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COMPUTERIZED TOMOGRAPHY RADIOLOGISTS TRAINING

**PALESTINIAN HEALTH SECTOR REFORM AND DEVELOPMENT
PROJECT**

SHORT-TERM TECHNICAL ASSISTANCE REPORT

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ACRONYMS

CD	Compact Disc
CT	Computerized Tomography
DVD	Digital Versatile Disc
HIS	Health Information System
MOH	Ministry of Health
PACS	Picture Archiving and Communications System
PMC	Palestine Medical Complex
SOW	Scope of Work
STTA	Short-Term Technical Assistance
USAID	United States Agency for International Development

ABSTRACT

This consultancy assignment occurred between October and December 2012. The assignment duration was planned to last until May 2013, but was ended abruptly due to a delay in a release of United States Agency for International Development (USAID) funding to the Palestinian Health Sector Reform and Development Project (the Project). The planned tasks for this assignment were:

- Conduct initial visits to one or two Computerized Tomography (CT) departments to better understand the workflow and the challenges faced by the radiologist in using the advanced software features of the CT work stations.
- Develop an outline for an on-the-job coaching approach to address different aspects of the CT software operation for Ministry of Health (MOH) radiologists.
- Provide on-site coaching for the radiologists at the four targeted MOH Hospitals.
- Arrange for visiting tours for the radiologist at neighboring hospitals.

The consultant was only able to carry out initial visits to CT departments, and began carrying out on-the-job coaching to radiologists when the assignment was concluded due to lack of funds.

SUMMARY OF RECOMMENDATIONS

Within the next month the MOH should:

- Optimize the USAID donated Health Information System (HIS) to flag contraindications for iodine injection, such as known allergy and impaired kidney function.
- Apply radiation dose reduction techniques to Cardiac CT protocols such as current dose modulation.
- Optimize the communication with the patient and the atmosphere at the scanning area in order to allow for a more pleasant patient experience and better co-operation.
- Start performing more comprehensive assessments of cardiac CT cases including cardiac function assessment and valves assessment.
- Improve the residency program including more exposure to CT cases and supplying teaching materials and textbooks.

Within the next six months the MOH should:

- Facilitate for adequate ultrasound scanners with appropriate capabilities such as: three probes with different frequencies, color Doppler function, flow wave Doppler, and the ability to communicate with a digital storage device.
- Facilitate for additional workstations/viewing stations for all sites to facilitate case review in parallel - by more than one radiologist. A dedicated station for the residency program.
- Facilitate for a professional robotic compact disc (CD) /digital versatile disc (DVD) writer to shorten study burning time, improve the workload and to cope with the increasing workload and the upcoming trend of more digitalization of the department, including digitalization of the ultrasound studies and conventional x-rays.

Within the next year the MOH:

- Facilitate for a picture archiving and communications system (PACS) shared by all the MOH hospitals that will improve knowledge sharing, offer an ideal archiving solution, avoid unnecessary exams, that can be used for teaching purposes and provide a good tool for management purposes.
- Digitize the ultrasound and x-ray studies in order to incorporate into the PACS in the future.
- Arrange alternative training sites for the residents in the fields not well developed or lacking at MOH hospitals. Perhaps consider incorporating the private sector in the training program to facilitate for more exposure for the resident doctors.

SECTION I: INTRODUCTION

The Palestinian Health Sector Reform and Development Project is a five-year initiative funded by the U.S. Agency for International Development (USAID), designed and implemented in close collaboration with the Palestinian Ministry of Health (MOH). The Project's main objective is to support the MOH, selected non-governmental organizations, and selected educational and professional institutions in strengthening their institutional capacities and performance to support a functional and democratic Palestinian health sector able to meet its priority public health needs. The Project works to achieve this goal through three components: (1) supporting health sector reform and management, (2) strengthening clinical and community-based health, and (3) supporting procurement of health and humanitarian assistance commodities.

