

**Table 2:** Comorbidities and Charlson Comorbidity Index score of patients with brain abscess and cerebritis at Mayo Clinic, 2009-2019.

Variables	No. of cases	Percentage, %	Median (SD)	Relative Risk (95% CI)	P-value
<b>Comorbidities</b>					
Acquired immunodeficiency syndrome	122	18.31		Reference	
Cancer	190	28.52		1.41 (1.15-1.72)	<0.0008*
Cerebrovascular accidents	387	58.10		3.17 (2.66-3.77)	<0.0001*
Chronic obstructive pulmonary disease	278	41.74		2.27 (1.89-2.73)	<0.0001*
Congestive heart failure	249	37.38		2.04 (1.69-2.46)	<0.0001*
Diabetes mellitus	299	44.89		2.45 (2.04-2.93)	<0.0001*
Hypertension	305	45.79		2.50 (2.08-2.99)	<0.0001*
Liver disease	205	30.78		1.68 (1.38-2.04)	<0.0001*
Peripheral vascular disease	307	46.09		2.51 (2.10-3.01)	<0.0001*
Renal disease	290	43.54		2.37 (1.98-2.85)	<0.0001*
<b>Charlson Comorbidity Index Score</b>					
1-4	163	24.47		Reference	
5-9	260	39.03		1.59 (1.35-1.87)	<0.0001*
10-14	109	16.36	10.90 (9.52)	0.66 (0.53-0.83)	<0.0003*
15-19	15	2.25		0.90 (0.05-0.15)	<0.0001*
21-29	50	7.50		0.30 (0.22-0.41)	<0.0001*
30-33	69	10.36		0.41 (0.32-0.54)	<0.0001*

Abbreviations: CI, confidence interval; No, number; SD, standard deviation; a, Chi-Square Test;  $\mu$ , Mean.

**Conclusion:** Male, White Non-Hispanics, and elderly patients seem to be the most prevalent patient population at risk for brain abscess or cerebritis. This investigation provides clinicians the demographic data needed to identify potentially complex patients with brain abscesses.

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### 345. Early Oral Therapy for *Streptococcus anginosus* Purulent Brain Infections: A Single Center Experience

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**Session:** P-11. CNS Infection

**Background:** Pediatric *Streptococcus anginosus* intracranial pyogenic are commonly treated with prolonged intravenous (IV) antibiotics, exposing patients to risks of a long-term central catheter. Antibiotics with high oral bioavailability, such as levofloxacin, may allow early oral transition.

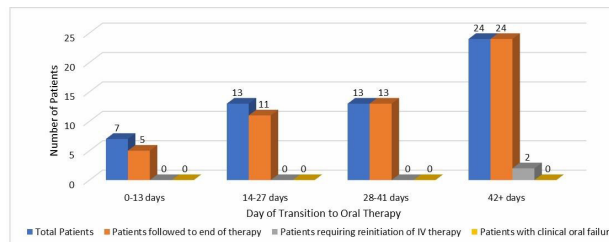
**Methods:** To characterize patients with *S. anginosus* intracranial infections transitioned to oral therapy, we performed a retrospective review at Children's Hospital Colorado from 1/2004 to 2/2019. Inclusion criteria were radiologic evidence of an infected parenchymal, subdural, or epidural fluid collection AND a positive culture for *S. anginosus* from an intracranial source, specific extracranial sources (sinus, scalp, orbit), or blood. The primary endpoint was oral antibiotic failure defined as worsening infection on oral therapy. Comparisons were done using Fisher's exact test.

**Results:** 94 patients met inclusion criteria, 57 of whom were transitioned to oral therapy during treatment. Oral levofloxacin was used in 54 of the 57. 12% of oral transitions occurred in the first 14 days of therapy (range 3–8 days), and 35% in the first 28 days. Patients transitioned in the first 28 days were more likely to have an epidural collection ( $p < 0.01$ ), and less likely to have a subdural collection ( $p = 0.03$ ) or brain abscess ( $p < 0.01$ ). Of the 57, none had oral antibiotic failure. Contributing reasons for oral transition included central line complications (18%), IV medication reaction (18%), hematologic abnormality presumed secondary to IV antibiotics (33%), and provider judgement (56%). Two patients required re-introduction of IV therapy for reasons other than clinical failure (one for medication non-adherence and one for adverse reaction to levofloxacin).

