
Managing ED Patients with Possible CNS Infection: What Therapies for Which Diagnoses, and When?

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Global Objectives

- Improve CNS infection pt outcome
- Know how to quickly evaluate infection risk
- Know how to use anbx, antivirals, steroids
- Provide rationale ED use of therapies
- Facilitate disposition, improve pt outcome
- Improve Emergency Medicine practice

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Session Objectives

- Present a relevant patient case
- Discuss key clinical questions
- State key learning points
- Review the procedure of LP
- Discuss the procedure of infection Rx
- Evaluate the patient outcome and ED documentation

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A Clinical Case

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EMS Presentation

- 51 year old 0028 CFD EMS call for AMS
- Per family, high temp, flu-like symptoms
- Fever and hallucinations
- Hot, flushed, diaphoretic, oriented x 1
- VS 140/P, HR 120, RR 30
- Glucose 300
- Hx DM, HTN
- Recent viral illness

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ED Presentation

- August 2002, Illinois, 1:01 AM
- ED Presentation non-verbal, moaning
- Temp 102.2
- Responds to verbal, moans "Help me."

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ED History

- Viral Sx, N/V/D for 2 days
- Taking NSAIDs, refused PMD admit
- No drugs or EtOH history
- Hx psoriasis

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ED Physical Exam

- Agitated, confused, combative, diaphoretic
- Pupils: 2-3 mm, non-reactive; airway OK
- Neck: supple, no thyromegaly
- Cardiopulmonary: tachycardia, tachypnea
- Abdomen: non-tender
- Neuro: No CN or ext motor weakness, mild tremor, mild nystagmus on central gaze
- Skin: old psoriasis, no new rash

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Key Clinical Questions

- What are the differential diagnoses?
- What are the etiologies?
- What tests must be performed?
- What therapies must be provided?
- What consultations are required?
- What outcome is likely?

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Encephalitis: Key Concepts

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Fever, AMS Differential Dx

- Encephalitis
- Meningitis
- Meningoencephalitis
- Encephalomyelitis
- Sepsis

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Viral Encephalitis Etiologies

- Arboviruses: mosquitoes, ticks
- Herpes viruses:
 - Herpes simplex
 - Epstein-Barr
 - CMV
 - Varicella zoster
- Measles virus

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Encephalitis Signs and Sx

- Sudden onset
- Meningismus
- Stupor, coma
- Seizures, partial paralysis
- Confusion, psychosis
- Speech, memory symptoms

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Arbovirus Encephalitis

- Mosquitoes or ticks (vectors)
- Vector-transmitted infection
- Mosquitoes
 - 10% encephalitis rate if infected
 - 150 to 3000 cases per year
- Ticks
 - Rocky Mountain spotted fever
 - Non-US Russian encephalitis

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Arbovirus Encephalitis

- Eastern equine
- Western Equine
- St Louis
- California
- Japanese B
- West Nile

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Arbovirus Encephalitis Sx

- St Louis & West Nile common in US
- Less than 1% cause CNS symptoms
- Sx 2-14 days post-exposure
- Fever, HA, N/V, lethargy
- West Nile Virus:
 - Maculopapular rash, morbilliform rash
 - Loss of muscle tone and weakness

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Arbovirus Motor Sx

- Motor disorders common
- Severe general weakness
- Ataxia, voluntary motor problems
- Tremor, partial paralysis
- Dysphasia, Broca's aphasia
- Hearing and visual symptoms

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Encephalitis Diagnosis

- Find treatable etiologies
- CT: no changes early
- MRI: early HSV changes detectable
- EEG: temporal lobe HSV changes
- LP: elevated WBCs and protein
- Labs:
 - Leukocytosis, LFTs, coags, chem, tox
 - Viral cultures

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Encephalitis Serum Ab Tests

- Virus only at 2-4 days (too early)
- Serum Ab titres
 - Low early levels
 - 4-fold increase in convalescent titres
 - Obtained 3-5 weeks after sx onset
- PCR: will replicate virus DNA
 - Quick results (hours)
 - Sensitivity equal to viral culture

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West Nile Virus Encephalitis

- Mosquito-borne, expanding area
- 1/5 mild febrile illness
- 1/150 meningitis, encephalitis
- Advanced age is greatest risk factor
- Clues as to likely WNV infection:
 - Infected birds or cases identified
 - Late summer
 - Profound muscle weakness

