Hyperthyroidism (also known as Graves' disease)

Patient and family information, brought to you by the Education Committee of APSA

Overview - "What is it?"

Hyperthyroidism occurs when the thyroid gland, located in the neck, becomes overactive and produces too much thyroid hormone. The thyroid makes hormones to regulate metabolic functions within the body and help the body grow. An imbalance in hormone production affects the body in a negative way. Thyroid hormone stimulates the body's metabolism, so too much thyroid hormone causes the body to work abnormally hard.

Hyperthyroidism is rare in children and the incidence increases as children age. Incidence of hyperthyroidism 0.1 in 100,000 in young children and 0.3 in 100,000 in adolescents.

Conditions causing hyperthyroidism include:

- ***Graves' Disease:*** An autoimmune disorder where the body produces antibodies which stimulate the thyroid hormone production. Grave's disease accounts for 95% of hyperthyroid cases in children.
- ***Goiter or Thyroiditis:*** generalized enlargement of the thyroid. Thyroiditis can occur due to several reasons including medications, iodine deficiency, virus, inflammatory or autoimmune disfunction.
- ***Nodules*** (one or more separate masses in an otherwise normal sized thyroid gland) are extremely rare; however, thyroid nodules in children are cancerous 20% of the time. The most common reason why a person would have a cancerous thyroid nodule would be history of neck irradiation.
- ***Congenital hyperthyroidism*****:** genetic disorders causing mutations to receptors on the thyroid to release hormones.

Associations: Children with other autoimmune diseases are at risk for Graves' disease.

Signs and Symptoms - "What symptoms will my child have?"

Early signs: Childhood symptoms include nervousness, irritability, diarrhea, weight loss even in the setting of increased appetite, insomnia, fatigue, hair thinning and poor performance in school.

Later signs/symptoms: Neck swelling (goiter) and exophthalmos (protruding eyes), weight loss, sweating, heart palpitations (irregular heartbeat) may be seen over time. Children with hyperthyroidism for a long time can have delayed onset of puberty or menstrual cycles.

Diagnosis - "What tests are done to find out what my child has?"

Physical Exam: Children may have high blood pressure, fast heart rate and weight loss. Palpation (feeling) of the neck by parent or physician may identify a single nodule/lump vs swelling throughout the entire thyroid gland.

Labs: Blood work is the initial set of testing and is checked for increased levels of thyroid hormones (T4 and T3). TSH, a hormone from a gland in the brain (pituitary gland) which stimulates the thyroid, should be low unless there is a pituitary tumor present.

Thyroid scan: A Radioactive Iodine Update (RAIU) test may be performed and looks for increased tracer uptake (activity) throughout the thyroid gland. A small amount of radioactive iodine tracer is injected in a vein or given by mouth, followed by thyroid examination with a special machine to see how much radioactive tracer is taken up by the thyroid gland.

Thyroid Ultrasound: may be obtained if there is a question of a mass or a nodule in the gland. An ultrasound uses sound waves to create an image or picture of parts of the body without using radiation.

Thyroid biopsy: Obtaining thyroid tissue by using a needle inserted into a thyroid nodule—also called fine-needle aspiration (FNA). The tissue will be evaluated under a microscope and can guide the next step in management. This particular step is helpful to rule out cancer if there is a nodule. Ultrasound can guide the surgeon to where the needle can be placed to target the nodule.

Conditions that mimic this condition: An enlarged thyroid gland can sometimes be caused by thyroid cysts, tumors or inflammatory conditions of the thyroid (thyroiditis).

Treatment - "What will be done to make my child better?"

