MitoAction
The Brain’s Mitochondria

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The Brain

![Diagram illustrating the brain's sensory input and motor output processes.](image)
Brain Facts

- The brain contains 100 billion cells
- Each nerve cell connects to 1 to 10 thousand other nerve cells
- The brain uses 20% of your body’s energy but only makes up about 2% of your body’s weight
- Your brain triples in size in the first year of life
Energy Demands

- Because the energy demands are so high for the brain, it often doesn’t work right in people with mitochondrial disease.
Common Brain Symptoms

- Symptoms are often sporadic and can be related to the underlying metabolic status
  - Seizures
    - Myoclonus
  - Ataxia
  - Strokes
  - Migraine Headaches
Seizures

- Definition = uncontrolled electrical activity in the brain that may produce a physical convulsion
- Epilepsy = recurrent, unprovoked seizures
Seizure Classification

- Partial Onset
  - Simple Partial
  - Complex Partial
  - Partial with secondary generalization
- Generalized Onset
Seizure Types

- Tonic
- Tonic-Clonic
- Absence
- Focal Motor
- Sensory
- Myoclonic
- Atonic
Special Considerations in Mitochondrial Disease

- Seizures are often partial onset & may change over time
- Seizures may be very difficult to treat
- Seizures may be triggered by metabolic changes in the body
- There are certain medications that must be avoided: DEPAKOTE
Myoclonus

- Definition = brief, involuntary twitching of a muscle
- It may or may not be associated with a seizure
Myoclonus

- Often associated with mitochondrial disorders
- Can be debilitating & a major cause of injury
- Treatments are available to help with the symptoms
Special Considerations in Mitochondrial Disease

- There are several effective treatment options for myoclonus:
  - Levetiracetam (Keppra)
  - Clonazepam (Klonopin)
  - Topiramate (Topamax)
  - Acetazolamide (Diamox)

DO NOT USE VALPROIC ACID (DEPAKOTE)
Ataxia

- Definition = lack of coordinated movements when performing voluntary actions
- Often caused by cerebellar degeneration
- Seen frequently in people with mitochondrial disease
Ataxia Symptoms

- Tremor
- Poor balance
- Wide-based gait
- Breathy speech
- Scanning eye movements
Ataxia Treatments

- There is no medical treatment for ataxia
- Patients are encouraged to seek therapy:
  - Physical therapy to help build strength and enhance mobility
  - Occupational therapy to help with daily living tasks, such as eating
  - Speech therapy to improve speech and aid swallowing
Special Considerations in Mitochondrial Disease

- Ataxia increases your risk to fall and injury yourself
- Ataxia is often progressive in people with mitochondrial disease
- Assist devices (canes, walkers) can allow patients to maintain mobility while decreasing the risk of falls
Strokes

- Definition = rapidly developing loss of brain function from a disrupted supply of blood to the brain
Causes of Stroke

- Clotted blood vessel
- Emboli
- Lack of oxygen
- Bleeding
- Vasospasm
Special Consideration in Mitochondrial Disease

- Strokes in mitochondrial patients usually occur at a younger age.
- Strokes in mitochondrial patients are usually not from clotted blood vessels and will not respond to standard treatments (tPA).
Special Consideration in Mitochondrial Disease

- Blood vessels dilate (get bigger) and constrict (get smaller) in response to the needs of the part of the body they are supplying
Special Consideration in Mitochondrial Disease

- Vasospasm is a sudden unnecessary constriction of the blood vessel that results in decreased flow
- Recent studies have shown that strokes in people with MELAS may be caused by vasospasm
Special Consideration in Mitochondrial Disease

- Nitric Oxide is a chemical produced by the cells that causes blood vessels to dilate (get bigger)
- Nitric Oxide production requires L-arginine
- Research has shown that patients with MELAS do not have enough L-arginine in their blood
Special Consideration in Mitochondrial Disease

- A vasospastic stroke may be helped by using either L-arginine or L-citrulline to increase nitric oxide production.
- Mitochondrial patients who develop a vasospastic stroke should receive L-arginine through an IV – this may decrease the severity of the stroke.
Special Consideration in Mitochondrial Disease

- Patients with a high risk to have vasospastic strokes may be placed on daily oral L-arginine to try and prevent a stroke from occurring
Migraine Headaches

Definition = chronic headache syndrome where patients develop moderate to severe headaches often associated with other symptoms

- Photophobia
- Phonophobia
- Nausea
- Vomiting
Types of Migraine Headaches

- Migraines without aura
- Migraine with aura
  - Confusional
  - Hemiplegic
  - Basilar
  - Acephalic
- Cyclic vomiting/Abdominal migraine
- Retinal migraine
- Ophthalmoplegic migraine
Special Consideration in Mitochondrial Disease

- Migraines are a common feature of people with mitochondrial disease
- They can be severe and debilitating
- Migraines often have a vascular component and L-arginine may make them better or worse
Special Consideration in Mitochondrial Disease

- Prophylactic treatments are available for people who are experiencing frequent migraines
  - Topamax
  - Elavil
  - Propranolol

DO NOT USE DEPAKOTE
In Summary

- People with mitochondrial diseases experience common neurologic problems.
- The frequency of these problems is higher and symptoms may occur at a younger age.
- Treatments may be different in people with mitochondrial disease because the cause may be different.