The Role of Brain SPECT Imaging in Diagnosing and Treating Lyme Disease

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Disclosure Statement

- I am an employee of Amen Clinics, which performs brain SPECT imaging

- I receive income from the publication of a book
Goals of Talk

- Understand the difference between structural and functional brain imaging
- Understand typical brain scan findings for tick-borne infections
- Understand how to use functional brain imaging (brain SPECT) to better target treatment interventions
Lyme in My Life
Brain Imaging
How Do You Know Unless You Look?

**STRUCTURAL:**
- CT
- MRI

**FUNCTIONAL:**
- fMRI
- PET
- SPECT
Brain CT

- Only one article, in German, from 1987

- Use brain CT to check for structural lesions—subdural hematoma, tumors, dementia. Otherwise limited use for Lyme
Brain MRI

- MRI brain lesions in Lyme are rare and do not correlate with the course of the disease.
- Neuroborreliosis has to be considered when patients present foci of hyperintense signal (T2-weighted images) in white matter and brain stem. However, seen in only 7/66 infected individuals in one study.
- Lyme may be mistaken for MS on MRI; common in the patients I see.
fMRI

- Looks at the difference between task and control state
- Main application: pre-surgical language mapping for tumor removal
- Applying fMRI to other conditions is more difficult because the signal change in fMRI is very small
- Post-processing errors: an important paper suggests such errors may have invalidated as many as 40,000 published studies from the past 25 years
- No studies found for Lyme
PET

- Good resolution
- More costly and less available than SPECT
- Lyme appears to have two primary patterns on FDG (fluorodeoxyglucose) PET scans:
  - Specific temporal lobe hypometabolism
  - Diffuse cortical hypometabolism with deficits noted in bilateral gray and white matter regions, primarily in the temporal, parietal, and limbic areas
Single Photon Emission Computed Tomography
Looks at brain blood flow and activity
Small amount of radioactive tracer injected
SPECT looks at areas of the brain that:
  - Work well
  - Do not work hard enough
  - Work too hard
SPECT Most Studied Imaging for Tick-Borne Infections

SPECT Views of Healthy Brain

Surface view

Active view
SPECT: Fallon 1997 Paper

- Multifocal areas of decreased perfusion in cortex and subcortical white matter
- Pattern not specific for Lyme; can also been seen in:
  - HIV/viral encephalopathy
  - Chronic substance abuse
  - Inflammatory conditions such as lupus
  - Hypothyroidism
  - Carbon monoxide poisoning and other toxic exposure
- Improvement in SPECT perfusion after treatment shows that damage not permanent
- SPECT scans may be particularly helpful in:
  - Differentiating neuropsychiatric Lyme disease from primary psychiatric disorders
  - Differentiating Lyme disease from other syndromes that do not cause a diffuse process, as listed above
  - Monitoring the course of treatment
SPECT: Donta Paper

- 183 pts w/ chronic Lyme
- 75% demonstrated abnormalities in perfusion to various areas of the brain, most notably the frontal, temporal, and parietal lobes
- Seropositive and seronegative individuals had similar rates, types, and severity of perfusion defects
- Brain MRI abnormalities seen in 14% of patients.
- Antibiotic treatment, especially agents with intracellular-penetrating activity, resulted in resolution or improvement of abnormalities in 70% of patients in 1-2 years
SPECT vs. MRI

- In one study of 13 patients with confirmed Lyme encephalopathy, almost all (11/13) had a normal MRI scan, with just two showing areas of enhancement of white matter suggestive of lesions.
- All of the patients (13/13) had abnormalities on SPECT scans, where multiple areas of hypoperfusion were evident involving both cortical and subcortical areas.
- Following only a four-week course of antibiotic treatment, most patients in the Lyme encephalopathy group showed clear improvement in neuropsychiatric symptoms between one and three months after the treatment.
- Follow-up SPECT scans at six months following treatment showed improvements in brain blood flow in all of the patients.
Lyme: What I See on SPECT

First Pattern:
- Reported by Drs. Donta and Fallon
- Global hypoperfusion—low blood flow, low brain activity
- Scalloping—bumpiness on the surface
- Brain looks toxic, unhealthy

