EEG Abnormalities in Autistic Children: Neuromodulation & Medication Implications

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Sub-Clinical Epileptic Activity
30 – 60% of Autistic Children
With No Seizure History

EEG abnormalities impair normal functioning

EEG abnormalities are linked to neuropsychiatric symptoms

Many commonly prescribed medications increase abnormal activity

EEG abnormalities may benefit from antiepileptic medication

Even in the absence of overt clinical seizures
Swatzyna, Gunkelman & Stokan
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EEG/QEEG referred from June 1, 2009 to August 30, 2011
65 children in the study
25 (39%) are on the Autistic Spectrum
Of the 65 children, 20 (30%) had EEG abnormalities
Of the 25 ASD children, 10 (40%) had EEG abnormalities

Autistic Spectrum children are more likely to have EEG abnormalities that other children referred for EEG/QEEGs

Electroneurodiagnostic Study

Conventional EEG: Tracings & Interpretation
Functional Cortical Brain Mapping: Spectral Analysis, Absolute & Relative Power Maps & Graphs
LORETA: (Low resolution brain electromagnetic tomography) 3D localization using inverse solution
CNC 1020: Neurodiagnostic screening instrument assessing 42 neuropathologies
Diagnostic Impressions: Summary based on all data
Psychotropic Research Findings: Medication recommendations based on medical research
Recommendations for Further Testing
Treatment Recommendations: Including neurotherapy training protocols

Electroencephalographic Cerebral Dysrhythmic Abnormalities in the Trinity of Nonepileptic General Population, Neuropsychiatric, and Neurobehavioral Disorders

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(The Journal of Neuropsychiatry and Clinical Neurosciences 2008; 20:7–22)
Autism

Small et al., 1977; Tuchman et al., 1991; Rossi et al., 1995; Villalobos et al., 1996; Beaumanoir et al., 1996; Tuchman et al., 1997; Tuchman, Rapin, 1997; Gado et al., 2001; Hughes, Meystre, 2005; Carlbom et al., 2005; Kim et al., 2006; Chez et al., 2006

EEG abnormalities

EEG (subclinical) epileptiform dysrhythmia

Benign rolandic epilepsy

Paroxysmal EEG dysrhythmia

Subclinical EDs

EDs

Paroxysmal EEG dysrhythmia

EDs: focal sharp waves, multifocal sharp wave, generalized spike-wave complexes, and generalized paroxysmal fast activity/polyspikes

EDs right temporal localization

Tourette’s Syndrome

Bergen et al., 1982; Krumholz et al., 1983; Lees et al., 1984; Verma et al., 1986; Neufeld et al., 1990; Semerci et al., 2000

Dysrhythmia

Dysrhythmia: central spikes, generalized and paroxysmal slow activity, and background slowing

Dysrhythmia

Dysrhythmia; EDs

Dysrhythmia

ADHD

Small et al., 1978; Boutros et al., 1990; Hughes et al., 2000; Hemmner et al., 2001; Richer et al., 2002; Holtmann et al., 2003; Millichap, Millichap & Stack, 2011

Diffuse generalized and/or intermittent slow wave dysrhythmia

14/second and 6/second positive spike patterns; EDs; slow wave dysrhythmia

Abnormal EEGs; focal EDs; occipital/frontal; generalized spike-wave EDs; controversial 6–7/second and 14/second positive spike patterns; abnormal frontal/temporal slow waves; Frontal arousal rhythm; extreme spindles

EDs; rolandic spikes; focal abnormalities

EDs; generalized 3 Hz spike slow wave; generalized spike/multispikes; slow wave dysrhythmia

Midtemporal spikes; rolandic spikes; bilateral midtemporal and/or rolandic spikes;

Occipital spikes (19%) - Rolandic spikes in nonepileptic ADHD (prevalence 5.6%); right sided lateralization

Epileptiform discharges
Possible Explanation for Abnormal Electrical Activity

Encephalopathy
Paroxysms
Beta Spindles

Encephalopathy
Disease, Damage or Malfunction

Most common causes:
- Metabolic imbalance
- Toxic exposure
- Trauma (brain injury)
- Anoxic (oxygen deprivation)
May need to refer (endocrinologist or internist)
Medication is usually ineffective

Case 1
Encephalopathy
12 y/o Female
Medications: Vyvance 30 mg QAM, Clonidine .1 mg QPM, Trizadone 100 mg QAM
PDD NOS multiple issues with learning and language, anxiety, hypersensitive to mention a few
Recommended patient get blood work done to rule out her anemia (family history of sickle cell anemia), thyroid issues and hormone issues that may be the cause of her encephalopathy findings
Results: Patient was diagnosed with anemia and low thyroid function
Referred onto an Endocrinologist