The Project procured and installed three state of the art 16-slice CT scanners and one 64-slice CT scanner for four different MOH hospitals. Technicians and physicians from all sites were given initial training to allow for proper patient scanning, study interpretation and reporting. The new scanners allowed for the introduction of new exams that were not performed in these hospitals before, such as Cardiac CT angiography and Peripheral CT angiography. The new scanners have made significant changes to the workflow and workload of the affected CT departments. Accordingly, new needs appeared and further focused training for the technicians and doctors became a necessity.

Four consultation visits were conducted at MOH hospitals including two to the Palestinian Medical Complex (PMC) Hospital in Ramallah, one to Rafidia Hospital in Nablus and one to Alia Hospital in Hebron.

At all four sites, site visits began with a tour of the departments to assess the workload in the department, the adequacy of the equipment available, the level of the technician training, scanning protocols and the reporting process.

All sites mentioned have recently installed an HIS. The needs of the Radiology Department (the CT unit especially), vis a vis the HIS were discussed; including patient safety issues and workflow optimization.

The scanning protocols were reviewed by the consultant and suggestions for improvement were made. The consultant offered coaching and guidance on special cases seen at all sites, especially in relation to diagnostics and reporting. At the PMC, the focus was on cardiac CT scanning protocols, post processing techniques and reporting. At both Alia and Rafidia hospitals, the focus was on peripheral CT angiography post processing and reporting.

SECTION II: ACTIVITIES CONDUCTED

Palestinian Medical Complex (PMC), Ramallah

- Reviewed the cardiac CT scanning protocols with Dr. Adel Al-Khaseeb – The radiologist in charge, and recommended some changes to improve quality and reduce radiation dose.
- Suggested some changes in the technician’s workflow to improve efficiency and achieve better patient management.
- Conducted training for the radiologist on cardiac function and valvular function assessment from the CT scan.
- Performed exams interpretation, including providing and discussing rare and interesting cases.
- Discussed patient safety issues including steps to be held in order to assure implementation of safety measures
- Reviewed the HIS system features and suggested changes and improvements to fit for the radiology department, focusing on patient safety issues and workflow optimization.
- Discussed the need of specific equipment that is found to be crucial in order to improve the CT services provided. The equipment recommended are: an ultrasound scanner, additional CT workstation and robotic CD burner. Certain cases that are currently examined using the CT can be done using a high end ultrasound scanner that will reduce the load on the CT, and save the patient unnecessary exposure to radiation and intake of contract media.

Rafidia Hospital, Nablus

- Reviewed the general CT protocols in use and suggested some changes
- Reviewed and discussed interesting neuro- and body cases.
- Conducted a tour in the department, and had an exposure to the workload and the difficulties faced during the renovation process.
- Discussed the lack of a high-end ultrasound scanner increases the load on the CT scanner, and exposes some patients to unnecessary radiation and iodinated contrast, similar to the PMC
- Discussed the newly implemented HIS and recommended some changes. For example it was recommended to add obligatory fields in the request form for radiology service to indicate the medical condition of the patient for the referring physician to provide e.g.: pregnancy, allergy, asthma, creatinine level, the presence of communicable diseases etc. . In addition, “the request form” is recommended to include the name of the referring physician and his/her contact information. Further recommended to develop a mechanism to integrate the lab results of the referred patient with the request to be seen by the radiologist and to use the HIS in defining CT appointment and scheduling of patients.

Alia Hospital, Hebron

- Reviewed the peripheral CT angiography protocol.

- Provided on-site coaching on advanced post processing of CT angiography studies.
- Reviewed interesting and rare cases.
- Reviewed general head and abdominal cases including a discussion with the referring physician.
- Similar to the situation at both the PMC and Rafidia hospitals' radiology departments, the lack of a presence of a high end ultrasound increases the load on the CT.

