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Nuclear cardiology: preventing coronary artery disease from becoming fatal

(Vienna, 16 November 2011) Without nuclear cardiology, mortality rates due to coronary artery disease (CAD) would be significantly higher as these imaging methods are capable to show heart disorders that would remain undetected by electrocardiogram. Meanwhile, innovative molecular imaging techniques promise to provide even deeper insights into the biological mechanisms of heart diseases, says the European Association of Nuclear Medicine (EANM).

Coronary artery disease (CAD) is the leading cause of death worldwide with most casualties expected to occur in developing nations. Nevertheless, there is a gleam of hope as mortality rates due to CAD have declined in recent years as a result of improved prevention, diagnosis, and management. One important means rendering possible this success has been myocardial perfusion scintigraphy (MPS). “This nuclear medical imaging method provides a reliable way to detect patients at risk at an early stage,” says EANM expert Prof. Albert Flotats (Autonomous University of Barcelona). It allows doctors to see how well blood is reaching the heart muscle through the coronary arteries, making it possible to assess very accurately the risk of complications such as a myocardial infarction.

At the beginning of the procedure, the patient receives an injection of a small amount of a radioactive tracer. The tracer substance travels through the bloodstream and is taken up by heart tissue in proportion to blood flow. Healthy heart tissues will show uptake of the radioactive material while those damaged or supplied by vessels with obstructive lesions will not. A camera which produces images based on gamma rays given off by the tracer is used to take detailed pictures of the heart. These show which parts are not being adequately supplied with blood. MPS can also be used after a myocardial infarction in order to establish whether tissue that has not been perfused has already died or is just “hibernating”. In such a case, a treatment promoting perfusion, for example a bypass operation, might be appropriate.

Benefits far outweigh potential risks

Although patients highly benefit from MPS, which is often capable to show disorders that remain undetected by electrocardiogram, the method has come under debate recently. Critics are pointing to alleged cancer risks caused by the radioactive substances used as tracers. According to EANM, the discussion is profoundly biased as the risks are being non-proportionally exaggerated compared to the benefits. “The accurate diagnosis we obtain through MPS far outweighs the small potential risks involved in having a scan,” says Prof. Flotats. “What critics ignore is the significantly higher risk of cardiovascular diseases going untreated, which can even result in immediate sudden death.” The risk caused by the radiation dose employed for nuclear imaging is in fact so small that it cannot be assessed in

clinical trials. The current risk estimates have been derived from studies of atomic bomb survivors by extrapolating data from Hiroshima to the lowest doses. “Thus no studies have ever verified the assumptions about cancer associated with the doses used in medical imaging,” says Prof. Flotats. Someone living together with a smoker is very likely to run a much higher cancer risk than a patient undergoing MPS.

Gaining new insights by molecular imaging

“Nevertheless, the principle of keeping radiation exposure as low as reasonably achievable is pursued, and currently several strategies to reduce radiation doses in nuclear cardiology have been explored, including the improvement of materials, design and software,” says Prof. Flotats. These strategies have recently enabled the integration of nuclear imaging methods with computed tomography scanners. This blending of methods (hybrid cardiac imaging) makes cardiac and vascular anatomical abnormalities and their physiologic consequences visible in a single setting and thus offers superior information compared to either stand-alone or side-by-side interpretation of the data sets. These hybrid systems also save the patients’ time as they combine different diagnostic routines within one procedure.

While MPS will remain a most valuable diagnostic method, new ways of tracking down the causes and indications of cardiovascular diseases are being explored. As Prof. Flotats points out, a very promising extension of nuclear cardiology techniques is molecular imaging: it will provide information on biological processes such as plaque inflammation, which is the starting point of severe cardiovascular disorders, or growth of new blood vessels (angiogenesis), which serves as repair mechanism of damaged tissues. In a not so far future, molecular imaging might also help to determine the efficacy of new therapeutic modalities such as gene therapy and stem cell therapy.

For an animated introduction to nuclear medicine, please visit the website
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