

Echocardiography in Different Clinical Situations Appropriate use to do Better



Giuseppe Gullace¹, Slobodan Dodic², Marija Bjelobrk³, Snezana Bijelic³, Gabriele Catena⁴ and Quintilio Caretta⁵

¹Consultant Cardiologist, Multimedica Hospital Group, Milan & University of Florence, Italy

²Professor at Medical Faculty, University of Novi Sad, Serbia

³Cardiologist, Institute of CVD Vojvodina, Serbia

⁴Director of Cardiologia Territoriale, Italy

⁵Professor of Cardiology & Department of Medicina Sperimentale e Clinica, University of Florence, Italy

Submission: July 01, 2019; **Published:** July 15, 2019

***Corresponding author:** Giuseppe Gullace, Consultant Cardiologist, Multimedica Hospital Group, Milan, University of Florence, Italy

Abstract

In the last 5 decades the utilization of ultrasound has greatly developed into echocardiography, generating a confused picture of the echocardiographic technique, with patients who do not always receive the right echocardiogram. Previous publications have reported a proposal for reclassification of Echocardiography based on function, competence, applications, proper machines and purposes is intended to give a coherent and adequate definition of requirements, in order to have appropriate use of the technique related to place where it is used, the clinical situation, the related function, the information expected, the exam indications and the educational pathway and requirements for the accreditation of the operators and echo-labs. In this paper we revisit these proposals emphasizing the importance to use echo properly and appropriately as well as the need to acquire accreditation through a defined educational pathway and training and the possibilities to use it widely in different clinical conditions.

Keywords: Echocardiography; Cardiovascular physiology; Electrophysiological; Heart surgery

Introduction

Previous publications have stated a reclassification of echocardiography according to its appropriateness of use, its function- and competence-based profile and applications and the related educational pathways for competence and accreditation [1,2]. The reason was the increased development and knowledges that determined a better knowledge of cardiovascular physiology, as well as the advent of novel applications or novel echo modalities, the use related to the development of the technique and its widened employment that produces incredible images and data and the different scenarios in which echocardiography is used due to different physicians, machines, locations, educational and training pathway.

In addition, the technological development allowed the miniaturization of equipment and the improvement in transducer technology facilitated the integration of focused cardiac profiles and pushed the clinical cardiologist to the echocardiographic evaluation of the patient at the bedside and in the point of care. After this increased patient bedside use in cardiac care unit and cardiology ward, the miniaturized echocardiography gave way

to the cardiologic setting to help emergency physicians in the diagnosis, emergent treatment and triage decisions [1,2]. The location of portable and high-end full-equipped echocardiographic systems changed, becoming widespread in cardiac operating room, electrophysiological and catheterization laboratories in order to guide heart surgery and assist operators in cardiac invasive procedures.

On the base of the above considerations, a new classification of echocardiography for an appropriate use in different clinical situations and related educational programs and training was needed and defined [1,2].

The aim of this paper is to revisit what defined previously emphasizing the importance to have a properly tailored echocardiography for the given application field, based on one tool for that given place, one technique for that given clinical situation, one application for that given function, one modality for that given information, one exam for that given purpose, one educational pathway for that given competence (operator).

In continuing this project, the present paper will take into account for each application and profile the clinical use, the indications, the quality process, the accreditation requirements, educational tailored pathway contents and modalities, keeping in mind that the international echocardiographic associations conjunctly developed important statements on the use of pocket-size imaging devices [3], appropriateness use criteria [4], quality echocardiography laboratory operations [5] and training in echocardiography [6] but a reclassification of the echocardiography according to application- and competence-based profiles has been late stated [1,2,7].