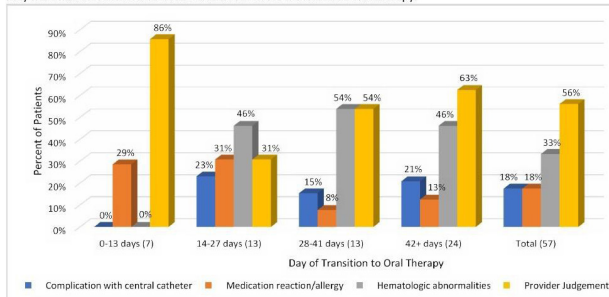
**Table 1:** Characteristics of patients transitioned to oral therapy (n= 57)

Race (percent)	Co-Pathogens Present	
Asian	Methicillin sensitive <i>Staphylococcus aureus</i>	16%
Black or African American	Methicillin resistant <i>Staphylococcus aureus</i>	0%
White	Coagulase negative Staphylococci	25%
Other	Other <i>Streptococcus</i> species	11%
Unknown	Gram negative aerobic bacteria	14%
<b>Ethnicity (percent)</b>		
Hispanic	Anaerobic bacteria	14%
non-Hispanic	Candida species	4%
Other	<b>Number of Source Control Procedures</b>	
Unknown	Zero	32%
<b>Age (average years)</b>		
11.1	One	51%
<b>Sex (percent female)</b>		
35%	Two	14%
<b>Intracranial Diagnosis</b>		
<b>Laboratory Data</b>		
Brain Abscess	Average highest C-reactive protein (mg/dl)	14.7
Subdural Abscess/Empyema	Average C-reactive protein before oral transition (mg/dl)	0.9
Epidural Abscess/Empyema	Average highest Erythrocyte sedimentation rate	66
<b>Presumed Source of Infection</b>		
<b>Average erythrocyte sedimentation rate before oral transition</b>		
Sinogenic	<b>Contributing reasons for oral transition</b>	
Otogenic	Complication with central catheter	18%
Trauma	Medication reaction/allergy	18%
Hematogenous/unknown	Hematologic abnormalities	33%
<b>Co-Diagnoses</b>		
<b>Provider Judgement</b>		
Orbital Abscess	Length of IV therapy (average days)	37
Osteomyelitis	Length of total therapy (average days)	84
Sinus Thrombosis		

**Figure 1:** Outcomes of oral transition versus timing of oral transition.



**Figure 2:** Reason for transition to oral therapy versus timing of oral transition. Note that single patients may have had more than one documented reason for transition to oral therapy.



**Conclusion:** We observed success and tolerance of levofloxacin-based oral therapy for pediatric pyogenic intracranial *S. anginosus* brain infections and confirmed the frequent occurrence of adverse events associated with IV treatment. Transition to oral therapy should be considered, particularly if complications of IV therapy arise in treatment of an epidural infection. A subset of patients in our study transitioned within the first 14 days of therapy; prospective studies are needed to characterize the safety of such very early transition.

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### 346. Eastern Equine Encephalitis and Use of Intravenous Immunoglobulin Therapy and High-Dose Steroids

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**Session:** P-11. CNS Infection

**Background:** Eastern equine encephalitis (EEE) is a mosquito-borne viral infection with significant neurological morbidity and mortality. The clinical presentation and patient outcomes after treatment with IVIG, high-dose steroids, or standard of care alone in EEE remains unclear.

**Methods:** A retrospective observational study of patients admitted to two tertiary academic medical centers in Boston, Massachusetts with EEE from 2005 to 2019.

