Normal growth

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ارزیابی رشد وکوتاهی قد از شایعترین دلایل مراجعه به کلینیک های غدد است.

رشد نرمال نشانه ای از سلامتی جسمی ووضعیت تغذیه ای کودک است

آگاهی از سیرنرمال رشد به تشخیص زودتر بیماریهای مختل کننده رشد کمک می کند و اطلاع از وارياسیون های نرمال مانع انجام بررسی های اضافه می شود.

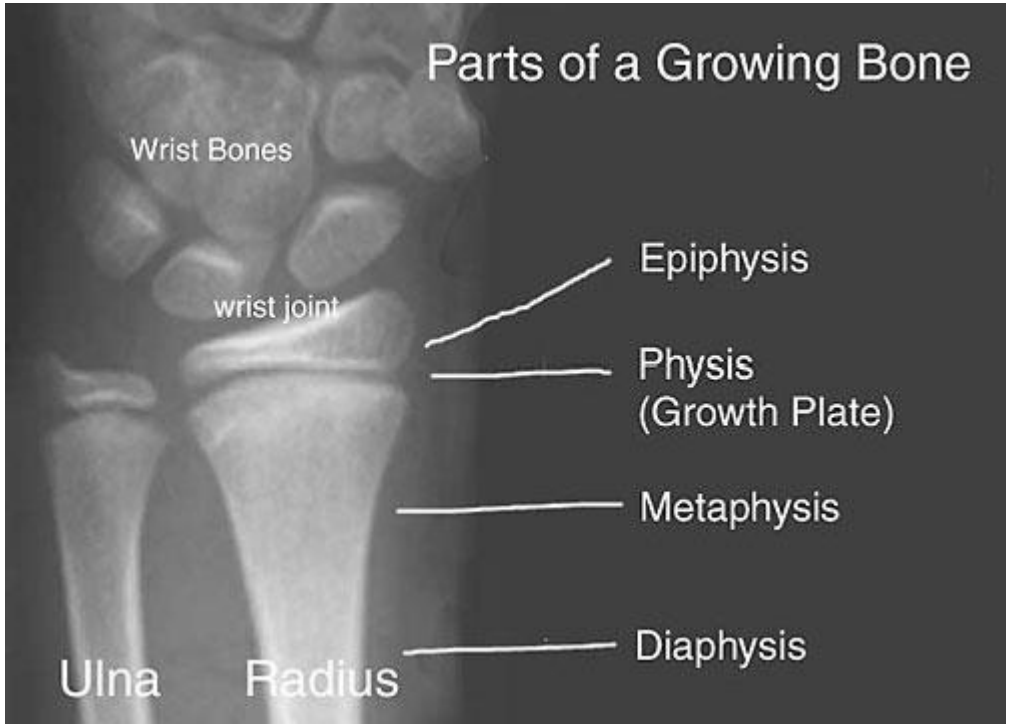
رشد یک سیر قابل انتظارازبدو تولد دارد وحاوی دوره هایی از افزایش رشد، growth spurt و دوره هایی با رشد کمتر است.