Paroxysms
Transient Cognitive Impairment
Epileptic type of discharges not associated with seizures
Can occur in any part of the brain
Location can usually be correlated with issues
Found in 40% of autistic children and 25% of ADHD children
Take a different medication approach (antiepileptic)
EEG/QEEG can identify when therapeutic dose is reached

Case 2
Paroxysms
23 y/o Female

Concussion one month ago
History of learning, focus and concentration issues
EEG/QEEG findings: transient paroxysmal bursts in the EEG

Treatment
- Neurotherapy 20 sessions
- Started Trileptal and switch to Lamictal
- Added Ritalin ? mg BID

Results: Passed biochemistry after two attempts prior to treatment

Beta Spindles
Anxiety Spectrum Issues

- Also called an irritable cortex or an easily kindled cortex
- Stimulants will make far worse
- Although rare, can even trigger a psychotic episode
- Made worse with benzodiazepines

The brain lacks GABA and needs relaxatory medications
19 y/o Male
Medications: Klonopin 3mg QD
Lamictal 200 mg QD
Dropped out of college due to anxiety
EEG/QEEG identified beta spindles and studies suggest medications that affect the benzodiazepine receptors can cause beta spindles at higher dosages
Treatment: Slow titration off of Klonopin and neurotherapy
Results: Beta spindles eliminated and anxiety minimal and patient back in college

Behavior May Not be the Best Way to Select the Appropriate Medication

Multiple causes for behavior and symptoms
Anxiety/anger/irritability
Distractibility/poor concentration/confusion
Learning/memory issues
Psychosis

Three Reasons to Consider an EEG/QEEG Electroneurodiagnostic Study

Apprehensive about starting your child on medicine for the first time and want avoid medicating based on behavior
Tried a medicine on your child and it made their symptoms worse
Your child is on several medications and symptoms are still unacceptable
Medications For Focus and Concentration and Their Impact on EEG Abnormalities

Stimulants (Ritalin and Adderall)

Increase fast beta (beta spindles), which can increase agitation, worsen anxiety and in some extreme cases bring out psychotic symptoms

The QEEG can be extremely helpful in guiding the treatment of a highly anxious ADHD patient who has had side effects or poor response to first line treatment

Strattera
Norepinephrine Reuptake Inhibitor

Strattera is a nonstimulant FDA approved for the treatment of ADHD

As a nonstimulant, it does not lower the seizure threshold or increase beta spindling, which increases symptoms of anxiety

By increasing norepinephrine in the brain, it can improve hypoarousal (low alpha) as indicated by the QEEG

Medications for Irritability are often the Same Classes of those that Target Mood Swings

The SSRIs (Lexapro, Prozac, Zoloft, Celexa, etc) have targeted irritability and aggression in studies.

However, these medications also decrease seizure threshold and can also disinhibit patients or even exacerbate irritability.

The QEEG can give evidence to help predict the risk and/or benefit
Mood Stabilizers: Depakote, Neurontin & Lamictal Target GABA

Depakote is a mood stabilizer commonly used in Child Psychiatry to decrease mood swings and aggression.

When these clinical symptoms are present with the QEEG demonstrating Beta Spindling, Depakote becomes a strong first-line choice

Neurontin also targets GABA, which creates a calming effect on the brain, and decreases Beta Spindling

More on Mood Stabilizers

Lamictal also has excellent clinical evidence as a mood stabilizer with antidepressant qualities.

It appears to be effective in decreasing abnormalities on the QEEG such as paroxysmal discharges

Trileptal is another mood stabilizer with strong clinical data on decreasing mood lability.

The Trileptal advances the peak frequency so it is appropriate for children with slow to normal peak frequency alpha children

However, for children with fast peak frequency alpha it can exacerbate symptoms of hyperaroused. It is best when alpha activity is low or normal

Atypical Antipsychotics (Risperdal, Abilify, Seroquel & Geodon)

These medications can effectively target agitation, irritability, and overreactivity

Can also decrease the seizure threshold, placing patient at increased risk for seizures when abnormal discharges are present
Alpha 2 Agonists
Intuniv & Kepvay

Nonstimulants recently approved by the FDA for the treatment of ADHD symptoms
No risk of lowering the seizure threshold
Works by elevating the level of norepinephrine in the intracellular space, which heightens alpha activity
In ADHD, this should normalize the alpha activity, improving focus and alertness
Has calming effect on Beta Spindling

Failure to Identify
Can Have Dire Consequences

Inhibiting appropriate
Medication selection and management
Testing
Diagnosis
Treatment planning
Treatment and
Prognosis

Neurotherapy for ASD Research