

The background features abstract, overlapping geometric shapes in various shades of blue, ranging from light sky blue to deep navy blue. These shapes are primarily located on the left and right sides of the slide, framing the central text area. The shapes include triangles, polygons, and layered rectangles, creating a modern, dynamic feel.

# An approach to Short Stature in Kids

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# Definition of Short Stature in Children

- ▶ Defined as Individuals with a height more than 2 SD below the corresponding mean height for age, sex and population group (roughly equivalent to height below the 3rd percentile)
- ▶ Fall into the shortest 3% of the population
- ▶ Childhood is the only time available for growth, and delaying investigation and management of growth disorders is liable to result in poorer outcomes with regard to final height.
- ▶ Action should not be deferred until puberty in the hope that catch-up growth will occur.
- ▶ Only 18% of growth remains after entry into puberty.

# Measuring Children:

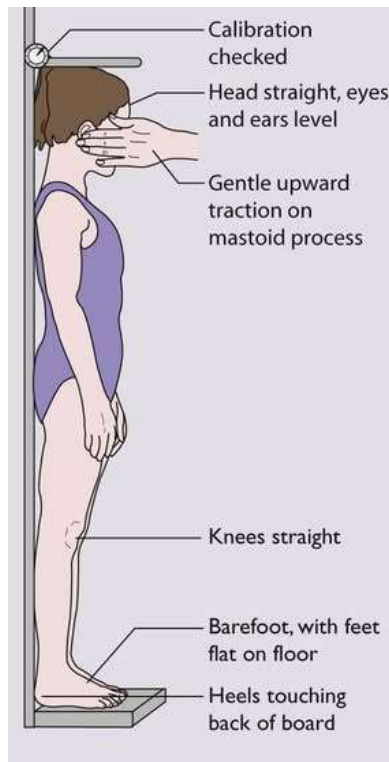
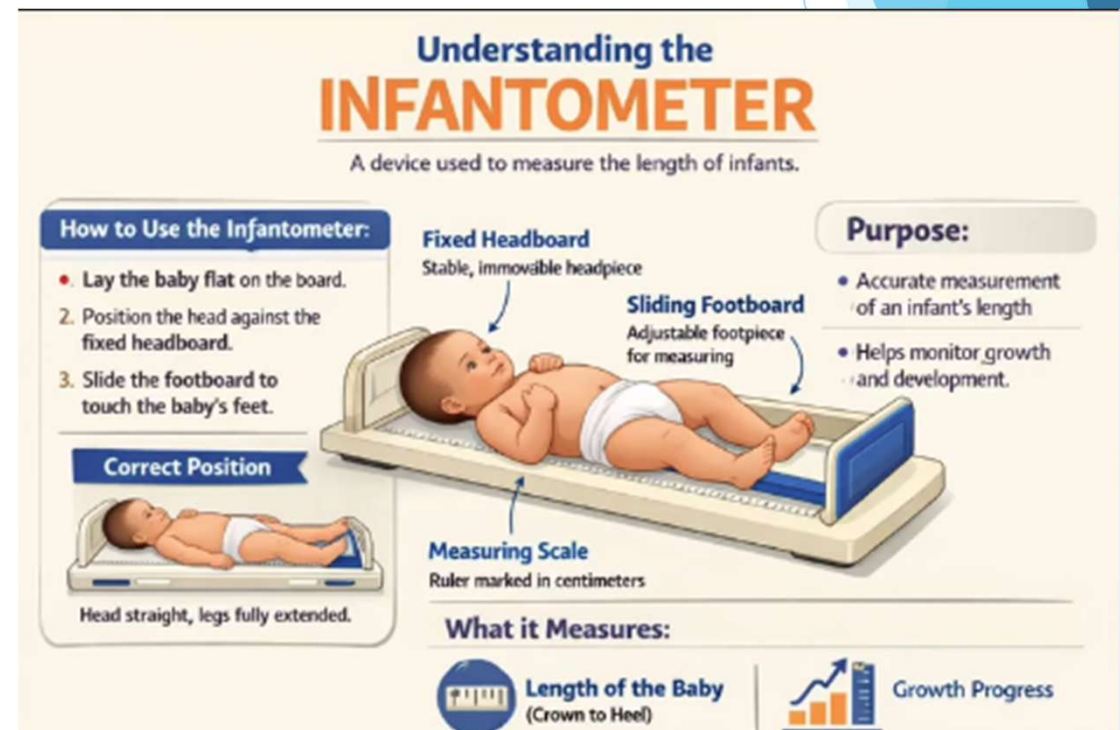
- ▶ **It is impossible to begin to manage what we cannot measure.**
- ▶ it is imperative that children are measured when they come into contact with health care providers such as clinic sisters, general practitioners or Paediatricians.
- ▶ Height should be measured with an appropriate stadiometer device.
- ▶ The child (>2years of age) should stand with the heels, buttocks and occiput touching the wall, and the eyes and ears in the Frankfurt plane.
- ▶ Children < 2years: Measure the length.
- ▶ **Children are longer than they are tall.**

