IMAGING OF SARCOIDOSIS WITH EMPHASIS ON PET CT AND PET MRI

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OUTLINE

- **Pulmonary Sarcoidosis- Conventional Imaging**
  - Chest X-ray
  - Computed tomography
  - Drawbacks of conventional imaging
- **Cardiac Sarcoidosis- Role of MRI**
- **PET CT**
  - Role in disease burden, treatment response, prognosis
  - Role of PET CT in assessing response to therapy in Cardiac and extracardiac disease
- **PET MRI**
SARCOIDOSIS

- Immune mediated Multisystem involvement
- Lung and mediastinum involved in 90% cases
- Cardiac Sarcoidosis is seen in 5-10% patients in clinical studies and 30% cases on autopsy
- Incidence peaks in the 3rd decade of life In the United States
- Age-adjusted annual incidence among African-Americans is more than triple that among Caucasians (35.5 vs 10.9 per 100,000 inhabitants)
ROLE OF CONVENTIONAL IMAGING
Chest radiography is a part of the initial work-up in all suspected cases.

- More than 90% CXR is abnormal.
- Bilateral Hilar Lymphadenopathy (BHL) in 50-80% cases, typically symmetric and non-compressive.
SILTZBACH SARCOIDOSIS STAGING

- STAGE 0: No abnormalities
- STAGE 1: Lymphadenopathy
- STAGE 2: Lymphadenopathy and pulmonary infiltrates
- STAGE 3: Pulmonary infiltrates
- STAGE 4: Fibrosis

- No correlation with PET FDG uptake (Mostard et al. 2013)
- Does not correlate with PFT, dyspnea or 6min walk (Keir et al.)
UTILITY OF COMPUTED TOMOGRAPHY

• Role of CT (ATS/ERS/WAOS)–
  1. Atypical clinical or radiographic findings
  2. Normal CXR but clinical suspicion of sarcoidosis
  3. Detection of pulmonary complications
HRCT – DISEASE ACTIVITY

- May be useful in differentiating Active inflammation from irreversible fibrosis in selected patients with stage 2 or 3 sarcoidosis.

- Nodules, ground-glass opacities, and alveolar opacities are suggestive of granulomatous inflammation that may be reversed with therapy.

- Honeycomb-like cysts, bullae, broad and coarse septal bands, architectural distortion, volume loss, and traction bronchiectasis are indicative of irreversible fibrosis.
HILAR LYMPHADENOPATHY
CALCIFIED NODES
MICRONODULES 2-4mm
CT IMAGING FINDINGS

GALAXY SIGN

GROUND GLASS OPACITY

FIBROTIC AND CAVITARY CHANGES

ASPERGILLOMA
CT IMAGING FINDINGS

PERILYMPHATIC NODULES

LARGER NODULES

MASS LIKE LESIONS
CT FINDINGS- CLINICAL IMPLICATIONS

- Extent of disease and pulmonary functions correlate well (Drent et al)
- CT is limited value in assessing inflammatory activity in fibrotic disease and ground glass.
- Oberstein visual scoring has good correlation with PET activity (Kejsers et al, JNM 2011)
CARDIAC SARCOIDOSIS

- Sudden death in unsuspected individuals up to 35% (30-65%) (OPSHARMA 1993)
- Studies use MHFW criteria as the gold standard 1993, 2006
- Endomyocardial biopsy-patchy involvement, RV biopsy
CARDIAC-IMAGING GOALS

- Identifying early lesions
- Differentiating active inflammation or scar in heart
- To assess the active disease burden in heart
- To assess response to treatment
MR IMAGING DELAYED ENHANCEMENT

- Due to myocyte injury and leak in active inflammation
- Due to accumulation in collagenous scar in interstitium
- Non ischemic distribution
- Even if subendocardial, associated nonischemic distribution also present
- Correlates well with risk of adverse events (11.5 fold)*

*Patel et al CirC 2009
DELAYED ENHANCEMENT
LIMITATION OF MRI

Active inflammation vs scar—cannot be differentiated on MRI alone

ROLE OF PET MRI
ROLE OF PET CT
ROLE OF PET CT IN SARCOIDOSIS

- Pulmonary Sarcoid
  - Disease diagnosis- Guide biopsy location
  - Extent of disease, Occult lesions, Explain symptoms, Prognosis
  - Extent of inflammation and guide treatment
  - Unexplained persistent symptoms without serological signs of inflammation
- Active Cardiac sarcoidosis
PET correlates well with serological markers including ACE and sIL-2R (Kejsters et al)

Negative predictive value for serological markers and PET is however moderate

PET CT is useful in persistent/unexplained symptoms without serological markers
FDG correlates with number of neutrophils and CD4vcells in BAL.

- FDG uptake in areas such as Bone and Cardiac involvement have therapeutic implications.
- Inflammatory activity on PET is target for therapy.
- PET CT can be helpful in identifying inflammatory activity in fibrosis.
- PET CT can assess treatment response.
PET -PULMONARY

CASE 1

CASE 2
PET - PULMONARY

CASE 3
PET - PULMONARY
CASE - PROGRESSIVE PULMONARY DISEASE ON TREATMENT
Decreased septal inflammation increase scar
ROLE OF PET MRI
PET MRI

- Complementary techniques
- PET – Inflammation, Specificity
- MRI – Scar, Sensitivity of MRI
- Disease burden
- Active lesions well mapped
- Guide treatment
- Biopsy guide
- Avoid perfusion scans
- PROTOCOL AND PREPARATION
CASE 1 PET MRI
CASE 3 PET MRI
Chest Radiography and CT can be used in most patients to monitor pulmonary disease.

In patients with suspected cardiac involvement, PET CT may be a better investigation to assess disease burden and treatment.

PET MRI can be used a single stop investigation to evaluate Cardiac sarcoidosis.

SUMMARY
REFERENCES


THANK YOU