

D-SPECT Clinical Case Study: Dynamic Study for the Evaluation of Intermediate Coronary Stenosis

Submitted by Dott.ssa Teresa Mannarino and Prof. Wanda Acampa. Data and images courtesy of Department of Advanced Biomedical Sciences, University of Naples Federico II, Naples, Italy.
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Patient Information:

Female, 67-years old. Smoker.
History of hypertension,
dyslipidemia, angina, dyspnea.
Previous Acute Coronary Syndrome
(ACS) and revascularization of left
anterior descending artery (LAD).

Clinical Scan:

Dynamic SPECT Myocardial Perfusion
Imaging. Evaluation of intermediate
stenosis in the Circumflex artery
(LCx) in patient with known coronary
artery disease (CAD).

Dose:

- 37MBq for pre-scan
- 179 MBq for rest scan
- 538 MBq for stress scan

Imaging Protocol

One-day rest-stress protocol. A dose of 37 MBq of 99mTc-Sestamibi was administered for a 60-second pre-scan acquisition to check patient position, identify the location of the heart, and to set the angle limits of scanning for each detector (region of interest-centric scanning). For rest dynamic images, an intravenous bolus of 179 MBq 99mTc-Sestamibi was administered at the rate of 1–2 cm³/s using an automatic injector system and flushed with 30 mL of saline to ensure consistent delivery of a tight bolus.

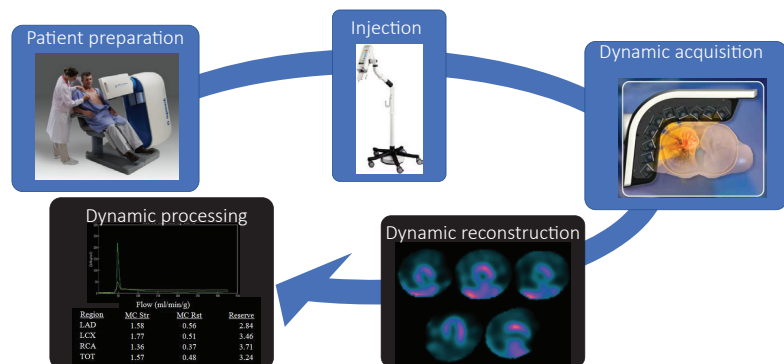
A list-mode acquisition of 6 minutes was started at the time of injection. Standard SPECT rest perfusion images were acquired at the end of the rest dynamic scan; the time per projection was set to target the recording of 1000 myocardial kcounts, thus allowing a scan duration of less than 10 min. Thereafter commenced pharmacologic stress test using dipyridamole. Dipyridamole was infused at dose of 0.56 mg/kg intravenously over a 4-min period (142 mcg/kg/min). Throughout the duration of infusion, monitoring of heart rate and rhythm, blood pressure, and electrocardiography were performed.

Four minutes after completion of dipyridamole infusion, a second bolus of 538 MBq of 99mTc-Sestamibi was injected for dynamic stress acquisition using a 6 minute list-mode acquisition and subsequently followed by a SPECT stress gated acquisition of 4 minutes. At the end of the dynamic stress acquisition, a dose of 100mg of aminophylline was administered intravenously in the event of chest pain or other symptoms, or after significant ST depression.

List-mode data were re-binned into 32 frames consisting of 21 × 3-s, 1 × 9-s, 1 × 15-s, 1 × 21-s, 1 × 27-s, and 7 × 30-s frames.

Summed and gated projections were reconstructed with an iterative maximum likelihood expectation maximization algorithm using 7 and 4 iterations, respectively.