Requirements

The classification of echocardiography previously proposed [1,2] is in line with the following objectives:

- a) Definition of clinical situation where echo application, or specifically echo profile, is more appropriate and indicated
- b) Definition of the objectives of the examinations in that specific clinical situation
- c) Suggestion of the proper indications for each profile and application
- d) Definition of the process for educational pathway and training, including the different modalities and the different types of competence
- e) Recommendation on the quality process and suggestion of some modalities that could be used
- f) Definition of accreditation requirements for each profile organization

The proposed classification was based on requirements such as application (*general comprehensive echocardiographic tool*), profiles (*the specific use with different modalities within each application*), modality (*specific echo technique used such as TTE, TEE, Contrast Echo, Stress Echo, Vascular Echo, Wall dynamics Echo, etc.*), location (*the place where echocardiography is performed*), machine (*fixed, mobile, portable, pocket*), operator (*who performs echocardiography*), reporting (*fully structured report or noted as series of data and information to complete the clinical evaluation*), archiving (*modality of image and report storage*).

In addition, requirements that represent general and common directions for all applications and profiles have been taken into account. They referred to the clinical situation (*clinical condition of the patients in which the echo examination is performed*), the objectives of the examination (*what is expected to obtain in performing the echo examination in that given clinical situation and location, using that given machine, performing that echo application or profile*), the indications of the examinations related to each profile (*specific use of each application or profile to obtain the expected and possibly accurate parameters and data for the clinical situation where echo is used*), the educational pathway, training and competence (*several different levels of expertise such*

as basic, general, high and specific levels, have been considered for the organization and management of the theoretical education, training pathways and examinations; considering competence as the minimal education, training and experience required to attain the cognitive and technical skills necessary for the performance of echocardiography [8] *competence certification needs to be the final procedure by which National Societies of Echocardiography evaluate and attest that the operator is able to adequately perform the technique, after having passed through a defined and controlled educational pathway and a final evaluation* [9]; *such a training has to take into consideration that specific knowledge is necessary for TEE*, [10] *pediatric/neonatal* [11,12] *and vascular* [13], *similarly the intensive coronary care knowledge is considered different* [14], the quality and accreditation process (*structure where echocardiography is performed*). The Echo Lab needs to be reshaped, with this development of echocardiography; the National and/or International Societies of Echocardiography need to evaluate and attest that each single operator or structure (echo lab) has the specific requirements requested to perform specific functions and activities (echocardiographic examinations) according to (UNI CEI 70001) (European rule), UNI CEI EN 45020/1996 (European rule) and DPR n 37, 14/01/ 1997 (Italian rule).

Applications

Basic echo

Definition: It is a cardiovascular Echo with basic modalities and approaches oriented to obtain an initial diagnosis and a clinical conclusion in the patient pathway (after complete clinical examination), or to require an extension in clinical examination and advanced echocardiography. Basic Echo shall be used for primary gross diagnosis in the clinical evaluation and to complete the cardiological visit during consultation. A comprehensive and complete examination of cardiovascular system is provided as well as a description of cardiovascular structures anatomically and functionally necessary to define a diagnosis. Information should also be used for therapy and follow up. In case of requirement of an extension or detailed examination, the patient is referred for additional and detailed investigation to a hospital Echo Lab for Advanced Echo exam [1,2,15].

The indications include first cardiac evaluation in or outside patients, complement to a physical examination, cardiologic counselling in- or outside health-care facilities and hospital, screening programs, triaging candidates for a complete echo examination.

This could be obtained using Echo standard, performed by Cardiologists in outpatient cardiology service (either located out of the hospital or in hospital as a dedicated section of Echo Lab), especially for first diagnosis or a *Visit extended cardiovascular Echo*, performed by Cardiologists, Internists, General practitioners at bedside in hospital ward, in outpatient cardiology care, general practice, to complete the clinical evaluation.

Education/Competence General (or basic/primary for general practitioners) level education pathway and competence is the minimum requirement. Certification competence is provided by Scientific Societies of Echo [3,5,16].

Quality control and Accreditation Review and quality control shall be connected with the reference Advanced Echo (Echo Lab). Periodical audit and subsequent validation, reporting and archiving audited shall be performed.

Advanced echo

Definition: This is a high-level cardiovascular echography, reference for clinical and instrumental diagnosis of adult and paediatric cardiovascular abnormalities and function, for detailed indication of medical and surgical treatment, for integration with other imaging diagnostic tools, for education, for health technology assessment and for research. The clinical situations include a detailed diagnosis, assessment, follow up and research. A comprehensive, detailed and complete examination of cardiovascular system is provided as well as a fine and detailed anatomically and functionally description of cardiovascular structures [5,17].