Second Pattern:
- Not reported in literature, but I have noted it in 10-20%
- Not scalloped
- Excessive limbic activity (inflammation)
SPECT
First Pattern: Scalloping

Healthy

Scallopded, toxic-looking
SPECT
Second Pattern: Limbic Overactivity (Inflammation)

Healthy

Inflammation

Elizabeth: After starting treatment. Note inflammation.
Adam: Male, age 22

- Depression
- Anxiety severe
- OCD
- Anger outbursts
- Social anxiety
- Lack of confidence
- Self-medication with marijuana
- Reversed sleep-wake cycle
Adam

- Reluctance to get optimal Lyme testing initially. Did not improve with treatment. I pushed, finally got IGeneX specialty lab testing—>Lyme positive

- Improved on Concerta and OCD medication. Pushing self more. Mood very much better. Less combative. Takes criticism better. Taking classes. Parents very optimistic. Thanked me profusely for insisting on testing for Lyme

- How did SPECT help?
  - He did not respond to reasonable psychiatric treatment, despite a number of different interventions
  - I kept thinking that we were missing something, and the scalloping on brain SPECT suggested a possible infection, which resulted in my pushing for good Lyme testing
Donna: Female, mid 40s

- Lyme and at least six other infections
- Striking speech problem
- Heavy metal toxicity with chelation, traumatic brain injury
- MANY neurological signs/symptoms, chronic pain, poor cognition
- Treatment with Dr. Burrascano and other well-known LLMD’s
- Ran scientific research foundation before she became sick with Lyme, artistic, interested in film
Donna: Before and After Treatment

Before Treatment: Dec. 2008
Concentration surface scan 12/8/2008

After Treatment: May 2010
ReSPECT--some improvement
Donna: Improvement

- Improvement, clinically and seen on SPECT, due to targeting the very low prefrontal cortex and temporal lobe activity with stimulant medication
- Speech improved dramatically
- Cognition, memory improved
- She received other treatments too, such as brain boost supplements
Elizabeth, 31 year old female

- Treated for Lyme and co-infections for about eight years by several very experienced clinicians and now significantly improved
- Probably infected for 12-13 years before diagnosis made
- Always very physically active with her animals
- Dog infected, horse infected
- Two episodes severe mono when young. Suspect mono reduced her immunity and made her more susceptible to Lyme
- Extensive series of consultations and work-ups prior to diagnosis of tick-borne infections
Severe weakness/fatigue
Migraine headaches → Irlen syndrome
Mood swings, irritability, anger
Brain fog/Cognition
Nightmares & severe insomnia
No driving or riding horse for 1-2 years
Home schooled/online classes
Unable to train/compete with dogs
Hypersensitivities to odors and fragrances
Elizabeth: SPECT Surface View

Elizabeth: 6/14/2012 Surface (concentration)
Elizabeth: Before and During Treatment

Before Treatment: June 2010

Herxing: Sept. 2010

Elizabeth: Before Lyme treatment started

Elizabeth: After starting treatment. Note inflammation.
Elizabeth: Inflammation Improved

November 2011

Elizabeth: Inflammation somewhat better, but not great.
Elizabeth

- How did SPECT help?
  - Underscored the need to reduce inflammation
  - Underscored need to reduce limbic hyperactivity → reduce irritability
  - Helped Elizabeth and parents understand and accept her issues

- Lamictal
  - Mood stabilizer/anticonvulsant
  - Helped reduce symptoms and likely contributed to decreased limbic overactivity seen on ReSPECT
Stem Cells

- Human embryonic stem cell treatment
- Brain SPECT before and after
- Stem cell treatment improved cerebral perfusion (blood flow) in many patients
SPECT: Summary

- Easy to do and to understand
- Raises index of suspicion about Lyme and toxicity
- Helps differentiate Lyme from other conditions
- Reduces guilt and shame, increases self-acceptance, patients and families are more accepting, “buy in” to brain problems, relieved to have diagnosis
- Targets specific brain areas for remediation, such as prefrontal and temporal lobes
- Helps follow progress of treatment, including with stem cells
- Documents degree of impairment for legal, disability, and insurance issues
- Helps reassess psychiatric diagnoses—I have rediagnosed several “bipolar,” “schizophrenic,” “OCD,” and “ADHD” patients
References