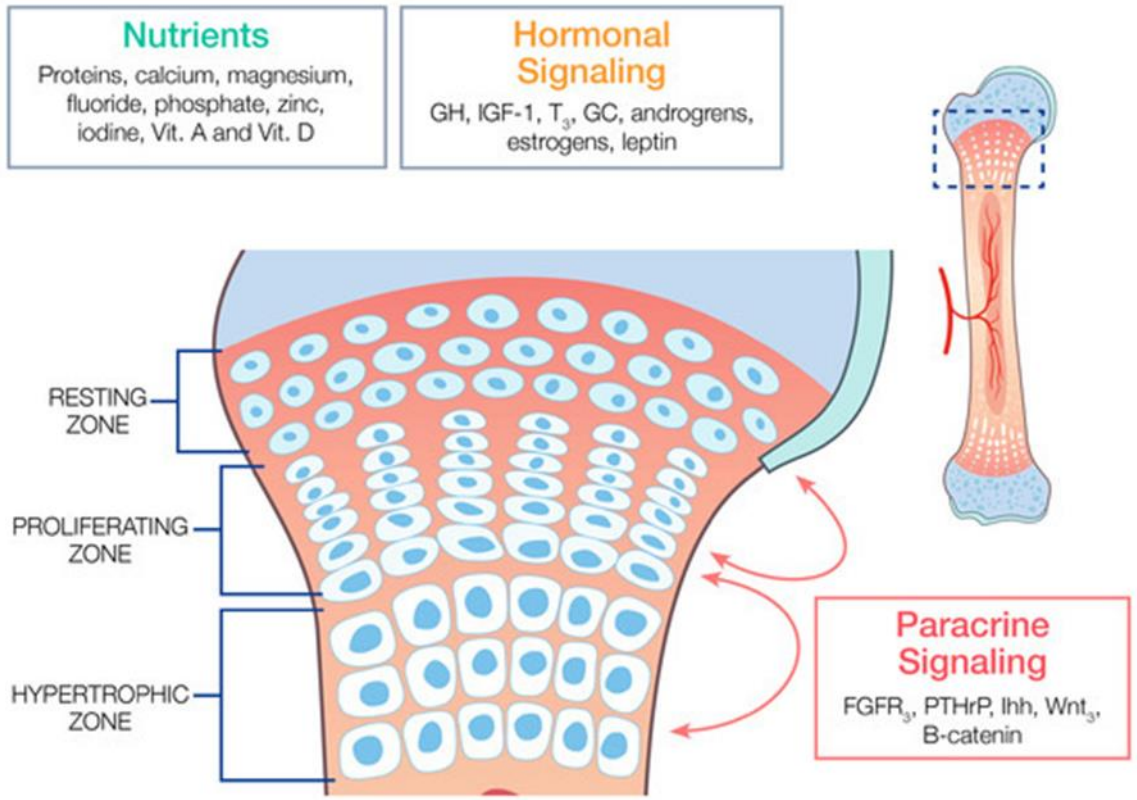
رشد قدی در کودکان عمدتا نتیجه رشد طولی اندامهای تحتانی و رشد طولی ستون مهره ها است. این افزایش طول ناشی از chondrogenesisدرمحل GROWTH PLATES است که صفحات نازک غضروفی در انتهای استخوانهای بلند و مهره هاست.

تنظیم کندروژنزیس در صفحه رشد توسط عوامل مختلفی صورت می گیرد ،شامل: سیگنالهای اندوکرین، سایتوکاینهای التهابی ،تغذیه، سیگنالهای پاراکراین و اتوکراین،ماتریکس اکستراسلولار و اینتراسلولار

هرکدام ازاین عوامل که تغییر کند می تواند برروی کندروژنزیس صفحه رشد تاثیر گذاشته و باعث انحراف رشد از حالت نرمال شود.

Growth plate





The rate of linear growth and the physiologic components regulating it, vary with age.

Conceptually, it is helpful to define growth as occurring in four discrete but congruent phases:

1. **Prenatal(intrauterine)**
2. **infancy**
3. **Childhood**
4. **adolescence**

سرعت رشد درهرکدام از این مراحل، متفاوت است.

Prenatal growth:

Prenatal growth averages 1.2 to 1.5 cm per week but varies dramatically.

the midgestational length growth velocity of 2.5 cm per week falls to almost 0.5 cm per week immediately before birth.

Infancy phase :

starting in midgestation and then rapidly decelerating until about 3 to 4 years of age

the growth initially is very rapid and gradually decelerates.

فاز رشد شیرخواری عمدتا تحت تاثیر nutrition است.

Childhood phase:

زمان شروع آن با فاز شیرخواری هم پوشانی دارد ودرمواردی که دیرتر شروع می شود می تواند با ISS همراهی داشته باشد.

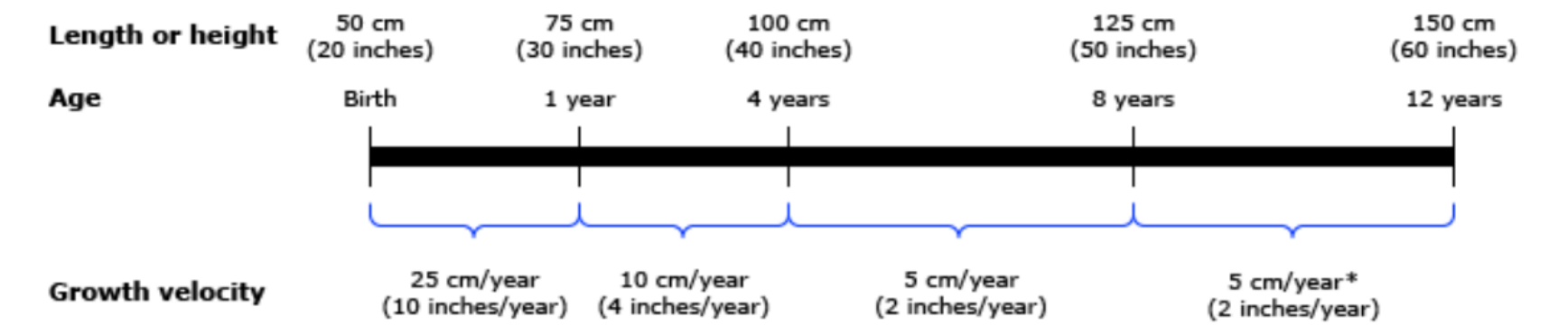
فازchildhood اززمانی که اثر فاکتورهای قبل تولد از بین می رود وتاثیرعاملی چون هورمون رشد پررنگ می شود، شروع می شود.