SECTION III: FINDINGS, CHALLENGES, RECOMMENDATIONS, AND NEXT STEPS

A. Findings

- Lack of essential equipment needed for better utilization of the CT scanner, such as an adequate ultrasound scanner as an alternative for certain studies, additional workstations and a CD/DVD writer
- Lack of non-ionized, iodine-based contrast at certain sites.
- Lack of compatibility between the HIS system and the workflow at the radiology department.
- Lack/deficiency of training in some fields such as comprehensive cardiac CT analysis and advanced peripheral CT post processing.
- Need more effort to make the patient's experience in the CT departments safer and more pleasant.

B. Challenges

- Finding budget for all the equipment needed.
- To convince the computer unit in each hospital and in the HIS management to make an effort to improve the workflow in the radiology department, focusing on patient safety issues.
- Explaining to the MOH pharmacy/drug stores department the clinical outcome differences between the use of ionized vs. non-ionized contrast media.
- Long-term planning to achieve fully digitalized radiology departments including the ultrasound and the x-rays before, or parallel to planning implementation of a PACS.
- Planning/looking for creative directions to improve the residency program, including sharing teaching material and including private health facilities in the teaching/training program.

C. Recommendations

- Purchasing new workstations for each site as needed, including the residency program.
- Purchasing adequate ultrasound scanners with all the Doppler options and all the probe types needed for each site.
- If needed, more training sessions with the radiologists.
- HIS system improvement to fit the radiology department needs and workflow.
- Supplying enough non-ionized iodine based contrast material.
- Seriously address patient safety issues.

D. Next Steps

- Full digitalization of the radiology department.
- Implementation of a PACS.
- Increase number of radiologists in each department to cope with the workload and to share knowledge and consultations.
- Training programs in the United States and Europe.

ANNEX A: SCOPE OF WORK

Short-Term Consultancy Agreement Scope of Work

SOW Title: **Computerized Tomography (CT) Radiologists Training**

Work Plan No: Technical , E.

SOW Date: 8/1/2012

SOW Status: FINAL

Consultant Name: Sobhi Abadi

Job Classification: Short-Term Local Professional Consultant

Reporting to: Hazem Khweis – Procurement Manager.

I. Palestinian Health Sector Reform and Development Project Objective

The Project is a five-year initiative funded by the U.S. Agency of International Development (USAID), and designed in close collaboration with the Palestinian Ministry of Health (MOH). The Project's main objective is to support the MOH, select non-governmental organizations, and select educational and professional institutions in strengthening their institutional capacities and performance to support a functional, democratic Palestinian health sector able to meet its priority public health needs. The Project works to achieve this goal through three components: (1) supporting health sector reform and management, (2) strengthening clinical and community-based health, and (3) supporting procurement of health and humanitarian assistance commodities.

The Project supports the MOH in implementing health sector reforms needed for quality, sustainability, and equity in the health sector. By addressing key issues in governance, health finance, human resources, health service delivery, pharmaceutical management, and health information systems, the MOH will strengthen its dual role as a regulator and main health service provider. The Project also focuses on improving the health status of Palestinians in priority areas to the MOH and public, including mother and child health, chronic diseases, injury prevention, safe hygiene and water use, and breast cancer screening for women.

II. Specific Challenges to Be Addressed by this Consultancy

The Project has procured three 16 slices CT(s) for Beit Jala, Alia and Rafedia MoH Hospitals and a one 64 slices CT for Ramallah Hospital. The four CT(s) have been installed and under operation for over a year now. The Procurement team follows up on the utilization of the CT(s) and work closely with the CT technicians and the radiologists. An operational training was conducted on the workstations before the arrival of the scanners and a product application specialist from Philips conducted on site operational training at each of the four locations for initial scanners setting up and planning the CT acquisition protocols. Several visits for each location were conducted by the product application specialist to follow up on operation.

Further, four Radiologists and four Cardiologists one from each of the four hospitals received CT(s) attended a specialized training on Coronary Computed Tomography Angiogram (CTA) at The CT Academy Heart Center Alter Hof in Munich, Germany during 2011.

The Radiologists at the MoH Hospitals have been using the scanners to the best extent possible; however they have requested further assistance in the provision of more training on the use of the advanced diagnostic capabilities of the scanners specially Angiography and Cardiac exams. Such a need was communicated on several occasions and hence proceeded with the possibility of contracting a local STTA that can meet such a need.

