CONGENITAL ADRENAL HYPERPLASIA (CAH)

1. What are the adrenal glands?

The adrenal glands are two small structures on top of each kidney in the tummy. The outer part of the adrenal gland (called the cortex) makes three different hormones (sometimes called steroids):

Cortisol: controls the levels of energy, salt and sugar in the blood. Cortisol is also needed to help the body cope with the stress of infection or serious injury.

Aldosterone: stops the kidneys from losing too much salt in the urine and retains normal blood pressure.

Adrenal Androgens: sometimes referred to as male hormones but are made by the adrenal glands of both boys and girls.

2. What is Congenital Adrenal Hyperplasia (CAH)?

The term congenital adrenal hyperplasia (often shortened to CAH) describes the condition:

Congenital: means from birth

Adrenal: the glands affected

Hyperplasia: overgrowth or thickening of the outer layer of the gland which happens as the adrenal cortex tries to make steroids but is unable to.

3. Why does CAH happen?

The adrenal glands make steroid hormones starting from cholesterol. This is done by the action of several enzymes. Children with CAH have an adrenal enzyme that cannot work properly so they end up not being able to make enough cortisol. Three out of 4 children with CAH are also not able to make enough aldosterone. The body senses that there is not enough cortisol and tries to push the adrenal glands to make more. While trying to make enough cortisol the adrenal glands also make too much of the adrenal androgen hormones.

4. How is CAH inherited?

Genes are like a set of instructions for our body that are inherited from our parents, one from each parent, so we end up having two genes controlling each function. Children with CAH inherit a gene from each parent that has a compromising change in it (called a mutation). This means that the corresponding enzyme is not able to work properly and therefore the adrenal glands are not able to make enough cortisol.

5. How does CAH affect a child?

This depends on how much the particular enzyme is affected. In some children with CAH the enzyme is not working at all and therefore they are not able to make any cortisol. These children will be more affected and will be diagnosed with CAH at or soon after birth. In another subset of children the compromising change in the enzyme is milder and children are able to make some cortisol and therefore diagnosis of CAH is made later in childhood or puberty.

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The adrenal glands start to work before a baby is born, in the embryo. Babies who are seriously affected will make far more adrenal androgens than usual. In baby girls this affects how their external genital area develops. The clitoris gets bigger, the labia may be fused together and the openings for the vagina and urethra can be partly closed. Baby boys may have slightly darker skin than usual around their penis and scrotum but have no genital abnormality at birth.

In severe forms of CAH in which both cortisol and aldosterone production is affected, children will lose too much salt in their urine. This means the salt levels in the blood will become dangerously low within the first two or three weeks of life. and they will develop hypotension. The baby will not be gaining weight, is likely to be vomiting, become dehydrated and unsettled. If this is not treated the baby will become critically ill and collapse. This is called an 'adrenal crisis' and can be fatal if not treated promptly.

Girls and boys who are less severely affected may be diagnosed in early childhood or puberty when they develop pubic hair too early, girls show a male hair pattern or excessive hair growth, severe forms of acne, menstrual irregularities etc.

6. Are there different types of CAH?

CAH is always caused by an adrenal enzyme that is needed to make cortisol, with complete or partial insufficiency.

Sometimes CAH is classified into different subgroups (based on the specific enzyme affected or the remaining ability to produce cortisol) in order to help us better understand the condition or decide on the best treatment options. The ability of the affected adrenal enzyme to make cortisol may be different even in children from the same family. The most common form of CAH, overall comprising approximately 95% of cases, is called 21-hydroxylase deficiency and results from the enzyme labeled CYP21 being affected. The enzyme may be affected completely or partly.

7. How is CAH treated?

CAH is treated by replacing the hormones that the adrenal glands are unable to make.

The tablet most commonly used in children to replace cortisol is known as **hydrocortisone**.

The tablet used to replace aldosterone is known as **fludrocortisone**. For babies affected by low aldosterone levels, extra salt (called sodium chloride) is usually needed for during the first year of life in order to help them maintain their salt levels.

8. What about the high androgen levels?

Giving the child hydrocortisone and fludrocortisone means that their body stops pushing the adrenal glands to overwork, so they no longer make excessive amounts of adrenal androgens.

9. Will my child develop normally?

The treatment goal is to remain healthy with normal growth and development as well as preventing health problems in later life. However, it can be hard to get the balance right between giving too little or too much treatment:

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- Too much hydrocortisone causes weight gain and slowing of growth; too much fludrocortisone may cause high blood pressure
- Not enough hydrocortisone and fludrocortisone can cause poor weight gain, too much salt loss and high levels of androgens. It can also mean an adrenal crisis is more likely to happen during fairly minor illnesses.

In order to retain the balance in a growing child, regular follow up appointments in the department and hormone tests are needed. At clinic appointments children are weighed and measured and examined by a doctor to look for any signs pointing to excessive or inadequate therapy.

10. Can my child lead a normal life?

Yes. If the child complies with treatment and is followed regularly it will develop normally, lead a healthy life and they should be able to do everything their friends do.

11. What happens if my child is unwell or sick?

In a person not affected by CAH, the body is able to make more cortisol if needed, e.g. during illnesses, operations or other stressful situations. Children with CAH are unable to do this. They need to take extra hydrocortisone to help their body cope and stay well.

Your child will need double (or sometimes triple) their usual dose of hydrocortisone during childhood illnesses. If the child is seriously ill, has an accident or cannot take the medications due to vomiting, hydrocortisone must be given by an intramuscular injection. Do not worry, you will be trained for such actions. The child must then be taken to the children's ward or nearest emergency department for assessment and treatment.

All families with an affected child should have an injection of hydrocortisone available and know how to give it. Some children may have low blood sugar during severe illness; they will need extra carbohydrates or glucose at these times.

12. Are there any long-term problems?

People with CAH usually have to take lifelong steroid medication. If treatment is well managed during childhood most patients with CAH reach normal height. Keeping the right balance of steroid medication is important to avoid the complications of osteoporosis, obesity and hypertension. Some adults have reduced fertility but there is an increasing number of options available to overcome this.

13. Suggested sites for further information:

www.livingwithcah.com

www.eurospe.org

www.apeg.org.au

www.caresfoundation.org

www.dsdfamilies.org

HNE Kids Health. Autosomal Recessive Inheritance Genetics http://www.youtube.com/watch?v=Nv6qUsKYodA