During this time, a normal child’s height, plotted on a growth curve, typically remains within a given growth channel; **it does not cross percentile lines on the growth curve**

the childhood phase characterized by an average growth rate of 5 to 6 cm per year (range 4.5-7.0 cm)

قبل از شروع pubertal spurt بصورت نرمال یک کندی رشد موقت وجود خواهد داشت: Normal deceleration of height velocity

Estimates for normal growth rates in children



Normal length or height at various ages during childhood, and the growth rate between those timepoints, are approximated by multiples of five when measured in centimeters (this is sometimes termed the "rule of fives"). Actual height and growth rate in a healthy child can vary substantially around these approximations.

Adolescence phase: a sigmoid-shaped “puberty” phase that comprises the adolescent growth spurt

زمان تبدیل فاز Childhood به فاز پوبرتی با شروع تولید sex steroid ها همزمان می باشد.

Growth spurt of 8-14cm/yr due to Synergistic effects of sex steroids and growth hormone

Depending on the age of puberty onset, growth rate may accelerate (early puberty) or decelerate (delayed puberty) compared to peers

حدود ۲۰درصد قد بزرگسالی درزمان پوبرتی حاصل می شود.

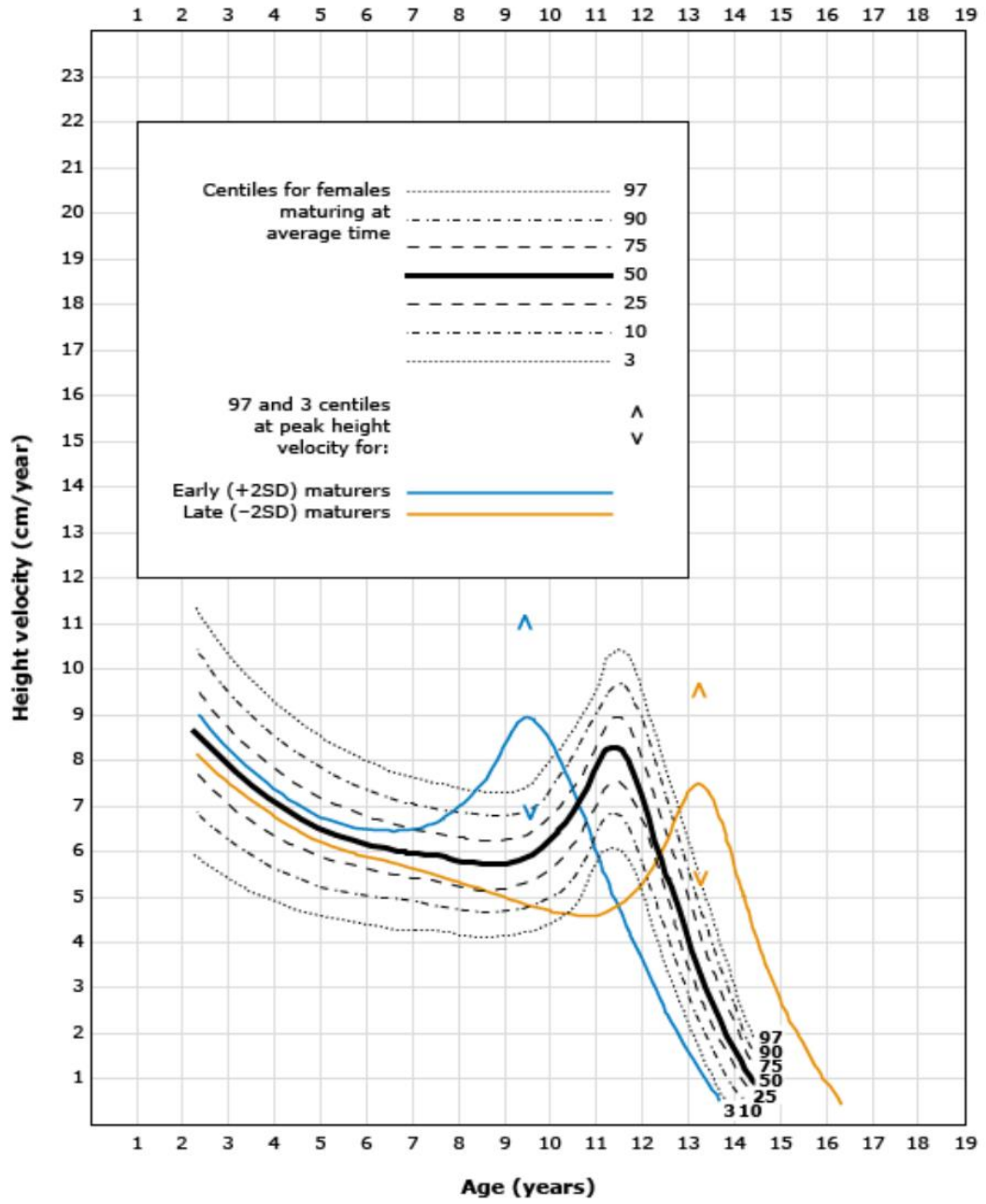
درابتدا سرعت رشد اندامها نسبت به trunk بیشتراست و ابتدای پوبرتی ظاهر یک نوجوا ن بیشتر بصورت all hands and feet است و درمراحل late puberty تنه هم رشد طولی خواهد داشت.

