08:30 - 10:30 S6 - Nuclear Cardiology and Cardiac CT Hall H

Chairs: **S. Livschitz**
A. Marmor

08:30 **A Multi-Center Trial of High-Speed Versus Conventional SPECT Imaging: Quantitative Results of Myocardial Perfusion and Left Ventricular Function**
T. Sharir [1], P.J. Slomka [2], S.W. Hayes [2], W.H. Martin [3], M.F. DiCarli [4], J.A. Ziffer [5], D. Dickman [6], S. Ben-Haim [7], D.S. Berman [2]
[1] Tel Aviv, [2] Los Angeles, [3] Nashville, [4] Boston, [5] Miami, [6] Caesarea, [7] London

08:45 **Coronary Artery Calcification and Framingham Risk Score to Predict Coronary Events in Subjects under Primary Prevention Care**
Y. Buber, N. Koren-Morag, M. Motro, S. Segev, E. Konen, E. Schwammenthal, J. Shemesh
Ramat Gan

09:00 **A Novel Method to Reduce the Acquisition Time of Myocardial Perfusion SPECT Scan: a Comparative Study**
N. Zafrir [1], B. Yuzepovich [2], I. Mats [1], A. Solodky [1], D. Blazar [1], Y. Hasid [1], A. Battler [1]
[1] Petah Tikva, [2] Haifa

09:15 **Does Obstructive Coronary Plaque Have Different Composition to Non-Obstructive Plaque? A Study Using 64-Slice Cardiac CTA in Asymptomatic Type 2 Diabetics**
D. Halon, T. Gaspar, I. Dobrecky-Mery, M. Azencot, N. Peled, B. Lewis
Haifa

09:30 **Clinical Predictors and Prognostic Value of Tl-201 SPECT Myocardial Perfusion Imaging in Octogenarian Patients Without a Previous History of CAD**
S. Livschitz [1], S. Rosen [2], M. Oettinger [1], R. Levi [1], E. Yaskil [2], A. Caspi [1]
[1] Rehovot, [2] Haifa

09:45 **Comparison between CT and Nuclear Perfusion to Predict Late Myocardial Function Following Reperfused Acute Myocardial Infarction**
J. Lessick, Y. Agmon, S. Abadi, Z. Keidar, H. Hammerman, S. Rispler, E. Ghersin, A. Engel, O. Israel, A. Sabag, S. Carasso, A. Roguin
Haifa

08:30 - 10:30 S6 - Nuclear Cardiology and Cardiac CT (Cont.) Hall H

10:00 **Diagnostic Performance of High-Speed Myocardial Perfusion Imaging: Correlation with Coronary Angiography**

A. Wolak [1], D.C. Marcelo [2], J. Ziffer [3], W. Martin [4], S. Hayes [5], J. Gerlach [5], D. Dickman [6], S. Ben-Haim [8], T. Sharir [7], P. Slomka [5], D. Berman [5]
[1] Beer Sheva, [2] Boston, [3] Miami, [4] Nashville, [5] Los Angeles, [6] Cesarea, [7] Tel Aviv, [8] London

10:15 **The Routine Use of Multi-detector Coronary Computed Tomography in the "Fast Track" Evaluation of Patients with Acute Chest Pain**

R. Beigel, D. Oieru, O. Goitein, P. Chouraqui, E. Konen, J. Or, H. Hod, S. Matetzky
Ramat Gan

A Multi-Center Trial of High-Speed Versus Conventional SPECT Imaging: Quantitative Results of Myocardial Perfusion and Left Ventricular Function

Tali Sharir [1], Piotr J Slomka [2], Sean W Hayes [2], William H Martin [3], Marcelo F DiCarli [4], Jack A Ziffer [5], Dalia Dickman [6], Simona Ben-Haim [7], Daniel S Berman [2]

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A novel high-speed SPECT camera employing cadmium zinc telluride crystal arrays has been shown in a single center study to detect a similar amount of myocardial perfusion abnormality compared to conventional Anger SPECT camera (conventional SPECT) in up to one seventh the acquisition time. This study compares quantitative results of myocardial perfusion and function by high-speed SPECT to conventional SPECT in a large prospective multi-center trial.

Methods: Two-hundred twenty four patients (127 males) underwent one-day Tc-99m sestamibi rest/ stress SPECT with D-SPECT and A-SPECT at four centers: Cedars-Sinai Medical Center (CSMC) (n=57), Vanderbilt University Medical Center (VUMC) (n=54), Brigham and Women's Hospital (BWH) (n=58) and Miami Baptist Hospital (MBH)(n=55). D-SPECT MPI was performed within 30 min of A-SPECT. Rest/ stress acquisition times were 20 and 15 minutes, respectively for A-SPECT, and 4 and 2 minutes, respectively for D-SPECT. Perfusion was analyzed using QPS software, deriving the total perfusion defect (TPD) of stress and rest, expressing overall extent and severity of perfusion defects. Due to the higher image resolution QPET (rather than QGS) was used for EDV, ESV and EF measurements. Perfusion and function measurments were automatically generated for the stress and rest images of D-SPECT and A-SPECT.

Results: D-SPECT stress and rest TPD in the entire cohort correlated linearly to A-SPECT TPD over a wide range of perfusion abnormality ($r=0.96$, $p<0.0001$). High linear correlation between D-SPECT and A-SPECT stress TPD was seen at each of the participating centers ($r=0.97$, 0.96, 0.97, 0.97 for CSMC, VUMC, BWH, and MBH, respectively, $p<0.0001$). Normalcy rates (normal defined as TPD<5%) in 61 patients with low prescan likelihood of coronary artery disease were 95.1% and 90.2% for D-SPECT and A-SPECT, respectively, p=ns. Post-stress EF, EDV and ESV by D-SPECT correlated linearly to A-SPECT over a wide range of EF and volumes ($r=0.88$, 0.96, 0.98, respectively, $p<0.0001$). Similarly, excellent linear correlation was observed between resting EF, EDV and ESV by D-SPECT and A-SPECT ($r=0.81$, 0.97, 0.97, $p<0.0001$).

Conclusions: The results of this prospective multicenter clinical trial demonstrate that the novel high-speed SPECT technology provides objective quantitative measures of myocardial perfusion and function, comparable to conventional SPECT imaging at up to one seventh the acquisition time.

Coronary Artery Calcification and Framingham Risk Score to Predict Coronary Events in Subjects under Primary Prevention Care

Y Buber, N Koren-Morag, M Motro, S Segev, E Konen, E Schwammenthal, J Shemesh

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Background: It has been demonstrated that coronary artery calcification (CAC) predicts coronary events in asymptomatic subjects as well as in diabetic, hypertensive, elderly, patients with chronic renal failure and in different ethnic origin. The relevancy of CAC score in subjects under primary prevention care is not yet elucidated.

Objective: To study the contribution of CAC and Framingham risk score for risk stratification in participants of annual check-up program.

Methods: 652 consecutive subjects (mean age 55±7 range 41-76, 83%male) who consented to perform cardiac CT for CAC score had been recruited. Men above 40 and women above 50 years without coronary artery disease or diabetes were included. All underwent medical interview, physical examination, blood tests, stress test and 16-slice CT without contrast injection. Subjects and their physician were advised to treat risk factors according to the current guidelines. Coronary events, defined as acute MI or unstable angina which resulted in PCI or CABG, and cardiac death, were reported while a final phone call 7 years after the CT.

Results: 6 acute MI and 12 unstable AP were reported. None of the 327 subjects without detectable CAC experienced an event. Higher CAC score category was associated with higher rate of events while no significant difference was observed by Framingham risk groups:

CAC score	**Events**	**Framingham**	**Events**
0	0/327(0)*	***0-9***	9/397 (2)**
1-300	7/266(3)	***10-20***	8/232(3)
>300	12/59(20)	***>20***	1/23(4)
	P<.001		P=.601

*event /subjects(percent)

The association of CAC with events are highly significant also among the low Framingham category: ***0* - 0/243, ***1-300*** - 4/127(3%) and ***>300*** -5/27(19%) p <.001

Conclusion: CAC contributes to risk stratification of subjects under primary prevention care better than the Framingham score.

A Novel Method to Reduce the Acquisition Time of Myocardial Perfusion SPECT Scan: a Comparative Study

Nili Zafrir [1], Bella Yuzepovich [2], Israel Mats [1], Alejandro Solodky [1], Doron Blazar [1], Yosef Hasid [1], Alexander Battler [1]

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Purpose: A novel algorithm of image processing " Evolution for cardiac"(EFC), enables to reduce the time scan of gated SPECT myocardial perfusion imaging (MPI) up to half of the standard time scan. Validation of gated SPECT and clinical results of the reduced time algorithm compared to the standard full time protocol was investigated.

Methods: The reduced time algorithm was processed on 97 SPECT MPI studies. Included patients who referred for stress MPI with clinical relevance of CAD and BMI< 30 Kg/m². The patients were scanned twice and sequentially by full time acquisition for gated SPECT (17.17 min for low dose (8-10 mci) and 14.52 min for high dose(25-30 mci) of Tc 99m sestamibi) and by reduced time acquisition (8.4 min and 7.10 min respectively). The processing was done blindly by Myovation software using OSEM for the standard scan and by EFC for reduced time acquisition.

Results: Patient mean age was 61± 14 (26% women). In the 50 patients, analyzed by Bland Altman model, the differences of the summed stress scores (SSS) in full time SPECT compared to reduced time SPECT were between + 3.6 and – 3.5 and in the summed rest scores (SRS) between +2.4 and –2.7. There were also highly significant correlation of rest and stress LVEF (r=0.97, r=95 p<0.0001 respectively) between full time and reduced time scans. The clinical diagnosis of normal, ischemia or scar was identical in 47 from 50 patients.

Conclusions: Reduced time scan for gated SPECT has demonstrated comparable results to full time scan and can replace the full time acquisition in patients with BMI under 30, using one-day protocol stress-rest as well as rest- stress sequence.

Does Obstructive Coronary Plaque Have Different Composition to Non-Obstructive Plaque? A Study Using 64-Slice Cardiac CTA in Asymptomatic Type 2 Diabetics

David Halon [1], Tamar Gaspar [2], Idit Dobrecky-Mery [1,2], Mali Azencot [1], Nathan Peled [2], Basil Lewis [1]

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Background: We prospectively examined 64 slice coronary CT angiograms (CTA) in an asymptomatic patient cohort at high risk for coronary events to examine differences in the characteristics of coronary plaque between pts with non-obstructive disease and pts with coronary luminal narrowing.

Methods: Type 2 diabetics, 55-74 yrs, with no history of coronary artery disease underwent CTA in the confines of a prospective, ongoing, outcomes study. Coronary luminal narrowing was assessed visually on CTA as <25%, 25-50% or >50% and plaque as absent, calcified (≥50% calcium), non-calcified (no calcium) or mixed (<50% calcium) using a 17 segment coronary arterial model.

Results: In120 pts [age 63.7 yr, 44 (36.7%) men] coronary plaque was present in 40 (90.9%) men and 65 (85.5%) women (ns) but was more extensive in men (5.7±3.4 vs 3.2±2.2 coronary segments, p=0.001; total plaque length 56±56 vs 30±31 mm, p=0.02). Non-obstructive lesions were mostly calcified (in >70% of cases) while 50% of obstructive lesions (>50% narrowing) were non-calcified and only the minority (11.5%) calcified (p<0.001) (Table). Findings were similar for men and for women.

Plaque characteristics in relation to severity of luminal narrowing

	Segments with plaque	Calcified	Mixed	Non-calcified
Luminal narrowing	N (% total segments)	N (% segments within luminal narrowing group)		
<25%	258 (55.4)	183 (70.9)	46 (17.8)	29 (11.2)
25-50%	156 (33.5)	58 (37.2)	54 (34.6)	44 (28.2)
>50%	52 (11.1)	6 (11.5)	20 (38.5)	26 (50.0)
		P<0.001		

Conclusions: In asymptomatic type 2 diabetics: 1. Coronary plaques were present on 64 slice cardiac CTA in most patients (>85% women, >90% men). 2.Half the obstructive plaques were non-calcified, while calcification was present in >70% of minimally obstructive lesions. 3. Progression of plaque to luminal stenosis appears to be due to mechanisms unrelated to calcification.

Clinical Predictors and Prognostic Value of Tl-201 SPECT Myocardial Perfusion Imaging in Octogenarian Patients Without a Previous History of CAD

