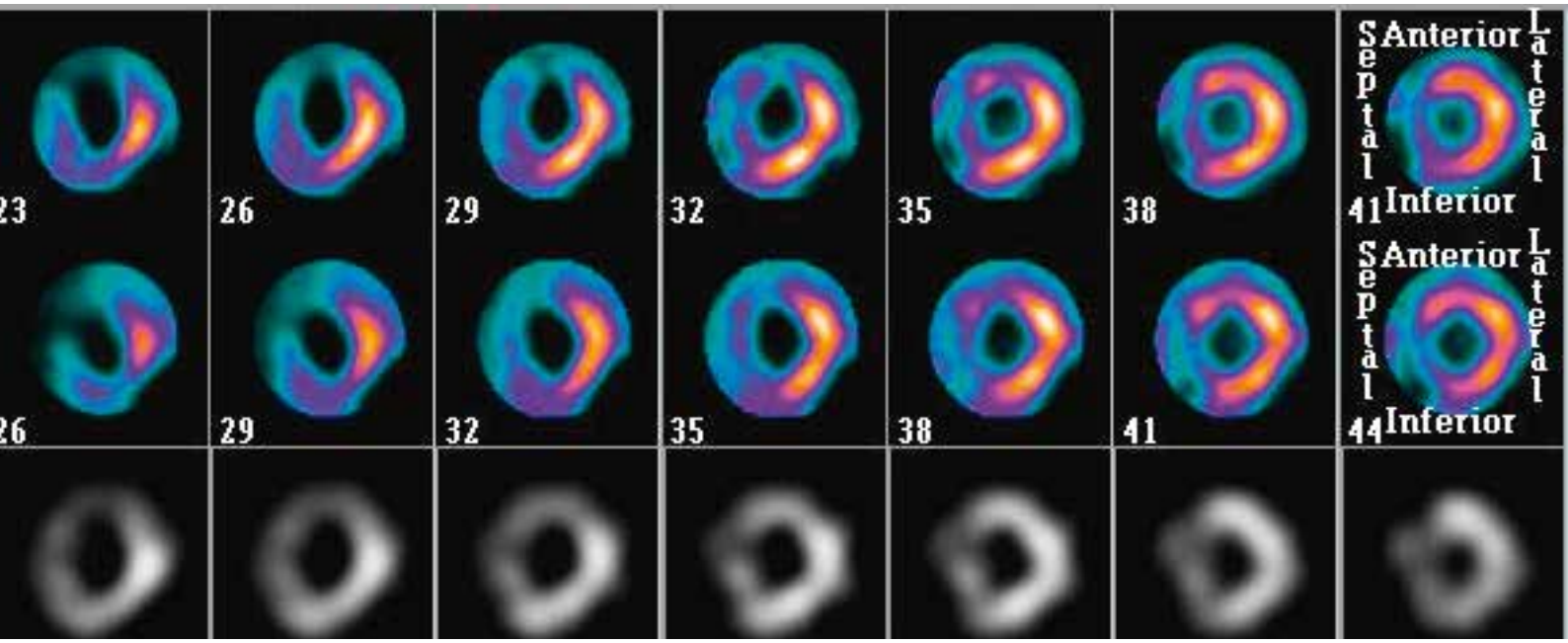
HELPING YOUR HEART WITH NUCLEAR IMAGING



Myocardial perfusion imaging (MPI) reveals how well the heart muscle is supplied (or perfused) with blood.
(Photo: E. Estrada Lobato/IAEA)

The IAEA is helping in the fight against cardiovascular diseases (CVDs) by assisting its Member States in using nuclear science and technology to track and monitor CVDs. Nuclear imaging techniques allow doctors to look inside a patient's body and see how organs function without running the risk of surgery.

CVDs kill more people than just about anything else on the planet. The World Health Organization (WHO) estimates that roughly 30 per cent of all deaths in 2008 were caused by CVDs. That number is increasing, and by 2030 the WHO estimates that more than 23 million people will die annually from CVDs. For comparison, that is equivalent to roughly the entire population of a medium-sized country.

What are cardiovascular diseases?

CVDs are a group of disorders that can affect a person's heart and blood vessels. They range from diseases that affect blood vessels specific to organs or muscles, like coronary heart disease and peripheral arterial disease, to blood clots, heart birth defects, and damage to the heart muscle from systemic diseases like rheumatic fever. The scope of CVDs is vast and they can affect people from all walks of life. While heart attacks, strokes, and high blood pressure are conditions often associated with the fast-food diets prevalent in rich countries, or countries with aged populations, the truth is that over 80 per cent of CVD deaths occur in low and middle income countries. It is in these countries that assistance is most needed.

Nuclear Imaging for CVDs

Doctors use imaging technology to 'see' inside of a patient's heart and find out how it is functioning and to check its overall condition in order to make a diagnosis. One of the imaging technologies widely promoted is myocardial perfusion imaging (MPI). MPI works by injecting a radiotracer (a compound in which a stable isotope is replaced with a radioisotope that can be followed and traced as it moves within the body) which localizes in the heart muscle of the patient in proportion to the blood supply. The radiotracer emits small amounts of radiation that is picked up by a sensitive camera and processed into images. These images reveal how well the heart muscle is supplied (or perfused) with blood. A patient normally exercises on a treadmill or stationary bike

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during the examination to increase blood flow to the heart and to let the doctor know how the heart performs under physical stress.

Perspectives on CVDs and the IAEA's Role

In October 2014, the IAEA hosted a 'Meeting on regional project design review on the technical cooperation programme for the Latin American region'. During the meeting, Fernando Mut, a nuclear physician working at a clinic in Montevideo, Uruguay, and Amalia Peix, Deputy Director of Research at the Institute of Cardiology in Cuba, shared their personal insights.

