Seizures, Absence (Petit Mal)

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Risk

- Incidence of absence seizures in USA is 1.9–8 cases per 100,000 population.
- Seizures are most common in children aged 4–14 y but rare in adults.

Perioperative Risks

- Risk of transition of absence seizures into tonic-clonic seizures or SE is low but still possible.
- Seizure induced sequelae, including physical injuries, tachycardia, hypertension, hypoxia, metabolic acidosis, pulm aspiration, elevated ICP, and cerebral edema.

Worry About

- Seizure induction with periop drugs and hyperventilation can occur, especially with sevoflurane induction.
- Altered pharmacokinetics and dynamics with anticonvulsants: Resistance to neuromuscular blockers and opioids with chronic therapy
- Maintain serum anticonvulsant levels.

Overview

- Absence seizures are a common seizure disorder of childhood; up to two-thirds of pts are girls.
- Age of onset has bimodal distribution, with the first peak at 6–7 y (childhood) and the second around 12 y (juvenile).
- International League against Epilepsy classification of absence seizures:
  - Absence seizures: Typical or atypical.
  - Absence with special features: Includes myoclonic absence and eyelid myoclonia.
- Typical absence seizures are brief absence (5–20 sec), with impairment of consciousness and an abrupt onset/offset, often accompanied by one or more mild motor manifestations: staring, behavioral arrest, eyelid fluttering, or hand/face automatisms.
- Atypical seizures have a less rapid onset/offset with more motor features and prolonged seizures.
- Hyperventilation and bright flickering lights are common triggers for absence seizures, except for atypical absence seizures, which often occur during drowsiness.
- Attacks may be few or occur >100 times per d.
- Accidental injuries are rare.
- Minimal postictal sequelae occurs: EEG and consciousness return immediately.
- SE may occur: Convulsive and nonconvulsive SE are possible
- Remission rate for childhood absence epilepsy is 80%; juvenile myoclonic epilepsy carries a high risk of generalized tonic-clonic seizures.

Etiology

- Strong genetic predisposition in otherwise normal children.
- A mutation in the GABA (A) receptor gene was found in some pts with childhood absence epilepsy.
- Structural lesions in adults.

Usual Treatment

- ESM or VPA are first-line drugs. If there is a high risk of generalized tonic clonic seizures, VPA should be used.
- LTG is an alternative agent. Often a combination treatment may be needed.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEME	Agranulocytosis (ESM, VPA) Thrombocytopenia (VPA) Pancytopenia (ESM)			CBC with plt count
RESP	Hyperventilation may induce seizure			
GI	Hepatotoxicity (ESM, VPA) GI upset (VPA)	GI Sx		Liver enzymes
CNS	EEG typically normal between seizures Normal development is rule			EEG
ENDO	Insulin resistance and metabolic syndrome (VPA) Subclinical hypothyroidism (VPA)			Blood sugar TSH
MS	Mild myoclonic movements		Movements	

Key References: Barakat A, Mallory S: Anaesthesia and childhood epilepsy, *Contin Educ Anaesth Crit Care Pain* 11:93–98, 2011; Tenney JR, Glauser TA: The current state of absence epilepsy: can we have your attention? *Epilepsy Curr* 13(3): 135–140, 2013.

Perioperative Implications

Preoperative Preparation

- Continue anticonvulsants on the day of surgery.
- Determine characteristics of typical seizures and frequency, compliance with anticonvulsants therapy.
- Ensure therapeutic anticonvulsant levels.
- Avoid triggers (e.g., bright flashing lights, hyperventilation, crying).

Monitoring

- Routine
- Depth of anesthesia monitors

Airway

- No issues

Induction (General Anesthesia)

- Standard induction drugs provide anticonvulsant action.
- Sevoflurane induction in conjunction with hypocapnia can produce epileptiform spikes and seizure activity in children.
- Avoid etomidate and ketamine; these lower seizure threshold.

