OPTUMHealth Education

ELECTROCONVULSIVE THERAPY (ECT)

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Introduction

- Background
  - History
  - Public perception
- ECT Nuts & Bolts
  - Indications/relative contraindications
  - Administration of ECT
  - Morbidity, mortality, side effects
- ECT in Special Populations
  - Older adults
  - Pregnancy & breastfeeding
  - Children & adolescents
  - Status epilepticus
- Convulsive & Nonconvulsive Brain Stimulation Methodologies: Present & Future

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Objectives

- Describe the indications, risks, benefits, and side effects of ECT for both general patient populations and special patient populations (including the elderly, children and adolescents, and pregnant patients)
- Identify the processes and procedures for ECT, including recent advances in its administration
- Discuss the differences between retrograde and anterograde amnesia and how they are measured
- Recognize the current public perception of ECT and its influence on selection of ECT as a treatment choice
- Define the concept and history of ECT and other brain stimulation modalities, with an emphasis on the differences and similarities between ECT and these modalities (e.g., transcranial magnetic stimulation, vagus nerve stimulation, deep brain stimulation, magnetic seizure therapy, transcranial direct current stimulation, and experimental modalities)

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What is Electroconvulsive Therapy (ECT)?

- Use of externally applied electrical current to generate a generalized tonic-clonic seizure of adequate duration for therapeutic benefit
- Most rapid and effective treatment for severe depression, response rate 64-87%
- 8-12% of psychiatric inpatients
- Mortality rate 1:10,000, equivalent to anesthesia, less than childbirth
- Reduces mortality of depression by decreasing suicides and cardiac events

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A Brief History of ECT

- 1934: Laszlo Meduna, camphor, Metrazol, schizophrenia, catatonia
- 1938: Ugo Cerletti & Lucio Bini, electrical induction, schizophrenia
- 1940: N. America, NYSPI, ECT replaces Metrazol
- 1944: Wladimir Liberson, shortened stimulus duration
- 1952: Holmberg & Thesloff, anesthesia, pentothal 1945, succinylcholine 1949
- 1954: Thorazine, dawn of psychopharmacology
- 1960s: Antipsychiatry movement, Thomas Szasz et al, rise of psychopharmacology, decline of ECT
- 1970: Right unilateral
- 1975: One Flew Over the Cuckoo's Nest
- 1976: Constant current, brief pulse prototype
- 1980s: Revival of ECT as meds proved less efficacious than expected

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ECT Public Perception

- Coercive psychiatry, social deviance
- Pre-anesthesia, blackouts, fractures
- Cognitive side effects
- 1947: Snake Pit
- 1975: One Flew Over the Cuckoo's Nest
- 1978: Standards for informed consent
- 1992: Dick Cavett (1980 treatments)
- 2006: Kitty Dukakis: Shock: The Healing Power of ECT
- In a 2001 study in Britain researchers found vast differences among the professions in their knowledge of and attitude towards ECT.
- While psychiatrists and nurses stated that ECT was more likely to be beneficial than harmful only 32% of social workers and 14% psychologists agreed.
- Although there was an increase in utilization from 1985 to 2001, the statistics regarding mental health professionals' beliefs about ECT barely changed
- Recent patient surveys suggest that patients who have undergone ECT treatment generally have a positive attitude about their treatment and are likely to support further treatment

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Anti-ECT/Anti-Psychiatry Movement

- Citizens' Commission on Human Rights (CCHR) – Scientology-funded
- Committee for Truth in Psychiatry (CTIP) – Linda Andre
- Anne Donahue, 1995, Vermont
- 2005: Tom Cruise
- Websites:
  - ECT.org
  - Cchr.org (Scientology)
  - Freedommag.org (Scientology)
  - Harold Sackeim on ECT.org

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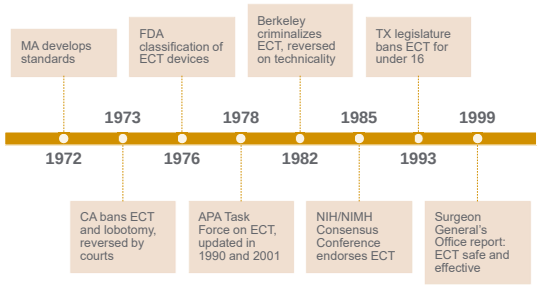
ECT Legislation