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West Nile Virus Encephalitis

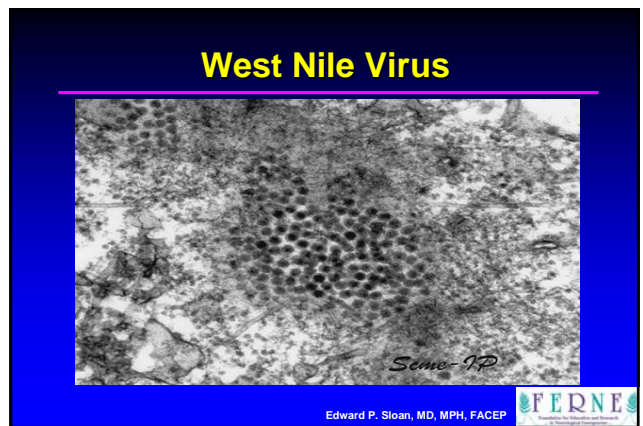
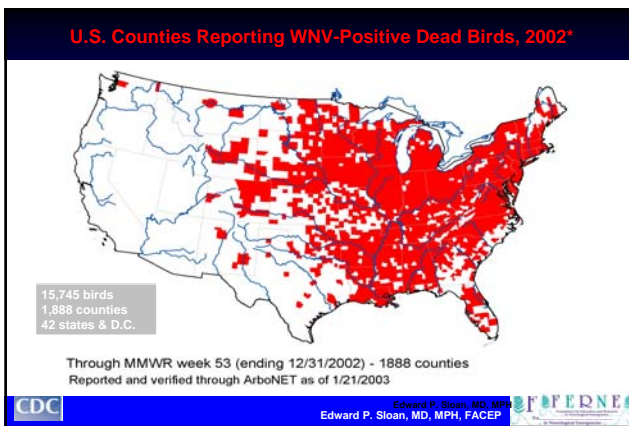
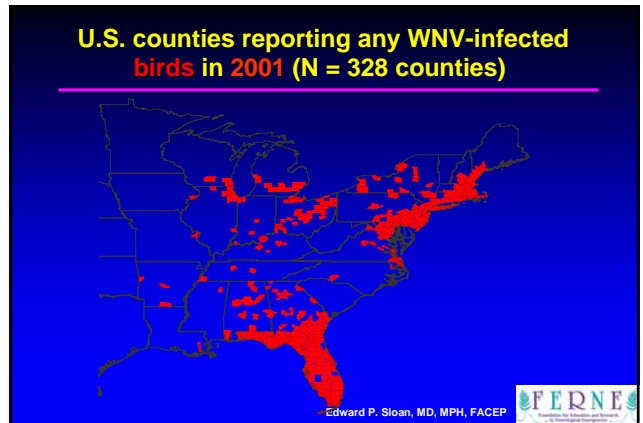
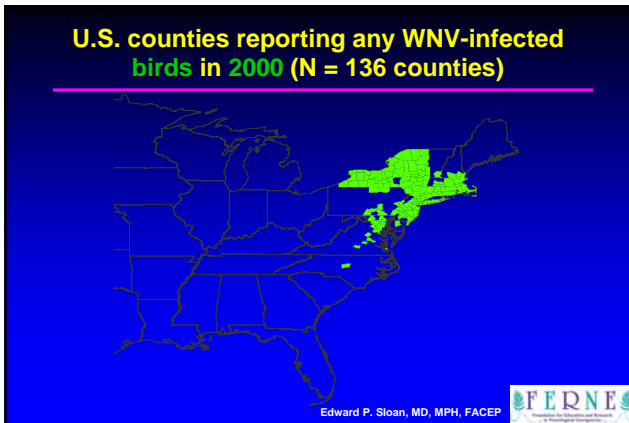
- IgM Ab testing via Elisa useful
- Test of serum or CSF
- False positives can occur
 - Other flaviviral infections (dengue)
 - Prior vaccination (yellow fever)
- Rapid reporting is essential

