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► To cite this version:

Théo Pezel, Augustin Coisne, Hani Mahmoud-Elsayed, Giulia Elena Mandoli, Sarah Moharem Elgamal, et al.. EACVI communication paper first international young dedicated multimodal cardiovascular imaging simulation education event organized by the ESC. *European Heart Journal - Cardiovascular Imaging*, 2020, 21 (2), pp.124-126. 10.1093/ehjci/jez299 . hal-02440636

HAL Id: hal-02440636

<https://univ-rennes.hal.science/hal-02440636v1>

Submitted on 21 Feb 2020

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**EACVI Communication Paper: First International Young dedicated
Multimodal Cardiovascular Imaging Simulation Education Event**

Organized by the ESC

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Total Word count: **1499**

Conflict of interest: none declared

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The European Association of Cardiovascular Imaging (EACVI), a branch of the European Society of Cardiology (ESC), is dedicated to the promotion of excellence in clinical diagnoses, research, technical development, and teaching in cardiovascular imaging (CVI). However, education has changed during last decades, moving from text-based manuals to multimedia education readily accessible by e-learning(1). Indeed, the new generation of physicians is calling for a more personalized training focused on clinical practice. Thus, the EACVI has developed a e-learning program with numerous webinars ([https://www.escardio.org/Sub-specialty-communities/European-Association-of-Cardiovascular-Imaging-\(EACVI\)/Education/EACVI-distance-learning](https://www.escardio.org/Sub-specialty-communities/European-Association-of-Cardiovascular-Imaging-(EACVI)/Education/EACVI-distance-learning)), with the aim of giving a comprehensive training and preparing for EACVI certification. As an extension of this e-learning program, during the 2019 ESC conference in Paris, ESC, EACVI and French Society of Cardiology (FSC) organized the first international training event by simulation in cardiology during an international congress.

EACVI Simulation Education Event

This event was organized by the College of young French cardiologists and the French branch of the Heart Imagers of Tomorrow (HIT) of the EACVI on Sunday the 1st of September 2019 at the iLumens center for simulation of the University of Paris. 172 young cardiologists from 43 different countries worldwide participated in 3 different workshops: a transesophageal echocardiography (TEE) simulator, workstations with clinical cases of interventional TEE and workstations for post-treatment by cardiac magnetic resonance (CMR). Teaching was provided by a team of 16 international experts in cardiovascular imaging of EACVI and FSC, allowing workshops with small groups (less than 15 junior cardiologists per group) to promote transmission of tips and tricks by experts.

We also conducted a survey among the participants according to the recent guidelines of the EACVI Scientific Initiatives Committee(2), to evaluate their views on teaching by simulation. All the participants answered the survey. The average age of the participants was 31±3 years and 68% were residents or fellows in training. Only 48% of the participants had already participated in a simulation workshop while 91% considered this teaching method as “very important” or “necessary” in

cardiology. Furthermore, the participants were generally very satisfied with the workshop, with an average overall assessment of 9.4/10, 88% of them considering they have learned something important that could be useful in their daily practice.

EACVI workshop on echocardiography simulation

A workshop was dedicated to the mitral valve with the use of TEE simulators based on high-fidelity mannequins, a modern tool for learning the normal cardiac anatomy and the various pathologies in a secure setting(3) without compromising the safety of patients with a better ethical approach(4). The simulator allowed real-time 3D reconstitution of the anatomy of the heart by means of several modules and levels with different cases of mitral valve diseases. The main benefit of this workshop was to correlate the different TEE views with a 3D model of the heart to better understand the anatomical relationships by freeing themselves from time constraint and invasive and unpleasant nature of examination on a life-size mannequin, performed in presence of supervisors (**Figure 1**). Interestingly, this workshop mainly involved young cardiologists who were starting out with using TEE as 32% of the participants had never performed TEE previously, and for the others, the average TEE experience was 1.3 years, with an average of 4 TEE procedures performed per week. Assessing the mechanism of the mitral regurgitation with 3D-TEE is challenging and the workshop was associated with a significant improvement of the confidence of anatomical knowledge ($5.6\pm 1.2/10$ vs $2.3\pm 0.8/10$, $p<0.001$).