**Results:** Of 17 patients (mean [SD] age, 50 [26] years; 10 (59%) male, and 16 (94%) White race), 17 patients had fever (100%), 15 had encephalopathy (88%), and 12 had headache (71%). Eleven of 14 patients with cerebrospinal fluid (CSF) cell count differential had a neutrophil predominance (mean [SD], 60.6% of white blood cells [22.8]) with an elevated protein level (mean [SD], 112 mg/dL [48.8]). Affected neuroanatomical regions included the basal ganglia (n=9/17), thalamus (n=7/17), and mesial temporal lobe (n=7/17). A total of 11 patients (65%) received IVIG; 8 (47%) received steroids. Of the patients who received IVIG, increased time from hospital admission to IVIG administration correlated with worse long-term disability as assessed by modified Rankin Score (mRS) ( $r=0.72$ ,  $p=0.02$ ); steroid use was not associated with mRS score. The mortality was 12%.

**Figure 1.** Imaging Characteristics: Typical Pattern of MRI Involvement and Affected Neuroanatomical Regions in Patients with Eastern Equine Encephalitis. All images displayed are the T2-FLAIR sequence. (A) Representative images of pattern of typical neuroanatomical region involved in one patient with demonstrated involvement of the temporal lobe and pons, temporal lobe and midbrain, and basal ganglia by T2-FLAIR hyperintensity (panels left to right). (B) Representative images of patients with mild (mRS 0–2), moderate (mRS 3–4), and severe (mRS 5–6) disability score at discharge. (C) Representative images of one patient over course of hospitalization at days 1, 4, and 10 after admission. (D) Quantification of neuroanatomical region involvement in initial MRI of patients with EEE as determined by T2-FLAIR hyperintensity. An area was scored as abnormal only once per patient.

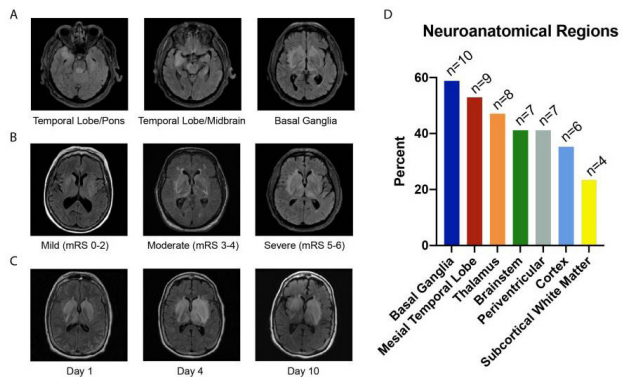


Figure 2. Outcomes in Patients with Eastern Equine Encephalitis. Patient disability by modified Rankin Score (mRS) of EEE patients at admission to the hospital, discharge from the hospital, and last recorded follow-up (A). Time to IVIG administration compared to mRS at discharge (B), and most recent clinical follow-up (C).

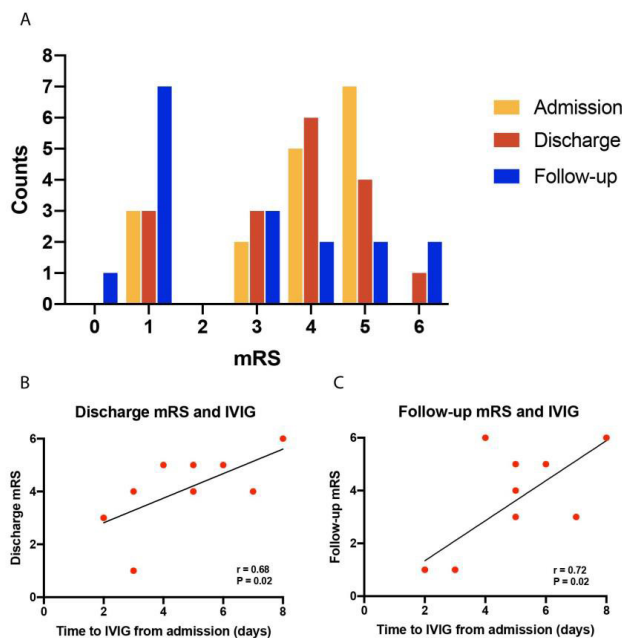


Table 1. Demographics, Clinical Characteristics, and Laboratory Data in Patients with Eastern Equine Encephalitis. Abbreviations: CSF = cerebrospinal fluid, WBC = white blood count, EEG = electroencephalogram, ALT = alanine aminotransferase, AST = aspartate transaminase. Demographic data was collected for all patients with confirmed EEE. Altered mental status included any description of encephalopathy, confusion, or difficulty with attention. Seizures were defined as clinical events with a high-degree of suspicion to be true seizures, and were entirely comprised of generalized tonic-clonic seizures.