Diagnosis of cardiovascular pathology is finalized to medical/surgical treatment, prognosis, follow up and research. The profiles used are represented by complete Transthoracic and Transoesophageal Echo, Wall Dynamics, 3/4D and Stress Echo, Vascular Echo, Paediatric Echo. All used for general and high-level diagnosis and morpho - functional evaluation in Echo Lab, detailed and sophisticated morpho functional diagnosis, research activity and pre - and post cardiovascular interventional examination.

Education/Competence. High level education pathway and competence is required [1,2]. Quality control and Accreditation Certification competence is provided by Scientific Societies of Echo [3,5,16-23]. Echo Lab shall be accredited [18]. The location is subordinated to all accreditation requirements requested for Echo Lab.

Focused echo

Definition: This is a cardiovascular echography performed by specialist doctors, in different places and clinical settings to obtain information, which at that time they require. It is an examination that answers a specific diagnostic question. The objectives are to detect focused information and to answer specific questions in particular cardiovascular situations and context, providing diagnosis in critical care and in procedure assistance.

The European Association of Cardiovascular Imaging attributed the term of FoCUS to the cardiac ultrasound examination used generically in the point-of-care and performed according to standardized but restricted scanning protocol to add information to the physical examination, by an operator not necessarily fully trained in echocardiography but appropriately trained in FoCUS (Focused Cardiac Ultra Sound), who is at the same time usually responsible for immediate decision-making and/or treatment [7].

Defined in this way it seems similar to Fast Echo (not mentioned); but if it is this, the applications reported below are not included. We prefer to use the term FOCUSED (separately from FAST) as targeted and selected.

It may be used in Coronary Care and Intensive Care Units to orient towards a gross diagnosis, to checking the clinical situation and to focusing an emergency condition obtaining immediate information for the present clinical evaluation and therapeutically decision making [17,22,24], in Interventional Cath-Lab and electrophysiology Lab, used after a previous detailed examination, to assist the operators' procedures and to monitor and finally assess the interventional procedure with particular attention to the onset of unexpected complications [25-28]. In Operating Room to provide important anatomic, morphological and function information on cardiac patient during surgery, after a previous detailed examination oriented to surgical planning, monitoring and finally post-operative management of patients with particular attention to the onset of unexpected complications [21,29-33].

It is suggested as a complement to a physical examination in the coronary and intensive care unit, tool for a fast-initial screening in an emergency setting, semi-quantification of extravascular lung water [34,35], procedure assistance in Cath-Lab, Electrophysiology Lab and Operating Room application in clinical situations and problem - based approach.

Education/Competence Specific level education pathway and competence is required. Quality control and Accreditation Certification competence is provided by Scientific Societies of Echo [16,24,25,28-31]. Review and quality control shall be connected with the reference Advanced Echo Lab [18,36].

Fast echo

Definition: This is a cardiovascular echography performed in emergency situation out of the hospital or in the first aid room of the hospital to obtain rapidly information for clinical assessment and therapeutic decision-making. Due to the emergency situation, the principle - based application is look for what you need in few minutes (usually less than 3 minutes) in the point of care (that is any place out of the hospital where emergency occurs such as on the road or at patient's home where physician is called for urgent clinical conditions and has to decide or not to hospitalize the patient or at the gate of the hospital) [37]. Echo Fast must be performed within a general exploration and clinical problem-based (and not organ-based) assessment in order to get the information needed for diagnostic and therapeutical decision making. It must not be considered a complete diagnostic echo examination (no final diagnosis is performed) but just the tool to get information to add to the clinical examination.

Noted information must be reported within clinical context in the clinical record and must be documented by corresponding images. Certification competence is provided by Scientific Societies of Echo. Review and quality control shall be connected with the referent Advanced Echo Lab.

Education/Competence Primary level education pathway and competence is required [38]. Quality control and Accreditation Certification competence is provided by Scientific Societies of Echo. Review and quality control shall be connected with the referent Advanced Echo Lab.

