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# The new place of imaging in cardiology, from diagnosis to treatment

*La nouvelle place de l'imagerie en cardiologie, du diagnostic and traitement*

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The world of cardiology has changed, and continues to develop apace. We are moving from medicine based on scientific proofs to personalized medicine [1]. Scientific research is ongoing, and the amount of knowledge required to treat a patient is increasing. We have many specificities to deal with, and some of these patient characteristics come from imaging techniques that are used largely in the field of cardiovascular diseases [2].

New approaches are starting to be applied, which may have a considerable effect on the way we use imaging techniques in the near future [3]. Artificial intelligence is emerging; in fact, machine learning and other statistical approaches that can be grouped under the umbrella of “artificial intelligence” are ubiquitous. Increasingly, these approaches are applied to assist us, especially in the field of imaging [3], which may change practices and decision-making processes significantly.

For the moment, and probably for some time to come, personalized medicine is based essentially on discussion and confrontation within the Heart Team [4, 5]. Discussion between specialists, including imaging specialists, is and will continue to be fundamental to ensure good decision-making processes in personalized medicine [6].

This issue of *Archives of Cardiovascular Diseases* emphasizes the relevance of imaging techniques and their use in combination to optimize diagnosis and ultimately to provide patients with the best possible treatment for cardiomyopathies and ischaemic heart disease. As illustrated by the research published in this issue, we are still struggling with non-invasive variables that can best quantify left ventricular function or be used to better characterize filling pressure and prognosis [7, 8]. Studies are based on rather small numbers of patients, and imaging specialists often propose pathophysiological concepts and demonstrations. We are less prone to demonstrate the effect of imaging tools on treatment. We know from recommendations and guidelines that much remains to be done to demonstrate that imaging techniques can be robust and key in the decision-making process in, for instance, the field of heart valve disease [9], where new concepts have emerged. We have yet to demonstrate that low-flow low-gradient aortic valve stenosis and preserved ejection fraction is a clinical situation that needs to be considered for percutaneous or surgical aortic valve replacement (after careful evaluation, including echocardiography and, at least, cardiac computed tomography) [10, 11]. Also, the recent COAPT and MITRA-FR trials – randomized studies dedicated to the treatment of secondary mitral regurgitation – have provided new

concepts, such as that of disproportionate secondary mitral regurgitation [12-14]. Thus, we can highlight how fundamental it is to evaluate heart valve disease correctly using imaging techniques, including assessment of valve anatomy and the impact on the heart chambers, and quantification of regurgitation.

Echocardiography is important, but other imaging techniques must also be considered [12]. As illustrated in Fig. 1, the imaging specialist often starts with transthoracic echocardiography; although this modality provides key data, additional information may be required. The most appropriate tools (exercise stress tests, three-dimensional transoesophageal echocardiography, cardiac computed tomography) must be selected, according to the clinical context. Single-photon emission computed tomography (SPECT), positron emission tomography (PET) and nuclear imaging techniques have great additional value [15]. In addition, of course, cardiac magnetic resonance imaging can be especially helpful for tissue characterization, to help with the diagnosis of many cardiovascular diseases; this imaging tool is also advancing towards characterization and quantification of flows and valvular heart diseases [16].

The combined use of imaging modalities is relevant, not only for cardiovascular diseases, but also for assessing the effects of treatments on the heart, and it is required increasingly in the extensive field of cardio-oncology [17].

There is, therefore, much to be learnt in this issue of *Archives of Cardiovascular Diseases*, but a great deal remains to be explored, in terms of better application of the different imaging techniques to the wide variety of clinical situations that the cardiologist has to deal with.

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## Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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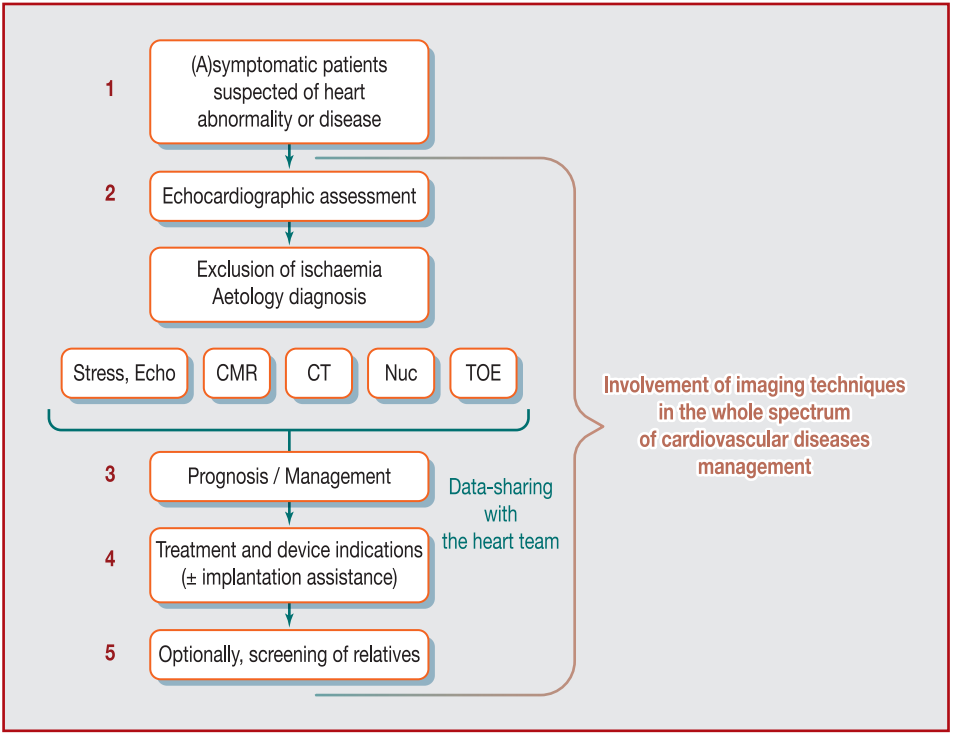
**Figure legend**

**Figure 1.** Combined use of imaging techniques according to clinical needs and local expertise.

CMR: cardiac magnetic resonance imaging; CT: computed tomography; Echo: echocardiography; Nuc: nuclear imaging; TOE: transoesophageal echocardiography.


1
(A)symptomatic patients suspected of heart abnormality or disease
2
Echocardiographic assessment
Exclusion of ischaemia
Aetology diagnosis
Stress, Echo
CMR
CT
Nuc
TOE
3
Prognosis / Management
4
Treatment and device indications (± implantation assistance)
5
Optionally, screening of relatives
Data-sharing with the heart team
Involvement of imaging techniques in the whole spectrum of cardiovascular diseases management