Electroconvulsive Therapy

The use of electroconvulsive therapy (ECT) to induce generalized seizures is indicated in the management of psychiatric patients with refractory depression, mania or schizophrenia with affective disorders. Management of these patients includes special consideration for the remote environment in which they are performed, attention to anesthetic-induced changes in seizure threshold, hemodynamic changes associated with ECT, appropriate airway management and provision of short acting anesthesia with blunting of hemodynamic and musculoskeletal responses to the procedure.

ANESTHETIC CONSIDERATIONS:

- Remote location
  - Limited access to skilled help and emergency anesthetic equipment
  - Crash cart should be readily available
  - Emergency airway equipment should be readily available
  - Staff should be familiar with the procedure and use of anesthetic medications
- Airway management
  - Often performed without endotracheal intubation – risk of aspiration
  - Consider supraglottic device if difficult BMV
  - ETT if clinically indicated or prolonged seizure
- Physiologic changes associated with ECT
  - Initial response: vagal predominace (bradycardia, hypotension)
  - Late response: sympathetic stimulation (tachycardia, hypertension, increased O2 consumption, arrhythmias)
  - ICP/IOP: increased ICP/IOP
  - Increased intragastric pressure
- Anesthetic and cardiovascular medication induced changes in seizure threshold and duration
- Psychiatric patient
  - Review medications and be aware of significant drug interactions
  - Potentially uncooperative patient
- Contraindications to ECT
  - ABSOLUTE:
    - Recent MI (within 3 months)
    - Recent CVA (within 3 months)
    - Pheochromocytoma
    - Long bone fracture
    - Increased ICP
    - Intracranial or aortic aneurysm
  - RELATIVE:
    - Angina
    - CHF
    - Pacemaker
    - Severe pulmonary disease
    - Severe osteoporosis
    - Pregnancy
    - glaucoma & retinal detachment

ANESTHETIC GOALS:

- Attenuate hemodynamic response to ECT
- Optimize seizure threshold and duration
- Rapid emergence
- Avoid gross movements and MSK injury

HISTORY

- Usual anesthetic history, may be difficult to obtain
- Old anesthetic records (usually multiple treatments)
- Careful assessment of cardiopulmonary and neurologic status
- Review indications for treatment: refractory major depression, contraindication to pharmacological approach, profound depression, controversial: mania, schizophrenia, eating d/o, catatonia
- Review medications:
  - **TCAs** – block reuptake of 5-HT, norepinephrine → deplete central adrenergic stores → unpredictable response to indirect-acting sympathomimetics, direct-acting may cause exaggerated response; anticholinergic effects
  - **MAOIs** – irreversible complex with MAO → prevents breakdown of intraneuronal norepinephrine, 5-HT, dopamine → indirect-acting sympathomimetics can cause HTN crisis, direct acting may cause exaggerated response
  - **Lithium** – prolongs effects of depolarizing, certain nondepolarizing relaxants, sedatives (barbiturates); may increase incidence of confusion & memory loss d/t ECT
- Assess co-existing disease:
  - **Pheochromocytoma** → absolute contraindication
  - Myocardial disease
  - Increased ICP
  - Recent CVA
  - Aneurysmal disease (aortic and cerebral)
  - Pseudocholinesterase deficiency
  - Difficult airway
  - GERD
  - Pacemakers / AICD

- Atrial fibrillation → ECT may convert, ensure patient anticoagulated

PHYSICAL

- **GENERAL** - vitals
- **CNS** - signs of increased ICP
- **RESP**
- **CVS** - signs of CHF (large heart, JVP, rales, rhythm)

INVESTIGATIONS

- **Labs**
  - Only for underlying disease
- **Imaging**
  - EKG – previous MI, conduction disorder
  - Echo, Holter as needed

OPTIMIZATION

- Aspiration prophylaxis (sodium citrate, ranitidine, metoclopramide)
- Ideally, Lithium, MAOIs & TCAs should be discontinued 2 weeks prior to ECT
- AICD
  - Have defibrillator deactivated (pre-op or with magnet)
  - External defibrillator in room
- Pacemaker → change to asynchronous mode

ANESTHETIC OPTIONS

- GA with mask, LMA or ETT

ANESTHETIC SETUP

- **Drugs**
  - Resuscitation medications and hemodynamic meds available
    - Atropine or glycopyrrolate to treat bradycardia & asystole
    - Ephedrine / phenylephrine for hypotension
    - NTG, SNP, labetalol or esmolol for hypertension & tachycardia
- **Equipment**
  - CAS monitors
  - PNS
  - Routine equipment including bite block, oral airway, styletted endotracheal tube, laryngoscope & suction
  - Peripheral IV, consider invasive monitoring for high risk (for first few treatments esp.)
  - Seizure activity may be monitored by unprocessed EEG or by limb isolation

