Overview: ECT and rTMS

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Goals:
• To understand the procedures, practice, and current theories of the mechanisms of both ECT and rTMS.

• To be familiar with the indicated and currently recognized uses of each modality, as well as the potentials for their use in the future.

• To be able to differentiate the appropriate application of each treatment modality, with a focus on patient selection for optimal outcomes.
Disclosure

- I have no financial relationships with any commercial interest related to this presentation to disclose.

- I will be discussing unapproved uses of commercial products, or investigational use of a product not yet approved for these purposes, during my presentation at this educational activity.
Outline

- Impacts of untreated depression for context
- ECT (Electroconvulsive Therapy)
  - History
  - Modern procedure
  - Indications/predictive factors
  - Efficacy
  - Side effects/drawbacks
- rTMS (repetitive Transcranial Magnetic Stimulation)
  - Also future applications
- Discussion/Q&A
Depression: Impact
ECT: History

- **1927**: Sakel: Insulin Shock Therapy: Insulin induced coma with occasionally hypoglycemic convulsions: First biologic treatment for schizophrenia
- **1930’s**: Von Meduna-hungarian psychiatrist discovered therapeutic value of seizures using camphor and Metrazol
- **1938**: Cerletti and Bini italian psychiatrists induced seizures utilizing electrical stimulus: no anesthetic or muscle relaxant
- **1940’s**: first used in the US
- **1950’s**: anesthesia was first introduced for ECT
- **1950-70**: significant overuse of ECT for treatment of conditions like character disorders, psoriasis, enuresis, ulcers
- **1970’s**: widespread use of antidepressant and antipsychotic medications decreased the use of ECT
- **1990’s**: improvements and modifications improved safety and reduced side effects: resurgence of ECT
ECT: Portrayals and Controversy

ECT in literature and, more commonly, in film shows it as a negative and cruel treatment, and leaves the mistaken impression of a brutal, harmful, and abusive maneuver with no therapeutic benefit.


A lightning rod for the anti-psychiatry movement.

Far from accurate portrayals of the modern practice of ECT.
ECT: Modern Basics

- Anesthesiologist
  - Propofol or brevital
  - Succinylcholine or rocuronium

- Pulses instead of sine-wave delivery of energy

- Regular, Brief, Ultra-brief delivery

- Right unilateral, bilateral, bifrontal placement
ECT: What happens

- Procedure lasts 5-15 minutes
- Recovery period 30 min
- Treatments 3 times a week, with index course of 6-20 treatments
- Continuation/Maintenance treatment option
ECT Devices
ECT Devices
ECT: How it works

- We’re still not really sure

- But...
ECT: How it works (Theories)

- Von Meduna (1934)- Autopsies of patients w/seizure disorders and of patients w/Schizophrenia: Difference in Glial cell proliferation
- Neurotransmitter levels all increase after seizure
- Enhanced dopaminergic and serotonergic transmission, increased noradrenergic function
- During seizure- PET studies show an increase in BBB permeability and in cerebral blood flow and metabolism.
- After seizure, blood flow and metabolism is decreased especially in the frontal lobes. Research shows this correlated w/ response.
- Reduction of cholinergic sensitivity-reduction of brain Ach levels and increase of Choline acetyltransferase and acetylcholinesterase
- Recruitment of GABA; downstream recruitment of glutamate
- Cortisol burn-out
ECT: Primary Indications

- Major Depression
- Catatonia
- Schizophrenia
- Schizoaffective Disorder
- Mania
ECT: Other Indications

- Life threatening delirium
- OCD- no controlled studies
- Autistic self-injury
- Pseudo-dementia
- Parkinson’s Disease- presence of off-on phenomenon predictive of positive response (treats rigidity)
- NMS
- Intractable epilepsy/status epilepticus
ECT: Positive Predictors

- Acute episode
- Prior good response
- Low energy
- Weight loss
- Delusions
- Poor concentration
- Acute catatonia
ECT: Negative Predictors

- Chronicity
- Poor relationships
- Axis II Disorder
- Substance Abuse
- Poor response to ECT in the past
ECT: Use as first-line

- Consider primary use of ECT with the following:
  - Need for rapid definitive intervention
    - Medically ill, risk of inanition including extreme slowing with poor intake and significant weight loss
    - Psychotic depression, catatonia, manic delirium
    - Risk of suicide
  - Treatment history – previous ECT response
  - Pregnancy
  - Patient preference
  - Lack of clinical response to multiple med trials
  - Intolerable medication side effects
ECT: Contraindications

- There is only ONE suggested absolute medical contraindication to ECT: Cochlear implant
- Risk/benefit analysis is performed by psychiatrist, medical doctor and ECT consultant
ECT: When to use caution

- **Cardiovascular:**
  - Pacemakers, AICD
  - Anticoagulation Therapy
  - Recent MI
  - Unstable angina
  - Uncompensated CHF
  - Severe valve disease
  - Aneurysms

- **Central Nervous System:**
  - Increased ICP
  - Intracerebral mass
  - Recent CVA
  - Pre-existing neurological disorders that predispose to delirium (MS, MG, basal ganglia dz, etc.)

