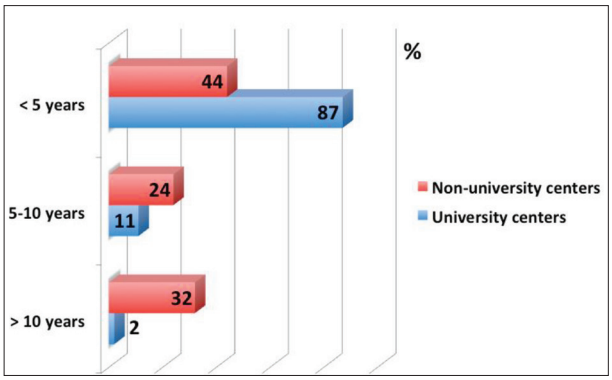

Figure 3. The age of the newest echocardiographic machine in university *versus* non-university centers

27% of respondents, occasionally by 37%, while 36% never obtain ECG signal during echocardiographic examination. All echocardiographic studies are being recorded and archived by 39% of respondents, 41% do this occasionally and 20% never record or store their examinations. The practice of attaching ECG electrodes and archiving exams is significantly more employed by physicians from university hospitals than by their colleagues from non-university centers ($p < 0.01$, for both) (Figures 1 and 2).

Almost all respondents (96%), always evaluate systolic and diastolic function of the left ventricle (LV), although systolic LV function is frequently assessed (55%) using non-standard methods (M-mode based Teichholz formula was reported by 24% and visual assessment by 31% of respondents). The newer echocardiographic machines (purchased over the last five years) are more often available at university than non-university centers (87% *versus* 44%, $p < 0.01$, Figure 3). Approximately 20% of respondents reported that the last echocardiographic machine at their center was purchased more than 10 years ago.

DISCUSSION

This is the first survey carried out by the ECHOS about the current echocardiography practice in Serbia. The scope of the survey and the response rate are in agreement with similar surveys conducted by the European and British cardiac imaging societies [6, 7]. The majority of echocardiographers (48%) who answered the survey had more than ten years of echocardiographic practice, which is in line with a trend of rapid aging of the healthcare workforce in the EU and Serbia [8]. The majority of respondents were from university hospitals whose echocardiography standards are, on average, at the higher level compared to non-university centers in terms of equipment and technical aspects of examination (ECG electrodes attachment and exams archiving). These three components of echocardiography practice are also measures of quality and, for the time being, are not at the satisfactory level in Serbia.

While equipment renewal depends on financial solvency of the center and society, regular ECG electrodes attachment and exams archiving policy are inexpensive, purely technical issues entirely dependent on the human factor, i.e. attitude of the echocardiography laboratory director. It is important to note that many advanced echocardiographic techniques (e.g. strain and 3D echocardiography) are technically impossible without a stable ECG signal. On the other hand, advantages of recording and archiving exams are numerous, including medico-legal issues, the possibility of off-line analysis for clinical purposes, research, and education, as well as comparison of patient examinations recorded at different time points. Although routine ECG electrodes attachment and exam archiving are significantly more frequently performed in the university setting, it is surprising that these basic technical aspects of echocardiographic examination are not regularly implemented in a large proportion of patients examined in university hospitals. The activities to raise awareness of these quality issues regarding image acquisition will be among the ECHOS priorities. In Serbia, echocardiography is performed mostly by cardiologists and internal medicine specialists. It should be noted, in a significant number of university centers, exams are being performed by residents or fellows whose reports should be supervised and signed by fully trained senior physicians.

In the past, some of the best echocardiographers in Serbia were technicians/nurses, while the current survey revealed that only one center has echo sonographers performing examinations. There are many potential reasons for the lack of motivation of technicians/nurses to pursue a career of echo sonographer and the ECHOS will acknowledge their value by establishing the committee for echo sonographers within the association. Finally, with miniaturization of ultrasound devices and rising availabilities for training, echocardiography became attractive to non-cardiologists [3, 4]. There is a trend of increasing use of echocardiography in emergency settings by non-cardiologists, i.e. emergency physicians, intensive care specialists, anesthesiologists, cardiac surgeons, and cardiac physiologists [9]. Our survey revealed that only a small percentage of non-cardiologists (radiologists, anesthesiologists, and intensive medicine specialists) are currently using echocardiography in their practice. The ECHOS supports this trend but insists on high-quality training and will work towards establishing education and accreditation in focus cardiac ultrasound on European and national level.

A daily caseload varied to a great extent, with two thirds of respondents performing more than five examinations, and approximately one third more than 10 examinations. In addition, the majority of respondents have less than 30 minutes to complete the examination. The ECHOS supports quality over quantity and with that also supports international standards (45 minutes per examination – for image acquisition and reporting) as good practice to maintain quality and prevent musculoskeletal injuries of echocardiographers [10, 11].

