ECTs

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1

Indications

Acute drug resistant affective disorders

1. Major depression, single or recurrent episode
2. Bipolar major depression, depressed or mixed type
3. Bipolar disorder, mania or mixed type
4. Schizophrenia
   - Catatonia
   - Schizophreniform or schizoaffective disorder
5. Atypical psychosis
6. Other conditions
   - Organic delusional disorder
   - Organic mood disorder
   - Acute psychotic disorder
   - Obsessive-compulsive disorder
   - Dysthymia
7. Miscellaneous conditions
   - Parkinson's disease
   - Neuroleptic malignant syndrome
   - Secondary catatonia
   - Lethal catatonia

Sosa, S. Anesthesia Management for Electroconvulsive Therapy- Practical Techniques and Physiological Background. Springer; 2016.

2

Contraindications

According to the American Psychiatric Association (APA), ECT has no absolute contraindications; however, certain conditions pose a relatively high risk:

(1) unstable or severe cardiovascular conditions such as recent myocardial infarction, unstable angina, poorly compensated congestive heart failure, and severe valvular cardiac disease;

(2) aneurysm or vascular malformation possibly susceptible to rupture with increased blood pressure;

(3) increased intracranial pressure, as may occur with some brain tumors or other space-occupying cerebral lesions;

(4) recent cerebral infarction and hemorrhage;

(5) pulmonary conditions such as severe chronic obstructive pulmonary disease, asthma, or pneumonia;

(6) patient status rated as American Society of Anesthesiologists (ASA) level 4 or 5; and

(7) pheochromocytoma.

Mankad MV, Weiner RD. Adverse effects. In: Mankad MV, Beyer JL, Weiner RD, Krystal AD, editors. Clinical manual of electroconvulsive therapy. Arlington: American Psychiatric Publishing, Inc.; 2010. 119-42.

American Psychiatric Association. The practice of electroconvulsive therapy: recommendations for treatment, training, and privileging: A task force report of the American Psychiatric Association. 2nd ed. Washington, DC: American Psychiatric Association; 2001.

3

Legalities in Texas

- Over age of 16
- Involuntary and incompetent patients whose guardian consents to treatment
  - Not on involuntary patients who have not been deemed incompetent
- For 65+YO a statement by two physicians that the treatment is medically necessary is required
- Appropriate labs <30 days old
- Pseudocholinesterase level or documented previous use of succinylcholine
- No more than 24 ECTS in 12 month period or 15 ECTs in 8 consecutive weeks unless a second physician not involved in care documents the necessity of the additional treatments

4

Preoperative Workup

- CBC
- BMP
- EKG
- Serum pseudocholinesterase if there is no documentation of successful use of muscle relaxant medication with general anesthesia or no record of previous testing
- +/- UPT
- +/- head CT to rule out intracranial lesions
- Medication list specifically antiHTN and mood stabilizing drugs
- Most recent records from cardiologist

5

Seizure Goals and Pathophysiology

Goal

- 30 sec to 2 min seizure to optimize therapeutic effect and minimise cognitive impairment
- Therapeutic action dependent upon duration, intensity, and characteristics of seizure

Pathophysiology

- Synchronous depolarization of cell membranes allowing seizure
- 10-15 sec tonic phase involving parasympathetic activation (bradycardia and hypotension)
- 30-60 sec clonic phase involving sympathetic activation (tachycardia and HTN)
- EEG seizure activity is more prolonged than motor seizure activity
- Increased intragastric, intraocular and intracranial pressures
- Increased CBF and cerebral metabolism leading to intracranial HTN
- Autonomic response depends on seizure duration and intensity

6

Induction Medications

Methohexital <1 mg/kg

- Drug of choice
- CI: acute intermittent porphyria

Etomidate 0.15-0.3 mg/kg

- Prolonged seizure duration
- Exaggerated hypertensive response.
- Increased incidence of confusion/ delirium
- Increased nausea/vomiting
- Myoclonic jerks
- Possible adrenal suppression

Propofol <1 mg/kg

- Shorter seizure duration

7

Induction Medications

Avramov MN, Husain MM, White PF. The comparative effects of methohexital, propofol and etomidate for electroconvulsive therapy. Anesthesia and Analgesia. 1995; 81: 596 – 602.

