Neuroradiology of AIDS

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AIDS

- 90% of HIV patients have CNS involvement
- 10% of AIDS patients present first with neurological symptoms
- 73-80% of AIDS patients have significant neuropathic lesions at autopsy
- 100% of AIDS patients must have CNS involvement
- HIV is a neurotropic virus
Neurotropic HIV³

Infection of CNS cells – monocyte-macrophage derivation.

Astrocytes, oligodendrocytes, glial Cells and ?neurons

Encephalitis mediated by cytokines

Neurological symptoms occur irrespective of opportunistic infxns

CNS as reservoir for the HIV

Lipton SA et al. NEJM 1995; 332:934-940
AIDS Dementia Complex

- 40% of AIDS patients have neurological complaints

- AIDS Dementia Complex: Progressive memory loss, altered mental status, arm weakness, and gait instability

- Focal lesions: Seizures, focal motor or sensory deficits, cranial nerve palsies

- Non-focal lesions: Decreased mental status, altered level of consciousness, headaches and other non-specific findings
Indications and Goals of CNS Imaging

- **Indications:** Decreased mental status, Altered level of consciousness, Headaches, Seizures, Focal motor or sensory losses, Cranial nerve palsies

- **Accurate Diagnosis** – non-specific clinical features

- **Guide therapy** – choice of Rx and follow-up

- **Severity of neurologic disease correlates with imaging findings**
Oslen WL, Cohen W. 
Neuroradiology of AIDS. 
Radiology of AIDS 1998
MR Technique

- T1 vs T2 spin echo sequences
- T1 weighting: short TR (repetition time) and short TE (echo time)
- T2 weighting: long TR (repetition time) and long TE (echo time)
- Most brain lesions increase brain water content
- T2 weighting more sensitive to changes in brain water content
- Anatomic resolution much better with T1 weighting
- Thus, T1 weighting only *after* detection of lesion by T2 weighting
Radiologic Manifestations

- Atrophy
- Mass lesion(s)
- White matter disease
- Head and Neck Neoplasms

- (Leptomeningeal and Ependymal disease)
Cerebral Atrophy

- Diffuse cerebral atrophy
- Enlarged ventricles and sulci of atrophy
- Detected equally well on CT and MRI
- Etiology – HIV subacute encephalitis
- Memory loss and Psychomotor slowing
- Progression to Dementia, Death

T2WI demonstrating prominent sulci
Ddx for Cerebral Atrophy

- Old Age
- Dehydration (esp secondary to chronic diarrhea)
- Encephalitis (HIV, CMV, HSV)
- Cachexia
Progressive Atrophy

Mass Lesions

T1WI + contrast demonstrating enhancing mass lesions

Sakaie KE, Gonzalez RG. Imaging of Neuroaids
Ddx for CNS Mass Lesions

Infection vs. Tumor: esp in immuno-compromised pts

Infections: Toxoplasmosis, Tuberculosis, Candida albicans, Cryptococcus, HSV encephalitis, Bacterial abscesses

Tumors: Lymphoma (primary CNS, Hodgkin’s, Non-Hodgkin’s), Glioma, Kaposi’s sarcoma, Metastatic disease

Toxoplasmosis vs Primary CNS Lymphoma in AIDS patients
Toxoplasmosis

- Toxoplasma gondii
- Obligate intracellular protozoan
- Up to 70% adults seropositive
- Sub-clinical, mild infection in general population
- Reactivation in AIDS patients
- Most common mass lesion in AIDS patients
- Treatable CNS disease (sulfadiazine-pyrimethamine)

T1WI + contrast: Multiple enhancing mass lesions

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Toxoplasmosis

- Multiple mass lesions with surrounding vasogenic edema
- “Ring enhancing lesions”
- Cortex and Basal Ganglia
- T1: low signal intensity
- T2: medium high signal intensity

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Primary CNS Lymphoma

- Clinical Sxs: Encephalopathy, seizures, cranial nerve palsies, focal motor or sensory losses
- Extremely poor prognosis < 2 mos
- ? Regression with radiation therapy
- Peripheral lesions - supratentorial
- Multiple lesions in AIDS patients
- Also “ring enhancement”

Sakaie KE, Gonzalez RG. *Imaging of Neuroaids*
Toxoplasmosis vs Primary CNS Lymphoma

“Ring enhancing mass lesions”

Sakaie KE, Gonzalez RG. Imaging of Neuroaids
Functional MRI (fMRI)\(^1\)

- 2 types of experiments:
- Regional hemodynamic changes secondary to brain activation. Studies of vision, speech, audition, and memory.
- Dynamic contrast fMRI. Use of injectable contrast agent. Study of neuroAIDS.
- \(r\text{CBV} \) – relative Cerebral Blood Volume
- \(r\text{CBF} \) – relative Cerebral Blood Flow
fMRI

A. Control vs Patient

High CBV = Red
Mod CBV = Yellow
Low CBV = White

B. Patient pre vs post Rx

High CBV = Red
Mod CBV = Yellow
Low CBV = White

Sakaie KE, Gonzalez RG.
Imaging of Neuroaids
Primary brain lymphoma lesion

Toxoplasmosis lesion

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Thallium SPECT¹

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Progressive Multifocal Leukoencephalopathy (PML)\textsuperscript{5}

PML

Papova virus (JC virus)

Demyelination and necrosis of white matter

Mental status changes, visual loss, aphasia, hemiparesis, ataxia

Relentless progression

Mean time to death = 18 wks

T2WI: sub-cortical hyperintense signal in right hemisphere

Sakaie KE, Gonzalez RG. Imaging of Neuroaids
Progressive PML – 8 Weeks Later\textsuperscript{5}

PML – post 4 weeks of HAART$^6$

PML – post 4 months and 21 months of HAART$^6$

HAART x 4 mos

HAART x 21 mos

CNS Tuberculosis

- Right parietal tuberculoma
- Multiple enhancing cerebellar tuberculomas
- Left parietal tuberculous abscess

Corr, PD. CNS Tuberculosis. www.eMedicine.org
Head and Neck Neoplasms

Benign Adenoid enlargement


Oslen WL, Cohen W. Neuroradiology of AIDS. Radiology of
References

3. Lipton SA, Gendelman HE. Seminars in Medicine of the Beth Israel Hospital, Boston: Dementia Associated with the Acquired Immunodeficiency Syndrome N Engl J Med 1995; 332:934-940, Apr 6, 1995
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