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Journal of Interdisciplinary Medicine

EDITORIAL

CardioIMAGE — the Image of a Cardio Team

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Cardiac imaging faced a tremendous and continuous development during the last years. Limited in the past to traditional ultrasonography, the recent expansion of new technologies for cardiac imaging, such as 3D ultrasound, nuclear cardiology, cardiac magnetic resonance, intracardiac imaging, intravascular ultrasound, or intravascular optical coherence tomography, made cardiac imaging the most fashionable and multifaceted sub-speciality of cardiology, which rapidly became indispensable for a medical decision in all fields of cardiology.

CARDIAC IMAGING – THE HEART OF CARDIOLOGY

Cardiac imaging is nowadays an essential tool not only for establishing an accurate diagnosis but also for guiding the therapeutic procedures in many sub-specialities of cardiology.

Interventional cardiology is possibly the field where the role of cardiac imaging is the most obvious. Cardiac computed tomography (CT) is able to provide a noninvasive assessment of coronary circulation and a complex analysis of atheromatous plaques, at the same time evaluating their vulnerability and the consequent risk of plaque rupture. Intravascular ultrasound (IVUS) and optical coherence tomography (OCT) are frequently used in the cathlab for plaque characterization and for evaluation of stent apposition to the vessel wall. Endothelial healing after stent placement or the progression of the neoatherosclerotic process within the implanted stents are also frequent indications for intracoronary imaging. The recent introduction of bioabsorbable stents opened a new indication for OCT – assessment of the stent struts resorbtion, while the recent concept of vulnerable plaque sealing using bioabsorbable scaffolds requires intracoronary visualization, too. Near-infrared spectroscopy is another invasive technique useful for interventional cardiology, being able to provide relevant information on the lipid plaque components. Cardiac CT is also useful for assessing the complexity of coronary lesions and for the estimation of calcium burden, relevant information that help the interventionist to plan the procedure.

Emergency cardiology is another field in which cardiac CT plays a significant role, as demonstrated by the recent introduction of the CT-based triple-rule-out protocols in the emergency rooms, for excluding acute coronary syndromes, pulmonary embolism, and acute aortic dissection in one single step in patients presenting with acute chest pain.

Pediatric cardiology is a field in which cardiac ultrasound, CT, and cardiac magnetic resonance imaging (MRI) can be considered gold standards for diagnosing complex heart malformations, replacing classical cardiac catheterization.

Electrophysiology is another field of cardiology that encountered a rapid development in the last years. Nowadays, extremely complex procedures, based on intracardiac navigation using three-dimensional imaging guidance, are performed in the EP labs on a daily basis. The ablation of pulmonary veins rapidly became the procedure of choice in many cases of atrial fibrillation and is currently performed using sophisticated 3D guidance and imaging-based reconstruction of the left atrial architectonics.

 DOI: 10.1515/jim-2017-0056

FIGURE 1. The CardioIMAGE platform implemented in May 2017. **A** – Cardiac MRI; **B** – Cardiac CT 128 slices.

The role of cardiac MRI in the quantification of myocardial fibrosis prior to the procedure has been well demonstrated in relation to the risk of recurrence.

Cardiac MRI and myocardial viability

Cardiac MRI plays a major role in assessing the viability of the infarcted myocardial tissue in patients suffering from myocardial infarction. Myocardial viability is the key factor that determines the long-term evolution of patients surviving an acute myocardial infarction, and a correct estimation of the infarct size and viability degree is essential for guiding the long-term therapy of these patients.

CardioIMAGE — A SOLUTION EXPECTED FOR A LONG TIME

In Romania, the lack of complex imaging platforms for cardiac applications significantly limited the development of cardiac MRI for many years. In too many cases, patients with large infarctions were sent abroad to undergo cardiac MRI or nuclear tests for assessment of their myocardial viability. CardioIMAGE was designed as a project trying to address an acute need of the Romanian healthcare system and of medical research at the same time, aiming to develop a complex imaging platform, including CT multislice and MRI equipments dedicated for cardiac applications. Initially, this project for the creation of a cardiac imaging platform unique in Romania was denied from grant application by two state institutions (hospital or academic) between 2010 and 2015. However, the enthusiasm and professionalism of a dedicated team made this dream possible in 2017. Not only that the CardioIMAGE project was placed on the top position in the national competition of research infrastructures in 2016,[1] but it was also finalized with success after 9 months. In May 2017, the CardioIMAGE platform, including the latest generation cardiac MRI and the most modern 128 slice-cardiac CT,