The deviations from the proposed guidelines of chamber quantification seem to be another weakness of echocardiography practice in Serbia. Although the majority of respondents evaluate both systolic and diastolic LV function, systolic LV function is not routinely quantified using guideline-proposed criteria. Instead, visual estimation or obsolete, M-mode based methods are still frequently being used which is a serious downfall, since many guideline-directed pharmacological and device therapies depend on accurate measurement of LV ejection fraction. All these technical, logistical, and fundamental inefficiencies are possible barriers to further development of echocardiographic centers outside university hospitals. TOE and SECHO, as well as advanced echocardiographic techniques seem to be the exception rather than a rule in non-university hospitals. It is, therefore, not surprising that the majority of respondents need expert supervision.

Only 12% of respondents are satisfied with the current personal educational level in echocardiography, while the vast majority is willing to master new techniques and to have new modalities implemented in their centers. While some of these advances (e.g. strain and 3D echocardiography) require substantial investments in new equipment and software, those regarded as direly required at institutional level (TOE and SECHO) can be established without significant costs. The ECHOS will address the needs expressed in this survey by organizing dedicated teaching courses and workshops in order to accelerate the development of advanced echocardiography in non-university centers.

It is important to underline that the current survey was voluntary; thus, it is possible that our members who chose to participate had particularly strong opinions towards the survey questions resulting in a positive or negative response bias. In line with this, the actual echocardiography practice in Serbia may be somewhat different from what the survey results revealed. However, in the absence of the central register or the national network of echocardiography laboratories, it is impossible to obtain more credible data. Similar to other imaging societies, the ECHOS will use data from the current survey to create an action plan in order to provide guidance to its members and foster development of echocardiography in Serbia. In parallel with the publication of the textbook on clinical echocardiography, ECHOS will produce and propose a series of expert consensus documents and position statements on training, education, competence and accreditation in echocardiography in Serbia. Ultimately, the production of national guidelines for the practice and implementation of echocardiography in clinical practice should be the final step towards a bright future of echocardiography in Serbia.

Less than 50% of ECHOS members participated in the present survey and a great care must be taken when extrapolating our results to the entire population of echocardiographers in Serbia. On the other hand, response rate to this survey is comparable to similar surveys run by international organizations [7, 12]. In addition, it would be of interest to assess the views expressed in this survey with regard to the level and type of education of the respondents. Unfortunately, data on education in echocardiography are not available and will be addressed in an upcoming ECHOS survey.

CONCLUSION

There is room for improvement in all aspects of echocardiography practice in Serbia. Advanced echocardiographic techniques, SECHO and TOE are needed but rarely performed outside the university hospitals in Serbia. In order to achieve a better adherence to standards of practice in echocardiography, the development of national guidelines and personal and laboratory accreditation are necessary.

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Conflict of interest: None declared.

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Актуелно стање ехокардиографије у Србији – национална анкета Ехокардиографског удружења Србије

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САЖЕТАК

Увод/Циљ Сврха националне анкете Ехокардиографског удружења Србије је процена актуелног стања ехокардиографије у Србији, доступности различитих ехокардиографских техника и потреба за напредовањем на личном и институционалном нивоу.

Методе Анкета састављена од 20 питања о демографским подацима, броју и распрострањености ехокардиографске опреме и техника, стандардима извођења прегледа и писања извештаја, као и приоритетима за едукацију, послата је електронском поштом свим члановима Ехокардиографског удружења Србије.

Резултати Анкету је попунило укупно 106 чланова (42%). Ехокардиографске прегледе најчешће обављају кардиолози и специјалисти интерне медицине. Трансезофагеална ехокардиографија, стрес ехокардиографија и *speckle tracking* ехокардиографија су доступне у око 20% центара, тродимензионална ехокардиографија у 11%, док се контрастна ехокардиографија обавља само у два центра. Мање од трећине анкетираних чланова редовно користи електрокардиографске електроде и снима прегледе. Скоро сви анкетирани чланови (96%) увек процењују систолну и дијастолну функцију леве коморе, иако се систолна функција леве коморе често процењује (55%) употребом нестандардних метода. Новији ехокардиографски апарати чешће су доступни у универзитетским него у неуниверзитетским центрима (87 наспрам 44%, $p < 0,01$). Стрес ехокардиографија се сматра најпотребнијом техником на нивоу центра, док су *speckle tracking* ехокардиографија и трансезофагеална ехокардиографија најчешће навођене личне аспирације анкетираних чланова.

Закључак Напредне технике, стрес ехокардиографија и трансезофагеална ехокардиографија су неопходне, али ретко доступне ехокардиографске технике ван универзитетских центара. У циљу бољег поштовања стандарда ехокардиографске праксе, доношење националних препорука као и лична и лабораторијска акредитација делују као неизбежан потез.

Кључне речи: ехокардиографија; анкета; Србија