Maintenance

- Normocarbia unless otherwise indicated
- Interaction between NMBs and anticonvulsants

Extubation

- Delayed emergence could be because of sedation from periop anticonvulsant use and nonconvulsive SE.

Regional Anesthesia

- Check coagulation profile; use lowest effective LA dose.
- Avoid transarterial injections.

Postoperative Period

- Anticonvulsants should be restarted as soon as possible.
- Adequate pain management is important to avoid stress-induced hyperventilation.

Anticipated Problems/Concerns

- Major periop morbidity is rare.
- Transition of absence seizures into tonic-clonic seizures or SE is the major concern, which would modify the periop risk.

Seizures, Epileptic

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Risk

- Incidence of epilepsy estimated to be 0.5–2.3%.
- 30–40% of pts with epilepsy will develop intractable seizures (>1/mo refractory to two or more medications).
- Approx 400,000 people in USA have medically uncontrolled epilepsy.

Perioperative Risks

- Epilepsy has causality with a variety of syndromes throughout multiple systems.
- Various psychiatric disorders are assoc with epilepsy (e.g., migraines, depression, psychosis), and antiepileptic drugs are associated with mood, behavior, or cognition disturbances.
- 2 cases per 1000 pt-years result in sudden death associated with epilepsy.
- Many antiepileptic drugs induce hepatic enzymes (p450) or inhibitors which may affect blood levels of drugs such as warfarin, tricyclic antidepressants, statins, chemotherapeutic agents, and antivirals. Specific to anesthesia are NDMRs.

Worry About

- Different anesthetic effects on seizure threshold.
- Antiepileptic drug therapy-induced resistance to NDMRs and opioids.
- Anticonvulsant-induced blood dyscrasia (carbamazepine and others), hepatitis (valproate and others), Stevens-Johnson syndrome, toxic epidermal necrolysis (lamotrigine and others; 10× greater risk for carbamazepine with Chinese ancestry), and hyponatremia (oxcarbazepine).
- Rapid IV administration of IV phenytoin can cause profound hypotension.
- Acidosis in pts following a ketogenic diet as part of an anticonvulsant regimen.

Overview

- Epilepsy can lead to significant reduction in pt ADLs.
- Cognitive decline can be worsened by organic damage from refractory epilepsy, side effects of an anticonvulsant regimen, and increased social isolation from societal misunderstanding of the disease.
- Newer AEDs are generally well tolerated, but most still have significant side effects.
- Seizures are categorized as partial (simple, complex, or with generalization), generalized (convulsive or nonconvulsive), absence, nonepileptic (pseudoseizures), or unclassified. Up to 56% of comatose neurologic ICU pts have seizure activity.

Etiology

- Congenital often associated with other syndromes such as tuberous sclerosis, neurofibromatosis, multiple endocrine adenomatosis, and Jervell-Lange-Nielsen syndrome.
- Acquired associated with traumatic brain injury, stroke, brain tumor, Alzheimer, or idiopathic causes.

Usual Treatment

- Antiepileptic drugs, as monotherapy or in combination, include phenytoin, barbiturates, benzodiazepines, carbamazepine, and newer agents such as levetiracetam, lamotrigine, topiramate, oxcarbazepine, and many others.
- 13% of epileptic pts are thought to be candidates for epilepsy surgery, but only about 1% actually undergo surgery.
- Surgical techniques include temporal lobectomy (sometimes with epileptic foci mapping performed awake or asleep), deep brain stimulators, or fiberoptic laser ablation.
- A ketogenic diet is a nonpharmacologic approach to epileptic management.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEENT	Gingival hyperplasia	Phenytoin use		
CV	Cardiac tumors with tuberous sclerosis Increased incidence of sudden death with epilepsy (anesthetic implications unknown) Hypotension	Tuberous sclerosis Phenytoin use	Murmur possible	ECHO
RESP	Pulm involvement with neurofibromatosis; lipoid pneumonia	Neurofibromatosis Ketogenic diet	Cor pulmonale Pneumonia	CXR ECG Chest CT
GI	Anticonvulsant-induced hepatitis	Anticonvulsant use (except levetiracetam)	Jaundice, tender RUQ	LFTs if symptomatic
ENDO	Hyponatremia, hypothyroid, acidosis	Carbamazepine use (rare); ketogenic diet		Na^+ Plasma glucose, ketones
CNS	Tolerance to opioids, psychiatric disturbances, depression	Anticonvulsant use Organic brain disease		Assess effects of preop sedatives
MS	Tolerance to NDMRs	Anticonvulsant use		TOF monitoring in the OR