III. Objective and Result of this Consultancy

The Project is seeking to hire the services of a local short-term consultant, Dr. Sobhi Abadi, to:

- Assure proper utilization of the donated CT(s) to the Palestinian Ministry of Health through funding from USAID.
- Enforce proper patient safety protocols and working procedures during CT exams.
- Reduce unnecessary scanning.
- Upgrade MoH's CT Radiologists skills in performing advanced CT procedures specially Angiography and cardiac exams.
- Work closely with MoH's CT Radiologists to upgrade their abilities in interpreting CT exams results.

With the procurement of a number of CT scanners for MoH the project will be targeting to introduce re-from in the way CT departments are managed, assure the proper utilization of the scanners and improve the diagnostic services provided by MoH hospitals. Consequently the ultimate goal would be improving the quality of health

care provision.

IV. Specific Tasks of the Consultant

Under this Scope of Work, the Consultant shall perform, but not be limited to, the specific tasks specified under the following categories:

- A. **Background Reading Related to Understanding the Work and Its Context.** The Consultant shall read, but is not limited to, the following materials related to fully understanding the work specified under this consultancy:
- Years 4 Implementation Plan
 - MoH Institutional Development Plan (IDP)
 - Most recent annual and quarterly report
 - Technical Purchase Order TPO#61 CT scanners
- B. **Background Interviews Related to Understanding the Work and Its Context.** The Consultant shall interview, but is not limited to, the following individuals or groups of individuals in order to fully understand the work specified under this consultancy:
- Dr. Jihad Mashal (DCOP)
 - Nadira Shibley, Procurement Director
 - Hazem Khweis, Procurement Manager
 - MoH Counterparts.
- C. **Tasks Related to Accomplishing the Consultancy's Objectives.** The Consultant shall use his/her education, considerable experience and additional understanding gleaned from the tasks specified in A. and B. above to:
- Conduct initial visits to one or two CT departments to better understand the workflow and the challenges faced by the radiologist in using the advanced software features of the CT work stations.
 - Develop and outline for an on job coaching approach to address different aspects of the CT software operation MoH radiologists
 - Provide on-site coaching for the radiologists at the target four MoH Hospitals.
 - Arrange for visiting tours for the radiologist at neighboring hospitals

V. Expected Products.

Within the first seven working days of the assignment, the consultant should provide the methodology for successfully completing the work (STTA Methodology).

The substance of, findings on and recommendations with respect to the above-mentioned task shall be delivered by the Consultant in a written report, policy statement, strategy, action plan, etc. for submission to USAID (STTA report template). A draft of this report is due no later than 3 business days prior to the consultant's last day of work (unless otherwise specified) and final no later than 7 business days after the consultant's last day of work. Please note that USAID requires a debrief to be scheduled prior to your last day of work.

VI. Timeframe for the Consultancy.

The timeframe for this consultancy is on or about October 1, 2012 and will conclude on or about May 1, 2013. The Consultant will be working in country.

VII. LOE for the Consultancy.

The days of level of effort are estimated to be up to 30 days for work in West Bank

VIII. Consultant Qualifications.

The chosen consultant, Dr. Sobhi Abadi, has the following qualifications which were found to be suitable for this consultancy:

Educational Qualifications:

- Masters degree in related field or equivalent in experience

Work Experience Qualifications

- At least 10 years of experience in the field of Radiology
- Experience with international standards development
- Familiarity with USAID and international experience