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Background: Myocardial perfusion imaging (MPI) is routinely used in octogenarian pts for the diagnosis of coronary artery disease (CAD) although the value of this non-invasive test has not been well established in this aged-group pts. The aim of this study was to identify the clinical predictors of stress induced abnormal MPI (AMPI) and to evaluate the prognostic and risk stratification value of AMPI in this group of pts. without a previous history of CAD.
Methods: The study population included 339 pts, ≥ 80 years old (mean age= 83.3± 2.7) who were referred to stress Tl-201 SPECT MPI for the diagnosis of CAD. Semi quantitative visual analysis was performed using a 17 segment and a 5 point scoring scale (0= normal to 4= no uptake). Cardiac death and non-fatal myocardial infarction were considered cardiac events (CE) during a follow-up period of at least 3 years.
Results: An AMPI was present in 154 pts (45.4%). The incidence of AMPI was significantly higher in males in comparison with females (57% vs 37%, $p< 0.0003$) and in diabetics (57% vs 43%, $p= 0.038$). Anginal syndrome and pulmonary edema were more frequently in those with AMPI than with a normal MPI (49% vs 30%, $p= 0.0005$) and (6% vs 1%, $p= 0.0072$), respectively. In contrast to non-anginal chest pain more frequently reported with normal MPI (30% vs 19%, $p=0.016$). AMPI was present in 53% of pts with an abnormal resting ECG in contrast to 36% of with a normal ECG ($p= 0.0017$). Based on multivariate analysis the best predictive model of an AMPI (Chi-Square 44.8, $p< 0.0001$) included the following independent variables: male gender, Diabetes, anginal syndrome, pulmonary edema and resting ECG. CE were recorded in 18 (8.8%) of the 204 pts that met the follow up criteria. On multivariate regression analysis age and MPI were the only significant predictive variables of CE ($p=0.0026$ and $p=0.0006$, respectively). Patients that developed CE were significant older (83.1± 2.8 vs 84.7± 2.9 years, $p=0.0083$). The incidence of CE was significantly higher in pts with AMPI than in those with a normal MPI (15.9% vs 3.5%, p=0.0019), moreover those pts with a SSS >10 have a higher incidence of CE in comparison to those with a SSS <10 (29% vs 4.1, $p< 0.0001$) resulting in an odds ratio of 7.6, $p=0.0002$.
Conclusion: In octogenarian pts without a previous history of CAD, male gender, Diabetes, anginal syndrome, pulmonary edema and resting ECG are clinical predictors of an abnormal MPI. Tl-201 SPECT MPI has a significant predictive value for the development of CE and yield in the risk stratification of octogenarian pts.

Comparison between CT and Nuclear Perfusion to Predict Late Myocardial Function Following Reperfused Acute Myocardial Infarction

Jonathan Lessick [1], Yoram Agmon [1], Sobhi Abadi [2], Zohar Keidar [3], Haim Hammerman [1], Shmuel Rispler [1], Eddie Ghersin [2], Ahuva Engel [2], Ora Israel [3], Anat Sabag [1], Shemi Carasso [1], Ariel Roguin [1]

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Background: Early hypoenhancement (EH) on CT, as well as delayed hypo- (DH) and hyper-enhancement (DE) have been shown to be correlated to perfusion defects on SPECT following acute myocardial infarction (AMI), however there has been no comparison between the two methods regarding their ability to predict late (4 months) myocardial function.
Methods: 20 patients (17 male, age 54 ± 9) with a reperfused first acute STE AMI underwent cardiac CT, early and 24 hour Thallium SPECT, and contrast echo within 4 days of AMI, followed by a repeat contrast-echo exam 4 months later to assess the change in myocardial function. Perfusion defects on CT were identified on 6 short-axis reformations and their areas planimetered and summed. SPECT and echo were scored using a 16 segment model. For each segment SPECT was scored from 0 (no defect) to 4 and echo from 1 (normal) to 3. Scores were summed for each heart.
Results: The infarct-related artery was LAD=13, LCx=4, RCA=3. 1 patient died before the follow-up echo. For the remaining patients, late myocardial function correlated best with SPECT (r=0.87), whereas CT EH (r=0.61), DH (r=0.67) and DE (r=0.63) showed more moderate correlations, increasing to 0.73 using multivariate analysis combining the 3 variables. The number of myocardial segments involved (5.8±4.2 by echo) was underestimated by SPECT (3.4±2.7) and both early (4.7±3.3) and late (3.2±4.3) CT. The relative reduction in myocardial blood volume measured as ratio of CT values in abnormal:normal regions was also moderately related to late function for both early (r=0.58) and delayed CT (r=0.49).
Conclusions: SPECT summed perfusion grade correlates better with late myocardial function after acute MI than CT defect size however it significantly underestimates infarct size. Both size and degree of CT perfusion defects may have value in predicting late myocardial function.

