EDITORIAL

Relieving Pressure: How Artificial Intelligence is Redefining Echocardiography Practice

Aliviando la presión: cómo la inteligencia artificial está redefiniendo la práctica de la ecocardiografía

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Echocardiography, an essential tool in modern cardiology, has experienced exponential growth in terms of use and application. This boom is due to several factors, such as increased age of the population, low costs, and extensive availability, as well as technological advances leading to improved image quality.

However, the increased demand and complexity of echocardiography have brought about new difficulties. An international study revealed that 58% of cardiac imaging specialists suffer from burnout, mainly as a result of work overload and administrative tasks. (1) In Argentina, the burnout rate among cardiologists is even higher. (2)

The growing complexity of echo tests has increased both its length and rates of errors and inconsistencies. One paper found that 83% of tests had at least one error or inconsistency, with a linear relationship between the higher number of tests evaluated per hour and an increased rate of error. (3)

In addition to these difficulties, there is the large inter-observer variability that has always characterized echocardiography (more than 10% for some specific measurements). (4)

In response to these challenges, artificial intelligence (AI) has emerged as a promising solution for echocardiography interpretation. Advancements in machine learning enable us to identify images, measure parameters, and even create reports, optimizing workflows and reproducibility of results. (5,6)

This issue of the Argentine Journal of Cardiology (Revista Argentina de Cardiología, RAC) contains a study by Cotella et al. (7) to evaluate the feasibility and efficacy of a new work paradigm using AI for the interpretation of echocardiograms. The algorithm was developed and validated based on the data from the WASE study, a multinational and prospective registry created in order to establish normal echocardiographic values according to the size and function of heart chambers in 2,000 healthy individuals from around the world. (8) The latter is important to minimize some usual biases in AI studies of cardiac images, such as acquisition, exclusion, population, and representation biases. (9) Convolutional neural networks (CNNs) were used to develop an AI model capable of interpreting echocardiograms. The model was able to identify views with 90% accuracy for 2D images and 94% accuracy for echo Doppler images, to rate images according to stacks based on anatomical structures or physiological events, and to automatically measure standard echocardiographic parameters with an excellent correlation with manual measurements by experts. Using AI reduced the echo time of interpretation by 40% and inter-observer variability in 15 of 16 parameters.

These results confirm the AI capacity to revolutionize how cardiologists interpret these tests.

The model being proposed stands out as it is compatible with any equipment brand when using the DICOM format as input and because it encompasses a large amount of workflow, from image rating to parameter measurement. A recent study has even added report creation to the AI functions, reducing the total amount of study time by 70%. (6)

While the AI model is promising, whether it will be applicable to all patients remains unknown. As the authors are aware, a limitation of this study is that only healthy individuals were enrolled. How would this model work in real-world consecutive patients with different conditions? The efficacy of the model might be reduced in these cases, a phenomenon known as data set shift. (10) Previous studies have found errors in left ventricular ejection fraction estimation by AI models in cases of severe ventricular dysfunction; and left ventricular mass automat-

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ed measurements also show differences in patients with hypertrophic cardiomyopathy and cardiac amyloidosis versus controls. (5).

Other challenges still affect application of AI models: How will the algorithm manage repeated views, extrasystoles or atrial fibrillation? Will it work best with new algorithms, such as using Transformers for the last CNN layer for rating purposes, which has shown superiority in terms of time series, as in echo videos? (11) Will performance be preserved in cases of poor windows?

In summary, AI is becoming an ally for the echocardiographer, with potential workload reduction and improved accuracy of results. However, there is still a lot to be done: these models need to undergo the complex external validation process in different populations of real-world consecutive patients with various conditions, as well as to adhere to all regulatory and ethical aspects prior to permanent inclusion into clinical practice.

Echographers will be looking forward to that.

Therefore, we can conclude that machines shall not replace physicians, but echocardiographers using AI will be relieved in their work.

Conflicts of interest

None declared.

(See author's conflict of interest form on the website).

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