# Monitoring Growth in Children

## Measuring a Child

Older than 2 years

Birth to 2 years



# Growth charts

## CDC (2000)

- ▶ Reference chart
  - ▶ observationally describe how children in the population grow

### Summary

- CDC = reference chart (how children do grow); WHO = standard chart (how healthy children should grow).
- WHO uses an idealised cohort, excluding prematurity, high altitude, low SES and maternal smoking.
- It also requires  $\geq 12$  months breastfeeding and normal weight-for-length ( $\pm 3$  SD).

## WHO (2006)

- ▶ Standard chart
  - ▶ describe how healthy children **should** grow
  - ▶ growing in ideal conditions
  - ▶ excluded:
    - ▶ Low socioeconomic status
    - ▶ Birth at altitude  $> 1500$  m
    - ▶ Birth at  $< 37$  wk or  $\geq 42$  wk
    - ▶ Multiple birth
    - ▶ Perinatal morbidity
    - ▶ Health condition
    - ▶ Maternal smoking
    - ▶ Breastfeeding  $< 12$  months
    - ▶ Weight-for-length  $> \pm 3$  SD

# Growth charts

## CDC (2000)

- ▶ Reference chart
- ▶ Cross-sectional data
  - ▶ 4697 observations on 4697 distinct children
  - ▶ measures start at age 2 months from NHANES I, II, III; mathematically connected to birth data from National Vital Statistics (weight) and Missouri and Wisconsin Vital Statistics (length)

### Summary

- CDC = reference chart (how children do grow); WHO = standard chart (how healthy children should grow).
- WHO uses an idealised cohort, excluding prematurity, high altitude, low SES and maternal smoking.
- It also requires  $\geq 12$  months breastfeeding and normal weight-for-length ( $\pm 3$  SD).

## WHO (2006)

- ▶ Standard chart
- ▶ Longitudinal data
  - ▶ 18973 observations on 882 distinct children
  - ▶ Racial/ethnic diversity
    - ▶ Brazil
    - ▶ Ghana
    - ▶ India
    - ▶ Norway
    - ▶ Oman
    - ▶ California

## Length-for-age GIRLS

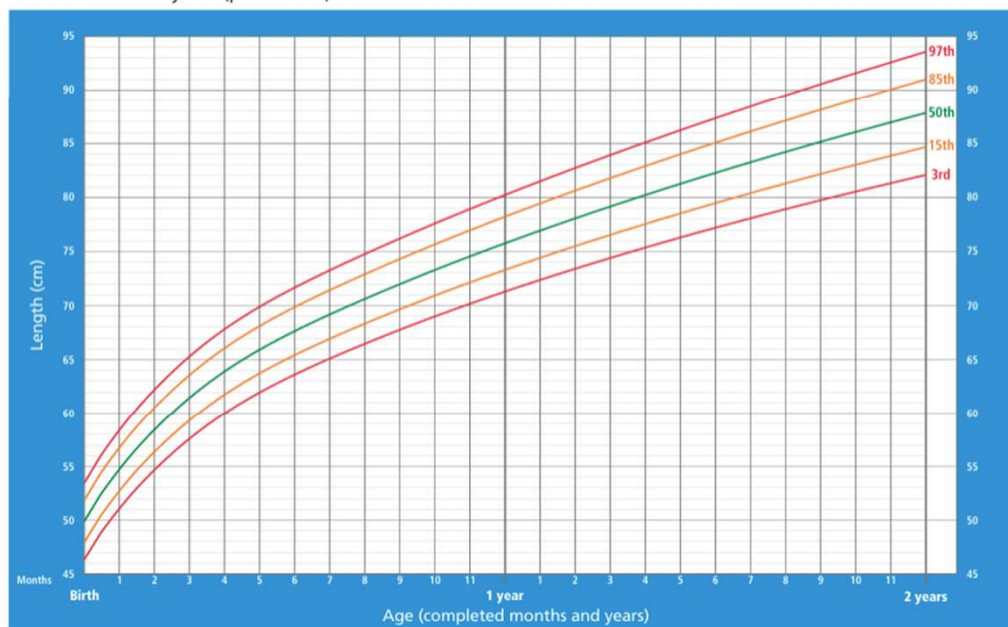
Birth to 2 years (percentiles)