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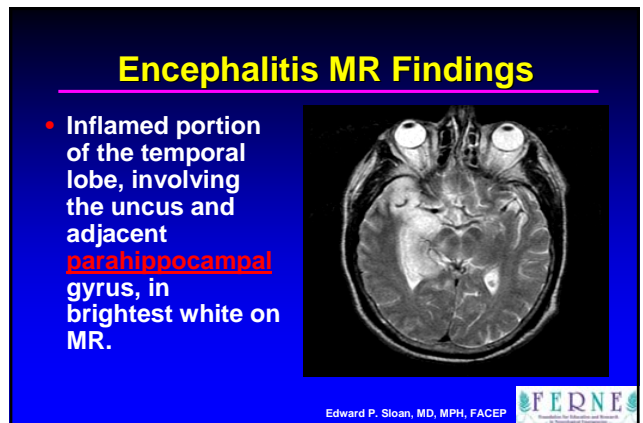
U.S. counties reporting any WNV-infected birds in 1999 (N = 28 counties)



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- WNV Encephalitis Diagnosis**
- Leukocytosis, lymphocytopenia
 - Hyponatremia
 - CSF pleocytosis, lymphocytes
 - Elevated CSF protein
 - Normal CT
 - MR: enhanced leptomeninges or periventricular areas
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WNV Antibody Diagnosis

- ELISA detection of WNV IgM
- 95% CSF WNV IgM rate
- IgM does not cross BBB
- CSF IgM suggests CNS infection
- 90% remain positive if tested within 8 days on symptom onset

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WNV Antibody Diagnosis

- Asymptomatic pts common
- In endemic area, IgM could be high
- Acute, convalescent titres
- Viral culture low yield
- Real-time PCR:
 - 55% CSF positive, 10% serum

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WNV Encephalitis Pt Outcome

- Overall, 4-14% mortality
- Age > 70, 15-29% mortality
- DM, immuno-suppression also predict worse outcome

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Viral Encephalitis Anti-virals

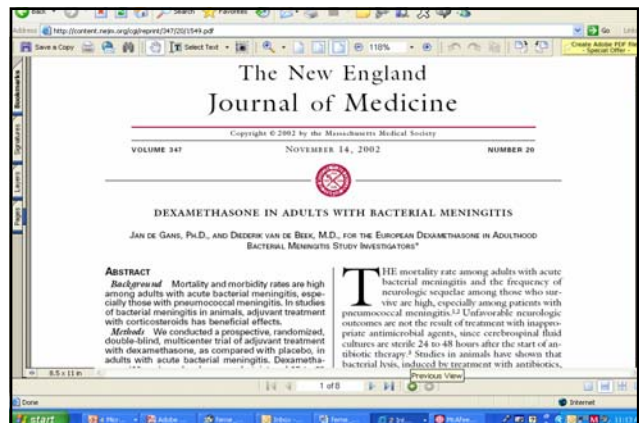
- Acyclovir for presumed HSV, HZ
- Foscarnet (Foscavir)
 - When resistant to acyclovir
 - If adverse reaction to acyclovir
- Foscarnet or gancyclovir in CMV
- Ribavirin (Virazole)
- None specific for arboviruses

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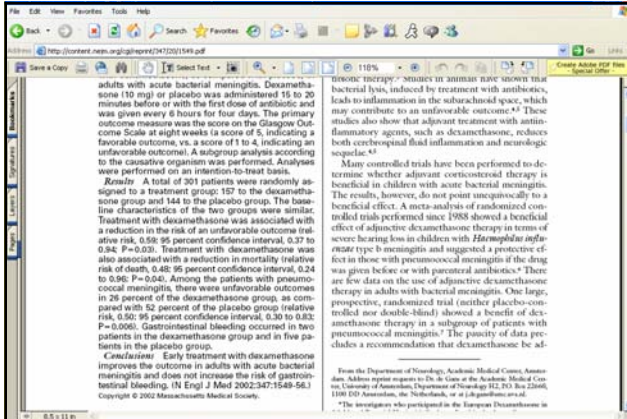
Steroids in Meningitis: Key Concepts

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Steroids in Meningitis

- 2002 European study
- Dexamethasone given before or with anbx
- Related to CNS permeability to anbx??
- Best effect with pneumococcus
- Do steroids have to be given early? Why?
- Should steroids be given if risk is low?
- What impact on US Rx paradigm?