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Indications for ECT

Major depressive episode
- Inanition
- Suicidality
- Agitation
- Inadequate PO intake
- Medication-resistant
- Medications contraindicated

Psychotic depression

Bipolar depression/acute mania

Catatonia

Schizophrenia with affective disturbance

Parkinson's disease esp. with affective disturbance

? Neuroleptic Malignant Syndrome

Status epilepticus

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(Relative) Contraindications to ECT

- Cochlear implant: only absolute contraindication
- Intracranial space-occupying lesions
- Recent CVA (< 3 months)
- Unstable brain aneurysm
- Increased intracranial pressure
- Pheochromocytoma
- Intracranial/intracardiac devices
- Cardiac disease (possibly safer than TCAs)
  - Recent MI (? timing)
  - CHF
  - Unstable angina

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Morbidity/Mortality

- Difficult to estimate, but rates generally cited are similar to those associated with minor surgery
  - Range from 2-10/100,000, depending on the definition of association with ECT (Texas dataset: Shiwach RS, et al. 2001. *Psych Svcs*; and Dennis NM, et al. 2017. *J ECT*).
- 2.4/100K deaths within one day of ECT
  - Suicide: most common cause within the first 2 wks.
  - Risk factors: older age, male sex
- Safety profile of ECT may be better than that of some antidepressants, e.g., TCAs
- Retrospective review of 2,279 patients:
  - 17,394 ECT treatments over a 13-year period
  - 21 patients (0.92%) experienced a complication (primarily cardiac arrhythmias)
  - No complications caused permanent injury or death. (Nuttall GA, et al. 2004. *J ECT.*)
- Mortality rates, longitudinally, are improved for those who received ECT vs. other treatments (Prudic J, Sackeim HA. 1999. *J Clin Psychiatry*), although this may reflect selection bias

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Pre-ECT Evaluation

- Psychiatric history and exam: indications, medication response
- Medical evaluation: general H&P, anesthesia evaluation
- Labs/studies
  - CBC
  - TSH
  - Electrolytes
  - Drug screen
  - Urinalysis
  - Chest x-ray
  - EKG
  - ? Brain scan

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Advances in ECT: Modified ECT (MECT)

Sedation	Muscle relaxants	Monitoring	Alternating current → unipolar current
Sine wave current → square wave current	Wide pulse width → brief pulse width → ultrabrief pulse width	Bilateral electrode placement → right unilateral, bifrontal	Dose titration
Frequency of treatments	Oxygenation	Anesthesia	TAKE-HOME MESSAGE: ECT is not a static field, it is dynamic with ongoing research

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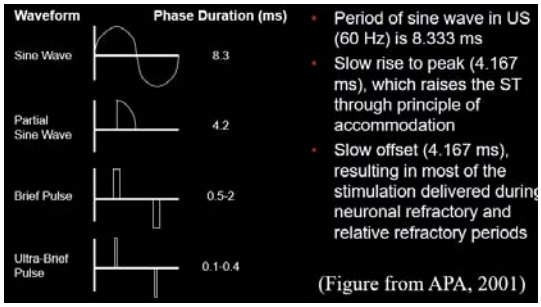
ECT Current Modifications



- Period of sine wave in US (60 Hz) is 8.333 ms
- Slow rise to peak (4.167 ms), which raises the ST through principle of accommodation
- Slow offset (4.167 ms), resulting in most of the stimulation delivered during neuronal refractory and relative refractory periods

(Figure from APA, 2001)

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Administration of ECT: Modified ECT (MECT)

- Equipment
- Personnel
- Medications
- Sedation: Brevital (methohexital), etomidate
- Muscle blockade: succinylcholine
- Heart rate/BP meds: atropine, beta blockers (esmolol), Ca channel blocker (nicardipine)
- Bite block
- VS and seizure monitoring: EKG, pulse ox, EEG, limb tourniquet
- Pre-oxygenation
- Seizure termination PRN
- Dose titration/seizure threshold determination
- Post-op agitation: midazolam, lorazepam, Haldol PRN
- Recovery
- Toradol, antiemetics PRN
- Post-ECT monitoring
- Clinical response monitoring: HAM-D
- Cognitive monitoring