- 10 patients for total of 90 bilateral maintenance treatments in prospective, randomized, cross-over study
- Premedicated with glycopyrrolate 0.2 mg and labetalol 20-30 mg
- Methohexital or propofol (0.75, 1.0, and 1.5 mg/kg), or etomidate (0.15,0.2, and 0.3 mg/kg),
- Succinylcholine 1.0-1.4mg/kg
- Durations of EEG and motor seizures were longest after etomidate and shortest after propofol
- No dose-related differences in motor and EEG seizure durations with etomidate
- Methohexital and propofol produced dose dependent decreases in motor and EEG seizure duration
- Awaking times were similar for all three medications although discharge time was 5-7 min longer after etomidate than methohexital or propofol due to prolonged cognitive dysfunction
- Propofol and methohexital, at doses more than 1 mg/kg, lead to 35%-45% decreases in ECT-induced seizure duration compared to etomidate
- Etomidate, 0.15-0.3 mg/kg, has minimal effect on the duration of ECT-induced seizure activity

Gurmamik S, Young R, Alesker E. Divided doses of methohexitone improves ECT outcome. Can J Anaesth. 1996;43:535.

- Split dose of methohexital (total dose 0.66-0.8mg/kg) to prolong seizures but prevent recall.
- The first (75% of total MH) is given together with succinylcholine (0.8-1.0 mg/kg) and remainder is given after convulsions.

8

Muscle Relaxation

Succinylcholine 1-1.4mg/kg

- CI: neuromuscular disease, hyperkalemia, MH susceptibility, pseudocholinesterase deficiency

Rocuronium 0.4-0.6 mg/kg (+ sugammadex 8mg/kg)

9

Muscle Relaxation

Mirzakhani, H., Guchelaar, H.-J., Welch, C. A., Cusin, C., Doran, M. E., MacDonald, T. O., Bittner, E. A., Eikermann, M., & Nozari, A. (2016). Minimum Effective Doses of Succinylcholine and Rocuronium During Electroconvulsive Therapy: A Prospective, Randomized, Crossover Trial. *Anesthesia and Analgesia*, *123*(3), 587–596.

- Crossover, blinded, prospective randomised study involving 227 ECT sessions in 45 patients
- Succs 0.8mg/kg or roc 0.4mg/kg initially administered and dose adjusted up/ down according to assessment of blockade
- Succs 0.77-1.27mg/kg or roc 0.36-0.6mg/kg needed for twitch suppression of 90+%

Kadoi Y, Hoshi H, Nishida A, Saito S. Comparison of recovery times from rocuronium- induced muscle relaxation after reversal with three different doses of sugammadex and succinylcholine during electroconvulsive therapy. J Anesth. 2011;25:855–9.

- 17 patients who underwent at least 10 ECT sessions induced with propofol (1 mg/kg) and rocuronium (0.6mg/kg) *or* succinylcholine (1 mg/kg)
- Patients who received rocuronium were infused with sugammedex 16, 8, or 4 mg/kg immediately after the seizure stopped
- Rocuronium (0.6 mg/kg)-sugammadex (8 mg/kg) had equipotent efficacy as succinylcholine (1.0 mg/kg) in terms of both induction time of neuromuscular effects and recovery from neuromuscular effects

10

Seizure Augmentation

Hyperoxia

- Beneficial to FRC
- May improve seizure quality, seizure duration, and decrease stimulus charge needed to elicit seizure.

Hyperventilation/ hypocapnia

- Ventilation rate of 40–45 per minute is associated with end tidal CO2 below 30 mmHg
- Limited research showing its efficacy in enhancing seizures yet it has no adverse effects in ECT
- May magnify an increased vasoconstrictive response to hypocapnia in patients with altered cerebral physiology (Alzheimers, neurotrauma, meningitis, vascular disorders)

11

Seizure Augmentation

Longer time period between induction and ECT

Taylor R, Wark H, Leyden J, et al. Effects of the Anaesthetic-ECT time interval and ventilation rate on seizure quality in electroconvulsive therapy: A prospective randomised trial. Brain Stimulation. 2020: 13; 450- 456.

- Prospective, crossover trial involving 54 patients induced with thiopentone in 209 ECT sessions
- Patients were randomised to variations in anaesthetic technique at four sequential ECT treatment sessions: short or long anesthetic-ECT time interval (1 min 30 sec vs 2min 30 sec) and normal ventilation or hyperventilation (8-10 breaths/min vs 25 breaths/min)
- Longer time intervals between induction and ECT produced higher quality seizures of longer duration.
- Ventilation rate did not significantly influence seizure quality or duration

Caffeine (250-1000 mg) as caffeine sodium benzoate

- Caffeine sodium benzoate (CSB) 500 mg/2 mL contains caffeine 250 mg/2 mL
- Caffeine citrate has been used during CSB shortages successfully for ECT
- Less stimulus required and longer seizure durations
- Less effect on seizure quality
- Possible tolerance to efficacy of caffeine over time requiring increased doses over treatment course without increasing stimulus
- SE: anxiety, tremors, olfactory sensations, arrhythmias