Prepubertal growth is similar between boys and girls.

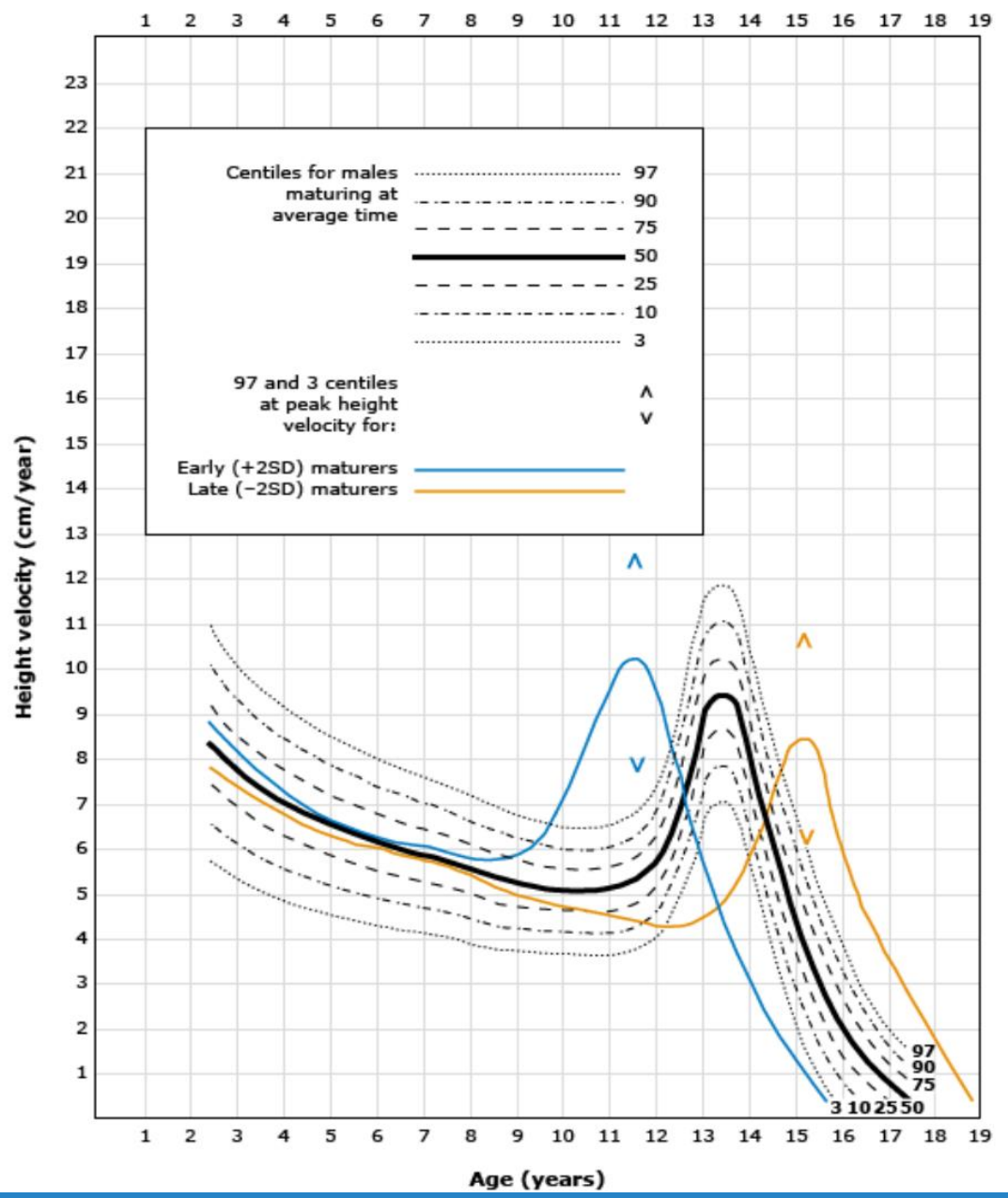
The height difference between men and women, an average of 13 cm, is accounted for by two factors:

1. boys grow for an average of 2 years longer than girls, because girls have an earlier onset of puberty and, consequently, earlier cessation of growth. Therefore, prepubertal growth is greater for boys; they are 8 to 10 cm taller when their puberty starts compared with girls' heights when their puberty starts.
2. boys achieve a greater maximal pubertal growth velocity than girls, giving them 3 to 5 cm greater pubertal growth.

Height velocity in American females 2 to 19 years



Height velocity in American males 2 to 19 years



The adult height is not influenced by the chronologic age at onset of the pubertal growth spurt because any additional time for prepubertal growth that occurs when puberty is late is balanced by the fact that pubertal growth is smaller the later it occurs

After puberty, chondrocyte proliferation in the growth plate slows and senescence occurs due to depletion of stem-like cells in the resting zone of the growth plate

Variants of normal growth

There are two variants of normal growth whose characteristic patterns are such that children exhibiting these growth variants are often evaluated for a growth disorder.

1. **Genetic “rechanneling**” : infant height curve crosses percentile lines as the growth moves away from the influences of the intrauterine environment and toward the child s genetic potential. It is typically accomplished by 9 to 12 months of age.

Variants of normal growth

2. **constitutional delay of growth and development (CDGD):**

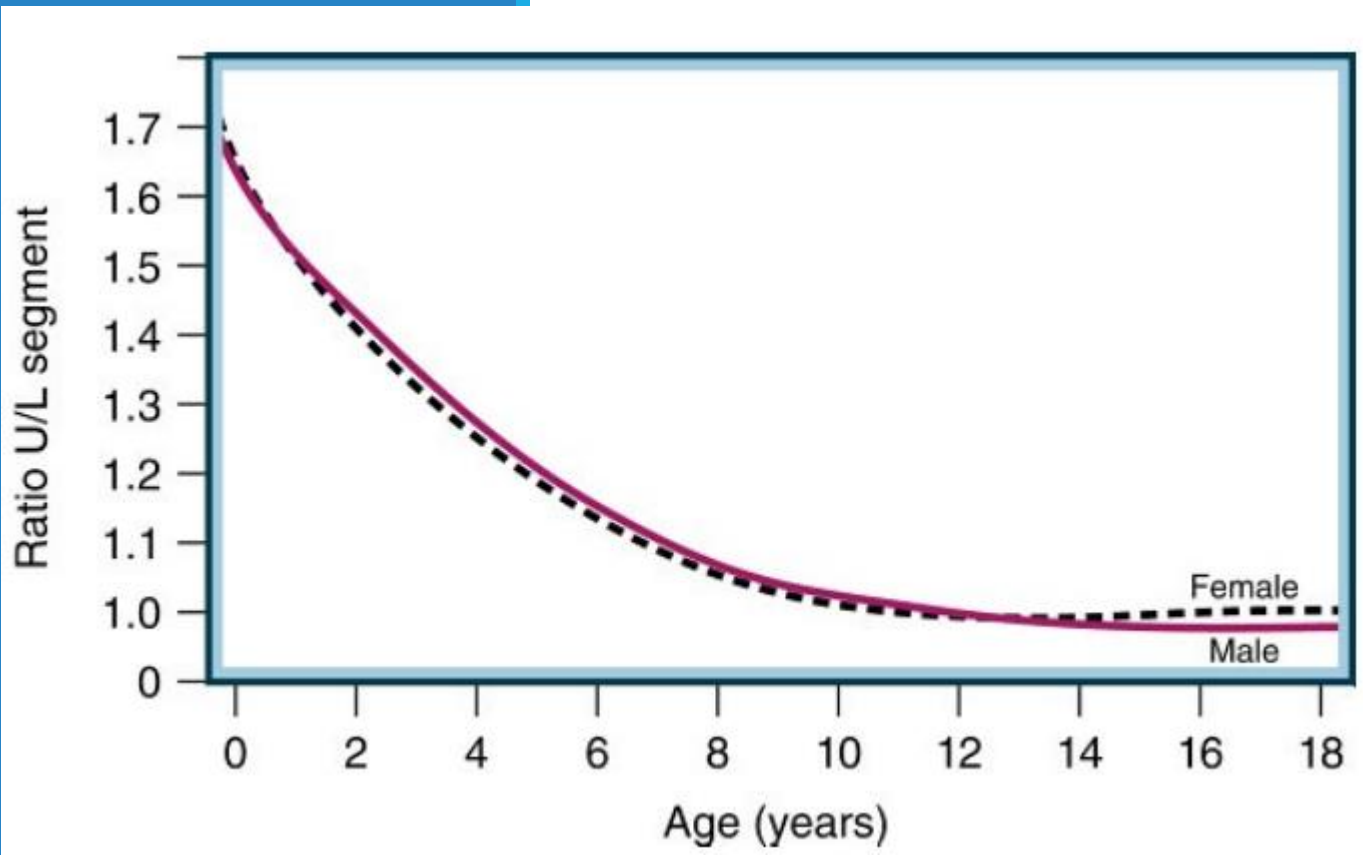
during most of their childhood, they grow at a height percentile below that expected based on their genetic potential.

