Letter to the Editor

Artificial intelligence in echocardiography

La inteligencia artificial en la ecocardiografía

To the Editor,

Application of artificial intelligence (AI) to the health field is revolutionizing medical knowledge and practice, including diagnostic imaging by echocardiography. From the perspective of cardiac sonographers, as the development and use of AI increases, the basic concepts of this technology are gaining importance as a part of continuous improvement in their daily work.

Lonraric et al.[1] have indicated that AI has an impact on improving automation and standardization of all the components of the clinical workflow. This includes other imaging modalities such as computed tomography and magnetic resonance, which are affected by a strong dependence on the experience and variability between specialists.

Two subfields serve as the basis for most IA functions: *machine learning* (automatic learning), which involves programming a computer to store and analyze data using statistical management techniques in order to learn from experience and enable predictions in obtaining new data; and *deep learning*, which uses multilayer configurations known as artificial neural networks and is useful for processing huge amounts of data.[2]

AI applied to echocardiographic examination has helped to improve the accuracy of image reading, as machine learning and deep learning algorithms allow accurate recognition of 95% to 98% of the slices obtained. This enables faster, more confident examinations, and provides the information and time to compare, associate, and interrelate diagnostic concepts between all the imaging studies of a particular patient.[3]

It should be noted that there is some concern that this type of echocardiographic examination may replace the work of standard echocardiography. Nonetheless, the idea that their work could be substituted by remote robotic scanning systems motivates health professionals to rapidly acquire these necessary skills and techniques.[4]

In conclusion, AI is an important tool for echocardiography and an interesting element for image analysis, interpretation, and optimization.[5] AI will not replace cardiac sonographers, but it will help make their practice more efficient.

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M. Regalado: manuscript writing and review. A. Medina: manuscript writing and review.

CONFLICTS OF INTEREST

None to declare.

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The danger of meta-analyses

El peligro de los metanálisis

To the Editor,

According to the Cochrane organization, improving precision is one of the main objectives of meta-analyses.[1] Effectively, most studies that do not demonstrate statistically significant differences are only useful for recommending that a larger study—with the power to observe such differences—be carried out. Given the difficulty of obtaining a large enough sample size, meta-analyses represent a free, simple way to reduce the effect of random sampling.

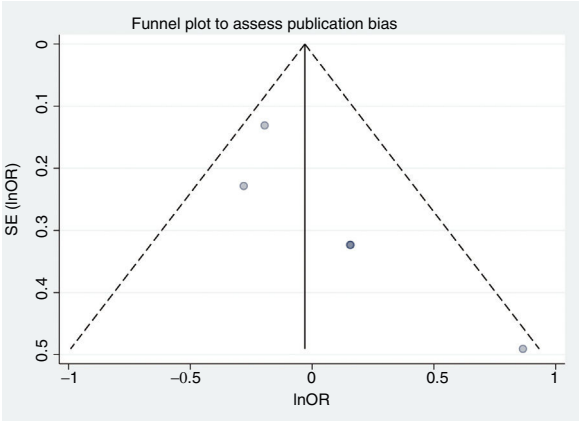

Figure 1. From the data reported by Verdoia et al.[2], funnel plot to assess publication bias for the endpoint of death.[2]

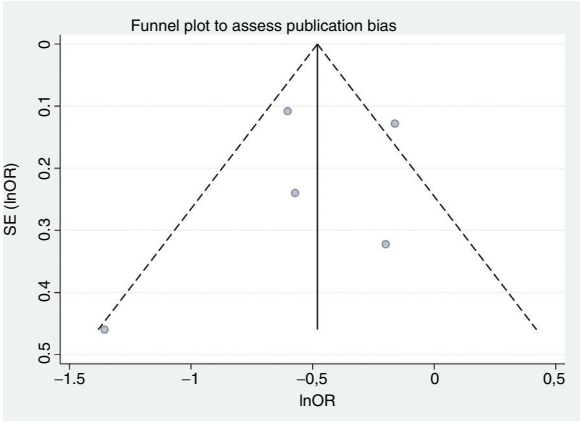

Figure 2. From the data reported by Verdoia et al.[2], funnel plot to assess publication bias for the endpoint of major bleeding.[2]

Two fundamental dangers cast a shadow on this interesting approach: heterogeneity, or inconsistency, and publication bias. The first, meaning the possibility that the studies are so different that calculating a simple mean is not appropriate, is a limitation faced by any research group working on this arduous task. A meta-analysis with high levels of inconsistency makes certain undesirable courses of action necessary. One option is to cancel the analysis, as, ultimately, one should not calculate a mean from studies that are fundamentally different. Another option is to investigate the reasons for these differences and focus the project on these, something which is always difficult and, at times, impossible, particularly when the number of studies is small.[1] Unlike individual studies, where the sample size required to reach the study objectives can be planned in the initial stages, authors conducting a meta-analysis are faced with this reality in the later stages, those of data analysis.