Medicine: Depending on the cause of hyperthyroidism, certain medications can be offered and are typically the first step in treatment. For Graves' disease, anti-thyroid medication that blocks thyroid hormone production are usually tried first. These medications are quite effective. Sometimes, medications which help with side effects of hyperthyroidism, such as racing heart rate and high blood pressure, are added (beta blockers). Long-term remission may be achieved in 25-65% of patients after the medications are stopped, which indicates a high relapse rate. If caused by thyroiditis, or inflammation of the thyroid, anti-inflammatory medicines, steroids or antibiotics, and time is needed for the condition to get better. It can take two months to more

than a year for some therapies for the child to get well fully. Long term medication is difficult to be compliant with, especially in children, and less than 30% achieve long lasting remission after 2 years of oral medication.

Radioactive isotopes: This method of treatment uses highly radioactive iodine (radioactive I^{131}) to destroy the thyroid gland in children with Graves' disease. The radioactive iodine is given through a vein, and it is taken up by the thyroid gland. The radioactivity destroys the thyroid. This is a good approach in some patients who find taking daily medications to be hard and those who are not candidates for surgery. Although effective, there is the risk of hypothyroidism (low thyroid levels) is increased especially when used in children. Typically, radioactive iodine is not recommended in children younger than five years of age.

Surgery: Indications for surgical therapy are reserved for children who have appropriately taken the antithyroid medication, but hyperthyroidism reoccurred, for those who are unable to take medications daily, and for those who had toxicity from the antithyroid medications. Surgery is used less commonly than radioactive therapy, unless child has a large nodule/goiter or protruding eyes. Total thyroidectomy (removal of all of the thyroid gland) is the surgery. Depending on the extent of the operation and the size of the gland removed, a drain may be left in place to gather fluid that may collect post-operatively

- **Preoperative preparation:** Patients are often started on a hormone blockade, iodine medication and a beta blocker preoperatively, to protect against the release of extra thyroid hormone during the operation. Extra release of hormones may increase the heart rate and blood pressure at dangerously high levels during the stress of surgery.
- **Postoperative care:** An overnight stay is usually recommended. Pain medications are given. Blood levels of calcium may be monitored as well as quality of voice (hoarseness or breathiness). Your child will be monitored with blood tests to make sure they do not need thyroid supplement due to hypothyroidism.

Risks/Benefits: Surgery is effective in treating hyperthyroidism. However, it does require an operation with complications occurring roughly 5% of the time. Complications include bleeding, wound infection, damage to the nerves controlling the vocal cords, damage to the parathyroid glands which control calcium levels in the blood, scarring, and hypothyroidism. Of these complications, 1-2% may persist long term.

Home Care - "What do I need to do once my child goes home?"

Diet: Your child should be able to resume a normal diet without restrictions.

Activity: Your child can return to normal activity.

Wound care: Keep the incision clean and dry for 24-72 hours after surgery. After this, children are able to shower and wash the incision with soap, but avoid submerging the incision in water

for another 1-2 weeks. Your surgeon will give direct instructions how to manage the incisional care.

Medicines: Medication for pain such as acetaminophen (Tylenol®) or ibuprofen (Motrin® or Advil®) or something stronger like a narcotic may be needed to help with pain for a few days after surgery. Stool softeners and laxatives are needed to help regular stooling after surgery, especially if narcotics are still needed for pain.

- Take any thyroid hormone replacements as directed.
- If calcium levels are found to be low, calcium supplements may be necessary.

What to call the doctor for: Redness around the wound, swelling or green/yellow drainage from the incision, recurrence of symptoms (racing heart rate, palpitations), changes in voice patterns, difficulty swallowing, tingling and numbness of the fingers and around the mouth.

Follow-up care: You will follow up with your surgeon to check the wound and make sure things are healing well. Your pediatrician and/or endocrinologist will check thyroid hormone levels to make sure these normalize after surgery.

Long Term Outcomes - "Are there future conditions to worry about?"

The two major long-term risks of surgery are hoarseness caused by injury to the nerve controlling the voice box that runs adjacent to the thyroid gland, and low calcium levels due to injury to the glands (parathyroid) that control calcium.

Your child will have long-term follow up with his/her pediatrician or endocrinologist (doctor specializing in disorders of endocrine glands such as the thyroid gland).

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