IMAGING OF INTRACRANIAL INFECTIONS

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Plan

- Introduce MR sequences that are useful in the diagnosis of intracranial infections
- Learn a systematic approach for the interpretation of imaging findings
- Review a series of cases
Several outbreaks of encephalitis in this century
  ebola, zika

In endemic areas, common cause of neurological morbidity
  tuberculosis, cysticercosis

Urbanization and encroachment on natural environments, ease of world travel and climate change
  mosquito-borne diseases - malaria, dengue, and viral encephalitides

Immunosuppressed and immunodeficient states
  post-transplant, chemotherapy, disease modifying therapy, recreational drug use, HIV

Transmissible virus and protein particles
  prion
CNS INFECTIONS: APPROACH

Supporting Clinical features, background info and laboratory findings
rash, travel or therapy, CSF, CD4 counts

Pathogens
location of infection within the CNS, geographic exposures,
vaccination status, age, surgery and immune suppression

Imaging of neuraxis to include spinal cord and caudal equina
extent of involvement; multifocal, diffuse, atypical clinical or CSF findings

Choice of Tools and Tricks
diagnosis and monitoring
ROLE OF IMAGING

• LOCATION AND EXTENT OF INVOLVEMENT
• TYPE OF INFECTION
• DETECTION OF COMPLICATIONS
• GUIDANCE TO BIOPSY OR THERAPY
• RESPONSE TO THERAPY
### Intracranial Infections

#### Calvarial
- Osteomyelitis

#### Meningeal
- Leptomeningeal
- Pachymeningeal
- Arachnoiditis
- Effusions
- Empyema

#### Ventricular
- Choroid Plexitis
- Hydrocephalus
- Pneumocephalus
- Ventriculitis

#### Parenchymal Lesions
- Encephalitis / Myelitis
- Cerebritis
- Abscess
- Cysts
- Granuloma
- Gliotic scar
- Calcification
- Infarcts - arterial or venous
- Haemorrhages
MR CONTRAST MECHANISMS

Endogenous

- relaxation (T1; T2; T2*)
- diffusion (DWI, DTI)
- susceptibility (T2*, SWI)
- flow (MRA, ASL, CSF flow)
- perfusion (DCE, DSC, ASL)
- BOLD (fMRI)

Exogenous

- Gd-chelating agents (BBB, perfusion)
T1-weighted hyperintense signal
- Fat
- Proteinaceous fluid
- Melanin
- Methaemoglobin
- Mineralisation (manganese, copper)
- Gadolinium

T2-weighted hypointense signal
- Fat
- Melanin
- Early methaemoglobin
- Colloid
-Calcium
PARENCHYMAL DISEASE

Conventional MRI (T1, T2, T1 postcontrast)

- Ring enhancing lesion
- Basal ganglia solr
- Grey matter T2 hyperintensity
- White matter T2 hyperintensity

WJR 2014; 28; 6(9):716-725
BRAIN ABSCESSES

- Tuberculoma
- Toxoplasmosis
- Bacterial
- TB
RING ENHANCING LESIONS

- Metastases
- GBM
- Infarction
ABSCESS - DWI
FRONTAL SINUSITIS  →  EMPYEMA  →  CEREBRAL ABSCESS

Restricted diffusion due to highly viscous material within the abscess
DWI - FUNGAL ABSCESS – INTRACAVITARY PROJECTIONS
SWI- ABSCESS


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A 57-year-old man with a right temporal necrotic glioblastoma.

BASAL GANGLIA SOL

Rangarajan K et al. Patterned approach to CNS infections

Basal ganglia solr

Diffusion
- Restriction
  - Lymphoma
  - Toxoplasma or cryptococcus
- Free diffusion

Perfusion
- Increased
  - Lymphoma
- Decreased
  - Trehalose

Spectroscopy
- Choline
  - Lipid lactate with everything else diminished
- Cryptococcus
- Lymphoma

Gradient
- Blooming-likely toxoplasma
- Toxoplasma
BASAL GANGLIA INVOLVEMENT - CRYPTOCOCCUS
BASAL GANGLIA INVOLVEMENT - TOXOPLASMOsis
BASAL GANGLIA INVOLVEMENT - TOXOPLASMOSIS
GRAY MATTER - ENCEPHALITIS
HERPES SIMPLEX ENCEPHALITIS
HERPES SIMPLEX ENCEPHALITIS
CREUTZFELDT - JAKOB DISEASE
WHITE MATTER - ENCEPHALITIS

White matter hyperintensity

Location of T2/flair hyperintensity

- Symmetrical periventricular, subcortical sparing
- Asymmetrical, posterior location, subcortical involvement

Magnetization transfer

- Severe reduction
- Mild-moderate reduction

HIV

PML

PML

HIV
HIV LEUKOENCEPHALOPATHY
PROGRESSIVE MULTIFOCAL LEUKOENCEPHALOPATHY
IMAGING IN MENINGITIS

• 85% of acute bacterial meningitis: Pneumococcus or Streptococcus

• Lumbar puncture and urgent initiation of antibiotic therapy, without prior imaging
MENINGEAL ENHANCEMENT

LEPTOMENINGEAL

PACHYXMENINGEAL
TB MENINGITIS

Post-contrast T1-weighted
CRYPTOCOCCAL MENINGITIS

Post-contrast T1-weighted
CRYPTOCOCCUS: EPENDYMAL ENHANCEMENT

VENTRICULITIS
SUBDURAL EMPYEMA
OSTEOMYELITIS
CNS INFECTIONS: APPROACH

CT

MR T1W, T2W
FLAIR ; STIR
neuroparenchymal features
meningeal processes
extra-axial collections

Gd-enhanced

DWI
ce rebritis, abscess , empyema, ventriculitis
ischaemic complications

MR Spectroscopy
metabolic signatures
THANK YOU

ANY QUESTIONS?
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