Uruguay

Fernando Mut described the important work the Agency does in reaching out to cardiologists in his country and other parts of Latin America by not only raising their awareness of nuclear imaging techniques like MPI, but also by training them in acquiring and using such techniques. Mr. Mut has been recruited several times by the IAEA for educational purposes and has participated in many training courses across the region under the Agency's support.

Left: Fernando Mut, nuclear physician from Montevideo, Uruguay.

Right: Amelia Peix, Deputy Director of Research at the Institute of Cardiology in Cuba.

(Photos: M. Madsen/IAEA)

Mr. Mut explained why MPI is performed before more complex and serious diagnosis procedures and why it is in particular an important technique at his clinic: "MPI is a 'gatekeeper' technique that is relatively inexpensive, has practically no risk to most of the population — we don't use it on pregnant women — and it tells us a lot about the heart and its functioning. There are other ways to measure the functioning of the heart, with ECG (electrocardiography) and echocardiography being safe and non-invasive go-to technologies. Unfortunately, they don't always tell us enough about a patient's condition, and are usually only a first step in identifying a CVD. More thorough diagnostic techniques like angiography (an X-ray imaging technique that involves inserting a catheter into an artery) have a surgical aspect and with it a very small, but present, degree of risk, and so we try to only use it when needed."

Cuba

Amalia Peix, who is the Deputy Director of Research at the Institute of Cardiology in Cuba, noted her country's strong healthcare system. However, there are barriers to increasing the use of MPI in Cuba. These are its prohibitive cost, and the economic embargo that hampers the importation of equipment.

Ms. Peix described the IAEA's support to the Institute and drew attention to an IAEA technical cooperation project about six years ago that, together with contributions from the Cuban government, allowed us to rebuild our clinic's nuclear cardiology department with new equipment and trained staff."

"The IAEA held two workshops and arranged for nuclear cardiology lecturers to visit us. Their support helped train us and find us good gamma cameras.

"The IAEA also offered us opportunities to collaborate and share experience in several nuclear cardiology activities. Working with the Agency, we received support for multicentric studies involving developing countries, as well as assistance in disseminating the benefits of nuclear medicine techniques."

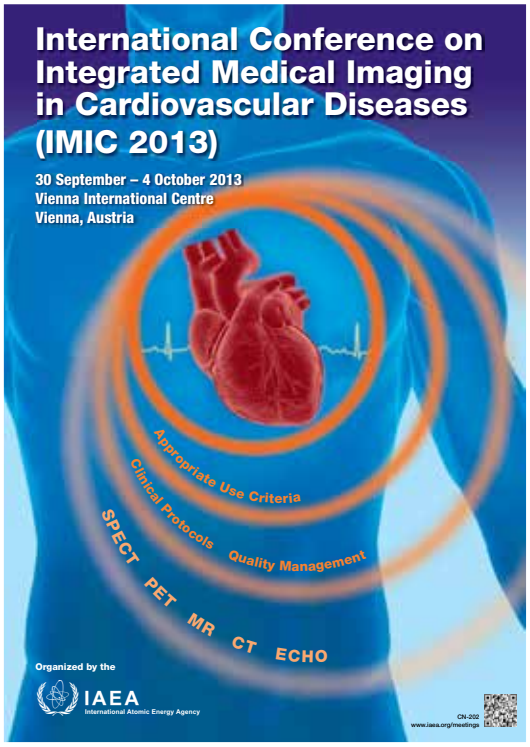
"The Institute's patients are open to the idea of nuclear medicine," Ms. Peix said. "Though, usually they have only heard of radiation and nuclear medicine being used on cancer patients, and they get a little concerned when

we caution them to stay away from children for a twenty-four hour period after an MPI procedure. We explain to our patients how the procedure does not make them radioactive and that almost all of the technetium [the radioisotope that labels the compounds used as radiotracers in MPI] will leave their body within a day. Fears of radiation are easily overcome with education and this is significant as nuclear techniques are an important tool in diagnosis and guiding us towards appropriate CVD interventions."

Education's role

Education and knowledge sharing is key to dealing with CVDs and actions are being taken to disseminate the latest CVD research globally. In 2013, the Agency held its first International Conference of Integrated Medical Imaging in Cardiovascular Diseases (IMIC 2013), a five-day intensive conference that gathered 350 participants from 91 Member States to exchange knowledge, experience and research findings on the topic of CVDs.

At the conference, the importance of a need for a worldwide initiative to combat the challenge of cardiovascular diseases was highlighted. This would require coordination and partnership of non-governmental international organizations with national governments to increase awareness, to actively promote prevention of CVDs, and to provide efficient and cost-effective assistance in disease management.



The meeting also provided information on how the IAEA meets these needs through its collaborations with Member States and professional societies. These partnerships achieve their goals through the provision of information and educational material, online and on-site training courses, via technical cooperation projects and coordinated research activities.

In addition to IMIC 2013 being accredited by the European Union of Medical Specialists and providing Continuing Medical Education credits to the young medical professionals who attended the conference, it also served as a platform to promote the IAEA's online educational webinars that focus on MPI and computed tomography.

Beyond the Clinic

The IAEA's support in nuclear technology and imaging will only take the fight against CVDs so far, as the frontlines of this battle are actually fought in each and every potential CVD patient. While for some people CVDs may be unavoidable, most CVDs can be prevented by addressing their risk factors and by conducting a campaign promoting prevention. Studies have shown that smoking, physical inactivity and an unhealthy diet can all raise the risk of developing a CVD, yet they are also manageable through lifestyle choices. But even when a country's population achieves a low rate of CVDs, it will still be important that inexpensive and cost-effective options are available for screening and monitoring CVDs, and for that nuclear imaging will continue to be a valuable tool.

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