

Difficulty Introducing Contrast Echocardiography in Daily Clinical Practice in South America: A Matter of Economy?

Por Que é Tão Difícil Introduzir a Ecocardiografia com Contraste na Prática Clínica Diária na América do Sul: Uma Questão de Economia?

Ricardo Ronderos^{1,2,3}

¹ICBA - Instituto Cardiovascular Buenos Aires Argentina, Buenos Aires, Argentina. ²Instituto de Cardiología La Plata, La Plata, Argentina.

³Universidad Nacional de La Plata, La Plata, Argentina.

Contrast echocardiography has shown invaluable utility in the clinical setting during the last 20 years. Most studies have demonstrated its successful application in different clinical scenarios. Ultrasound contrast agents (UCA) have evolved incredibly since their first-generation iterations at the end of the last century. From weak and short-term duration agents like Levovist™ to the development of fluorocarbons with simple storage requirements like Definity™ and Sonovue™, significant improvements have been achieved and the logistics in echocardiography labs became easier. Nevertheless, their clinical application did not increase as expected, especially in South America.

To analyze this fact, we must consider the probability of a new diagnostic technique becoming a regular and widespread diagnostic tool. A new diagnostic technique should be superior to its predecessors and available in different clinical scenarios; feature simple instrumentation, simple interpretation, well-defined normal patterns; be attractive and comprehensive in terms of image quality; and be cost-effective to ensure acceptance by health system financiers.^{1,2} (Figure 1)

A disruptive technology is the one that proves necessary over time, garners increased interest, and fulfills market expectations. Therefore, it must not only be needed; it must achieve success and acceptance. Hence, let us analyze UCA development and applications from this point of view.

First, the available contrast agents improved from requiring difficult storage with freezing to a simple powder vial that can be storage in the echocardiography lab. Nevertheless, an intravenous catheter should be placed during the echo exam to inject the contrast; this simple change created difficulty, especially in South America, where physicians work alone taking images without technicians in daily practice.

Doctors must perform this simple but time-consuming

procedure during echocardiography exam. Second, to prepare the UCA for injection, more time is needed, and for many contrasts, extra devices are needed; for others, an infusion pump should be added. All these facts significantly increase the time required for echocardiography. All these issues increase the cost, which is not reflected in reimbursement.^{3,4}

Second, to apply contrast during echocardiography, the proper machine settings must be selected according to the involved study and/or contrast application. Imaging interpretation, despite the simplification of image acquisition and rendering, requires a learning curve that is longer if contrast studies are infrequently performed in the echocardiography lab.⁴ The dearth of studies due to high time requirement, logistical problems, UCA cost and reimbursement problems make an explosive combination that works against the learning curve in busy echocardiography labs.

To obtain a good and diagnostic contrast echocardiogram, excellent quality pictures must be achieved; therefore, if training is incomplete, success is impossible. I remember a personal experience in which one of the most powerful companies distributed a marketing survey in Argentina. Almost 65% of responding physicians reported that they were not interested in using UCA in daily clinical practice. Why? Because of all these topics listed above!

Third, let us consider the market point of view. The South American market, except for Brazil, is not large enough to provide UCA to the region. If the market is limited and the physicians who must use the product are not excited, the product cannot be successful. The Brazilian market is large and probably requires significant effort to cover the entire region, but the same difficulties occurred in Brazil as in Argentina, Colombia, and Chile.

At the beginning of the 21st century, I had the opportunity to lead an amazing group of specialists to develop guidelines for contrast use in clinical practice. Almost all Latin American countries participated in this initiative sponsored by the National University of La Plata and Bristol Myers Squibb. The results were published almost simultaneously by Argentinian, Brazilian, Mexican, and other Latin American Societies of Cardiology Journals.^{5,6} Despite these publications, most markets in Latin America still lack UCA products.

Therefore, market and physician acceptance matter.

A disruptive technology is one expected by the market that solves problems or simplify solutions compared to former products. (Figure 1)

Keywords

Echocardiography; Contrast Echocardiography; Cost-Benefit Analysis.

Mailing Address: Ricardo E Ronderos •

Calle 6 No 212 La Plata 1900 Argentina.

E-mail: trotare@hotmail.com

Manuscript received 08/15/2022; revised 8/17/2022; accepted 8/18/2022

Editor responsible for the review: Daniela do Carmo Rassi Frota

DOI: 10.47593/2675-312X/20223504eed_16i



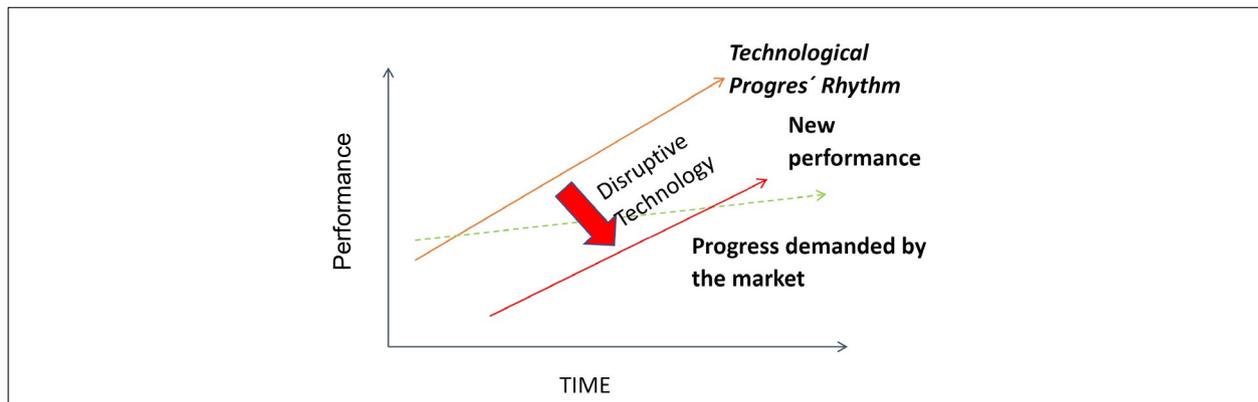


Figure 1 – Impact of disruptive technology in medicine.

