Imaging Instrumentation

Group 1 Report
19-21 November 2007

Dr Hideo Muruyama, Japan
Prof. Shengzu Chen, China
Dr Noriah Jamal, Malaysia
Assoc. Prof. Dr Rujaporn Chanachai, Thailand
Mr. Nguyen Manh Hung, Viet Nam

- On behalf of Prof. Dr Ahmad Zakaria and Group 1 members, Dr Muruyama will present on the summary of the discussion for Guideline Notes For Performance Evaluation Of PET/CT.

- Country reports were presented by 5 countries: China, Japan, Malaysia, Thailand and Viet Nam.

- China: number of PET and PET/CT is increasing. The current number is 100 and 65 cyclotron. The QA and QC program of PET and PET/CT has been carried out routinely and successfully.

- Japan: An example of practice on QC of PET and the performance of the next generation prototype PET, jPET-D4 were presented. Role of cross calibration was emphasized to confirm the accuracy of the performance.

- Thailand: The number of PET/CT is 4 and 2 cyclotron. Acceptance test of PET/CT was performed according to NEMA NU-2 2001 and AAPM 39, the results of the test were compared with the manufacture specifications. Such periodic maintenance is important for QC of PET.

- Malaysia: Draft of Notes For Performance Evaluation of PET/CT was presented for group discussion. PET/CT draft has 2 parts PET and CT with the total of 55 pages. The performance of PET is based on NEMA NU- 2 2001 and CT is on AAPM 39.

- Viet Nam: CT and SPECT are currently used, and there is a plan to set up cyclotron and PET/CT centre in Tran Hung Dao Hospital. The documents of QC for SPECT and CT were issued by the Government. Activity of FNCA project is very important.

Summary of Group 1 Report

- A draft of PET/CT Performance Evaluation is proposed based on the standard of NEMA NU-2 2001 for PET and the Guideline of AAPM 39 for CT.
- Performance evaluation of PET has been put into practice in FNCA countries according to the proposal of previous FNCA workshop.
- Periodic performance evaluation of PET was confirmed to be of importance for QC.
- Cross calibration is an important practice with a pool phantom and a dose calibrator.
- FNCA activity is useful for all the countries which have a plan to establish centre of PET/CT in the future.

Recommendations

- Activity of FNCA should be increased to support expert mission for workshop and site training course for QA/QC of PET/CT.

- Copyrights of NEMA and AAPM should be taken care for the publication of the documents for QC/QA.

FNCA 2007: Workshop on Cyclotron and Positron Emission Tomography (PET) in Medicine 20 Nov 2007 Kuala Lumpur. Malaysia.

GROUP 2

Group Members

- Dato' Dr. Rehir Dahalan (Malaysia)
- Dr. Zulkifli Mohd. Hashim (Malaysia)
- Mr. Syed Asraf Wafa (Malaysia)
- Mr. Azahari Kasbollah (Malaysia)
- Ms. Siti Najila (Malaysia)
- Ms. Rasyieda Abdullah (Malaysia)
- Dr. Kazutoshi Suzuki (Japan)
- Mr. Takehiko Kato (Japan)
- Mr. Yoshihito Kameda (Japan)
- Prof. Fan Wo (China)
- Mr. Jiranadai Saramkanan (Thailand)

Planning & Implementation

- **Radiation Safety**
  (Design of Premises)
  - Malaysia
- **Radionuclide Production**
  (^{18}F & ^{18}F-FDG)
  - China & Thailand
- **QA/QC of PET Radiopharmaceuticals**
  (^{18}F-FDG)
  - Japan

Activity Planning

- **First draft** to be submitted to Malaysia **before 30th April 2008**.
- **1 month** to complete of review and comments (to be submitted **end of May 2008**).

NO.	SUBJECT	CONTENTS
1	**Radiation Safety** • (Malaysia – leader) • Refer to ICRP/NRCP or other documentations	**1. Radiation Protection** a. Documentations/records b. Radiation exposure limit **2. Radiation Safety Education** a. Syllabus **3. Design of premises** a. Layout – Concept layout (refer to Hospital Putrajaya (*16 MeV*), Wijaya International Medical Centre (*11 MeV*) & other 30 MeV cyclotron models. b. Equipment and system c. Shielding d. Ventilation e. Radioactive waste management

NO.	SUBJECT	CONTENTS
1	**Radiation Safety** • (Malaysia – leader) • Refer to ICRP/NRCP or other documentations	**4. Control of radiation exposure** a. Control Exposure i. Administration ii. Technology b. Monitoring of exposure c. Control of radiation exposure to public d. Emergency response **5. Health Physics** a. Requirement of safety officer [before and after Flourine-18 production] b. During transferring fluorine-18 to synthesize FDG module c. Surface contamination

NO.	SUBJECT	CONTENTS
2	**Flourine-18 production and synthesize of FDG**	**1. General operating procedure** **2. Operation of cyclotron** a. Checklist or inspection before bombardment b. Distribution of FDG c. Maintenance of Cyclotron
3	**Quality Assurance and Quality Control of PET Radio-pharmaceutical**	**1. Qualification of personnel** **2. Documentation** **3. Quality Control Criteria** a. Radionuclidic identity / purity b. Radiochemical identity / purity c. Chemical purity d. Specific activity e. pH f. Osmolarity g. Stability h. Filter Integrity i. Residual solvent

QUALITY CONTROL CRITERIA FOR ^{18}F-FDG

- **Remark: ONLY STERILITY TEST carry out after released of the drug. Other tests must be done before drug released.**

Quality Control Tests	Acceptance Criteria	Frequency Of Test	Frequency Of Test
		GMP	Non-GMP
Appearance	Clear, colorless or slightly yellow	**Every Batch**	**Every Batch**
pH	5.0-8.0	**Every Batch**	**Every Batch**
Radionuclidic Identify	Half-life: 105 - 115 min	**Every Batch**	**Every Batch**
Radiochemical Identify / Radiochemical Purity	>95% (Radio-TLC)	**Every Batch**	**Every Batch**
Kryptofix 222	<50 μg/mL	**Every Batch**	**Every Batch**
Residual Solvents	<0.04% acetonitrile, <0.5% alcohol, <0.5% ether	**Every Batch**	**Twice per year**

Bacterial Endotoxins	175 EU/V	**Every Batch**	**Every Batch**
Sterility	Meets the Test	**Every Batch**	**Every Batch**
Membrane Filter Integrity	>50 psi	**Every Batch**	**Not necessary**
Radionuclidic Purity	>99.5% (511, 1022 keV)	**Not necessary**	**Twice per year**
Specific Radioactivity	No carrier added	**Not necessary**	**Not necessary**
ClDG	- (USP: <1.0 mg/V)	**Not necessary**	**Once a year**
Aluminium Ion	- (Japanese Std: <10 µg/mL)	**Not necessary**	**Not necessary**
Osmolality		**Not necessary**	**Not necessary**

TERIMA KASIH
THANK YOU

FNCA 2007
Workshop on Application of Cyclotron and PET in Medicine

19 – 21 November 2007

PET CLINICAL DIAGNOSIS

35 Tahun 1972 - 2007
AGENSI NUKLEAR MALAYSIA

GROUP 3

PET CLINICAL DIAGNOSIS

Work plan members 2007

Dato' Dr Mohamed Ali Abdul Khader	MALAYSIA
Dr Fadzilah Hamzah	MALAYSIA
Ms Dang Yaping	CHINA
Dr Tomio INOUE	JAPAN
Dr Nobukazu TAKAHASHI	JAPAN
A.P Dr Pawana Pusuwan	THAILAND
Dr Jonas Francisco Santiago	PHILIPPINE
Dr Le Ngoc Ha	VIETNAM

COMPONENTS OF PROJECT

Theme: Publication of case review of clinical PET

Activity: Establishment of the FNCA Case Review Database System for Clinical PET to Generate the Educational Materials.

Target Outcome: Publication of Case Review of PET-CT Clinical Cases in CD form.

Group Discussion

- Cases Presented:
  - Japan : 2
  - Thailand : 5
  - Malaysia: 9
  - Philipines: 1
- Others:
  - Philippines : State of PET in Philippines
  - China : Study on "Application of PET/CT in Diagnosis and Management of Lung Cancer"
  - Japan : "Plan of Clinical Group in Japan"
  - Viet Nam : " Current status of PET and cyclotron establishment in Viet Nam"

Data in Case Card of Case 1

- Female
- 73 y.o.
- Chief complaint： no complaint
- Present and past history:

  She had medical therapy for Rheumatoid arthritis (RA) at small hospital near her house.

  The doctor detected small coin lesion in her right upper lung by chest X-ray examination in May 2001. Confirmed diagnosis can not be obtained by bronchoscopic examination.

  She was admitted to the department of 1st surgery of Yokohama City University hospital in October 2001.