Their height diverges even further from that of average children during the early teen years due to the declining prepubertal growth velocity of these children compared with the accelerating growth rate of children with an average timing of the onset of puberty.

children with CDGD have a late growth spurt, consistent with their late puberty, and this brings their height into the normal adult range

Body proportions

Body proportions, like growth velocity, also change with age; normal large-headed and short-limbed newborns gradually transition by late childhood to “adult” proportions, with arm spans roughly equivalent to height and upper-to-lower (U/L) body segment ratios approximating one.



Measurement of Growth

The identification of physiological and pathologic growth patterns relies on accurate measurements of length and height.

the most important tool in analysis of a child's growth is the plotting of accurate measurements on an appropriate growth chart. Although a seemingly simple process, correct positioning of a child for accurate length or height during assessment and accurate data recording are critical and should be done by a trained individual. .

Serial measurements taken to assess growth velocity should be obtained by the same individual to eliminate variations between examiners or equipment. Recording of data over 9 to 12 months is preferable to minimize the effects of measurement error and seasonal variations.

Bone age

نقش bone age : مقدار somatic maturation ومقدار پتانسیل قدی باقیمانده را مشخص می کند. با توجه به اینکه میزان ان براساس مقایسه با استانداردهای موجود مقایسه می شود و یک مقدار subjective است ،بهتر این است که پزشک غدد کودکان خودش مقدار انرا تعیین کند وفقط به گزارش رادیولوژیست اکتفا نکند.

radiographs of the hand can be helpful in detection of many skeletal disorders such as Madelung deformity and short fourth metacarpal

By using standard references, a child’s bone age and current height can also be used to estimate an adult’s height.

Bone age

The bone age is usually not reliable in children under the age of 5 years.

In children younger than 2 years, given the limited number and size of visible ossification centers in the hand, a hemiskeleton BA can be obtained by obtaining radiographs of the child's entire left upper and lower extremities. The number of ossification centers is determined and again compared to age-appropriate standards to determine the bone age.

MPH

Midparental height(MPH):

$$\text{Girls}: \frac{[\text{Father's height(cm)} - 13\ \text{cm} + \text{Mother's height(cm)}]}{2}$$

$$\text{Boys}: \frac{[\text{Father's height(cm)} + \text{Mother's height(cm)} + 13\ \text{cm}]}{2}$$

The midparental height calculation can be used to estimate a child's genetic target range height.

a significant disparity in the child's growth percentile (ie, ±10 cm) from the MPH percentile should prompt further investigation

MPH

when there is a relatively large disparity between the parents' heights, the calculated MPH becomes less informative.

statistical reassessment of population averages shows that the final height of offspring tends to regress toward the mean. If this is not taken into account, the shorter calculated MPH may be used to inappropriately explain the short stature of a child.


IRNA
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