Electroconvulsive Therapy in the Medically Ill: When Should it be Considered?

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Objectives

• Enhanced knowledge of the scientific literature published regarding the clinical efficacy and safety profile of Electroconvulsive Therapy (ECT) for depression.
• Review the physiological effects of ECT throughout the body.
• Enhanced knowledge of the literature regarding the use of ECT in medically ill populations.
Interactivity During the Lecture

WHERE YOU SIT IN CLASS/SEMINAR
And what it says about you:
- **Mid-Center:** "Bring it on."
- **Front Row:** Teacher's pet wannabes
- **Second-row sleepers:** Good intentions, bad narcolepsy
- **Nearest Exit:** Uncommittal
- **Back Row:** "Too cool for school"
- **Against the wall:** "I'm sensitive. Please ignore me."

Proximity to Lecturer:
- X = How much you care
- How sleepy you are

Electroconvulsive Therapy for Psychiatric Illness
A Renaissance for Brain Stimulation?

- Recognition that the brain is an electrochemical organ
- More than 1 in 3 patients receive inadequate symptom relief from antidepressant medications
- The development of neurocircuitry models of the brain
- Advances in technology have provided multiple means of modulating activity in key structures in the brain


The Advent of the CANMAT Neurostimulation Guidelines
Diagnoses for Which ECT is Considered Effective

1. Major Depressive Disorder
   - Especially with psychotic features, catatonia, inanition and suicidal ideation
2. Bipolar Disorder (both depressed and manic phases)
3. Schizophrenia
4. Catatonia


Percentage of ECT Treatments by Diagnosis by Year at UHN

Linear Regression Equation = 84.21 + 0.24x (p=0.67)
Rates of Use of ECT in Ontario

Figure 1  ECT rates in Ontario


Rates of Use of ECT in the Elderly

Figure 2 Prevalence of antidepressant and ECT use in Ontario’s older adults

How Safe is ECT?

- The mortality rate has been estimated to be less than 1 death per 73,440 treatments.
- Similar to the background rate associated with anesthetic induction.
- Serious complication rate of 0.53 - 0.92%.
- Lower overall mortality rate from natural causes in inpatients who have received ECT (RR=0.82, 95% CI 0.74-0.90).


Meta-Analyses of the Antidepressant Properties of ECT

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Difference in HDRS Score (from UK ECT Review Group, 2003)</th>
<th>Odds Ratio of Response (from Pagnin et al., 2004)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Real ECT vs. Sham ECT or Placebo</strong></td>
<td>9.7 (CI 5.7 - 13.5)</td>
<td>4.77 (CI 2.39 - 9.49)</td>
</tr>
<tr>
<td><strong>ECT vs. Antidepressant Medications</strong></td>
<td>5.2 (CI 1.4 - 8.9)</td>
<td>3.72 (CI 2.60 - 5.32)</td>
</tr>
<tr>
<td><strong>Bilateral vs RUL Electrode Placement</strong></td>
<td>3.6 (CI 2.2 – 5.2)</td>
<td></td>
</tr>
<tr>
<td><strong>One vs. Two vs. Three Treatments per week</strong></td>
<td>No difference</td>
<td></td>
</tr>
<tr>
<td><strong>High vs. Low ECT Dosage</strong></td>
<td>4.1 (CI 2.4–5.9)</td>
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</tbody>
</table>
**Speed of Antidepressant Response With ECT**


**Rate of Relief of Suicidal Ideation With ECT**

Which Depressive Subtypes Are Responsive to ECT?