Sessions regarding interventional cases of transcatheter mitral valve repair with the MitraClip[®] system were also organized to train the participants in this difficult and highly specialized technique. This workshop was associated with a significant improvement of the confidence of TEE with the MitraClip[®] procedure ($4.2\pm 1.1/10$ vs $1.1\pm 0.5/10$, $p<0.001$). Training for a procedure as technical as interventional TEE for MitraClip[®] would not have been as readily achievable without a simulation mannequin. Thus, instruction by simulation for interventional procedures allows for an increase in the ability of the students to perform these examinations in real and challenging situations(5).

EACVI workshop on the use of CMR workstation

A workshop was dedicated to hypertrophic cardiomyopathy on workstations, with the support of the CMR Section of the EACVI. The aim was to become familiar with the principle of the different sequences used in CMR using real clinical cases with daily practice softwares. The workshop was conducted in small groups of participants to allow maximal communication of technical hints and tips. Thus, participants could handle tools under the supervision of experts, improve their interpretation skills, make reliable measurements, avoid mistakes and produce a relevant examination report. During the workshop, the experts went from one trainee to another to show them how to make proper measurements (**Figure 2**). The main benefit of this training was to allow trainees to acquire a “proper method of analysis” without stress until the results were satisfactory.

This workshop mainly involved young cardiologists who were starting out with the use of CMR as 87% of the participants had never interpreted a CMR exam previously. This workshop was associated with a significant improvement in the confidence of CMR analysis ($4.3 \pm 1.1/10$ vs $1.4 \pm 0.7/10$, $p < 0.001$). The access to practice CMR is not always straightforward for cardiologists as only 12% of the participants said they could perform it easily in their center. Therefore, this kind of training also seems relevant to provide a better understanding of the interpretation of daily CMR reports. Indeed, 72% of the participants expressed they were much more comfortable with the interpretation of the CMR reports after the workshop.

Role of the simulation workshop in regard to EACVI certifications

The EACVI offers different types of certification in echocardiography, CMR, cardiac computed tomography, and nuclear cardiology (<https://www.escardio.org/Education/Career-Development/Certification/EACVI-Certification-Accreditation>). Among the participants at this event, only 4% had an EACVI certification in echocardiography(6) or CMR(7), although 79% of them are planning a future EACVI certification. This underscores the notion that simulation workshop training could be another step in education after instruction by e-learning accessible via EACVI webinars and before validation of an EACVI certification.

Conclusion

This ESC/EACVI/FSC/HIT simulation event was a success both for participants and supervisors. The survey showed a strong progression of knowledge and skills in echocardiography and CMR after workshops. 82% of the participants would like to regularly participate in similar events and 76% would recommend this event to their friends and colleagues. This training involving a simulator and workstations probably could be a way of education in cardiovascular imaging, allowing students to progress under an expert supervision, without time constraints or danger for patients. At the current time, there are no EACVI or American Society of Echocardiography guidelines on cardiac imaging training by simulation to standardize this method of teaching. This kind of event could be repeated in upcoming international congresses as a training method in non-invasive CV imaging.

Acknowledgements for organising the course

- Martine Gilard
- Francesca Sanguineti
- Gilles Barone-Rochette
- Olivier Lairez
- Florent Le Ven
- Jérôme Garot
- Iris Chapuis and Audrey Esperou Surrel (ESC)
- iLumens center (University of Paris)

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Figures



Figure 1 Dr Hanı Mahmud-Elsayed of the EACVI committee demonstrating the utility of TOE simulator to assess the mitral valve.



Figure 2 Prof. Jerome Garot and Dr Tomaž Podlesnikar of the CMR committee of the EACVI leading a workshop on post-processing and image analysis of CMR using workstations.