12

Seizure Augmentation

Ketamine (0.5mg/kg)

- Controversial whether it can enhance or accelerate antidepressant effects of ECT
- Increases seizure duration
- Increase BP, HR and ICP
- Possible better post ECT cognitive function

Remifentanil (1 µg/kg)

- To minimize methohexital or propofol dosage
- May not carry seizure inducing properties

13

Cardiovascular Adjuncts

Glycopyrrolate (0.2-0.4mg)

- Prevents profound bradycardia during initial parasympathetic response
- Can help mitigate excessive oral secretions caused by ECT

Labetalol (0.3 mg/kg)

Esmolol (1.0 mg/kg)- immediately before or after seizure

Nicardipine (1.25–5 mg)

NTG (3 µg/kg)

14

Common Adverse Events

Table 6.2 Post-ECT telephone interview 24 h after ambulatory ECT (762 ambulatory ECT procedures in 40 patients) (Revised from Ref. [5])

Adverse events	Headache	144 (19 %, 23 patients)
	Muscle pain	53 (7 %, 18 patients)
	Nausea	14 (2 %, 9 patients)
	Vomiting	2 (0.3 %, 2 patients)

Sato, S. Anesthesia Management for Electroconvulsive Therapy- Practical Techniques and Physiological Background. Springer: 2016.

15

Common Adverse Events

Headaches

- Acetaminophen (po or IV)
- NSAIDs (ibuprofen po, ketorolac)
- Sumatriptan

Muscle aches

- Acetaminophen (po or IV)
- NSAIDs (ibuprofen po, ketorolac)
- Consider nondepolarizing muscle relaxant prior to succinylcholine for refractory cases of generalized muscle pain

Nausea

- Ondansetron, dexamethasone, metoclopramide, droperidol
- Consider switching to propofol as induction agent in refractory cases

16

Complications

- Dental damage, tongue and lip lacerations, fractures, dislocations
- Prolonged seizure- over 120-150 sec
- Cognitive impairment
  - Agitation
  - Memory dysfunction

17

Prolonged Seizure

Risk factors

- Benzodiazepine withdrawl
- Proconvulsant medication (caffeine, lithium)
- Epilepsy

Management

- Midazolam 1-2mg or methohexial/ propofol bolus with 2nd dose if needed
- Lorazepam 2-4mg/ diazepam 5-10mg/ phenytoin 18-20mg/kg if sz continues after 2nd dose of anesthetic agent
- Intubate, check electrolyes and ABG, and stat neuro consult if still persists

18

Agitation

5 minute to 1 hour duration

Involves disorientation, restlessness, nonresponse to verbal commands, panic like behavior

Risk factors
- High stimulus current, restimulation, bilateral ECT
- High preECT anxiety level
- Lithium use
- Insufficient anesthetic doses
- Long seizure

19

Agitation

Adjuncts
- Midazolam (0.5-2mg)
- Haloperidol 5-20mg
- Methohexital (<0.5mg/kg)
- Propofol (0.5mg/kg bolus at end of sz +/- infusion)
- Dexmedetomidine (0.5 µg/kg dose administered 10 min prior to ECT or 1µg/kg x 10min at end of seizure)
  - Reduces acute HD changes induced by ECT
  - Reduces the extent of post-ECT agitation without affecting seizure duration or patient recovery time

Other considerations
- Left-handed patients with postictal agitation after unilateral ECT may improve when switched to contralateral placement in order to stimulate the nondominant hemisphere
- Hold lithium for 24 hours prior to ECT

20

Memory Disturbance

Risk factors
- High stimulus current, bilateral ECT, multiple treatments
- Older age
- Preexisting cognitive dysfunction
- Low education level

Anterograde amnesia
- Difficulty in learning new information
- Mainly in first 3 days posttreatment

Retrograde amnesia
- Difficulty in recalling information learned before ECT
- improves over weeks to months but may not completely resolve particularly for recall during the ECT treatment period

21

Good Resources

Loo C, Simpson B, MacPherson R. Augmentation Strategies in Electroconvulsive Therapy. *The Journal of ECT.* 2010; 26 (3): 202-207. doi: 10.1097/YCT.0b013e3181e48143.

Datto, C, Rai A, Ilivicky H, Caroff S. Augmentation of Seizure Induction in Electroconvulsive Therapy: A Clinical Reappraisal. *J ECT.* 2002;18(3):118-125.

Saito, S. Anesthesia Management for Electroconvulsive Therapy- Practical Techniques and Physiological Background. Springer: 2016.

22