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Steroids: Clinical EM Practice

- Study: Steroids given with antibiotics
- EM option: steroids with likely meningitis
 - Give steroids when meningitis is likely Dx
 - Likely benefit despite time delay?
- EM option: steroids with every anbx use
 - No clear benefit or risk with this approach
 - Many pts get ceftriaxone when risk is low

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A Perspective on Procedures

- Critically ill ED patients
- A medical emergency
- Limited time and resources
- A need to act
- “Emergency physicians take a surgeon’s approach to medical emergencies.”
- We do procedures

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Lumbar Puncture: The Procedure

Lumbar Puncture: Principles

- LP only if clinically feasible
- Be cautious if increased ICP possible
- Utilize sitting position if necessary
- Measure opening pressure if flow fast
- Be careful in setting of delirium
- Treat with antibiotics first
- CSF pleocytosis usu not bacterial meningitis

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Lumbar Puncture

- Perform a complete neurological exam

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Lumbar Puncture

- Perform a complete neurological exam
- Evaluate clinically for increased ICP

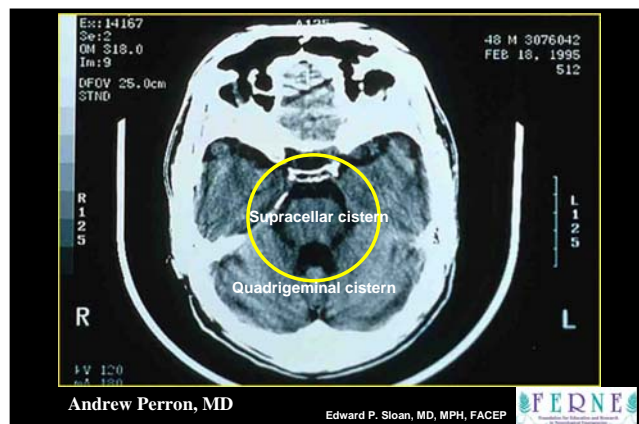
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Lumbar Puncture

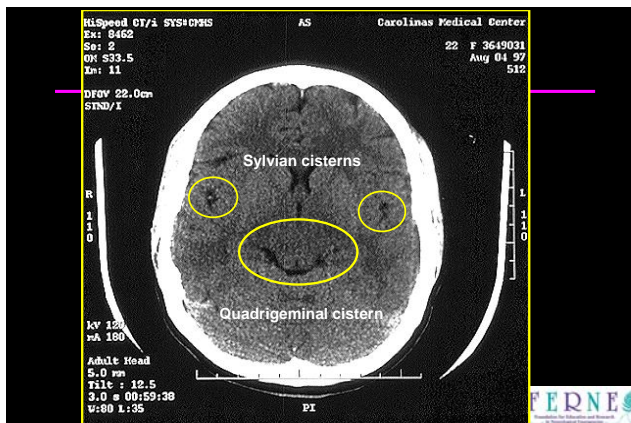
- Perform a complete neurological exam
- Evaluate clinically for increased ICP
- Obtain a CT prior to LP, assess ICP signs

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Andrew Perron, MD

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Lumbar Puncture

- Perform a systematic neuro exam
- Evaluate clinically for increased ICP
- Obtain a CT prior to LP, assess ICP signs
- Measure opening pressure when feasible
 - Measure in all LPs when feasible
 - May lead to other diagnoses

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Lumbar Puncture

- Perform a systematic neuro exam
- Evaluate clinically for increased ICP
- Obtain a CT prior to LP, assess ICP signs
- Measure opening pressure when feasible
- Consider sitting position, assess airway

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Lumbar Puncture

- Perform a systematic neuro exam
- Evaluate clinically for increased ICP
- Obtain a CT prior to LP, assess ICP signs
- Measure opening pressure when feasible
- Consider sitting position, assess airway
- Caution with delirious patient

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Lumbar Puncture

- Send CSF for interpretation:
 - Tube 1. Hematology: cell count, differential
 - Tube 2. Microbiology: gram stain, cultures, antigen testing
 - Tube 3. Chemistry: glucose, protein
 - Tube 4. Hematology: cell count, differential

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Lumbar Puncture

- Send CSF for interpretation:
 - Tube 1. Hematology: cell count, differential
 - Tube 2. Microbiology: gram stain, cultures
 - Tube 3. Chemistry: glucose, protein
 - Tube 4. Hematology: cell count, differential
- WBC, differential not subtle in bacterial meningitis and encephalitis??

