Abstract: P302

**Routine PET imaging of myocardial flow reserve using simple activity ratios - internal validation using Rb-82-chloride and N-13-ammonia**

**Authors:**
KY Wu¹, D Juneau², N Kaps³, JM Renaud¹, TD Ruddy¹, RS Beanlands¹, R De Kemp¹, ¹University of Ottawa Heart Institute - Ottawa - Canada, ²Centre de recherche du CHUM, Service de médecine nucléaire - Montreal - Canada, ³Queen's University, Biomedical and Molecular Sciences - Kingston - Canada,

**Topic(s):**
Positron Emission Tomography (PET)

**Citation:**
Ontario Research Fund (ORF-RE07-021)

**Background:** Myocardial flow reserve (MFR) measurement is a powerful tool that provides incremental diagnostic and prognostic information, but typically requires a dynamic PET acquisition protocol and specialized software and processing tools which have not been standardized across imaging centres.

**Purpose:** The objective of this study was to investigate the application of a simplified model for the routine estimation of MFR using only the stress/rest myocardial activity ratio (MAR) in patients undergoing rest-stress perfusion imaging using N-13-ammonia (NH3) or Rb-82-chloride (RB) PET.

**Methods:** Rest and dipyridamole stress dynamic PET imaging was performed in consecutive patients using RB or NH3 (n=250 each). The gold-standard reference MFR was quantified using a standard one-tissue compartment model. Stress/rest myocardial activity ratio (MAR) was calculated using the LV-mean activity from 2 to 6 minutes post injection. Simplified estimates of MFR were calculated using an inverse power function as $\text{MFR}' = \text{MAR}^\beta ÷ a$. The correlation between MFR' and MFR values was assessed using Spearman correlation. Ten-fold cross-validation was used to evaluate the accuracy of the proposed MFR' values using receiver-operator characteristic (ROC) analysis.

**Results:** For NH3, there was good correlation between the simplified MFR' and standard MFR values ($R=0.63$) with no bias in the MFR' values. The overall diagnostic performance of MFR' was very good with ROC area-under-the-curve (AUC)=83.2±1.2%. Negative predictive value of MFR'<2 was 82% to identify impaired MFR<2, with 73% sensitivity, 80% specificity and 77% accuracy. For RB, there was also good correlation between MFR' and MFR values ($R=0.73$) with no bias in the MFR' values. The overall diagnostic performance of MFR' was excellent for RB, with AUC=90.4±0.7%. The corresponding negative predictive of MFR'<2 was 90% to identify impaired MFR<2, with 78% sensitivity, 87% specificity and 85% accuracy.

**Conclusion:** MFR was estimated with very good accuracy using RB and NH3 according a highly simplified method that relies only on measurement of stress/rest myocardial activity ratios following tracer injection. This novel approach does not require dynamic imaging or tracer kinetic modeling of any kind, and can be easily standardized across PET imaging centres.
Abstract:

Routine PET imaging of myocardial flow reserve using simple activity ratios—internal validation using Rb-82-chloride and N-13-ammonia

Authors:
KY Wu 1, D Juneau 2, N Kaps 3, JM Renaud 1, TD Ruddy 1, RS Beanlands 1, R De Kemp 1

1 University of Ottawa Heart Institute – Ottawa – Canada, 2 Centre de recherche du CHUM, Service de médecine nucléaire – Montreal – Canada, 3 Queen's University, Biomedical and Molecular Sciences – Kingston – Canada

Topic(s):
Positron Emission Tomography (PET)

Citation:

Funding Acknowledgements:
Ontario Research Fund (ORF-RE07-021)

Background: Myocardial flow reserve (MFR) measurement is a powerful tool that provides incremental diagnostic and prognostic information, but typically requires a dynamic PET acquisition protocol and specialized software and processing tools which have not been standardized across imaging centres.

Purpose: The objective of this study was to investigate the application of a simplified model for the routine estimation of MFR using only the stress/rest myocardial activity ratio (MAR) in patients undergoing rest-stress perfusion imaging using N-13-ammonia (NH3) or Rb-82-chloride (RB) PET.

Methods: Rest and dipyridamole stress dynamic PET imaging was performed in consecutive patients using RB or NH3 (n=250 each). The gold-standard reference MFR was quantified using a standard one-tissue compartment model. Stress/rest myocardial activity ratio (MAR) was calculated using the LV-mean activity from 2 to 6 minutes post injection. Simplified estimates of MFR were calculated using an inverse power function as MFR' = MAR^ß ÷ a. The correlation between MFR' and MFR values was assessed using Spearman correlation. Ten-fold cross-validation was used to evaluate the accuracy of the proposed MFR' values using receiver-operator characteristic (ROC) analysis.

Results: For NH3, there was good correlation between the simplified MFR' and standard MFR values (R=0.63) with no bias in the MFR' values. The overall diagnostic performance of MFR' was very good with ROC area-under-the-curve (AUC)=83.2±1.2%. Negative predictive value of MFR'<2 was 82% to identify impaired MFR<2, with 73% sensitivity, 80% specificity and 77% accuracy. For RB, there was also good correlation between MFR' and MFR values (R=0.73) with no bias in the MFR' values. The overall diagnostic performance of MFR' was excellent for RB, with AUC=90.4±0.7%. The corresponding negative predictive of MFR'<2 was 90% to identify impaired MFR<2, with 78% sensitivity, 87% specificity and 85% accuracy.

Conclusion: MFR was estimated with very good accuracy using RB and NH3 according to a highly simplified method that relies only on measurement of stress/rest myocardial activity ratios following tracer injection. This novel approach does not require dynamic imaging or tracer kinetic modeling of any kind, and can be easily standardized across PET imaging centres.

Abstract: P302
Routine PET imaging of myocardial flow reserve using simple activity ratios—internal validation using Rb-82-chloride and N-13-ammonia.