Growth and Bone Age
Congenital Adrenal Hyperplasia

This leaflet is a joint production between
Professor Peter Hindmarsh and Kathy Geertsma
The series editor is
Professor Peter Hindmarsh
Professor of Paediatric Endocrinology
and Divisional Clinical Director for Paediatrics
and Adolescents at UCLH
Congenital Adrenal Hyperplasia
http://www.cahsus.co.uk

The ideas expressed are independent of the editor’s affiliations. Data provided is from current literature and should always be discussed with your endocrinologist first.

Professor Peter Hindmarsh
Health professional, parents and families
working together to provide the best support for children who have CAH
GROWTH

At each clinic visit your child’s height will be measured by an Auxologist who is a person specially trained in this field. We plot these measurements on a standard growth chart so we can keep track of how your child is growing. In childhood growth normally follows a regular pattern which is depicted by a set of curves on the growth chart; each curve represents a different percentile line of growth which differs in girls and boys, so a different chart is used for each gender (see Fig: 1 and Fig: 2).

How to Estimate Height

Genetic height potential can be roughly estimated by taking the height of each parent, adding these heights together and dividing this by two to get an average parental height.

* For girls MINUS 5.08 cm (2 inches) from the parental height which gives you her estimated height.

* For boys ADD on 7.62 cms (3 inches) which will give you his estimated height

Please note that this is an estimated height.

BONEage IN CAH

Bone maturation is influenced by the CAH condition itself as well as the treatment used.

* Under treatment leads to acceleration in skeletal maturity which means growth is completed quicker. As there is less time to grow, adult height will be less (Fig: 7).

* Over treatment can lead to bone age delay and if doses that are too high are used damage to growth plates can occur, again leading to less of an adult height being achieved (Fig: 7).

The first Bone age x-ray is usually taken at 3 years old and then repeated once a year.

In LOCAH (Late on set CAH) bone age can be very advanced at diagnosis due to being exposed to excess androgens.
**FOR ASSESSMENT OF HEIGHT**

From birth to two years old is the period when the most rapid growth takes place:

- In the first year of life a baby grows on average 25.4 cms (10 inches) and in the second year an average of 12.7 cms (5 inches).
- From two years old until a child starts puberty growth averages to about 5.08 cm (2 inches) to 6.35 cms (2½ inches) per year.

Growth accelerates again in puberty:

- In girls puberty usually begins between the ages of 8 to 11 years old, which is when their ovaries become active. Girls usually have their growth ‘spurt’ at the beginning of puberty.
- In boys puberty usually begins between the ages of 10 to 13 years old which is when their testes become active. Boys usually have their growth spurt in the second part of puberty.

Growth slows down towards the end of puberty and then stops. In girls this usually happens at the age of 15 years old and in boys around 17 years old, as shown in the graph below (Fig: 3).

**HOW BONE AGE IS DONE**

The bone age measures the maturity of the growth plates in the skeleton (Fig: 6).

An x-ray of the hand is taken, the hand is used because it has lots of growth centres that can be scored. Various scoring systems are available but all give a score for the shape and size of the growth plate area. The total of these scores give a maturity score, which can be translated into a bone “age”.

These values tell us how much growth has taken place so from this the estimated adult height can be predicted. However it is important to know that because the bone age reading involves interpreting a visual picture, the results can be variable so it is a good idea to get the same doctor (preferably your endocrinologist) to read it each time.

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**PERCENTAGE OF GROWTH COMPLETED AT A PARTICULAR AGE**

Note that at 13 years 87% of growth is complete in a boy and nearly 100% in a girl.
GROWTH PATTERNS IN CAH

In CAH the charts that show the rate of growth provide us with very important clues in how well we are doing in treating the condition as can be seen in Fig: 3.

- If treatment is good and medication is fine tuned, growth should follow a normal growth pattern, growing at a rate that is consistent with genetic potential. Illustrated in the growth chart below by a blue dashed line.

- If growth is slow and falls off the percentile, we know that over treatment has caused this. This means that the dose is too high which needs careful evaluation and adjusting. Illustrated in the growth chart below by a solid red line.

- If growth is happening too fast and rises above the percentile, we know that under treatment causes this, the dose is too low and again this needs careful evaluation and adjusting. Illustrated in the growth chart below by a dashed red line.

BONE AGE

Another valuable tool we use to keep track of growth is by using x-rays which show us the bone ‘age’. We use the growth charts to show the growth in relations to the chronological age (birth age) however the bone ‘age’ shows us skeletal development. In normal growth these ages usually do not vary too much, although there sometimes may be a difference of one to two years.

In childhood growth and development targets are more often linked to bone age rather than chronological age so this measurement is a good marker for long term growth.

We can then plot the bone age on the growth chart alongside the actual physical growth as shown in Fig: 5 which gives us a very clear picture of how both of these measurements correlate.

For assessment of Height we need:
1. Height of Person – ● (dot) on 9th centile line
2. Height of Parents – arrows for Mother and Father
3. Bone Age – marked as X

Here the bone age is more than the chronological age so less time with which to grow so we expect final height to be much less than range for parents (about 160 cms)