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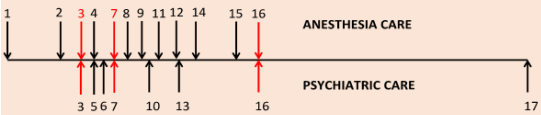
ECT Treatment Sequence of Events



1: Anesthesia set up
2: Pre-op assessment
3: Time out
4: IV and monitors
5 : ECT machine check and EEG lead placements
6: Limb tourniquet
7: Check with ALL if OK to start
8: Pre-oxygenation
9: Induction drugs
10: Inflate tourniquet
11: inject and test for muscle relaxants, insert bite block
12: Assure ventilation
13: Stimulate
14: Peak hemodynamic response
15: Return of spontaneous breathing
Rx Toradol and emetic drugs as needed
16: Transfer to recovery care
17: Discharge

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ECT Side Effects & Treatments

Headache	Muscle aches	Nausea (anesthesia)	Post-ictal agitation/confusion
Prolonged seizure	Physical trauma: fracture, contusions	Respiratory issues: COPD, asthma, obesity	Dental injury (bite blocker)
	Mania	Memory	

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Anterograde Amnesia

- Inability to recall recent events:
  - Difficulty retaining newly-learned information over a time delay
  - Once ECT begins you may experience anterograde amnesia
- Usually clears within several weeks of completion of ECT course.
- Most patients report that these effects clear completely within about eight weeks.
- Can be a problem for outpatient ECT in particular
- Monitoring:
  - MMSE: Modified Mini-Mental State Exam
  - Buschke Selective Reminding Test
  - Complex Figure Test

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Retrograde Amnesia

- Inability to recall distant events that occurred, or information obtained before ECT course
- Potentially persistent cognitive side effect
- Memory of impersonal or public events and their details may be more disrupted than memory for personal, or autobiographical events, especially significant ones
- Recent events (occurring within several months prior to ECT) likely more vulnerable than more remote events
- Most people report recovery of memories by six months after completion of ECT. Occasionally, recovery of memories can be incomplete
- Still controversial
- Varies widely with ECT electrode placement, pulse width, and treatment frequency

- Columbia University Autobiographical Memory Interview (AMI)

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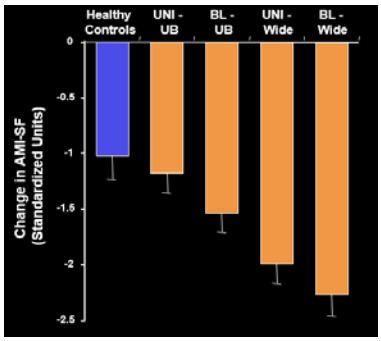
Cognitive Effects and Type of ECT

(Prudic J, Sackeim HA, et al. 2004, *J Biol Psych*)



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Post-ECT Treatment

- No treatment: relapse rates near 80%
- Psychotherapy
- Medication monotherapy:
  - relapse rates near 50% without, 25% with
- Medication combination
  - NTP + Li
  - Effexor + Li
- Continuation/maintenance ECT

- TAKE-HOME MESSAGE: ECT is very effective in getting people well but not in keeping them well

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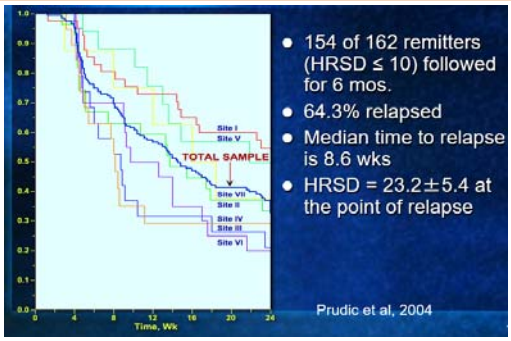
Relapse among Remitters



- 154 of 162 remitters (HRSD ≤ 10) followed for 6 mos.
- 64.3% relapsed
- Median time to relapse is 8.6 wks
- HRSD = 23.2±5.4 at the point of relapse

