MITOCHONDRIAL DISEASE AND AUTISM

Bridging the Gap

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OBJECTIVES

To provide basic background information on Mitochondrial Disease, its clinical features, diagnosis, treatment, prognosis, inheritance and to discuss its association with Autistic Spectrum Disorders (ASD).

DISCLAIMER

Dr Kendall and Virtual Medical Practice have no financial interest in any laboratory.
THE BIG QUESTIONS

What are Mitochondria?

What is Mitochondrial Disease?

• Unusual mitochondria in child with mitochondrial disease
• Note many cristae on the right as if this organelle is trying to compensate for its lack of function.
Our Bodies Cells

- Smallest functioning unit of our bodies
- Many cells together make up tissues
- Many sheets of tissues make up our organs
The Powerplants

- Located inside our body cells
- Composed of an inner and outer membrane
- The energy producing pathway is the respiratory chain
- The respiratory chain consists of 5 complexes (groups of chemicals) that produce ATP
The Respiratory Chain

- Oxygen & phosphate used to make energy
- Composed of five complexes or groups of chemicals with a total of ~90 subunits
- Energy packets are known as ATP
Electron Transport Chain
Mitochondrial Energy Disorders

- Found in 1 in 4,000 individuals
- Carrier rate of common mtDNA mutations may be as high as 1 in 200
- Caused by an alteration in our inherited blueprint (gene mutation) or “toxic” affect of external factor such as medication
- Results in decreased energy production and localized or widespread problems
The Genetics of Mito Disease

- There are hundreds of genes involved in coding for the various proteins and other compounds involved in OXIDATIVE PHOSPHORYLATION or mitochondrial energy production.

- These genes are contributed by two sets of inherited genetic material; the nuclear genes located inside the nucleus of our body cells and mitochondrial genes found inside the mitochondria of our cells.

- **Nuclear genes** are inherited from both parents and contribute the vast majority of the information needed for energy production.

- **Mitochondrial genes** are inherited EXCLUSIVELY through mom and contribute the remaining information.
Features of Mitochondrial Nuclear Genes

- Approximately 850 proteins are encoded for by the nuclear mitochondrial genes
- Many of these proteins are responsible for the control of electron transport chain structure and function and assembly
- Autosomal recessive inheritance of nuclear gene defects is probably the most common etiology of pediatric patients with mitochondrial disorders.

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Features of Mitochondrial DNA (mtDNA)

- Inherited exclusively through the maternal line
- Circular molecule, a number of copies in each mitochondrion (5-10 copies typical)
- 16,569 bases or pieces and 37 genes
- Mutated mtDNA may be present in varying amounts with wild type DNA (heteroplasmcy)
Mitochondrial DNA
HETEROPLASM OF mtDNA