Final Comments: The different scenarios of echocardiography use have aroused the need of an updated redefinition of application and profile related to the appropriateness of function and to the different physicians, machines, locations, modalities, proper indications of examinations, educational pathway and training, quality process and accreditation [1,2,7]. It is now important to put some statement in order to understand the main significance of the novel introduction and the advantage it is possible to have if Echo is appropriately used either in choosing the proper equipment or in fulfilling the diagnostic requirements and orient to the right diagnosis and therapeutical decision making. In this process the involvement of the Scientific Societies indications and guidelines is aimed to fix and re-establish their important physiologic role in indicating the right behaviour, the best physician teaching and education, the most appropriate and complete certification pathway. It is our opinion that educational pathways and training are responsibility of Scientific Societies of Echocardiography and that they alone or in partnership with Universities should perform suitable and appropriate programs that in the respect of the above reported levels bear all attendees to the respective competence. When changes occur, it is mandatory for Scientific Societies to manage changes in the better suitable way, addressed to control and improve the current situation.

Advantage: All the physicians will feel reassured receiving the information really important, especially in emergency patients [39,40] without caring to get an advanced echocardiography, very difficult to obtain in situations with limited patient mobility. Similarly, possible medico-legal concerns will be reduced with the help of the present reclassification.

Also, the companies producing echocardiographic equipment will benefit of this new schematic proposal: the right tools will be implemented and sold for the echocardiographic profiles that really need it [41]. The market will be wider and all the different physicians will be able to profit at best the equipment they buy, thanks to an appropriate training. Accordingly, the relationship operator-producer-purchaser will be realigned in a better fruitful collaboration [31].

When considering reimbursement and health technology assessment, the echocardiography reclassified following the present schematic will show a better cost/effectiveness ratio, obtaining a greater appropriateness of each modality. The National Health System, will deal much better with the echocardiographic requirements of the population (better appropriateness with shorter waiting lists), allocating the right physician with the right echocardiographic equipment in the current time of economic resources rationalization. Also, the home care for different pathologies (heart failure, but also cancer

and most of the chronically ill patients) will advantage of the right echocardiographic modality. Echocardiography in emergency use, especially in the point of care out of the hospital, is another important field of application to be set and promoted, due to its particular role in giving immediate information for critical patient treatment and management.

Operators: It is important to say and emphasize that echocardiography should be a method which belongs to those who know to use it in a correct and appropriate way. This means that echo is a powerful diagnostic tool to be used not only in Echo Lab or in outpatients services or in Cardiology wards by Cardiologists but also in many other clinical situations and locations by other specialists such as Intensive Care Unit, Emergency, bedside by the General Practitioner, anaesthesiologist if they are well trained and certified [32,37]. In this case an additional educational content and training should be administered regarding chest and abdominal scanning and addressed to allow the operators to recognize the presence of liquid or air where they are not usually present or pulmonary comets or organ fracture [34-37].

Machines: Not all the machines are suitable to perform a complete echocardiographic examination. Machines are classified as stationary, mobile, portable and pocket and this is not only related to the location and clinical situation where echo examination is performed but also to what should be looked for and to which modality is more suitable to use in that given situation. In this field, the present document aims to contribute to the validation of the equipments even if this should have been responsibility of industry. In fact, industry often puts on market machines, promoting themselves, that are not completely validated and have a more or less long period of uncertainty whose cost has a social burden and impact. Publications exist on technical feasibility, less on diagnostic accuracy, rare or none on therapeutic, patient outcome and social impact. This is due to the incompletely or not applied process of health technology assessment before the machine placing on the market [31]. Despite this industry's responsibility, the reclassification of echocardiography reported [1,2,7] tries to provide also indications and appropriateness of use of the machines in addition to the possible incremental value in the clinical and diagnostic process.

Clinical situations: Since the scenario of echocardiography use involves different clinical situations, objectives and purposes, modalities, examination content, operators, machine types and locations, a suitable educational pathway and training has been defined for application and profile. Educational program and Training are the most important requirement for the different operators who want to use echocardiography in the clinical condition and location they need to use it. This pathway has been designed and tailored with the specific objectives and diagnostic needs. A well-trained operator by skilled tutors and their competence certification should be conditioning echocardiographic performance in any application; without this, the risks of mistakes, abuse and incorrect and inappropriate examinations could lead echocardiography to be dangerous.