- Severe burns or muscle injury (possible hyperkalemia)
- Pulmonary impairment
- High anesthesia risk (ASA level 4 or 5)
ECT: Efficacy/Benefits

- Depressive Episode: naturally have 46% spontaneous remission by 31 mo, 30-50% response rate (much lower remission rate) to medications in 4-8 weeks, ~80-85% respond to ECT within 6-15 sessions (2-5 weeks) with a high percentage of those reaching remission (~60%)

- Catatonia: ~90% response rate to ECT, rapid

- Schizophrenia: ~75% have symptom improvement, chronic treatment sometimes needed to maintain improvement
ECT: Side Effects/Drawbacks

- Headache, muscle aches
- Nausea (from anesthesia)
- Brief confusion
- Memory impairment
  - Retrograde—for events nearest time of treatment patients may have gaps in their memories
  - Anterograde amnesia—rapid forgetting of newly learned information—until this resolves patient needs to be restricted from work, activities, driving etc
- No driving (or working some jobs) during treatment and for a short period after course ends
- Some medications are incompatible with treatment and need to be stopped before getting ECT
ECT: Safety

- Over 100,000 people in the US receive ECT every year
- Mortality is lower than for normal childbirth or any surgical procedure
- 1 per 80,000 treatments vs 18.5 for every 100,000 births
- Lower mortality rates in depressed patients receiving ECT than alternative treatment
- Most patients ultimately prefer ECT over routine dental care
TMS: History

- TMS, was first developed to use as a brain mapping tool, to measure cortical excitability, as a probe of neuronal networks, and as a modulator of brain function.
- Investigated for treating migraines
- In 1995, first documented human case report of rTMS in MDD
rTMS Basics

- Based on MRI technology
- FDA approved for the treatment of Depression in November 2008, in specific circumstances
- Non-invasive
- No anesthesia or sedation
- Approximately 35-45 minute daily (5x week) procedure
- 4-6 week treatment course
- No restrictions on driving
- Compatible with most medication regimens
TMS: What happens

- First treatment takes longer, have to find how much energy to use
- Treatment sessions: ~45 minutes daily
- Treatment course:
  - 5x/week for 4 to 6 weeks
  - Then taper over ~3 weeks
TMS: How it Works

- Based on Faraday’s Law
- The electric coil creates a magnetic field that can penetrate through the skull into the brain 2-3 cm. directly under the coil
- This causes very small electrical currents in the brain that activate cells by causing depolarization and subsequent trans-synaptic changes
- When placed over the left dorsolateral prefrontal cortex (DLPFC), can affect cells that interact with the limbic system in a way that can stimulate activity that decreases depressive symptoms
TMS: Indications

- Its use is approved for the treatment of depression that has one failed adequate trial of an antidepressant in the current episode of depression, for treatment-resistant depression, or for patients unable to tolerate the side effects of medications.
American Psychiatric Association Treatment Guidelines for Depression

First Line Treatment Attempts

4-6 Weeks
TMS Non-Invasive Non-Systemic

Single Antidepressant Medication Maintenance

Antidepressant Switch
- Non MAOI Class
- MAOIs / TCAs

Augmentation Strategies

Atypical Antipsychotic Augmentation

On-going Multiple Antidepressant Medication Maintenance

2 Months
4 Months
6 Months+

NEXT TRIAL
TMS: Contraindications

- It’s a mini-MRI, so... metal near the coil
- And that’s it
TMS: Efficacy

- ~60% response rate (higher for some types of depression) and ~40% remission rate
- rTMS therapy shows improvements in standard measures of functional status and quality of life
- When rTMS is compared to current standard of care using complex combination antidepressant medications
  - TMS results in decreased number of days lost due to illness, and increased work productivity,
  - TMS results in a net cost savings relative to current pharmaceutical standard of care
TMS: Side Effects

- Mild headache
- Scalp tenderness at site
- During FDA approval process, had instance of a seizure, but post-approval no known reports
- Can trigger hypomania in susceptible patients if stimulants and caffeine are not avoided
TMS: Side Effects

- No systemic side effects such as weight gain, sexual dysfunction, nausea, dry mouth, or sedation
- No adverse effect on cognition
- No evidence of emergent suicidal ideation
- <5% of patients discontinued due to adverse events
rTMS future applications

- Psychiatric:
  - Schizophrenia (negative symptoms and AH)
  - PTSD
  - OCD
  - Postpartum depression
  - Bipolar depression
  - Mania
  - Suicidality
  - Addiction and craving (specifically smoking cessation)
  - Bulemia nervosa
  - ADHD
rTMS future applications

- Neurologic:
  - *Parkinson’s disease*
  - ALS
  - MS
  - Post-stroke Aphasia, *Motor rehab*, *Neglect*, dysphagia
  - Writer’s cramp
  - Chronic pain including trigeminal neuralgia, fibromyalgia, *neuropathic pain* in general, *CRPS*, and migraine
  - *Tinnitus*
  - *Epilepsy*
  - Essential tremor
Potential future treatments

- FEAST (Focally Electrically Administered Seizure Therapy)
- tDCS
- T-PEMF
- Trigeminal Nerve Stimulation
- MST (Magnetic Seizure Therapy)
- Low field magnetic stimulation
- Cranial electrical stimulation
- Invasive: VNS, DCS, DBS, Ablative neurosurgery
Selected resources:


