

First experience of ^{18}F -FDG PET/CT scanning of sarcoidosis patients in Estonia

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Sarcoidosis epidemiology

Multisystemic chronic inflammatory disease of unknown etiology histologically by noncaseating granulomas in affected tissues

- Commonly starting at age 20-40 years.
- Female slightly more than male
- Prevalence 1-40 /100 000
- Higher incidence rates in Scandinavian countries (>50/100 000)



Organ involvement in sarcoidosis

U. Costabel. Eur Respir J 2001; 18: Suppl. 32, 56s–68s

- Disease usually presents with mediastinal and hilar lymphadenopathy and with variable involvement of the lungs

Organ	% of patients
Mediastinal lymph nodes	95-98%
Lungs	90%
Liver	50-80%
Spleen	40-80%
Eyes	20-50%
Peripheral lymph nodes	30%
Skin	25%
Nervous system	10%
Heart (clinically)	5%



Sarcoidosis clinical picture

- Very variable
- Depends on
 - ethnicity
 - duration of illness
 - site and extent of organ involvement
 - activity of granulomatous process
- Disease natural history and course under treatment are variable and unpredictable, ranging from spontaneous recovery to progression towards chronic and irreversible lesions escaping from any medical treatment.



Radiological imaging

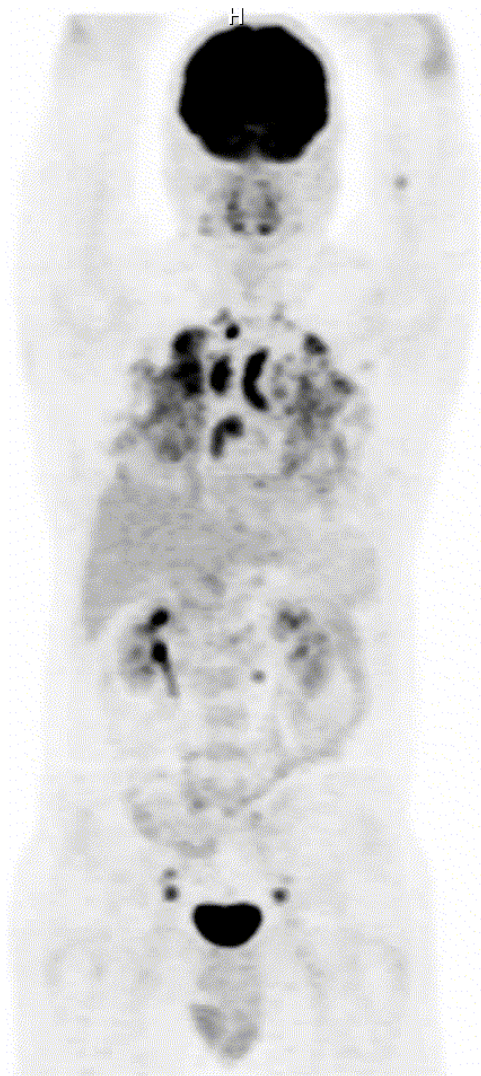
- Imaging plays an important role in sarcoidosis diagnosis and treatment strategy plan at both primary staging and patient follow up.
 - Chest X-ray
 - CT
 - ^{67}Ga – scintigraphy
 - ^{18}F -FDG PET/CT
- } to evaluate disease activity
and extent



^{18}F -FDG uptake by inflammatory cells

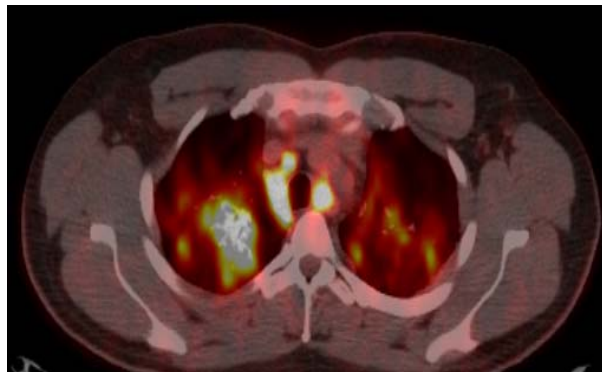
- It has been shown intense uptake of FDG in sarcoidosis, particularly in the associated lymphadenopathy
- The uptake of FDG increases when metabolic activity is increased by inflammatory cells. In sarcoidosis, macrophages are activated and play an important role in the formation of granulomas, which may explain why the granulomatous lesions of sarcoidosis show strong FDG uptake.
- In sarcoidosis, the degree of FDG uptake has been related both to activity of disease and to treatment responsiveness .





Typical pattern of ^{18}F FDG uptake of intrathoracic sarcoidosis stage II active phase.

Extrathoracic finding: ^{18}F FDG uptake in inguinal lymphnodes.



Standard uptake value (SUV)

$$\text{SUV} = \frac{\text{Activity in ROI (microcuries/ml)}}{\text{Dose (mCi) / Weight (kg)}}$$

- Semi-quantitative analysis which requires measurements of absolute concentration of positron emitter (in microCi/cc) in region of interest (ROI).

Depends on patient characteristics
tumor size
imaging protocol
scanner characteristics



Published data about ^{18}F -FDG PET/CT in sarcoidosis patients

- The usefulness for both the diagnosis and follow-up of sarcoidosis patients is not completely evaluated. Often small and heterogeneous patient series and case reports

1) Comparative evaluation of ^{18}F -FDG PET and ^{67}Ga scintigraphy in patients with sarkoidosis

Y.Nishijama et.al. J Nucl Med 2006 oct ; 47 (10): 1571-6.