<table>
<thead>
<tr>
<th>Subtype</th>
<th>Rates of Response</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychotic Depression</td>
<td>Psychotic Depression (95%)</td>
<td>Petrides et al. <em>Journal of ECT</em> (2001) 17: 244-253</td>
</tr>
<tr>
<td></td>
<td>Non-Psychotic Depression (83%)</td>
<td></td>
</tr>
<tr>
<td>Atypical Depression</td>
<td>Atypical (80.6%)</td>
<td>Hussain et al. <em>Journal of Clinical Psychiatry</em> (2008) 69:406-411</td>
</tr>
<tr>
<td></td>
<td>Typical (67.1%)</td>
<td></td>
</tr>
<tr>
<td>Bipolar Depression</td>
<td>Bipolar (50%)</td>
<td>Grunhaus et al. <em>Bipolar Disorders</em> (2002) 4 (Suppl. 1): 91-93</td>
</tr>
<tr>
<td></td>
<td>Unipolar (57.6%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Borderline PD (20%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other PD (52.4%)</td>
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</tr>
</tbody>
</table>

What are the Immediate Cognitive Effects of ECT?

Adapted from Sackeim et al *Neuropsychopharmacology* (2007) 32: 244–254
What are the Longitudinal Cognitive Effects of ECT?

Physiological Effects of ECT

Adapted from Sackeim et al Neuropsychopharmacology (2007) 32: 244–254
Electroconvulsive Therapy

The Phases of an ECT Treatment

- Anesthesia
- Muscle relaxant
- The electrical stimulus
- Seizure
- Post-ictal recovery

Physiological Effects of ECT: The Cardiovascular System

- Similar to a brief period of “vigorous exercise”
- Electrical stimulus results in bradycardia and hypotension
- Seizure results in activation of sympathetic nervous system and catecholamine surge
  - Tachycardia, hypertension and increased myocardial oxygen demand

ECT and the QTc Interval

ECT and Cardiac Disease

• ECT is considered a low-to-intermediate risk procedure according to the AHA
• ECT is associated with rapid, dramatic hemodynamic changes associated with Autonomic Nervous System activity
• Overall ECT-associated risk for cardiovascular complications is low but may be increased in vulnerable patients


ECT and Cardiac Disease

• Reliable SBP increases of 29-48% and DBP increases of 24-60% during ECT
  – Recommendation: continue usual antihypertensives, IV labetolol for hypertensive reactions
• ECT is safe in patients with pacemakers or ICDs
  – Recommendation: turn off pacemaker and turn off detection mode of ICD
• ECT safe within 10 days of an MI
  – Recommendation: EKG and echocardiography for risk stratification
• Safe in AAA
  – Recommendation: adequate BP control, serial U/S to characterize size
• Safe in Atrial fibrillation
  – Recommendation: maintain INR up to 3.5, unless risk of intracranial hemorrhage

Tess and Smetana. NEJM (2009) 360: 1437-1444
Physiological Effects of ECT: The Respiratory System

- Anesthetics blunt the ventilatory responses both to hypercapnia and hypoxemia
- Period of apnea during the ictal phase
- Exhalation against a closed airway results in a Valsalva maneuver
  - Return of systemic blood to the heart is impeded and the output of the heart is reduced

ECT and Pulmonary Disease

- 4/34 patients requiring daily asthma medications daily had an exacerbation of their asthma
- 0% complication rate in 34 patients with COPD
- **Recommendations:**
  - Adequate pre-oxygenation
  - Avoid theophylline

Physiological Effects of ECT: The Brain

- Cortical blood flow increases approximately 300% resulting in increases in ICP
- Cerebral oxygen demand increases approximately 200% during seizure activity


ECT and Intracranial Disease

- No cases of stroke in 2 large case series of 46,900 treatment sessions.
- Safe in patients with brain tumours and intracranial masses provided that there is not significant cerebral edema
- **Recommendation:**
  - Adequate BP control, neuroimaging, treat with dexamethasone if necessary

Physiological Effects of ECT: The Eye

- Transient increase in intra-ocular pressure associated with ECT
- Returns to baseline within 2 minutes of the completion of the seizure

ECT and Intra-Ocular Pressure (mmHg)