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CSF Interpretation

- Bacterial meningitis:
 - WBCs: Thousands+ WBCs, neutrophils
 - Frankly cloudy CSF fluid
 - Usually not CSF pleocytosis (inflammation)
- Viral meningitis, encephalitis:
 - CSF pleocytosis may be only finding
 - WBCs: lymphocytes, esp over time
 - CSF not frankly purulent

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Antibiotic Therapy: *The Procedure*

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Anbx Rx: Driving Principles

- Administer ceftriaxone early, prior to CT
- Consider meningitis risk carefully
- High risk patients: vancomycin, steroids
- Give steroids when pt deemed high risk
- Add acyclovir when encephalitis possible
- LP only if clinically feasible
- Be cautious if increased ICP possible

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Antibiotic Rx Procedure

- Administer 1-2 gr ceftriaxone stat

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Antibiotic Rx Procedure

- Administer 1-2 gr ceftriaxone stat
- If bacterial meningitis likely diagnosis, administer:
 - 10 mg dexamethasone
 - 1 gr vancomycin

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Antibiotic Rx Procedure

- Administer 1-2 gr ceftriaxone stat
- If bacterial meningitis likely diagnosis, administer:
 - 10 mg dexamethasone IVP
 - 1 gr vancomycin IVPB
- If viral encephalitis likely, administer:
 - 1 gr acyclovir IVPB over 1 hour

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Antibiotic Rx Procedure

- Administer 1-2 gr ceftriaxone stat
- If bacterial meningitis likely diagnosis, administer:
 - 10 mg dexamethasone IVP
 - 1 gr vancomycin IVPB
- If viral encephalitis likely, administer:
 - 1 gr acyclovir IVPB over 1 hour
- Treat close contacts: cipro 500 po x 1, rifampin 600 PO BID x 2 days, or ceftriaxone 250 IM x 1

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ED Treatment and Patient Outcome

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ED Management

- DDx: Viral Sx, AMS
- R/o encephalitis, meningitis, sepsis
- Need to R/o West Nile Virus (Illinois)
- 1:15 Haldol, Ativan
- 1:25 RSI with etomidate, pavulon, sux
- 4:40 Ceftriaxone 2 gr IV
- 4:55 Acyclovir 1 gr IV over 1 hour

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ED Diagnostics

- WBC 11,900 Hb 16.1
- Glu 313, Bicarb 25, chem ok
- 7.33 / 39 / 79 / 22 / 97%
- CXR: no clear infiltrate
- EKG: sinus tach
- UA: no UTI
- CT: no lesions
- LP: Unable x 2

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Consultations

- Neuro consult: LP under fluoro, EEG
- ID consult:
 - R/o septic shock, resp failure
 - R/o staph, given psoriasis
 - R/o pneumococcal pneumonia
 - R/o meningitis
 - R/o toxic or metabolic encephalopathy
 - Add vancomycin, obtain 2-D echo

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Hospital Course

- LP by neurosurgery:
 - 20 WBC, 20 RBC, glu 137, protein 32
- ID: viral synd, R/o aseptic meningitis
- Day 3: Possible sub-endocardial AMI
- Day 3: Seizure, rx with fosphenytoin
- Ceftriaxone to cefipime, quinalone
- Day 9: More responsive, temp to 102.6
- Day 10: Maculopapular rash

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Hospital Course

- EEG: Non-specific diffuse slowing
- ECHO: LV dysfunction
- Blood cultures negative
- Repeat CT: maxillary sinus fluid
- PCR negative for herpes simplex virus
- Tests for systemic vasculitides negative
 - Ab for myeloperoxidase
 - Ab for proteinase-3

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Hospital Course

- Legionella Ag in urine negative
- Mycoplasm antibody titre negativie
- Chlamydia pneumoniae IgG, IgA positive
- HIV Ab negative
- Day 11: West Nile Arbovirus (CSF) +

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Patient Outcome

- PM & R Consult: Comprehensive rehab
- Pt extubated, improved neurologically
- Pt able to understand plan
- Discharge on day 26:
 - nursing home/rehab care
 - able to speak, walk, begins to meet needs
- Seen in ED by same EM MD, doing well

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ED CNS Infection Pt Dx, Rx: *A Retrospective*

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ED CNS Infection Pt Dx & Rx

- Evaluate for meningitis, encephalitis
- Perform an LP if clinically indicated
- Know subtle signs of increased ICP
- Measure opening pressure
- Directed use of anbx, antivirals
- Steroids ASAP, if meningitis likely
- Treat ED staff, close contacts prn

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Questions??

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