ANNEX B: ASSIGNMENT SCHEDULE

- October 8, 2012: PMC CT department:
Met with Dr. Adeel Khaseeb and the two CT Technologists. Agenda items included a tour in the department, review of the used CT protocols and work on the interpretation of some exams conducted with the Radiologist.
- November 8, 2012: Rafidia Hospital – CT Department:
Met with Dr. Mahmoud Alwaynah and the two CT technologists. Agenda items included; tour in the radiology department, exposure to the residency program, discussion how to maximally utilize the benefits from the HIS system and case reviews
- December 17, 2012: PMC CT department
Met with Dr. Adeel Khaseeb and the two CT Technologists. Agenda items included : to share some interesting cases with rare pathologies of Cardiac CT exams with Dr. Adel, to perform CT cardiac exams with the technologists, to review and interpret the results with the Radiologist
- December 18, 2012: Alia Hospital CT Department:
Met with Dr. Nidal Tmazi, Radiologist in charge, and the two technologists. Agenda items included: a tour in the department, review of the used CT protocols, to provide on the job coaching on how to assess the peripheral CT angiography using an advanced application available on the Ct workstation and to review normal and abnormal CT angio cases.

ANNEX C: CONSULTANT CV

Curriculum Vitae – Dr. Sobhi Abadi

PERSONAL DATA

First name: Sobhi

Family name: Abadi

Date of birth: [REDACTED]

Place of birth: [REDACTED]

Address: Kfar Qara, POB 363
Israel

Phone: Work: 972-4-8543682 Mobile: [REDACTED]

E-mail: s_abadi@rambam.health.gov.il

EDUCATION

1992-1995 The Hebrew University and Hadassa Medical School at Jerusalem, Israel. B. MED. SC (medicine undergraduate). Graduation date: July 1995. Ceremony in January 2006.

1996-1999 The Hebrew University and Hadassa Medical School at Jerusalem, Israel. Medicine Doctor (MD). Graduation date: march 31, 2001. ceremony date: May 2001.
MD research project: "Apoptosis in the Pathogenesis of Prion Diseases"

2002-2004 Tel Aviv University at Tel-Aviv, Israel. Continuing Medical Learning – Radiology, four semesters.

LANGUAGES

Arabic, Hebrew, English

POST GRADUATE TRAINING AND WORK EXPERIENCE

1 Aug 2010 – current: Staff radiologist, Cardiac Imaging and Body Imaging; Department of Diagnostic Imaging, Rambam Medical Center, Haifa, Israel.

3 October 2011 – 21 October 2011: clinical observership, Abdominal and prostate MRI, Beth Israel Deaconess medical center affiliated to Harvard University, Boston, MA.

1-July 2009 – 30 June 2010: Clinical Fellowship, Abdominal Imaging, Radiology Department, McGill University, Montreal, Quebec, Canada.

1-July 2008 – 30-June 2009: Clinical Fellowship, Cardiac Imaging Unit, Radiology Department, Univesity Health Network, University of Totonto, Toronto, Ontario, Canada.

1-July 2006 – July 2008: Staff Radiologist, body imaging and cardiac imaging. Department of Diagnostic Imaging, Rambam Medical Center, Haifa, Israel.

1-Jan 2006 – 30-June 2006: Senior Resident (chief resident). Department of Diagnostic Imaging, Rambam Medical Center, Technion University, Haifa, Israel

1-May 2001 – 30-June 2006: Radiology Resident. Department of Diagnostic Imaging, Rambam Medical Center, Haifa, Israel

2001 – July 2006: lectures to medical students about medical imaging, Rambam Medical Center, Haifa, Israel

2002 – 2004: Lecturer to radiography students ; Anatomy and physiology of the respiratory system, Radiography School, Rambam Medical Center, Haifa, Israel

2002 – June 2008: Lecturer about medical imaging; Middle and high school pupils, Rambam Medical Center, Haifa, Israel

1-April 2000 – 31-3-2001: Medical Intern, Rambam Medical Center, Haifa, Israel

CERTIFICATES:

Israel Radiology Board exams, 2005.
USMLE step 2, knowledge skills, 2002.

PRESENTATIONS AND POSTERS IN CONFERENCES:

Abadi S, Ursani A, Mehrez H, Paul NS

Quantitative evaluation of techniques that target dose reduction to the female breast during CT coronary angiography: Assessing helical and volumetric data acquisitions European Congress of Radiology, March 4-8, 2010. Vienna, Austria.