MANAGEMENT OF ANESTHESIA

- **Induction**
  - Preoxygenation
  - Mild hyperventilation prior to shock
  - Ensure bite block placed
  - Method of airway control:
    - Generally simple face mask sufficient
    - Consider ETT:
      - Difficult airway with inability to ventilate
      - Pregnant patient
      - Aspiration risk
  - Consider premedication
    - Atropine or glycopyrrolate 1-2 minutes prior to induction to decrease bradycardia
    - Esmolol 1-2 mg/kg IV 1 minute prior to induction to attenuate increases in BP & HR that follow ECT (Esmolol may decrease seizure duration)
  - Induction agent:
    - **Methohexital** 0.5-1 mg/kg IV is prototypical agent (↓ seizure threshold, rapid awakening)
    - **Thiopental** 1.5-3 mg/kg has been used successfully (↑ seizure threshold, delayed awakening)
    - **Propofol** 2-3 mg/kg (↓ seizure duration, rapid awakening but no difference in outcome)
    - Etomidate may prolong seizure duration but has been used successfully
    - Ketamine prolongs seizure duration but exacerbates sympathetic response
    - Avoid benzodiazepines
  - Muscle relaxant
    - SCh agent of choice (small dose: 0.5 mg/kg)
    - If contraindication to SCh, use NDMR with reversal +/- ventilation
    - Mivacurium:
      - Need to use full dose to prevent movements
      - Can't use if pseudocholinesterase deficient
- **Maintenance**
  - Beta-blockers (e.g. esmolol 2-3 mg/kg), NTG, SNP, hydralazine, narcotics, clonidine, and lidocaine have all been used successfully to blunt the sympathetic response to ECT
  - Additional shocks may be needed, consider atropine prior to 2nd dose of SCh

- **Emergence**
  - Nothing specific

DISPOSITION & MONITORING

- Monitor in post-anesthesia care unit until fully conscious / pre-ECT state then return to place of origin
- Supplemental O_2
- In high risk patients, carefully consider the risks and benefits of the procedure, as the risk of complications from ECT may outweigh the risk of suicide, and the patient may yet respond to drug therapy

COMPLICATIONS

- Transient arrythmias (10-40%)
- Gastric aspiration (2.5%)
- MSK disorder (0.4%) including fractures
- HTN
- Myocardial ischemia
- Pulmonary edema
- Headache
- Agitation
- Amnesia
- SIADH

PATHOPHYSIOLOGY

- Mechanism of action is unknown but therapeutic effect is likely related to the amount of current passed through the brain
- It is administered to one or both cerebral hemispheres to induce a seizure
  - Typically the non-dominant hemisphere only to minimize memory loss
- The goal is to produce a grand mal seizure
  - A latent period of 2-3 seconds is followed first by a tonic phase of 8-12 seconds followed by a prolonged clonic phase (30-50 seconds)
- Concept that benefit is dependent on seizure duration is not substantiated
- A series of 8-12 treatments is administered at a rate of 2-3 per week
- Current mortality rate is 1 in 10,000-30,000 treatments
- **Indications:**
  - Primary role is the treatment of major depressive disorder with psychotic features
  - Used to treat intractable non-chronic schizophrenia, mania & catatonia
  - 75-90% of patients respond to ECT
- **Contraindications:**
  - Absolute: (these are listed as relative contraindications in Roizen & Fleisher, Essence but absolute in other references)
    - Recent MI (usually < 3 months)
    - Recent stroke (usually < 3 month)
    - Intracranial mass or increased ICP
    - Pheochromocytoma
    - Long bone fractures
  - Moderate:
    - Angina, CHF, pacemaker, pulmonary disease, severe osteoporosis, pregnancy, glaucoma & retinal detachment
- Patients are often taking psychotropic medications that interact with anesthetic agents:
  - TCAs – pressor response to direct acting agents is increased
  - MAOIs – may precipitate hypertensive crisis when both direct or indirect pressors are given
  - Lithium – may delay awakening & prolong duration of succinylcholine
- **Biphasic autonomic response**:
  - Initial parasympathetic ~10-15 seconds
    - Risk of significant bradycardia / asystole
  - Followed by sympathetic response
    - Hypertension, tachycardia, ↑ myocardial O_2 consumption
    - Risk of arrhythmias, EKG changes (↑ PR, QT, T-wave changes)
- **Other significant physiologic** responses:
  - ↑ ICP, ↑ CBF
  - ↑ IOP, ↑ intra-gastric pressure
  - Postictal confusion & memory impairment
  - Increased ACTH, cortisol & catecholamines
- **Special Populations**
  - Cerebral Aneurysms
    - Placement of art-line pre-induction
    - Ensure hemodynamic medications readily available
  - Intra-cranial mass lesion
    - Seriously consider avoiding procedure in setting of ↑ ICP but d/w neurologist / neurosurgeon
  - Pregnant patients
    - Consult with OB with considerations of prophylactic tocolytics
    - RSI with ETT and sevoflurane maintenance (potentiates uterine relaxation)
  - Atrial fibrillation → consider anti-coagulation
  - Cardiovascular disease
    - SSS / bradycardia → consider pre-treatment with atropine
    - CAD

- Pre-treat with beta blockers
- Non-invasive monitoring

Table 2. Effects of IV Anesthetic and Cardiovascular Drugs on the Duration of ECT-Induced Seizure Activity (relative to methohexital or saline, respectively)

Drug	Increased	No change	Decreased
Anesthetic drugs	Etomidate (36,42,43) Alfentanil (94,95)[b] Remifentanil (96)[b]	Methohexital (36–39)[a]	Thiopental (39,40), thiamylal (39), lorazepam (52), midazolam (54), ketamine (51), fentanyl (75), propofol (36,40,44–48)
Cardiovascular drugs	Aminophylline (114) Caffeine (115,116)	Clonidine (84), esmolol (74,86), labetalol (81), dexmedetomidine (83), nifedipine (79), nicardipine (81), nitroglycerin (86), trimethaphan (93), nitroprusside (92)	Diltiazem (82), lidocaine (9,75), labetalol (74,75), Esmolol (76,78)

Reference numbers are cited in parentheses.
ECT = electroconvulsive therapy.
[a] Compared with saline, methohexital decreases ECT seizure duration.
[b] Increased seizure time because of an anesthetic-sparing effect.

REFERENCES

- Roizen & Fleisher – Essence of Anesthesia p393
- Morgan (Lange 3rd), pg 596
- Miller 6th - Chapter 66