WHO Child Growth Standards

## Length-for-age BOYS

Birth to 2 years (percentiles)

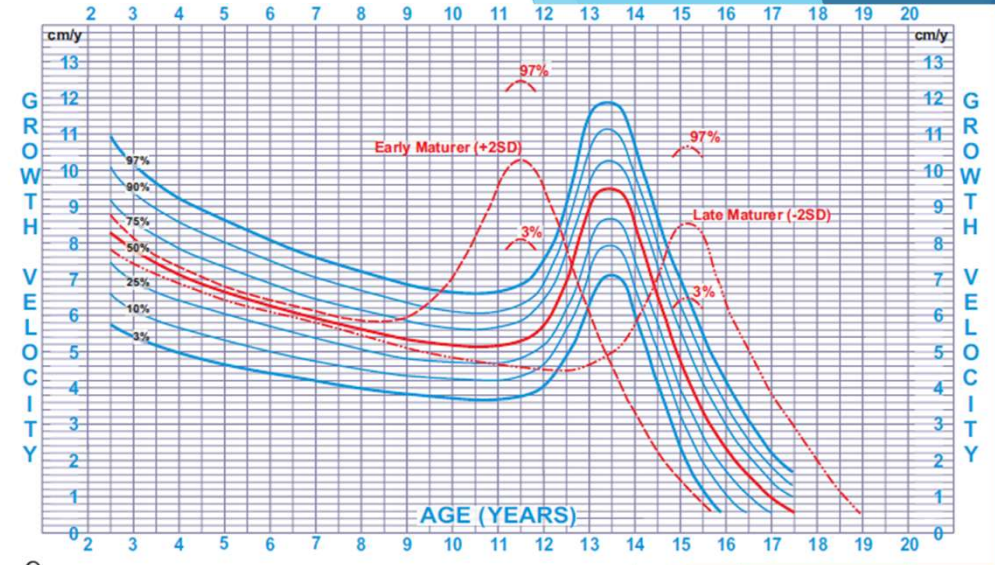
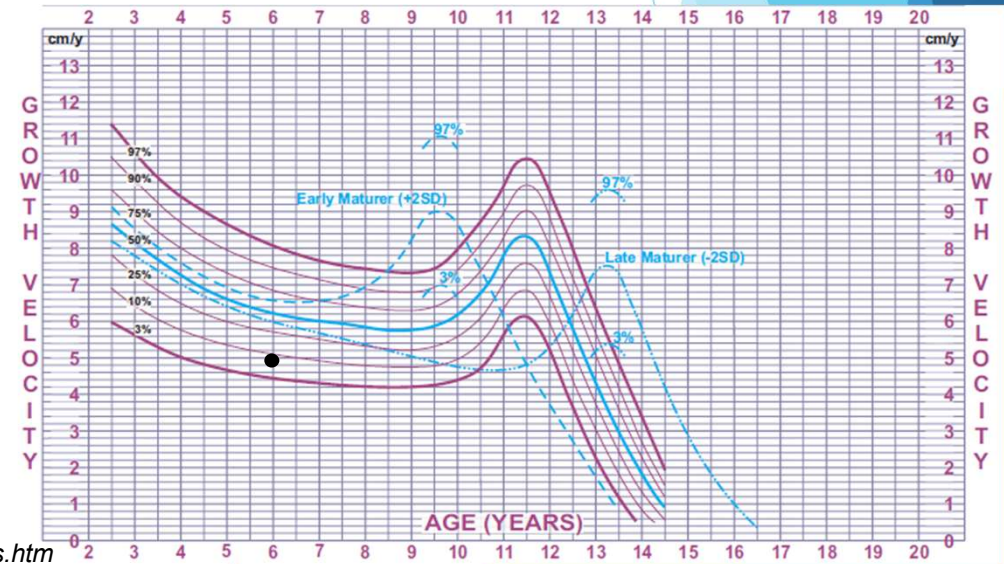