Data in Case Card of Case 1

- Clinical examination:

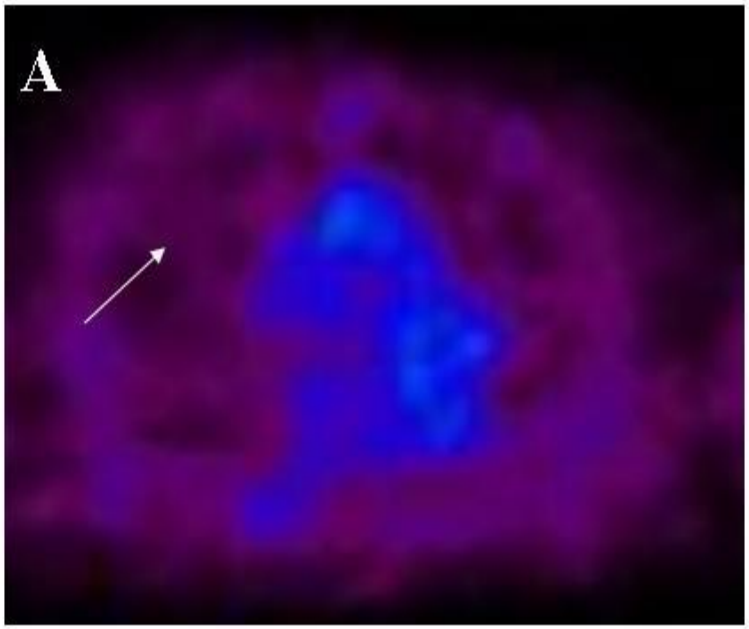
  Small coin lesion was detected in right S3 without LN metastases by CT.
- Image findings and interpretation:

  FDG did not accumulated in the small coin lesion in S3 detected in CT.
- Final diagnosis (confirmed diagnosis):

  Lung Cancer (Well differentiated adenocarcinoma) (T1N0M0, Stage IA).