Quality: Quality process is an important step of validation of echocardiographic examination to be performed periodically to improve accuracy, reliability, correctness, reproducibility and variability of echo examinations and skill, experience and competence of operators. Each in his own specific application/profile should compare data and opinions periodically with higher level competence (structure and/or skilled operator). A registry where validated examinations are archived should be provided; this qualifies the improvement level of Echo Lab and operator giving guarantees of comparability and reproducibility and attesting the validated activity of both. Within this a minimal data setting and accreditation requirements for each application/profile should be defined [36,42].

Conclusion

In conclusions, Echocardiography is a fantastic imaging tool that needs to be properly used according with clinical situations and objectives. A suitable educational pathway and training are basic conditions to perform echocardiography in a correct and appropriate way. This should be properly tailored according with the application of echo and its specific profiles. Echo indications, objectives and clinical situation should be constantly taken into account in order to differentiate information that are obtained for immediate clinical assessment from those necessary for diagnosis and detailed evaluation. Machines should be properly used for their specific purpose. Finally, a quality process periodically planned and achieved shall be a basic condition for continuous improvement and reduction of mistakes.

References

- Gullace G, Demicheli G, Monte I, Colonna P, Carerj S, et al. (2012) Re-classification of echocardiography according to the appropriateness of use, function- and competence-based profiles and application. *J Cardiovascular Echography* 22(3): 91-98.
- Gullace G, Demicheli G, Monte I, Colonna P, Mandorla S, et al. (2014) Educational pathway, competence, indication and quality process of the new classification of echocardiography according to appropriateness of use and application. *J Cardiovasc Med* 15(8): 674-682.
- Zuppiroli A, Corrado G, De Cristofaro M, Erlicher A, Galati A, et al. (2007) Documento di consenso SIEC. Dalla formazione degli operatori al referto. Documento di consenso sugli aspetti organizzativi dell'ecocardiografia in Italia. *G Ital Cardiol* 8(1): 49-67.
- Ryan T, Armstrong WF, Khandheria BK (2008) Task force 4: training in echocardiography endorsed by the American Society of Echocardiography. *J Am Coll Cardiol* 51(3): 361-367.
- Popescu BA, Andrade MJ, Madani LP, Fox KF, Flachskampf FA, et al. (2009) EAE recommendations for training, competence, and quality improvement in echocardiography. *Eur J Echocardiogr* 10: 893-905
- (2010) Standards for Accreditation in Adult Echocardiography Testing. ICAEL.
- Neskovic AN, Edvardsen T, Galderisi M, Garbi M, Gullace G, et al. (2014) Focus cardiac ultrasound: the European Association of Cardiovascular Imaging viewpoint. *Eur Heart J Cardiovasc Imaging* 15(9): 956-960.
- Ryan T, Armstrong WF, Khandheria B (2008) Task force 4: training echocardiography. *J Am Coll Cardiol* 51(3): 361-367.
- (2010) Standards for accreditation in adult echocardiography testing. ICAEL.
- Flachskampf FA, Badano L, Daniel WG, Feneck RO, Fox KF, et al. (2010) Recommendations for transoesophageal echocardiography: update 2010. *Eur J Echocardiogr* 11(7): 557-576.