WHO Child Growth Standards



# Growth velocity In Children

- ▶ Fastest growth: in utero
- ▶ Infancy
  - ▶ fastest growth “out in the world”
    - ▶ 25 cm over the first year of life
    - ▶ 10 cm over the second year
  - ▶ physiologic rechanneling
- ▶ Pubertal growth spurt
  - ▶ boys later and faster than girls (9.5 vs 8.3 cm/yr)
  - ▶ mechanism: estrogen and testosterone increases GH pulse amplitude (frequency unchanged)
- ▶ A growth rate that falls below the 25th percentile indicates that catch-up growth is not occurring
- ▶ Growth velocities below the 10th percentile indicate a child who will fall further away from the current height percentile



# Calculation of Mid Parental Height

**Boys:**

$$\frac{\text{Father's height} + \text{Mother's height}}{2} \\ \text{Plus 7cm}$$

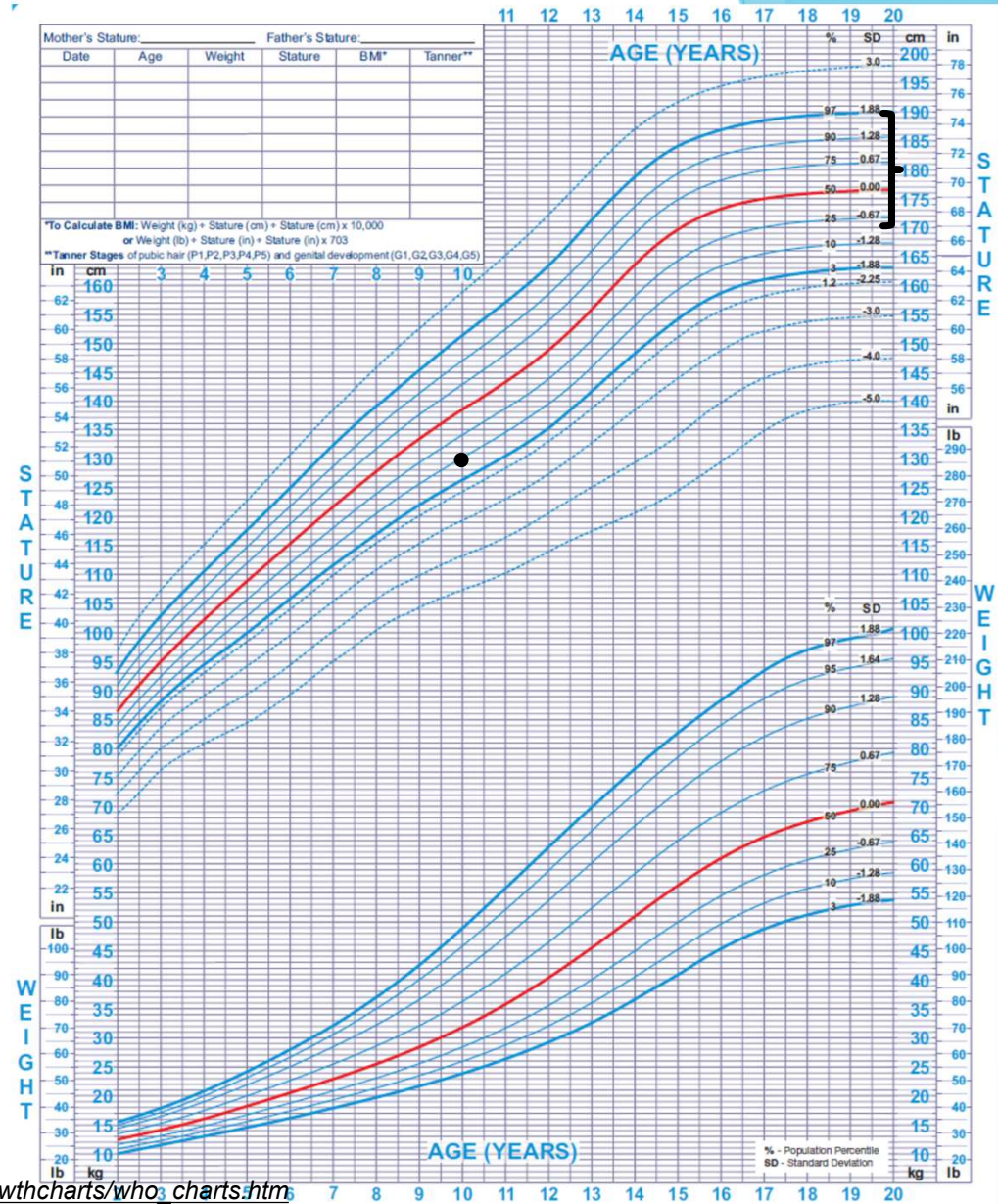
**Girls:**

$$\frac{\text{Father's height} + \text{Mother's height}}{2} \\ \text{Minus 7cm}$$

**The child's final height should fall within 1.5 Standard deviations or 2 Percentile lines above the MPH percentile (8.5 to 10cm around MPH)**

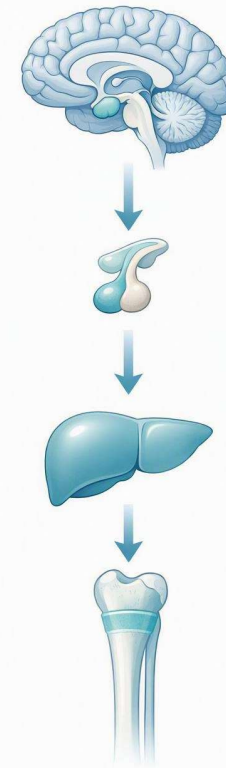
➤ Example:

- 10 year old male : Height 130cm
- Dad's Height : 178cm
- Mom's height : 168cm
- MPH calculation:  
$$= (178 + 168) / 2 + 7$$
$$= 346 / 2 + 7$$
$$= 173\text{cm} + 7\text{cm}$$
$$= 180\text{cm}$$
- Expected Range : (170cm to 190cm)



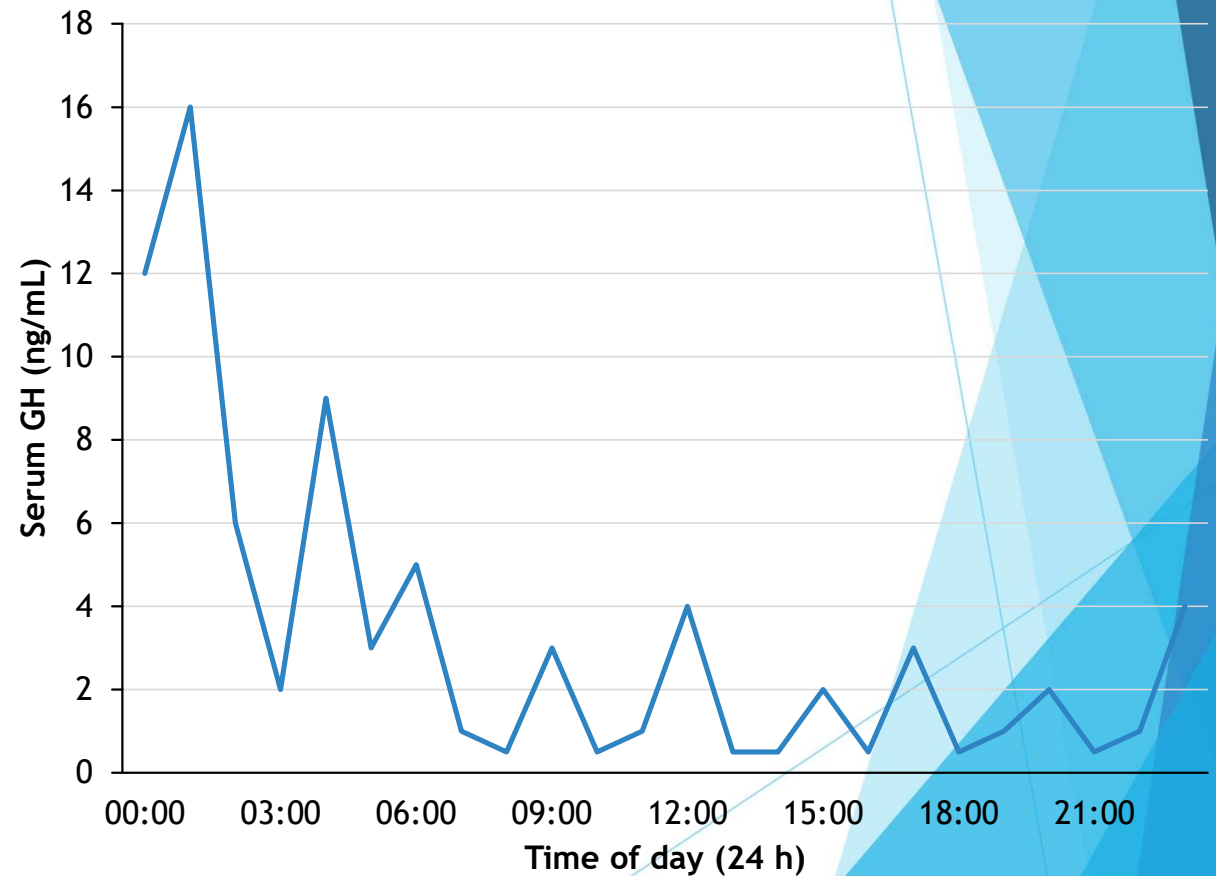
# Physiology of Growth: The GH-IGF-1 Axis