Abadi S, Torres F, Ayyappan A, Paul N, Doyle D, Nguyen E, Crean A. Takotsubo Cardiomyopathy- the role of diagnostic imaging.

2nd world congress of thoracic imaging and diagnosis in chest disease. 30 May – 2 June 2009

Paul N, Torres F, **Abadi S**, Ayyappan A, Nguyen E, Crean A, Doyle D.

CT depiction of Cardiac Anatomy on 320 MDCT.

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Detection of complications of apical hypertrophic cardiomyopathy by cardiovascular MRI: comparison with electrocardiography, echocardiography and radionuclide myocardial perfusion .

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Abolition of respiratory motion artifact with faster acquisition time in MDCT coronary angiography: comparison between 320 and 64-row scanners .
2nd world congress of thoracic imaging and diagnosis in chest disease. 30 May – 2 June 2009

Abadi S; Keidar Z; Rispler S; Brook OR; Roguin A; Israel O; Engel A
Hybrid Myocardial SPECT/64-slice CT Coronary Arteriography (CTCA) Derived Left Ventricular Function Parameters: Correlation and Intraobserver Variability Assessment
The 4th Research Day of Rambam Health Care Campus, Haifa, Israel December 27, 2007

Rispler S, **Abadi S**, Frenkel A, Keidar Z.
A novel approach using integrated cardiac SPECT/CT for the assessment of clinically significant coronary artery lesions in patients hospitalized for acute coronary syndromes
The 4th Research Day of Rambam Health Care Campus, Haifa, Israel December 27, 2007

Brook OR; **Abadi S**; Keidar Z; Rispler S; Roguin A; Shreiber R; Engel A
Variability of Calcium Score as measured by different software on the same CT study
The 4th Research Day of Rambam Health Care Campus, Haifa, Israel December 27, 2007

Brook OR, Filatov Z, Ilivitzki A, Kouzemko K, Beck-Razi N, Litmanovich D, Srour S, Abu Rahmah Y, **Abadi S**, Leiderman M, Michaelson M, Gaitini D
Sonographic detection of pneumothorax by radiology residents as a part of extended Focused Abdominal Sonography in Trauma (eFAST)
The 4th Research Day of Rambam Health Care Campus, Haifa, Israel December 27, 2007

Abadi S; Keidar Z; Rispler S; Brook O R; Israel O; Engel A
Hybrid Myocardial SPECT/64-slice CTCA Derived LV Function Parameters: Correlation and Intraobserver Variability Assessment
Radiological Society of North America Annual Meeting, Chicago, Illinois. **November 25–30, 2007**
*Brook O R; Filatov Z; Ilivitzki A; Kouzemko K; Beck Razi N; Litmanovich D, Srour S, Abu Rahmah Y, **Abadi S**, Lederman M, Michaelson M, Gaitini D.*

Sonographic Detection of Pneumothorax by Radiology Residents as a Part of Extended Focused Assessment with Sonography for Trauma (eFAST)
Radiological Society of North America Annual Meeting, Chicago, Illinois. **November 25–30, 2007**

*Keidar Z; Rispler S; **Abadi S**; Aronson D; Bar-Shalom R; Israel O*
Hybrid Cardiac SPECT/64-slice CT Assessment of the Relationship between Clinically Significant Coronary Lesions/Stenoses and the Presence and Degree of Arterial Calcifications
Radiological Society of North America Annual Meeting, Chicago, Illinois. **November 25–30, 2007**

Roguin A, **Abadi S**, Oshorov A, Engel A, Beyar R
Novel method for real time hybrid CT and angiography image registration in the cath lab
American Heart Association, Orlando, Florida. November 4-2007

Keidar Z, Bar-Shalom R, Rispler S, **Abadi S**, Roguin A, Nikolsky E, Engel A, Israel O.
Hybrid Cardiac SPECT/64-slice CTCA Imaging: Technical Feasibility & Initial Clinical Experience.
54th Annual Meeting of the Society of Nuclear Medicine, Washington June 2007