- Mertens L, Seri I, Marek J, Arlettaz R, Barker P, McNamara P (2011) Targeted neonatal echocardiography in the neonatal intensive care unit: practice guidelines and recommendations for training. Expert consensus statement. *J Am Soc Echocardiogr* 24: 1057-1078.
- Standards for accreditation in pediatric echocardiography testing. ICAEL 2010.
- Gerhard-Herman M, Gardin JM, Jaff M, Mohler E, Roman M, et al. (2006) Guidelines for noninvasive vascular laboratory testing: a report from the American Society of Echocardiography and the Society of Vascular Medicine and Biology. *J Am Soc Echocardiogr* 19(8): 955-972.
- Price S, Via G, Sloth E, Guarracino F, Breikreutz R, et al. (2008) Echocardiography practice, training and accreditation in the intensive care: document for the world interactive network focused on critical ultrasound (WINFOCUS). *Cardiovascular Ultrasound* 6: 49.
- Douglas PS, Garcia MJ, Haines DE, Lai WW, Manning WJ, et al. (2011) ACCF/AHA/ASNC/HFSA/HRS/SCAI/SCCM/SCCT/SCMR 2011 Appropriate Use Criteria for Echocardiography. *J Am Soc Echocardiogr* 24(3): 229-267.
- Flachskampf FA, Badano L, Daniel WG, Feneck RO, Fox KF, et al. (2010) Recommendations for transoesophageal echocardiography: update 2010. *Eur J Echocardiogr* 11(7): 557-576.
- Mor-Avi V, Lang RM, Badano LP, Belohlavek M, Cardim NM, et al. (2011) Current and Evolving Echocardiographic Techniques for the Quantitative Evaluation of Cardiac Mechanics: ASE/EAE Consensus Statement on Methodology and Indications Endorsed by the Japanese Society of Echocardiography. *J Am Soc Echocardiogr* 24(3): 277-313.
- Picard MH, Adams D, Bierig SM, Dent JM, Douglas PS, et al. (2011) American Society of Echocardiography recommendations for quality echocardiography laboratory operations. *J Am Soc Echocardiogr* 24(1): 1-10.
- Price S, Via G, Sloth E, Guarracino F, Breikreutz R, et al. (2008) Echocardiography Practice, Training and Accreditation in the Intensive Care: Document for the World Interactive Network Focused on Critical Ultrasound (WINFOCUS). *Cardiovascular Ultrasound* 6: 49.
- (2010) Standards for Accreditation in Pediatric Echocardiography Testing. ICAEL.
- Shanewise JS, Cheung AT, Aronson S, Stewart WJ, Weiss RL, et al. (1999) ASE/SCA guidelines for performing a comprehensive intraoperative multiplane transesophageal echocardiography examination: Recommendations of the American Society of Echocardiography Council for intra-operative echocardiography and the Society of Cardiovascular Anesthesiologists task force for certification in perioperative transesophageal echocardiography. *J Am Soc Echo* 2: 884-899.
- Mertens L, Seri I, Marek J, Arlettaz R, Barker P, et al. (2011) EXPERT CONSENSUS STATEMENT. Targeted Neonatal Echocardiography in the Neonatal Intensive Care Unit: Practice Guidelines and Recommendations for Training. *J Am Soc Echocardiogr* 24(10): 1057-1078.
- Gerhard-Herman M, Gardin JM, Jaff M, Mohler E, Roman M, et al. (2006) Guidelines for Non-invasive Vascular Laboratory Testing: A Report from the American Society of Echocardiography and the Society of Vascular Medicine and Biology. *J Am Soc Echocardiogr* 19(8): 955-972.
- Labovitz AJ, Noble VE, Bierig M, Goldstein SA, Jones R, et al. (2010) Focused Cardiac Ultrasound in the Emergent Setting: A Consensus Statement of the American Society of Echocardiography and American College of Emergency Physicians. *J Am Soc Echocardiogr* 23(12): 1225-1230.
- Zamorano JL, Badano LP, Bruce C, Chan KL, Gonçalves A, et al. (2011) EAE/ASE Recommendations for the Use of Echocardiography in New