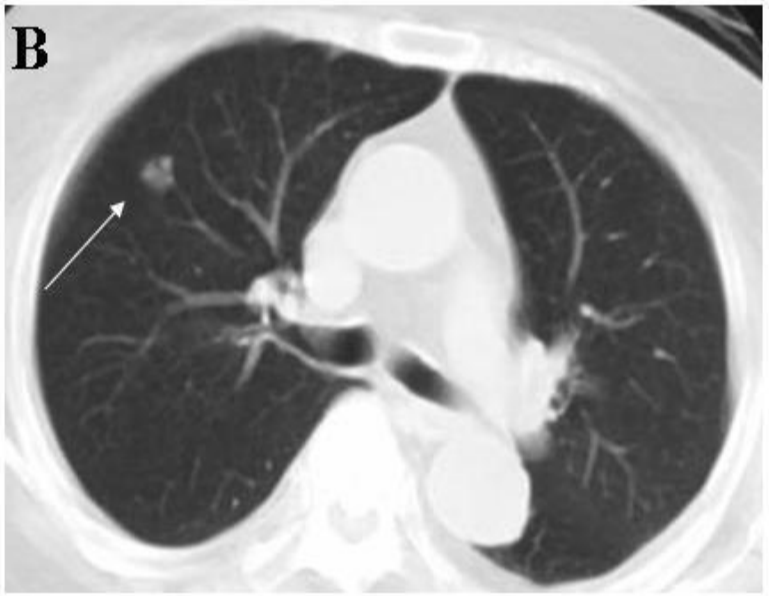
FDG-PET

Transaxial Image



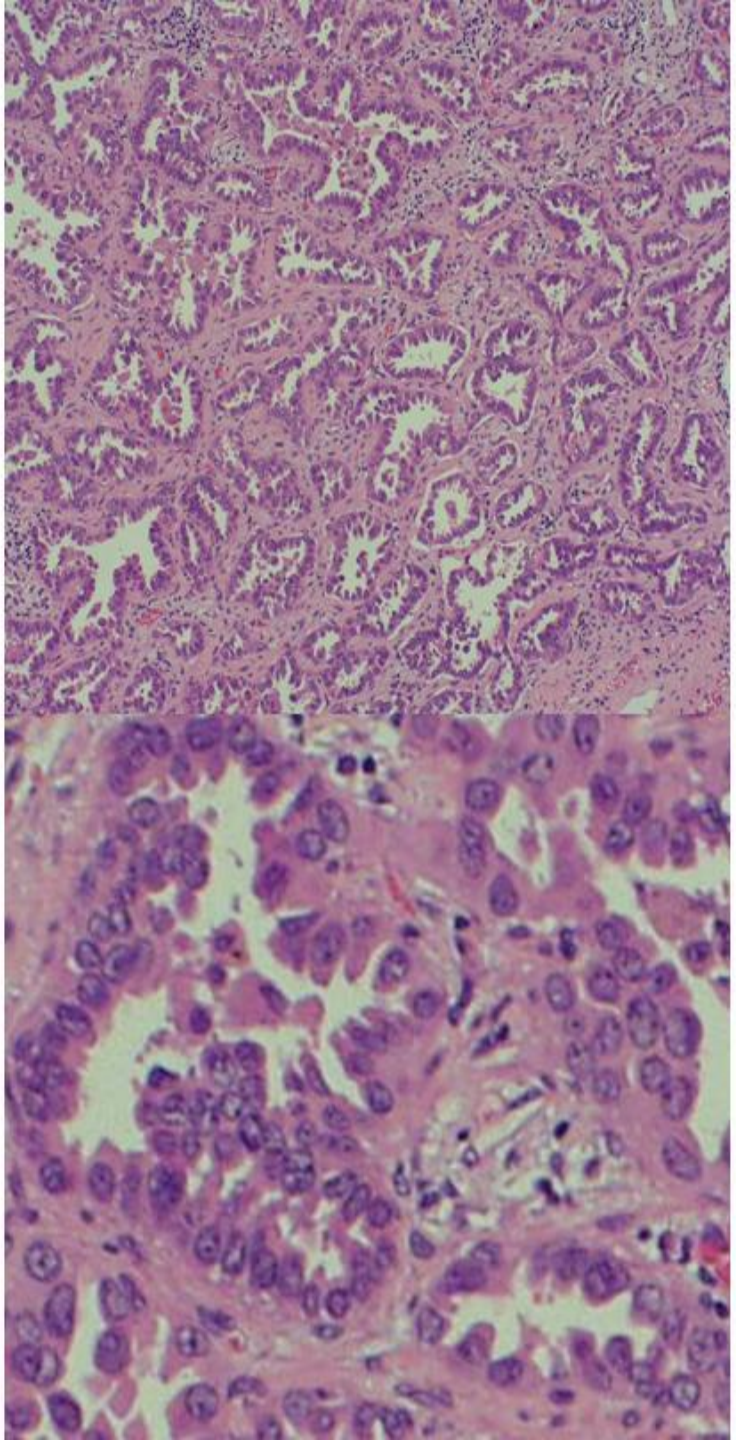
CT

Transaxial Image



Histopathological Result:

Well differentiated adenocarcinoma of the lung.



- Pearls and Pitfalls:

  FDG accumulation is low in well differentiated adenocarcinoma of the lung.
- Teaching point:

  Correlation was seen between FDG uptake and degree of cell differentiation in adenocarcinoma of the lung.
- References:

1. Higashi K J Nucl Med. 1998 Jun;39(6):1016-20
2. Nomori H. et al. Evaluation of F-18 fluorodeoxyglucose (FDG) PET scanning for pulmonary nodules less than 3 cm in diameter, with special reference to the CT images. Lung Cancer. 2004 Jul;45(1):19-27
3. Kim BT et al. Localized form of bronchioloalveolar carcinoma: FDG PET findings. AJR Am J Roentgenol. 1998 Apr;170(4):935-9.
4. Nomori H. et al. Visual and semi quantitative analyses for F-18 fluorodeoxyglucose PET scanning in pulmonary nodules 1 cm to 3 cm in size.Ann Thorac Surg. 2005 Mar;79(3):984-8

Contents of the Database

Case presentation

- Identification (Keyword for search engine)
  - Category (oncology/neurology, cardiology, infection,others)
  - System: Respiratory etc — Organ: lung etc
  - Diagnosis — (ex. Lung cancer)
  - Date of examination — day/month(eg January)/ year
  - Tracer used: — (ex. ^{18}F FDG-PET)
  - Sex
  - Age
- Chief complaint
- Indication (diagnosis/staging/assessment of therapy/restaging/others)
- Present and past history
- Clinical Examination
- Investigations

Contents of the Database

- Image findings and interpretation
- Final diagnosis (confirmed diagnosis)
- Additional comments or opinions
- Images: PET or PET/CT images & Reference Images (CT, MRI,US)
- Teaching Point (including pearls and pitfalls)
- Cross references: eg artifact/normal variant
- References (max of 5)
- Contributor (Hospital/Institutions, Country)

Work plan Input

- Methodology:
  - **Two cases** from each contributing country per month.
  - Sent to Malaysia in Jpeg format for images and Word Document for other information
  - Editing by Malaysia
  - Further input /comments from member countries.
  - First 2 cases from each member countries to be submitted on the last week of December 2007, subsequently last week of every month.
  - Target 100 cases by end of project.
- No short form is used in the case note.
- Informed consent : depends on the individual country.
- Email address with security authorized code for security and confidentiality purposes.

Topic	Cases	Achievements	Contributors
Artifacts			
Physiological Variants, Artifacts and Pitfalls	Dental Caries		
	Breast		
	Heart		
	Brain		
	Brown fat		
	Muscles		
	Thymus		
	Bowel hypermotility		
	Liver cyst		

THANKYOU