- ▶ **Hypothalamus:** releases GHRH (stimulatory) and somatostatin (inhibitory) to control GH secretion.
- ▶ **Anterior pituitary:** somatotrophs secrete growth hormone (GH) in pulsatile bursts.
- ▶ **Liver:** GH stimulates hepatic production of IGF-1 (somatomedin C), the main mediator of growth.
- ▶ **Growth plates:** IGF-1 drives chondrocyte proliferation at the epiphyses → linear bone growth.
- ▶ **Direct GH effects:** lipolysis, protein synthesis, and gluconeogenesis in muscle, fat, and other tissues.
- ▶ **Negative feedback:** rising IGF-1 and GH suppress GHRH and boost somatostatin, throttling further release.



# Pulsatile Release of Growth Hormone

- ▶ GH is secreted in discrete bursts, not continuously.
- ▶ Roughly 10-20 pulses per 24 hours, driven by GHRH and somatostatin.
- ▶ Largest pulses occur in slow-wave (deep) sleep, soon after sleep onset.
- ▶ Levels fall to near-undetectable between pulses.
- ▶ **Clinical note:** a single random GH level is unreliable - dynamic stimulation testing is needed to diagnose deficiency.



# Causes of Short Stature

- ▶ **Normal variants (most common)**
  - ▶ Familial (genetic) short stature
  - ▶ Constitutional delay of growth & puberty
- ▶ **Genetic / syndromic (OMIM 6182 Entries for Short Stature)**
  - ▶ Turner syndrome
  - ▶ Achondroplasia / hypochondroplasia
  - ▶ Russell-Silver, Noonan, Prader-Willi
- ▶ **Prenatal / growth restriction**
  - ▶ IUGR / SGA with no catch-up growth
- ▶ **Endocrine**
  - ▶ Growth hormone deficiency
  - ▶ Hypothyroidism
  - ▶ Cushing syndrome / steroid-induced
  - ▶ Pseudohypoparathyroidism
- ▶ **Chronic systemic disease**
  - ▶ GI: coeliac disease, IBD
  - ▶ Renal: chronic renal failure, RTA
  - ▶ Cardiac, respiratory, chronic anaemia
- ▶ **Nutritional & psychosocial**
  - ▶ Malnutrition; psychosocial deprivation

# Clinical Work-up of Short Stature

## ▶ History

- ▶ Birth weight / length, gestation (SGA, IUGR)
- ▶ Growth pattern and previous heights
- ▶ Parental heights and mid-parental target
- ▶ Puberty, systemic symptoms, diet, drugs (steroids), psychosocial