- Transcatheter Interventions for Valvular Heart Disease. *Eur J Echocardiogr* 12(8): 557-584.
26. Perk G, Biner S, Kronzon I, Saric M, Chitz L, et al. (2012) Catheter-based left atrial appendage occlusion procedure: role of echocardiography. *Eur Heart J Cardiovasc Imaging* 13(2): 132-138.
27. Chue CD, de Giovanni J, Steeds RP (2011) The role of echocardiography in percutaneous left atrial appendage occlusion. *Eur J Echocardiogr* 12(10): i3-10.
28. Gorcsan J, Abraham T, Agler DA, Bax JJ, Derumeaux G, et al. (2008) Echocardiography for Cardiac Resynchronization Therapy: Recommendations for Performance and Reporting—A Report from the American Society of Echocardiography Dyssynchrony Writing Group. *J Am Soc Echocardiogr* 21(3): 191-213.
29. Reeves ST, Glas KE, Eltzhig H, Mathew JP, Rubenson DS, et al. (2007) Guidelines for Performing a Comprehensive Epicardial Echocardiography Examination: Recommendations of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists. *J Am Soc Echocardiogr* 20(4): 427-437.
30. Feneck R, Kneeshaw J, Fox K, Bettex D, Erb J, et al. (2010) Recommendations for reporting perioperative transoesophageal echo studies. *Eur J Echocardiogr* 11(5): 387-93.
31. Gullace G (2008) L'appropriatezza in ecografia cardiovascolare, il miglioramento dell'evoluzione del cambiamento. *Giorn It Ecogr Cardio* 18(3): 11.
32. Savage RM, Licina MG, Koch CG, Hearn CJ, Thomas JD, et al. (1995) Educational program for intraoperative transesophageal echocardiography. *Anesth Analg* 81(2): 399-403.
33. Cahalan MK, Abel M, Goldman M, Pearlman A, Sears-Rogan P, et al. (2002) American Society of Echocardiography and Society of Cardiovascular Anesthesiologists task force guidelines for training in perioperative echocardiography. *Anesth Analg* 94(6): 1384-1388.
34. Picano E, Frassi F, Agricola E, Gligorova S, Gargani L, et al. (2006) Ultrasound Lung Comets: A Clinically Useful Sign of Extravascular Lung Water. *J Am Soc Echocardiogr* 19(3): 356-363.
35. Lichtenstein D, Mézière G, Biderman P, Gepner A, Barré O (1997) The Comet-tail Artifact. An Ultrasound Sign of Alveolar-Interstitial Syndrome. *Am J Respir Crit Care Med* 156(5): 1640-1646.
36. Gullace G, Carerj S (2004) Requisiti minimi di accreditamento e gestione per la qualità. *Giorn It Ecogr Cardio* 13(1): 88.
37. Gullace G, Castelnuovo S, Villa G, Sesana G, Neri L, et al. (2010) L'ecografia in emergenza sul territorio: Progetto DEM118 (diagnostica ecografica mobile 118). *N&A mensile italiano del soccorso* 19: 210.
38. Moscati R, Reardon R (2003) Clinical Application of the FAST Exam. In: Jehle D, Heller M (Eds.), *Ultrasonography in Trauma: The FAST*. American College of Emergency Physicians: Dallas, TX 39-60.
39. Fortuny E, Fernandez-Golfín C, Viliani D, Zamorano JL (2012) Multimodality imaging in pericardial diseases. *Journal of Cardiovascular Echography* 22(1): 1-10.
40. Carrilho-Ferreira P, Pinto FJ (2011) The role of multimodality imaging in takotsubo cardiomyopathy. *Journal of Cardiovascular Echography* 21: 143-151.
41. Chadderdon SM, Kaul S (2011) Myocardial contrast echocardiography in coronary artery disease. *Journal of Cardiovascular Echography* 21: 1-11.
42. Sicari R, Galderisi M, Voigt JU, Habib G, Zamorano JL, et al. (2011) The use of pocket-size imaging devices: a position statement of the European Association of Echocardiography. *Eur J Echocardiogr* 12(2): 85-87.



This work is licensed under Creative Commons Attribution 4.0 License
DOI: [10.19080/JOCCT.2019.14.555884](https://doi.org/10.19080/JOCCT.2019.14.555884)

Your next submission with Juniper Publishers will reach you the below assets

- Quality Editorial service
- Swift Peer Review
- Reprints availability
- E-prints Service
- Manuscript Podcast for convenient understanding
- Global attainment for your research
- Manuscript accessibility in different formats
(Pdf, E-pub, Full Text, Audio)
- Unceasing customer service

Track the below URL for one-step submission

<https://juniperpublishers.com/online-submission.php>