Key References: Kofke WA: Anesthetic management of the patient with epilepsy or prior seizures, *Curr Opin Anaesthesiol* 23(3):391–399, 2010; Kang HC, Chung DE, Kim DW, et al.: Early and late-onset complications of the ketogenic diet for intractable epilepsy, *Epilepsia* 46(2):272–279, 2005.

Perioperative Implications

Preoperative Preparation

- History and physical exam, including neuropsychiatric status.
- Determine antiepileptic drug Hx and review potential drug interactions.
- Obtain drug levels (phenytoin) if possible.
- Assess for signs of concurrent disease, such as murmur suggestive of myocardial tumor (tuberous sclerosis) or stigmata of neurofibromatosis.
- Lytes (Na+), plasma glucose, and ketones.

Monitoring

- For seizure surgery, EEG may be placed intraop.
- Epileptic mapping can be performed while pt is awake or asleep.

Airway

- Routine considerations

Preinduction/Induction for Epilepsy Surgery

- GA propofol or barbiturates (if available), etomidate are all acceptable. Avoid ketamine or nitrous-narcotic.
- For conscious analgesia craniotomy: Position determined by protection of pressure points. O_2 delivered by nasal prongs or facemask with capnography. Have airway adjuncts (nasal airway, LMA, ETT) immediately available. Analgesia/sedation administered using short acting opioid (remifentanil, alfentanil), propofol, and dexmedetomidine. Scalp block and local infiltration at frame pinning sites before surgical incision.

Maintenance

- Inhale anesthetic at less than 1 MAC, TIVA, or a balanced anesthetic are appropriate for GA.
- If the surgeon wishes to induce a seizure during intraop EEG monitoring, low dose propofol and inhalational less than 1 MAC are acceptable. To facilitate seizures, methohexital, etomidate, alfentanil, and remifentanil have been used.
- For conscious sedation, continued titration of sedation/analgesia during painful parts of procedure.
- Consider "asleep-awake-asleep" anesthetic plan with appropriate airway management during "asleep" portions of the surgery.

Extubation

- NMB agents and narcotics may not last as long as expected, with unanticipated coughing as procedure comes to close. Low dose IV lidocaine can suppress coughing. Consider remifentanil infusion until out of surgical frame.

Adjuvants

- Muscle relaxants: Enzymatic induction can lead to fast metabolism. Consider titrating an infusion to a desired train of four.
- Opioids tolerance with antiepileptic drug therapy.
- Recovery or withdrawal from anticonvulsant anesthetics can precipitate seizures.
- Antiepileptic drug levels can be significantly affected by anesthetics, changes in body physiology, ketogenic diet, and prolonged NPO status.

Postoperative Period

- Blood levels of antiepileptic drugs can be unpredictable. Be ready to redose additional anticonvulsants.
- Monitor serum glucose.
- Numerous case reports of postop seizures with a variety of anesthetics suggest ongoing concern for this possibility.

Anticipated Problems/Concerns

- Blood levels of antiepileptic drugs can be significantly affected by anesthetics, changes in physiology, and prolonged NPO status; may also affect non-AED drug levels as a result.
- Opioid tolerance may result in increased need for pain medication.
- Be prepared to treat postop seizures with additional anticonvulsants, benzodiazepines, barbiturates, or propofol.