

Special collaboration

# Appropriate use of noninvasive ischemia testing to guide revascularization decision making following acute ST elevation myocardial infarction in Latin American countries: Results from an Expert Panel Meeting of the International Atomic Energy Agency<sup>☆</sup>

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## ABSTRACT

Across Latin American and Caribbean countries (LAC), cardiovascular disease and especially ischemic heart disease is currently the main cause of death both in men and in women. For most LAC, public and community health efforts aim to define care strategies which are both clinically and cost effective and promote primary and secondary prevention, resulting in improved patient outcomes. The optimal approach to deal with acute events such as ST-elevation myocardial infarction (STEMI) is a matter of controversy; however, there is an expanding role for assessing residual ischemic burden in STEMI patients following primary percutaneous coronary intervention (PPCI). Although randomized clinical trials have established the value of staged fractional flow reserve (FFR)-guided revascularization, the use of noninvasive functional imaging modalities may play a similar role at a much lower cost. For LAC, available stress imaging techniques could be applied to define residual ischemia in the non-infarct related artery and to target revascularization in a staged procedure after PPCI. The use of nuclear cardiac imaging, supported by its relatively wide availability, moderate cost, and robust quantitative capabilities, may serve to guide effective care and to reduce subsequent cardiac events in patients with coronary artery disease. This non-invasive approach may avert potential safety issues with repeat and lengthy invasive procedures, and serve as a baseline for subsequent follow-up stress testing following the index STEMI event. This consensus document was devised from an Expert Panel Meeting of the International Atomic Energy Agency (IAEA), highlighting available evidence with a focus on the utility of stress myocardial perfusion imaging in post-STEMI patients. The document could serve as guidance to the prudent and appropriate use of nuclear imaging for targeting therapeutic management and avoiding unnecessary invasive procedures within LAC, where resources could be scarce.

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**Abbreviations:** CABG, coronary artery bypass graft; CAD, coronary artery disease; CFR, coronary flow reserve; CMR, cardiac magnetic resonance; CTP, computed tomographic perfusion; CVD, cardiovascular disease; ECG, electrocardiogram or electrocardiographic; FFR, fractional flow reserve; IAEA, International Atomic Energy Agency; IRA, infarct-related artery; LAC, Latin American and Caribbean countries; MI, myocardial infarction; MPI, myocardial perfusion imaging; PCI, percutaneous coronary intervention; PDS, perfusion defect size; PPCI, primary percutaneous coronary intervention; STEMI, ST-elevation myocardial infarction.

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**Palabras clave:**

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## Uso adecuado de las pruebas no invasivas de isquemia para guiar la toma de decisión sobre revascularización tras un infarto agudo de miocardio con elevación del segmento ST en países iberoamericanos: Resultados de la reunión de un panel de expertos de la International Atomic Energy Agency

### R E S U M E N

En los países iberoamericanos y caribeños las cardiopatías, y en especial las cardiopatías isquémicas, constituyen la causa principal de muerte tanto en varones como en mujeres. En muchos de estos países los esfuerzos sobre salud pública y comunitaria tratan de definir las estrategias de cuidados que sean efectivas desde los puntos de vista clínico y de costes, promuevan la prevención primaria y secundaria, y redunden en la mejora de los resultados de los pacientes. El enfoque óptimo para el tratamiento de episodios agudos tales como el infarto de miocardio con elevación del segmento ST (IAMCEST) es una cuestión controvertida; sin embargo, el papel de la valoración de la carga isquémica residual en los pacientes de IAMCEST tras un intervención coronaria percutánea primaria (ICP) se encuentra en expansión. Aunque los ensayos clínicos aleatorizados han establecido el valor de la revascularización guiada por la reserva de flujo fraccional (FFR) escalonada, el uso de técnicas de imagen funcionales no invasivas puede jugar un papel similar a mucho menor coste. Para los pacientes iberoamericanos y caribeños, podrían aplicarse las técnicas disponibles de imágenes de estrés para definir la isquemia residual en la arteria no infartada y orientar la revascularización en un procedimiento escalonado tras una ICP. El uso de imagen cardiaca nuclear, respaldado por su disponibilidad relativamente amplia, coste moderado, y capacidades cuantitativas sólidas, puede servir de guía a una atención efectiva y reducir los episodios cardíacos subsiguientes en pacientes con cardiopatía coronaria. Esta técnica no invasiva puede evitar las cuestiones de seguridad potenciales de los procedimientos invasivos prolongados y repetidos, y servir de referencia para las pruebas subsiguientes de estrés tras el episodio de IAMCEST inicial. Este documento de consenso fue diseñado por la Reunión del Panel de Expertos de la International Atomic Energy Agency (IAEA), destacando la evidencia disponible centrada en la utilidad de la imagen de perfusión miocárdica de estrés en pacientes post IAMCEST. El documento podría servir como guía para el uso prudente y adecuado de la imagen nuclear orientada a la gestión terapéutica, a fin de evitar los procedimientos invasivos innecesarios en los países iberoamericanos y caribeños, en los que los recursos podrían ser escasos.