Rispler S, Keidar Z, **Abadi S**, Roguin A, Ghersin E, Beyar R, Israel O, Aronson D.
Integrated SPECT/CT for the assessment of clinically significant coronary artery lesions in patients hospitalized for acute coronary syndromes
ESC Congress. Sep 1-5, 2007

Abadi S, Kogan I, Engel A, Israelit S, Shmolevski Y, ofer A.
The role of CT angiography in the diagnosis of acute mesenteric ischemia; a prospective single center study.
Poster at 91st Annual Meeting of the RSNA, Chicago, Il. November – december 2005

Zivari M. **Abadi S**, Adam D. Gaitini D.
Real-Time Control of RF Ablation by Ultrasound imaging.
2005 Annual Meeting of the Israel Radiological Association, Eilat, Israel. November 3-6, 2005

Soudack M, Bentur L, **Abadi S**, Haiman-Rais A, Ghershin E, Gaitini D.
The role of ultrasound in the management of pediatric chest disorders. Scientific exhibition.
Poster at the Radiological Society of North America Annual Meeting, Chicago, Illinois. November 2004

Abadi S, Soudack M, Haiman-Rais A, Gherishin E, Gaitini D.

The Role of Ultrasound in the Management of Pediatric Thoracic Abnormalities.
Annual Meeting of the Israel Radiological Association, Eilat, Israel. October 30, 2003

Abadi S, Mandel H, Golsher D.

Mitochondrial Neuro Gastrointestinal Encephalopathy (MNGIE) Disease and Multiple Sclerosis: Tips For Differential Diagnosis.

Annual Meeting of the Israel Radiological Association, Eilat, Israel. October 24, 2002

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Integrated SPECT/CT for assessment of haemodynamically significant coronary artery lesions in patients with acute coronary syndrome.
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Direct Quantification of Breast Dose during Coronary CT Angiography and Evaluation of Dose Reduction Strategies. AJR Am J Roentgenol. 2011 Feb;196(2):W152-8.

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Eur J Radiol. 2009 Mar 2. [Epub ahead of print]

Lessick J, Ben-Haim T, Mutlak D, **Abadi S**, Agmon Y, Gherishin E.

Quantitative evaluation of regional left ventricular function by multidetector computed tomography.

J Comput Assist Tomogr. 2009 Mar-Apr;33(2):204-10.

Roguin A, **Abadi S**, Engel A, Beyar R.

Novel method for real-time hybrid cardiac CT and coronary angiography image registration: visualising beyond luminology, proof-of-concept.

EuroIntervention. 2009 Mar;4(5):648-53.

Gherishin E, **Abadi S**, Yalonetsky S, Engel A, Lessick

Clinical evaluation of a fully automated model-based algorithm to calculate left ventricular volumes and ejection fraction using multidetector computed tomography. *Acute Card Care*. 2009;11(1):43-51.

Abadi S, Brook OR, Rispler S, Frenkel A, Engel A, Keidar Z. Hybrid cardiac SPECT/64-slice CTA-derived LV function parameters: Correlation and reproducibility assessment. *Eur J Radiol*. 2009 May 12. [Epub ahead of print]

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Lessick J, Ghersin E, **Abadi S**, Yalonetsky S.

Accuracy of the long-axis area-length method for the measurement of left ventricular volumes and ejection fraction using multidetector computed tomography. *Can J Cardiol*. 2008 Sep;24(9):685-9.

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Abadi S, Brook OR, Solomonov Y, Fischer D. Misleading positioning of a Foley catheter balloon. *British Journal of Radiology*. 2006; 79, 175-176.

ANNEX D: BIBLIOGRAPHY OF DOCUMENTS COLLECTED AND REVIEWED

The consultant should include a reference list of documents collected and reviewed for the purpose of this short-term assignment.

**ANNEX E: LIST AND COPY OF MATERIALS DEVELOPED
AND/OR UTILIZED DURING ASSIGNMENT**