Demographics	Overall Prevalence (n=17)	Received IVIG (n=11)	Did Not Receive IVIG (n=6)
Age, years (mean(SD))	50 (25)	55 (25)	41 (23)
Race, n (%)			
White	16 (94)	11 (100)	5 (83)
Hispanic	1 (6)	0 (0)	1 (16)
Gender, n (%)			
Male	10 (59)	6 (55)	4 (67)
Female	7 (41)	5 (46)	2 (33)
<b>Clinical Characteristics (n (%))</b>			
Fever	17 (100)	11 (100)	6 (100)
Altered Mental Status	15 (88)	10 (91)	5 (83)
Headache	12 (71)	7 (64)	5 (83)
Photophobia	3 (18)	1 (9)	2 (33)
Neck Stiffness	3 (18)	2 (18)	1 (17)
Nausea	5 (29)	2 (18)	3 (50)
Vomiting	6 (35)	2 (18)	4 (67)
Abdominal Pain	3 (18)	0 (0)	3 (50)
Respiratory Symptoms	2 (12)	1 (9)	1 (17)
Tremor	6 (35)	6 (55)	0 (0)
Seizures	7 (41)	5 (46)	2 (33)
Abnormal EEG	10 (59)	7 (64)	3 (50)
Prodrome, days, mean (range)	3 (0-9)	3 (0-7)	3 (0-9)
<b>Laboratory Characteristics (mean(SD))</b>			
CSF WBC, cells, uL	645 (712)	601 (709)	726 (777)
CSF Glucose, mg/dL	71 (20)	70 (20)	68 (22)
CSF Total Protein, mg/dL	112 (47)	107 (48)	108 (50)
Serum WBC, K/uL	12 (5)	12 (5)	12 (6)
Sodium, mmol/L	135 (4)	135 (4)	136 (3)
Platelets, K/uL	181 (44)	181 (44)	194 (33)
ALT, U/L	45 (50)	41 (38)	56 (69)
AST, U/L	62 (79)	70 (87)	39 (27)
Alk Phos, U/L	94 (134)	111 (157)	56 (8)

**Conclusion:** Clinicians should suspect EEE in immunocompetent patients with early subcortical neuroimaging abnormalities and CSF neutrophilic predominance. This study suggests a lower mortality than previously reported, but a high morbidity rate in EEE. IVIG as an adjunctive to standard of care may be considered early during hospitalization.

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#### 347. Etiologies in a Cohort of Pediatric Patients Who Underwent CSF Metagenomic Next Generation Sequencing

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**Session:** P-11. CNS Infection

**Background:** The differential diagnosis in pediatric patients presenting with concern for CNS infections and/or autoimmune disorders is broad. Despite recent advances in diagnostic modalities, many cases may remain undiagnosed. For example, approximately 50% of pediatric patients with encephalitis do not have an identified etiology. Use of metagenomic next-generation sequencing (mNGS) may improve the diagnostic yield. This study evaluated etiologies in a cohort of pediatric patients who underwent CSF mNGS.

**Methods:** Retrospective cohort study of all hospitalized patients < 21-years-old who underwent CSF mNGS at a tertiary pediatric hospital from June, 2017 - February, 2020. Final diagnosis was assigned by two independent study physician reviewers (pediatric infectious disease and neurologist) based on documentation including discharge summaries, consult notes, and subsequent clinic notes where available.

**Results:** Thirty-seven patients (59% female, median age 9 (1-17) years) were identified (21 with encephalitis). Twenty-six (70%) had a definite diagnosis - 10 (27%) infectious, 11 (30%) autoimmune, 5 (14%) other. The most common etiology was anti-MOG antibody associated meningoencephalitis (n=4, 11%). Among infections, Powassan virus encephalitis (n=3, 8%) was most common; other infectious etiologies