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In 2016, the total population of Latin America and the Caribbean countries (LAC) exceeded 900 million with an average life expectancy of approximately 76 years. Non-communicable diseases are responsible for nearly half of all deaths and given the high prevalence of cardiovascular risk factors (e.g., diabetes mellitus, obesity, and smoking), there is concern over a growing epidemic and potential for higher mortality related to cardiovascular disease.<sup>1</sup> Of recent, there has been mass migration of the populations across much of Latin America from rural to large urban areas where physical inactivity, poor diet, and pollution are contributing to greater rates of cardiovascular mortality. Thus, across Latin America, cardiovascular disease (CVD) is the main cause of death. As is plotted in Fig. 1, CVD and ischemic heart disease represent a majority of deaths and hospitalizations after age 45. Variability across Latin America with regards to access to timely health services and differences in healthcare systems further contribute to worsening CVD outcomes amongst patient populations.

The aim of the current report is to review appropriate indications for noninvasive testing following acute ST-elevation myocardial infarction (STEMI) whereby the use of advanced stress imaging technology may be particularly helpful to guide the use of coronary revascularization. For most LAC, public and community health efforts aim to define clinical care strategies which are both clinically and cost effective and promote primary and secondary prevention resulting in improved patient outcomes. This consensus document was devised from an Expert Panel Meeting of the International Atomic Energy Agency (IAEA) conducted in San Jose, Costa Rica from September 4–8, 2017. It will highlight available evidence with a focus on the utility of stress myocardial perfusion imaging in the post-STEMI patient. This document will serve as guidance to the prudent and appropriate use of stress nuclear imaging for targeting therapeutic management and avoiding unnecessary invasive procedures within LAC where resources could be scarce.<sup>2–6</sup>

### Clinical scenario of the diagnostic electrocardiogram for STEMI

STEMI is defined by characteristic ischemic symptoms with electrocardiographic (ECG) ST elevation and biomarker elevation, such as troponin. The ECG criteria include ST elevation (at the J point) in 2 or more contiguous leads of: (a)  $\geq 2$  mm in men and  $\geq 1.5$  mm in women in leads V2–V3 or (b)  $\geq 1$  mm in other leads, defined by the Universal Definition of MI.<sup>7</sup> ST depression across multiple leads occurring with ST elevation in aVR has been associated with significant left main or proximal left anterior descending artery occlusion.<sup>8</sup> Left bundle branch block can be considered a STEMI-equivalent, but is uncommon and should not be the sole determinant of acute MI.<sup>9,10</sup>

### Prevalence of obstructive coronary artery disease at angiography

From a pooled analysis of 8 international, randomized trials in STEMI, approximately half of the 28,282 patients had obstructive coronary artery disease (CAD) in the non-infarct-related artery (IRA).<sup>11</sup> Of this, nearly one in 5 have triple vessel CAD. STEMI patients who have multivessel CAD are often those who are older, with more prevalent risk factors, and have had a prior MI. For those STEMI patients with non-IRA obstructive CAD, 30-day (unadjusted) mortality is 2.6-fold higher than for those with single vessel CAD (4.3% vs. 1.7%,  $p < 0.001$ ). Many factors impact prognosis including the number of non-IRA vessels as well as the completeness of revascularization in the IRA; with differences in clinical outcomes noted through up to 7 years of follow-up.<sup>12</sup>

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