ECT and Ophthalmological Disease

- Transient increases in intra-ocular pressure safe in patients with glaucoma and recent eye surgery
- **Recommendation:** Long-acting anticholinesterase eye drops should be avoided prior to ECT

Physiological Effects of ECT: The Gastrointestinal System

- Increased intra-abdominal pressure during the ictal phase.
- Case reports of bladder and gastric rupture in cases of inadequate muscle relaxation and non-NPO status.
- **Recommendation:** Administer Succinylcholine, NPO after midnight


Physiological Effects of ECT: The Kidneys

- No change in creatinine levels post-ECT
- Succinylcholine results in an increase in $K^+$ levels up to 0.5 mEq within 1 minute of administration
- Risk of cardiac arrhythmia with hyperkalemia

ECT and Renal Disease

- Patients with MSK injuries and catatonia are especially at risk of hyperkalemia
- Recommendations:
  - Need to ensure that $K^+ \leq 5.0-6.0$ mEq in patients with chronic renal failure
  - Consideration can be given to rocuronium

Physiological Effects of ECT: The Musculoskeletal System

- Muscle relaxants minimize risk of fractures
- The most common adverse effects are myalgia (1/5) and headache (1/3).
- Recommendations:
  - BMD screening in women after the age of 70?
  - PRN acetaminophen or ibuprofen
Physiological Effects of ECT: Blood Sugars

- There is a small but immediate increase in blood sugar and plasma insulin levels post-ECT
- Insulin responses attenuated over the course of ECT
- Return to baseline within 1-3 hours


ECT in Patients with Diabetes

- 9% increase in blood sugar 20 minutes after ECT in 18 patients with Type 2 DM
- Same magnitude as seen in patients without DM
- No significant changes in insulin use post-ECT
- **Recommendation:** Blood sugar needs to monitored pre-ECT +/- adjustments in hypoglycemic treatments

When to Consider Electroconvulsive Therapy in the Medically Ill

Electroconvulsive Therapy in the Medically Ill

• There are no absolute contraindications

1. Is there a Psychiatric Indication?
   – Individualized risk/benefit ratio of continuing medication/psychotherapeutic treatment of depression

2. What are the Medical Risk Factors?
   – Complete history and physical
   – CBC, electrolytes, EKG, further investigations as needed

3. Can the Procedure be Modified to Minimize the Medical Risk Factors?
The Role of Brain Stimulation in the Treatment of Major Depression

Various treatments can be thought of as lying at various points of a spectrum of the degree of focal stimulation provided to the brain and the invasiveness of the technique.

- Psychotherapy
- Medications
- TMS
- ECT
- VNS
- DBS
## Summary of CANMAT Neurostimulation Guidelines

<table>
<thead>
<tr>
<th>Neurostimulation</th>
<th>Overall Recommendation</th>
<th>Acute Efficacy</th>
<th>Relapse Prevention</th>
<th>Safety and Tolerability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ECT</strong></td>
<td>First-line for MDD with psychosis or suicidality</td>
<td>Level 1</td>
<td>Level 1</td>
<td>Level 1</td>
</tr>
<tr>
<td></td>
<td>Second-line for treatment resistant or intolerant populations</td>
<td>Level 1</td>
<td>Level 1</td>
<td>Level 1</td>
</tr>
<tr>
<td><strong>rTMS</strong></td>
<td>Second-line</td>
<td>Level 1</td>
<td>Level 3</td>
<td>Level 1</td>
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<tr>
<td><strong>DBS</strong></td>
<td>Investigational</td>
<td>Level 3</td>
<td>Level 3</td>
<td>Level 3</td>
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</table>


## Conclusions
ECT and Medical Illness

• With the modern technique, ECT is a safe procedure with an exceeding low mortality rate (same as risk of general anesthesia)
• The acute antidepressant properties of ECT remain unsurpassed
• ECT remains an underutilized tool in our armentarium in 2013
• The physiological effects of ECT on multiple organ systems are well-characterized
• ECT is ideally administered in a general hospital setting

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