Prudic et al, 2004

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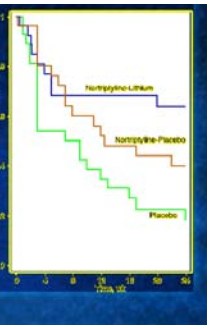
Medications Post-ECT Mitigate Relapse

- Relapse rates following ECT
  - 84%, placebo
  - 60%, NT alone
  - 39%, NT+Li.
  - Overall relapse rate 62%
- Most relapse occurs early
- Abrupt termination of ECT and (2) starting continuation pharmacotherapy only at ECT termination may both contribute to relapse. Does starting an antidepressant at the start of ECT reduce rates of early relapse?



Sackeim et al, AJP, 2001

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Continuation/Maintenance ECT

- Usually begun weekly, using a modality proven effective for the individual patient
- Interval extended, depending on patient condition
  - E.g., Weekly for ≤1 mo → biweekly for ≤2 mos → monthly for at least 2 mos. → wean if >2 mos. remitted
- Interval assessment of clinical status (2-4 wks):
  - New risks, medical history and physical exam
- Interval clinical status to determine need for and frequency of treatment
- Documentation of need for treatment every 3-6 mos.
- Cognitive assessment every 3 treatments

APA Task Force 2001

- Duration: same as maintenance pharmacotherapy
- Standards similar to C-ECT
- Minimum frequency usually every 1-2 mos.
- Patients who are symptom free for 2 mos. may be able to stop ECT
- Need should be re-evaluated every 6 mos.

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Anticonvulsant Hypothesis of ECT Mechanism of Action

Lack of correlation with released neurochemicals	Greater correlation with released anticonvulsant molecules	Lack of correlation with duration or amplitude of seizure
Post-ictal silence	EEG activity DLPFC pre-post ADM, ECT, CBT	Efficacy of VNS Correlation with rise in seizure threshold

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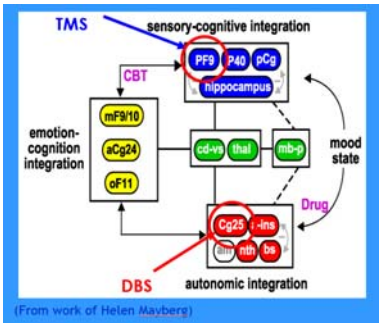
Targeting the Depression Circuit



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Basic Principles

- What we know/don't know
- Goal: recruit minimum number of neurons to fire synchronously so as to generate GTC seizure
- Seizure necessary but not sufficient
- Dissociation of efficacy and side effects
- Focality
- Laterality and depression circuit
- Seizure threshold rises with each treatment (B/L 3.5xST., RUL 6xST, BF 1.5xST)
- Special relationship between seizures and depression

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Clinical Review: Important Questions to Ask

- Is ECT indicated, is member appropriate?
- Medical clearance performed?
- Any relative contraindications? Appropriate precautions?
- Bilateral, right unilateral, or bifrontal?
- Pulse width?
- Stimulus dosing (times seizure threshold)?
- Frequency: 2 or 3 times a week?
- Adequate seizures? (min 20-30 sec)
- Concurrent medications? Meds that might affect seizure threshold (BZD, mood stabilizers)?
- Clinical response monitoring performed?
- Cognitive side effect monitoring performed? Modifications if side effects?
- Follow-up plan:
  - Medications? Therapy?
  - Outpatient ECT? Appropriate social supports?
  - Maintenance ECT?