Dynamic Scan Workflow:



D-SPECT CARDIO



Technology

Technology for Dynamic Imaging:

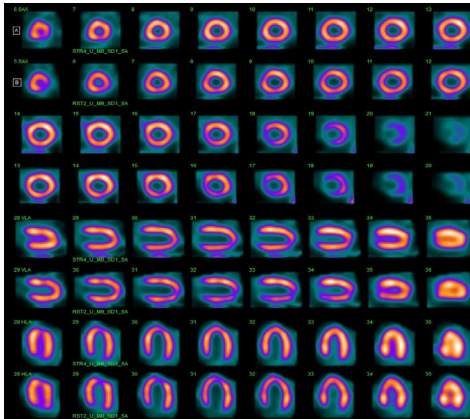
- digital detectors
- parallel collimators
- superior temporal resolution
- increased sensitivity
- list mode acquisition
- data rebinning capabilities to generate both static and dynamic image series

Dynamic scan acquisition requires not only the left ventricle, but all heart compartments, to be positioned in the field of view. The D-SPECT adaptive FOV allows user to adjust size for dynamic imaging, based on patient needs. No truncation.

Findings

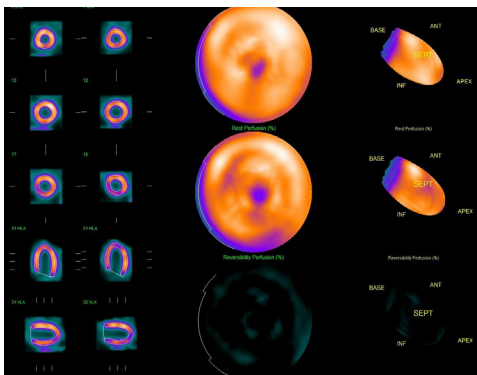
Normal perfusion. Normal left ventricular volumes and ejection fraction. Quantification of the dynamic data demonstrated a reduction of myocardial perfusion reserve (MPR) in the LCx, with normal MPR in other vessels. At last coronary angiography, an intermediate stenosis was identified in the LCx, however with no significant disease in other vessels.

Stress-Rest Myocardial Perfusion



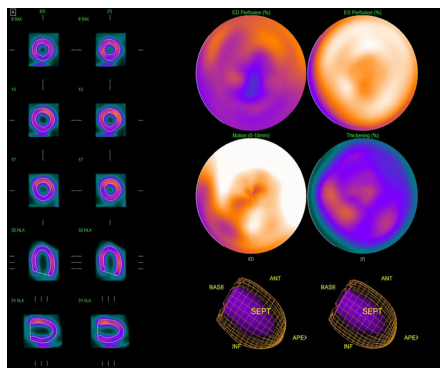
Sex	FEMALE
Limits	DSPECT
TID	0.94
LHR	--
SSS	0
SR%	0
SDS	0
SD%	0

Study	Dynamic SPECT_2~20~2019 8:59:00 AM
Dataset	STR4_U_MB_SD1_SA
Date	2019-02-20 09:50:32
Status	QC=2.45, IR=0.32
Database	D-SPECT Female Stress MIBI UPRIGHT
Volume	58ml
Wall	111ml
Defect	1ml
Extent	1%
TPD	1%
Shape	0.54 [SI], 0.85 [Ecc]

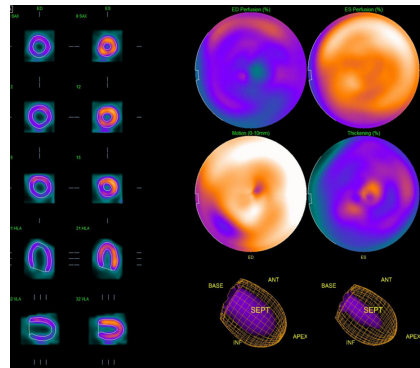


Study	Dynamic SPECT_2~20~2019 8:59:00 AM
Dataset	RST2_U_MB_SD1_SA
Date	2019-02-20 09:27:03
Status	QC=1.85, IR=0.29
Database	D-SPECT Female Rest MIBI UPRIGHT
Volume	62ml
Wall	112ml
Defect	0ml
Extent	0%
TPD	0%
Shape	0.57 [SI], 0.84 [Ecc]