Most papers showed no inferiority of contrast echocardiography myocardial studies versus nuclear medicine examinations. Single-photon emission computed tomography studies are used in routine medical practice despite randomized studies being seldom performed and well accepted and used widely.⁷⁻¹⁰

Radioisotopes are marketed by companies that also produce UCA, most of which (such as BMS and Lantheus) sold the UCA areas to money funds. Thus, it seems more sensible to continue studies of myocardial perfusion diagnosis than to pursue a non-widely accepted field such as contrast echocardiography. Moreover, the advent of multislice computed tomography to provide atherosclerotic plaque images in the context of a well-established diagnostic machine business seem to complete a not friendly context.¹¹

The last few decades involved automatic quantification and automatic image acquisition algorithms using machine learning and deep learning. Although UCA supply genuinely useful data about coronary capillary flow and coronary reserve using vasodilators, these contrast echocardiography studies are not included in such technical improvements. Another reason to keep contrast echocardiography as an artisan practice instead of a simple current study, the workflow advances to technician acquisition, automatic quantification, and offline delayed physician's interpretation.

Referências

1. Christensen Clayton. The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail. Harvard Business Review Press; 1st edition May 1, 1997.
2. The World Health Organization Choosing Interventions That Are Cost-Effective (WHO-CHOICE) Update. [Cited 2021 Nov 10]. Available from: <http://https://www.who.int/news-room/feature-stories/detail/new-cost-effectiveness-updates-from-who-choice>.
3. Cosyns B, Helfen A, Leong-Poi H, Senior R. How to perform an ultrasound contrast myocardial perfusion examination? *Eur Heart J Cardiovasc Imaging*. 2022;23(6):727-729. doi: 10.1093/ehjci/jeac028.
4. Ronderos R. Contraste en Ecografía. *Ecocardiografía e imagen cardiovascular en la práctica clínica*. Ed Distribuna Colombia 2015. p. 117-153.
5. Ronderos R, Boskis M, Corneli D, Cuenca G, et al. Foro Latinoamericano de expertos en ecocardiografía de contraste. Guías y recomendaciones para el uso de ecocardiografía de contraste. *Rev de la Fed Arg de cardiología*. 2007; (36) Supl (1).
6. Ronderos R, Morcef F, Boskis M, Corneli D, Gutierrez Fajardo P, et al. Forum Latinoamericano de ecocardiografía con contraste. Guidelines and recommendations for the use of contrast Echocardiography. *Arch Bras Cardiol* 2007 (88) Suppl (2) 1-12. doi: <https://doi.org/10.1590/S0066-782X2007000800001>.
7. Ibanez B, James S, Agewall S, Antunes MJ, Bucciarelli-Ducci C, Bueno H, et al; ESC Scientific Document Group. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC). *Eur Heart J*. 2018;39(2):119-177. doi: 10.1093/eurheartj/ehx393.

The application of contrast echocardiography was reduced to endocardial border recognition, left cardiac chambers opacification, and cardiac masses identification. Thus, the circle of disruptive technology closed.

In conclusion, in my humble opinion, echocardiographers have great responsibility in the unexpected small developments of contrast echocardiography. Financial issues are another reason to explain the difficulties in its development. Time revealed that an expected disruptive technique was not used despite its demonstrated usefulness in echocardiography labs in Europe and Japan. Here in Latin America, if UCA were widely available, most labs would be using it now and in the future despite economic problems. Reimbursement should be ensured as with other disruptive technologies.

Author contributions

Ronderos R; manuscript writing; Ronderos R; critical review of the manuscript for important intellectual content.

Conflict of interest

The authors have declared that they have no conflict of interest.

8. Ronderos RE, Boskis M, Chung N, Corneli DB, Escudero EM, Ha JW, et al. Correlation between myocardial perfusion abnormalities detected with intermittent imaging using intravenous perfluorocarbon microbubbles and radioisotope imaging during high-dose dipyridamole stress echo. *Clin Cardiol.* 2002;25(3):103-11. doi: 10.1002/clc.4960250305.
9. Lindner JR, Belcik T, Main ML, Montanaro A, Mulvagh SL, Olson J, et al. Expert Consensus Statement from the American Society of Echocardiography on Hypersensitivity Reactions to Ultrasound Enhancing Agents in Patients with Allergy to Polyethylene Glycol. *J Am Soc Echocardiogr.* 2021;34(7):707-708. doi: 10.1016/j.echo.2021.05.002.
10. Dawson D, Kaul S, Peters D, Rinkevich D, Schnell G, Belcik JT, et al. Prognostic value of dipyridamole stress myocardial contrast echocardiography: comparison with single photon emission computed tomography. *J Am Soc Echocardiogr.* 2009;22(8):954-60. doi: 10.1016/j.echo.2009.04.034.
11. Song FX, Zhou J, Zhou JJ, Shi YX, Zeng MS, Zhang ZY, et al. The diagnosis of coronary plaque stability by multi-slice computed tomography coronary angiography. *J Thorac Dis.* 2018;10(4):2365-2376. doi: 10.21037/jtd.2018.04.43.