We recently read a meta-analysis by Verdoia et al.[2] in *Revista Española de Cardiología*, in which the authors compared a short duration of dual antiplatelet therapy (1-3 months) with the standard 1-year duration following percutaneous coronary intervention. The primary efficacy endpoint was mortality at 12 months, and the safety endpoint was the rate of major bleeding complications. The authors concluded that the short treatment course reduced major bleeding without affecting survival. As survival was not affected, the lower bleeding rate led to the conclusion that a short course was preferable, lending weight and relevance to the study.

The authors specifically mentioned that they did not find significant heterogeneity for either of the 2 endpoints: safety and efficacy. Our first reflection is on the safety analysis, or rate of major bleeding. Figure 3 of the article showed an $I^2 = 66\%$. According to this test, 66% of the variability observed between the studies can be attributed to heterogeneity, rather than to chance. According to Cochrane, an I^2 of between 50% and 90% represents substantial heterogeneity.[1] Consistently, the *P* value for the assessment of heterogeneity was .02; this figure gains relevance when compared with the limit set by the authors of the article as the level for significant heterogeneity ($P < .1$). This suggests that the effect of the short treatment course on the rate of bleeding depends on circumstances that are as yet not established: in some conditions it may have a beneficial effect, but not so in others.

Our second reflection is on publication bias, the second danger of meta-analysis. This bias was assessed using funnel plots to look for asymmetry in the odds ratios and sample sizes. The aim of this was to detect the possibility of the small studies giving different results from the large studies. If this bias were present, a random effects model would enhance its impact.[1] The figures are not shown in the article, but if we draw up mortality and bleeding, the difficulty in visually assessing asymmetry with 5 studies becomes obvious (figure 1 and figure 2, respectively). Figure 1 appears asymmetrical and would suggest that, compared with the large studies, the small studies showed a benefit with the longer treatment duration. If we calculate Egger and Begg tests, they show $P = .07$ and $P = .09$, respectively, values that are significant if we use the usual limit of .1.

In summary, we wonder whether this meta-analysis of randomized clinical trials (highest level of evidence) has provided new information and improved precision or has been compromised by the dangers inherent to this type of analysis.

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D. Hernández-Vaquero: analysis and interpretation. R. Díaz: concept and writing. P. Avanzas: critical review. A. Domínguez-Rodríguez: concept and critical review.

CONFLICTS OF INTEREST

None.

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The danger of meta-analyses. Response

El peligro de los metanálisis. Respuesta

To the Editor,

We would like to thank Hernández-Vaquero et al. for their interest on our investigation. Indeed, as we acknowledged,[1] the most important limitations of our study concern the synthesis of data from heterogeneous trials, which included patients who differed widely in terms of their ischemic and bleeding risk profiles. Indeed, acute coronary syndrome patients ranged from the total population in the REDUCE trial[2] to far less than 50%, or complete exclusion of ST-segment elevation myocardial infarction patients.

Moreover, the definition of the study endpoints differed among the included trials, leading Verdoia et al.[1] to consider mortality, rather than the composite of "major cardiovascular events" as the primary study endpoint. In contrast, bleeding definition was not consistent across the studies. BARC 2-5 bleeding events were used in 3 studies and BARC 3-5 events were considered in 1 trial, while the STOPDAPT-2 applied the more stringent thrombolysis in myocardial infarction criteria, potentially explaining the greater benefits observed in the present study, which considered only severe bleedings.

Figures 2 and 3 clearly demonstrate that the included studies consistently showed a similar trend for benefit in the reduction of bleeding events with shorter dual antiplatelet therapy, with those events being associated with larger heterogeneity. In contrast, an opposite increase or reduction of deaths was reported in the REDUCE[1] and other trials, although resulting in an $I^2 = 36\%$, far lower that the threshold of 50% suggested by the Cochrane guidelines and reported by Hernandez-Vaquero et al.

As for publication bias, the same issues could certainly refer to the large number of meta-analyses that have appeared in the literature in the last few years, reaching similar conclusions to our own.

Therefore, while awaiting large scale dedicated randomized controlled trials, the possibility of pooling together the data from different studies, despite some potential limitations, should certainly be considered in order to broaden the spectrum of included patients and increase statistical power for clearly underpowered endpoints.

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AUTHORS' CONTRIBUTION

M. Verdoia and G. De Luca: conception and design, interpretation of the data; drafting of the article; final approval of the manuscript. E. Kedhi: interpretation of the data; critical revision of the article for important intellectual content of the article; final approval of the manuscript.

CONFLICTS OF INTEREST

None.

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