2) Results of 188 Whole-body Fluorodeoxyglucose Positron Emission tomography Scans in 137 Patients With Sarcoidosis

A.S Teirstein et al CHEST 2007; 132:1949-1953

3) ^{18}F -FDG PET/CT in sarcoidosis management: review and report of 20 cases.

J.J. Braun Eur J Nuc Med Mol Imaging (2008) 35: 1537-1543



First experience of 18-F-FDG PET/CT scanning of sarcoidosis patients in Estonia

- **Aim of the study:**

- to evaluate the 18F- FDG PET/CT findings in sarcoidosis patients
- to assess the extrathoracic localisations of sarcoidosis



Material and methods

- A retrospective study where all clinical/radiologically and histologically proven sarcoidosis patients who underwent ^{18}F -FDG PET/CT scanning in Tartu University Hospital from April 2007 to May 2010 were included
- 21 patients (7 male; 14 female)
- The mean age: 47 years (range 22-68)
- Mean duration of the illness 3,5 y
- Alltogether 25 scannings were performed



Material and methods

- Hybrid PET/CT scanner Discovery ST, GE Medical System was used.
- Patients were fasted at least 6 hours before injection
- Serum glucose level was below 6,6 mmol/l
- Administered ^{18}F -FDG activity was between 3 to 5,2 MBq/kg.
- Interval between injection and scanning time was 45 to 65 minutes.
- Imaging started with low dose CT-scan and followed with whole body PET scan.
- Scanning area: from eye level to mid thigh.



Results

- 3 patients didn't have any pathological FDG accumulation in whole body scan.
- 17 patients showed intrathoracic uptake:
 - Mediastinal lymph nodes(MLN) (3)
 - MLN + lung parenchyma (14)
- 1 patient had only extrathoracic lymphnode disease.
- 13(62%) out of 21 patients had extrathoracic FDG accumulation



Location of FDG accumulation in 13 patients with extrathoracic findings

Location	No
Extrathoracic lymph nodes:	
abdominal	9
neck	5
axillary	4
inguinal	2
Bone marrow	5
Spleen	2
Skin	2



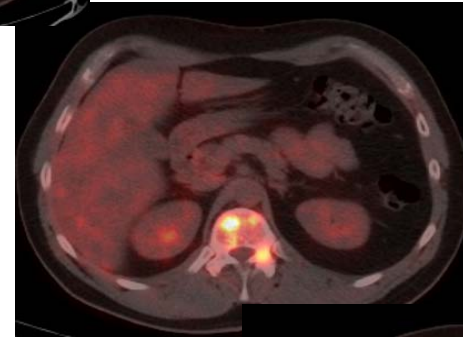
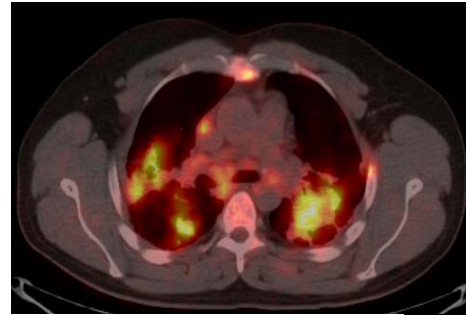
Repeated 18-F-FDG PET/CT scanning

- Repeated scanning was performed 4 times to 3 patients
- to evaluate the disease activity after corticosteroid therapy.
- 3 times was seen regression and 1 patient showed progression of disease based on standardized uptake value (SUV) and lesion FDG uptake spreading.



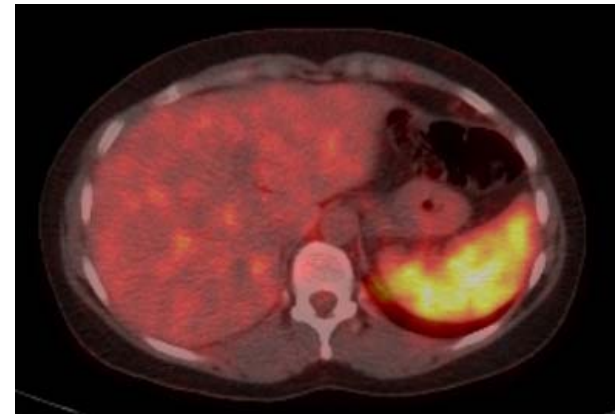
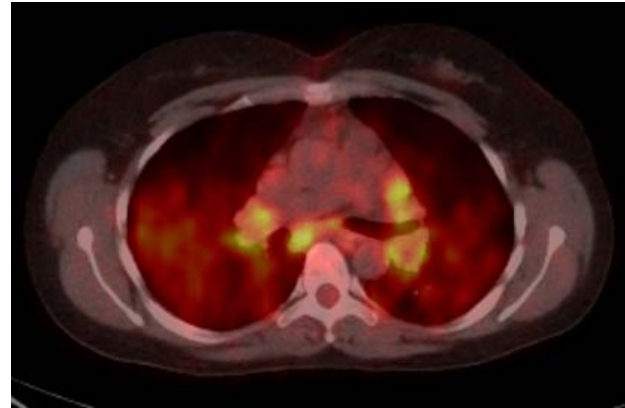
- Based on CT findings sarcoidosis stage II

- PET/CT showed FDG uptake on lung parenchyma and MLN-s and
iffuse patchy uptake of bone marrow



Based on CT findings sarcoidosis stage II

PT/CT showed additional FDG uptake in normal size spleen



Conclusions

- ^{18}F -FDG-PET/CT is more reliable to detect the disease activity and extent than CT alone
- and is more sensitive to detect extra-thoracic sarcoidosis, especially in bone marrow lesions.
- FDG accumulation in lesions lack specificity, to verify the sarcoid granulomas, sometimes additional biopsy is needed.






Apply phase-shift operator

$z=0$

the depth step $s(z, z)$



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