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ECT in Special Populations

- Older adults
- Pregnancy/breastfeeding
- Children & adolescents
- Status epilepticus

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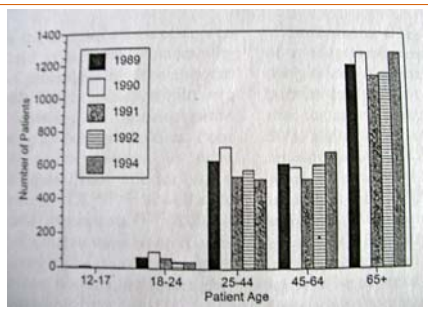
ECT and Age



Kramer. 1999. *J ECT.*

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ECT in older adults

Melancholic depression
- Severe inanition
- Inability to eat
- Suicidality

Psychotic depression
- Less likely to be given adequate medication trial

Treatment-resistant depression

Intolerance to medication side effects

Less Axis II comorbidity

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Administration of ECT in Older Adults

Seizure threshold rises with increasing age

Possible solutions:
- Withdraw sedatives/hypnotics
- Minimize barbiturate anesthesia
- Ensure adequate ventilation
- Replace lidocaine antiarrhythmic

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Cognitive Status in Older Adults Receiving ECT

Post-ECT delirium/confusion

Anterograde amnesia

Retrograde amnesia

Baseline cognitive status

Dementia vs. pseudodementia

Etiology of dementia (Alzheimer's, Lewy body, vascular)

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Dementia: Practical Measures

Electrode placement

Pulse width

Twice-weekly treatment

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ECT in Pregnancy and Breastfeeding

- Effects of untreated or undertreated depression or bipolar disorder on fetal development
- Effects of psychopharmacologic agents on fetal development
  - Teratogenicity: mood stabilizers
  - Antidepressants
- Safety and efficacy of ECT
  - ECT/seizure effects
  - Effects of anesthetics
- Risks:
  - Effects on fetal heart rate
  - Premature contractions
  - Fetal loss

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Administration of ECT in Pregnant Women

Ob/Gyn consultation	Fetal monitoring	Oxygenation but not hyperventilation; LMA
Hydration	Withhold anticholinergic agents	Nonparticulate antacids
Acetaminophen for post-ECT headache/soreness (avoid NSAIDS in 3rd trimester: early closure of fetal ductus arteriosus)	After 20 weeks, wedge under right hip	Emergency facilities/personnel available

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Breastfeeding

Nearly all psychotropic medications enter breast milk to some degree

Anesthetic agents in breast milk

Pump & store → pump & dump

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ECT in Children and Adolescents

- Underdiagnosis/misdiagnosis of mood disorders in children & adolescents
- Undertreatment of mood disorders
- Indications: acute depression, mania, psychosis, catatonia, suicidality
- Safety and efficacy of ECT
- Lower seizure threshold
- Different dose titration procedure
- Risk of prolonged seizure/status epilepticus
- Concern for persistent cognitive side effects

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Administration of ECT in Children & Adolescents

Informed consent

- Parental
- Second independent psychiatrist
- 72-hour hold

Seizure threshold, dose titration

Electrode size

Risk of status epilepticus

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ECT for Status Epilepticus

What is status epilepticus

- Seizure that persists for sufficient length of time or is repeated frequently enough that recovery between attacks does not occur
- 20-30 min duration can cause CNS injury
- Mortality in adults 20%

Why ECT?

Initiate treatment early (3-5 min)

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Other Brain Stimulation Methodologies: Nonconvulsive

rTMS: repetitive transcranial magnetic stimulation (FDA approved for depression, OCD; PTSD coming?)	dTMS: deep brain TMS Accelerated TMS Theta burst TMS	VNS: Vagus nerve stimulation (FDA approved)
DBS: Deep brain stimulation (FDA approved for PD, OCD, dystonia, but not depression)	tDCS: Transcranial direct current stimulation	CES: Cranial electrical stimulation
	Future LnL	

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Future of Convulsive Therapy

- MST (Magnetic Seizure Therapy)
  - Less intense stimulation (lower induced voltage)
  - More focal stimulation
  - Limited to superficial cortex (pros and cons)
  - More focal seizure spread
  - Less hippocampal remodeling
- FEAST (Focal Electrically-Administered Seizure Therapy)
  - Unidirectional current
  - Novel electrode design (small triangular anode, large cathode)
  - Novel electrode placement
  - Deeper stimulation than MST
  - More focal stimulation than ECT
  - Nonhuman primate implanted intracerebral electrode voltage mapping

Lisanby et al., *Clinical Neurophysiology*, 2003.
Scalia et al., 2004.
Berman, Sackeim et al, 2006.

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QUESTIONS

THANK YOU!