## ▶ Examination

- ▶ Accurate height, weight and height velocity, plotted on a growth chart
- ▶ Body proportions (US:LS ratio, arm span)
- ▶ Dysmorphism, Tanner staging, signs of systemic disease

Dahlgren, J., Wikland, K. & THE SWEDISH STUDY GROUP FOR GROWTH HORMONE TREATMENT. Final Height in Short Children Born Small for Gestational Age Treated with Growth Hormone. *Pediatr Res* 57, 216-222 (2005)

# Clinical Work-up of Short Stature

## ▶ Bone age

- ▶ X-ray of left hand and wrist
- ▶ Delayed in constitutional delay, GH deficiency, hypothyroidism;
- ▶ Helps predict adult height

## ▶ Investigations (guided by clues)

- ▶ FBC, ESR/CRP, U&E, LFTs, bone profile
- ▶ Thyroid function; coeliac screen (tTG, IgA)
- ▶ IGF-1 / IGFBP-3 and GH stimulation testing
- ▶ Karyotype in girls (Turner); genetic testing
- ▶ MRI pituitary if GH deficiency confirmed

# GH Stimulation Tests

## ▶ Clonidine stimulation test

- ▶ Oral alpha-2 agonist that stimulates GHRH release
- ▶ Common paediatric test; watch for drowsiness and hypotension

## ▶ Insulin tolerance test (ITT)

- ▶ Reference standard; insulin induces hypoglycaemia (glucose < 2.2 mmol/L) to trigger GH release
- ▶ Needs close supervision; risk of severe hypoglycaemia and seizures
- ▶ Avoid in epilepsy, cardiac disease and young infants

## ▶ Glucagon stimulation test

- ▶ Intramuscular glucagon; safe and well tolerated
- ▶ Preferred when ITT is contraindicated, including young children

# GH Stimulation Tests : Interpretation & local practice

- ▶ Sample GH at 30min intervals (0;30;60;90;120 min) after the stimulus
- ▶ Diagnosis rests on the peak GH reached (assay-dependent):
  - ▶ Peak < 7 µg/L on modern monoclonal assays (older cut-off < 10 µg/L)
  - ▶ Severe deficiency: peak < 3-4 µg/L
  - ▶ Confirm with two abnormal tests; check IGF-1 and thyroid status first
- ▶ **In South Africa: clonidine, glucagon and insulin tests are used - arginine is not available**

# Indications for Growth Hormone Therapy

## ▶ Children (approved growth indications)

- ▶ Growth hormone deficiency (congenital or acquired)
- ▶ Turner syndrome
- ▶ Prader-Willi syndrome
- ▶ Chronic kidney disease (pre-transplant)
- ▶ Born small for gestational age (SGA) with no catch-up by age 2-4
- ▶ SHOX gene deficiency; Noonan syndrome
- ▶ Idiopathic short stature (in some regions)

## ▶ Key principles

- ▶ Diagnosis must be confirmed before starting therapy
- ▶ Daily subcutaneous somatropin, titrated to response and IGF-1
- ▶ **Local funding and access criteria vary**

Dahlgren, J., Wikland, K. & THE SWEDISH STUDY GROUP FOR GROWTH HORMONE TREATMENT. Final Height in Short Children Born Small for Gestational Age Treated with Growth Hormone. *Pediatr Res* 57, 216-222 (2005)

# Growth Hormone Deficiency: Diagnosis

## ► Clinical clues

- GHD spans a continuum across the GH-IGF-1 axis
- Neonatal: hypoglycaemia, prolonged jaundice, breech or traumatic delivery
- Midline facial defects, cranial irradiation, head trauma, consanguinity
- Micropenis in male infants
- Poor growth velocity and short stature
- Cherubic facies, truncal obesity, small hands and feet

## ► Establishing the diagnosis

- Integrate clinical, auxological, radiological and biochemical data
- GH is pulsatile - a single random level is unreliable
- Provocative testing (clonidine, glucagon, arginine, insulin) after an overnight fast
- Peak GH below 7  $\mu\text{g/L}$  on modern assays (older cut-off 10); severe below 3-4
- IGF-1 and IGFBP-3 as age-specific screening tests
- MRI of the hypothalamic-pituitary region once confirmed



NB: Real patient, permission received from patients' parents for photo to be used for educational purposes.

