Rubidium – 82 in cardiological PET

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Rb-82 is a cation, with an intracellular uptake across the cellular membrane that reflects active transport. In experimental studies, myocardial uptake of rubidium parallels blood flows up to 2 to 3 ml/gm/minute, and after that the net uptake reaches a plateau, at the hyperemic flows often obtained during pharmacological stress with adenosine or dypiridamole. Despite this, qualitative assessment of relative rubidium perfusion defects are well correlated with those obtained experimentally from microspheres, and rubidium PET imaging showed both high sensitivity and specificity in the detection of functionally significant CAD. Moreover, rubidium PET imaging also demonstrated an incremental prognostic correlation with hard cardiac events (death or myocardial infarction).

Rb-82 has favourable physiologic and physical properties, however it is a difficult tracer to image. It emits an unusually high-energy positron, which can travel a considerable distance in tissue before annihilating, thereby affecting global image quality. Fast stress-rest protocols can be easily performed (approx 25-30 min for a complete study) due to its short half-life.

Dynamic imaging of the heart during the first two minutes allows for analysis of the Rb-82 concentration in both arterial blood and myocardial tissue as a function of time (input function). The kinetic behaviour of Rb-82 in tissue can be described by a two-compartment model which can be fitted to the patient time-activity curves. However, the simultaneous estimation of all parameters of the model, which include flow, cannot be performed easily, and the fact that the extraction fraction of Rb-82 is flow-dependent is a challenge for an accurate quantification of myocardial blood flow. Semi-quantitative indices of flow, such as dividing the mean tissue uptake over a certain period by the integral of the blood concentration, have been proposed as more practical for routine use.

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