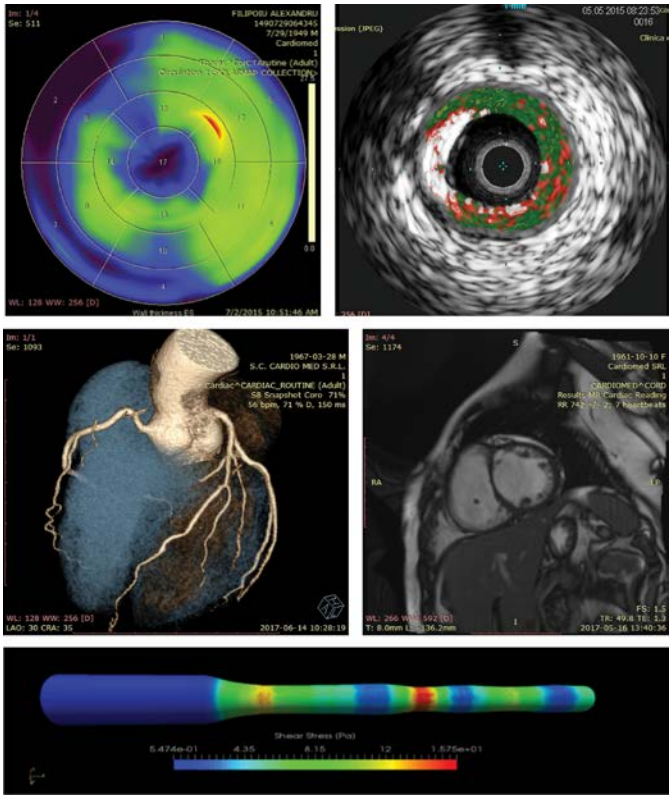

FIGURE 2. Computational imaging applications in CardioIMAGE platform: **A** – Computational polar maps; **B** – Intravascular ultrasound; **C** – 3D cardiac CT; **D** – Cardiac MRI; **E** – Computational flow dynamics for coronary shear stress evaluation

FIGURE 3. CardioIMAGE team — members of the: Cardio Med Medical Center, Tîrgu Mureș, Romania, University of Medicine and Pharmacy, Tîrgu Mureș, Romania, and County Clinical Emergency Hospital, Tîrgu Mureș, Romania

was succesfully implemented, with all the installations and necessary authorizations in place, and is currently in use (Figure 1). A modern supercomputer and sophisticated softwares for image processing make also possible 3D computational reconstructions of cardiac structures and coronary circulation and the development of hybrid and fusion imaging technologies, in a modern approach based on interdisciplinarity (Figure 2). The CardioIMAGE project was supported via the research grant no. 103545/2016, contract number 43/05.09.2016, entitled "High performance multimodal MRI/CT imaging platform, for applications in computational medicine, nanoparticles and hybrid imaging for the research of atherothrombotic disorders — CARDIO IMAGE" financed by the Romanian Ministry of European Funds, the Romanian Government and the European Union.

CardioIMAGE – A PROFESSIONAL TEAM

This issue of JIM publishes several articles dedicated to cardiac imaging that resulted from application of the CardioIMAGE equipments.[2–6] The role of cardiac CT in triple-rule-out protocols, the role of MRI in guiding stem cell transplantation after an acute myocardial infarction, or the role of CT in the identification of coronary fistulas or in diagnosing coronary disease in young patients, are nicely described by the authors.

The team of the CardioIMAGE project (Figure 3) should be congratulated for their nice results, for their dedication and professionalism. However, they should realize that from now on, they are facing great expectations when it comes to exploitation of this unique platform. Once implemented, such a great research infrastructure should generate excellent research and clinical results starting with the first day, and will be for sure opened to many collaborations with different medical disciplines.

REFERENCES

1. Program Operațional Competitivitate 2014–2020. Listă proiecte selectate pentru finanțare, listă proiecte de rezervă, lista proiectelor respinse. Available at: http://newpoc.research.ro/uploads/competitii/actiunea-1-1-1/2015/sectiunea-a/rezultate-selectie-proiecte-a.pdf
2. Opincariu D, Cernica D, Orzan M, et al. High-Risk Coronary Plaques Complicated with Acute Coronary Syndrome in Young Patients. *Journal of Interdisciplinary Medicine*. 2017;2:150-154.
3. Stănescu A, Himcinschi E, Morariu M. Cardiac Computed Tomography Assessment in Acute Coronary Syndromes — Do We Have Time for It in Emergency Settings? *Journal of Interdisciplinary Medicine*. 2017;2:140-143.
4. Jáni L, Mester A, Hodas R, et al. Computed Tomography Assessment of Coronary Fistulas. *Journal of Interdisciplinary Medicine*. 2017;2:155-159.
5. Mester A, Oltean-Péter B, Rodean I. Magnetic Resonance Imaging of Myocardial Function Following Intracoronary and Intramyocardial Stem Cell Injection. *Journal of Interdisciplinary Medicine*. 2017;2:112-116.
6. Lázár E, Bordi L, Benedek I Jr. Computed tomographic assessment of coronary arteries in patients undergoing stem cell therapy following an acute myocardial infarction. *Journal of Interdisciplinary Medicine*. 2017;2:136-139.