Gated Stress



Gated Rest

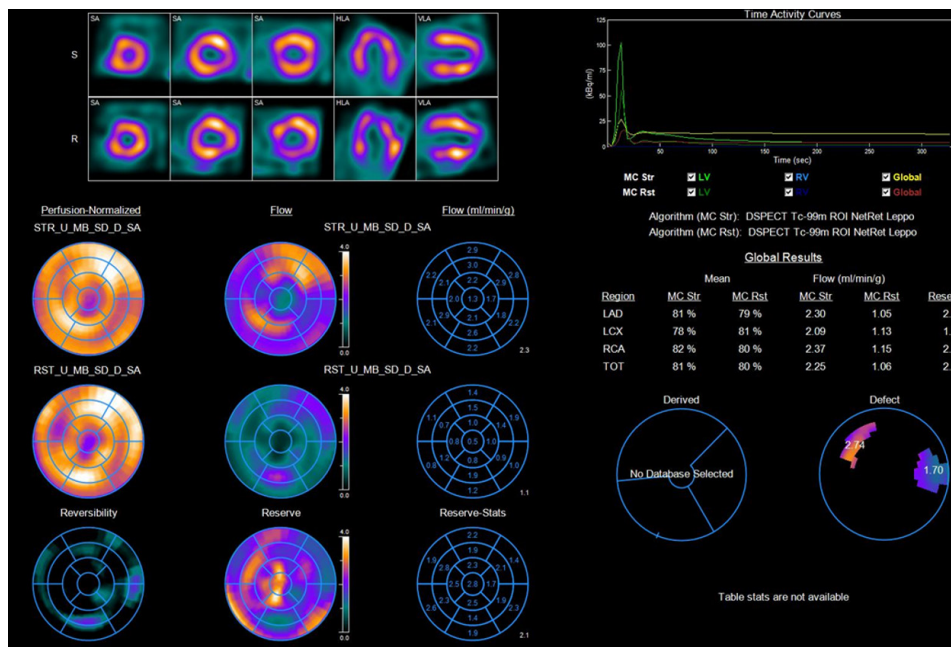




Institution:

The Department of Advanced Biomedical Sciences is a key department within the School of Medicine and Surgery of the University of Naples Federico II (UNINA), Italy.

The university was founded in 1224 and is one of the oldest public universities in the world with a long-established reputation for excellence in scientific research. The clinical research activity of the department is focused on the development and validation of diagnostic and therapeutic strategies in pathology and histology, cardiology and heart surgery, general surgery, diagnostic imaging and radiotherapy. Another research field is focused on the study of bioethical themes and deontology aimed to new advancements in forensic medicine. A distinctive characteristic of the research activity is the study of the disease during all its phases, from the molecular and pathophysiological patterns to the early diagnosis, prevention and therapy.



“This is a representative case in which the availability of quantification of Myocardial Perfusion Reserve (MPR) by D-SPECT Scanner may help the clinician in the explanation of clinical issues. In this patient with known CAD and a previously treated vessel (LAD), an intermediate stenosis was demonstrated in the LCx and, although standard perfusion imaging indicated a normal result, the quantitative analysis showed a relative reduction of MPR in the stenotic LCx vessel. This finding may reveal a functional significance of the known residual stenosis and should guide the clinician towards the most appropriate treatment for the patient.”
Dr. Mannarino

Authors:

Prof. Wanda Acampa is Associate Professor of Diagnostic Imaging and Radiotherapy at the Department of Advanced Biomedical Sciences of the University of Naples Federico II and Director of Nuclear Cardiology Program of the University Hospital Federico II. Prof. Acampa is a nuclear medicine physician and is active in research within the field of nuclear cardiology, and authorship of more than 100 peer review journal publications. She has a research position as Associate Researcher within the Institute of Biostructures and Bioimaging of the National Council of Research in Naples, Italy.

Dr Teresa Mannarino gained the Board Certification in Nuclear Medicine at the Department of Advanced Biomedical Sciences of the University of Naples Federico II, achieving the score of summa cum laude in December 2018. Since November 2018, she has been attending PhD training program in “Biomorphological and Surgical Sciences” at the same university under supervision of Prof. Wanda Acampa. From April to September 2019 she worked as Clinical Research Fellow at Nuclear Medicine Centre of the Manchester University NHS Foundation Trust, UK. Her research field is mainly focused on nuclear cardiology, in particular on SPECT and PET/CT imaging, as documented by various publications on international peer-reviewed journals.