Diagnostic Performance of High-Speed Myocardial Perfusion Imaging: Correlation with Coronary Angiography

Arik Wolak [1], Di Carli Marcelo [2], Jack Ziffer [3], William Martin [4], Sean Hayes [5], James Gerlach [5], Dalia Dickman [6], Simona Ben-Haim [8], Tali Sharir [7], Piotr Slomka [5], Daniel Berman [5]

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Background. Recently, a novel high-speed SPECT technology (D-SPECT) has been shown to detect a similar amount of perfusion abnormality compared with conventional Anger camera SPECT (A-SPECT), also normal limits for quantitative analysis of myocardial perfusion by this technology have been validated in a small patient group. To date the relationship of D-SPECT MPI findings to coronary angiography has not been reported.

Methods. We studied 67 patients from four US and two European medical centers who underwent D-SPECT and invasive coronary angiography (ICA) (50 patients) or coronary CT (CCTA) (17 patients) within < 3 months and with no intervening change in symptoms or coronary event in between. Clinical, angiographic and imaging data were transmitted to a core lab (CSMC) for quality control (QC) of LV contours and automated quantitative perfusion analysis. An experienced technologist blinded to the clinical data and imaging results performed the QC. Summed Stress Scores (SSS) ≥ 4 were considered abnormal. Receiver Operator Characteristics (ROC) areas under curve (AUC) were obtained by Analyze-It (v 2.10) statistical package.

Results. The mean age was 62±13 years, 26 (38.8%) were female, the mean BMI was 29.7±9.3 and the rates of diabetes, hypertension, hypercholesterolemia and smoking was 23.9%, 65.7%, 58.2% and 10.4% respectively. History of myocardial infarction, coronary angioplasty and CABG was present in 12(17.9%), 13(19.4%) and 4(6%) of the patients, respectively. Contours required correction in 14 (20.9%) of the studies. The mean SSS was 8.0±9.5. The sensitivity, specificity, accuracy and area under the curve for detection of ≥50% stenosis were 82%, 73%, 78% and 0.83±0.05. For detection of ≥70% stenosis the values were 85%, 68%, 76% and 0.82±0.05, respectively. When only ICA correlations were considered, the sensitivity, specificity, accuracy and area under the curve for detection of ≥50% stenosis were 88%, 76%, 84% and 0.86±0.06 and for detection of ≥70% stenosis the values were 90%, 73%, 84% and 0.85±0.06, respectively.

Conclusions. In this small study of the initial correlations of D-SPECT MPI with coronary angiography, D-SPECT appears to provide diagnostic performance similar to that reported with conventional Anger cameras.

The Routine Use of Multi-detector Coronary Computed Tomography in the "Fast Track" Evaluation of Patients with Acute Chest Pain

Roy Beigel [1], Dan Oieru [1], Orly Goitein [2], Pierre Chouraqui [1], Eli Konen [2], Jacob Or [3], Hanoch Hod [1], Shlomi Matetzky [1]

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Objectives: To evaluate the routine use of multi-detector computed tomography (MDCT) in a large cohort of patients presenting with acute chest pain (ACP) in a "real life" setting.
Background: The recently published AHA/ACC guidelines suggest that MDCT may be appropriate for investigating ACP. To date, only a few small studies have evaluated the use of MDCT in ACP, where it was not part of routine investigation.
Methods: We studied 785 consecutive ACP patients who underwent evaluation by MDCT or myocardial perfusion scintigraphy (MPS) after an observation period $\geq$ 12 hours. Patients with findings suggestive of significant coronary artery disease (CAD) were referred to coronary angiography.
Results: Forty-two patients were hospitalized due to evidence of myocardial ischemia and 44 patients were discharged after the observation period. Of the remaining 699 patients 340 underwent MDCT and 359 MPS. In 22 (7%) patients MDCT showed significant CAD and in 32 (9%) patients MPS showed significant ischemia. Significant CAD was confirmed by coronary angiography in 65% and 60% respectively. MDCT was non-diagnostic in 31 patients (9%). Extracardiac findings which might be related to ACP and/or necessitating further investigation were demonstrated by MDCT in 71 (21%) patients.
During a 3-month follow up, 1 (0.003%) patient with negative MDCT and 9 (3%) with negative MPS suffered an acute coronary syndrome or death, while re-hospitalization due to recurrent chest pain occurred in 9 (3.3%) and 21 patients (7.2%) respectively.
Conclusions: The use of MDCT can be an appropriate alternative to traditional non-invasive modalities for investigating ACP.