# Growth Hormone Deficiency: Dosing & Response

## ► Dosing & titration

- Start about 25-35  $\mu\text{g/kg/day}$ . Can increase to 43  $\mu\text{g/kg/day}$ .
- Daily subcutaneous somatropin - daily beats less frequent dosing
- Titrate to growth velocity, weight or IGF-1 level
- Continue until growth velocity below 2 cm/year or epiphyseal fusion

## ► Monitoring & response

- Regular endocrine follow-up with documented growth response
- IGF-1 peaks 6-9 months after starting; tracks efficacy and adherence
- Mean adult height improved from about 142 cm to 165-172 cm since 1985
- Favourable effects on body composition, bone and metabolism
- Poor response: check adherence, new pituitary deficits, systemic illness



# Growth Hormone Deficiency: Dosing & Response



## ► Dosing & titration-Weight-based

- (not recommended for obese patients)
- Initiate at 0.024 mg/kg/day
- Increase the dose according to individual patient requirements to a maximum of 0.034 mg/kg daily
- Use the patient's clinical response, adverse reactions, and determination of age- and gender-adjusted serum IGF-1 concentrations as guidance in dose titration.

## ► Monitoring & response

- Regular endocrine follow-up with documented growth response
- IGF-1 peaks 6-9 months after starting; tracks efficacy and adherence
- Mean adult height improved from about 142 cm to 165-172 cm since 1985
- Favourable effects on body composition, bone and metabolism
- Poor response: check adherence, new pituitary deficits, systemic illness.
- **Continue until growth velocity below 2 cm/year or epiphyseal fusion**

# Turner Syndrome: Diagnosis

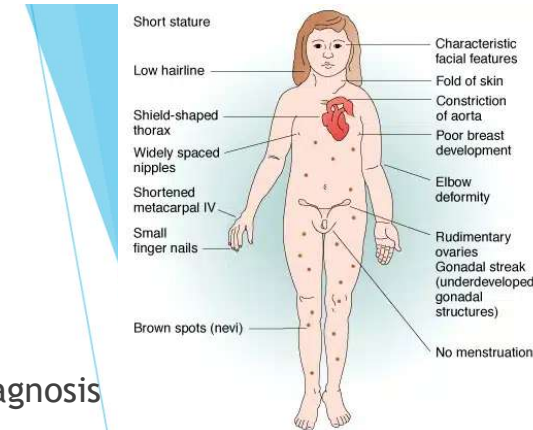
## ► Clinical features

- Commonest sex chromosome disorder in girls (1 in 2000-2500)
- Loss of part or all of an X chromosome (45,XO and variants)
- Short stature with a stocky build - the most common feature
- Untreated adult height about 142 cm (roughly 20 cm below average)
- Neonatal puffy hands and feet (congenital lymphoedema)
- Webbed neck, shield chest, cubitus valgus, high-arched palate [https://pubmed.ncbi.nlm.nih.gov/17708142/#:~:text=Am%20Fam%20Physician,3\)%3A405%2D10.](https://pubmed.ncbi.nlm.nih.gov/17708142/#:~:text=Am%20Fam%20Physician,3)%3A405%2D10.)

Am Fam Physician .2007 Aug 1;76(3):405-10.

## ► Work-up & associations

- Karyotype confirms the diagnosis
- Not GH deficient - GH stimulation testing is not required
- Exclude hypothyroidism and coeliac disease
- Screen cardiac, renal, thyroid and hearing (recurrent otitis)
- Gonadal failure causes primary or secondary amenorrhoea
- Multidisciplinary care from the time of diagnosis



# Turner Syndrome: Dosing, Response & Adjuncts

## ► Growth hormone

- Start rhGH about 45 µg/kg/day. Can titrate up to 67 µg/kg/day
- Begin early - benefit shown from as young as 9 months
- Longer treatment duration gives the greatest height gain
- Document growth response at regular endocrine follow-up

## ► Adjunctive therapy

- Oxandrolone if diagnosed late: add from age 8-10 years
- Dose 0.03 up to 0.05 mg/kg/day; stop at bone age 11-12
- Low-dose transdermal estradiol from bone age 11-12
- Increase estradiol over 2-3 years; add cyclic progestin later
- Individualise timing to protect adult height

# Small for Gestational Age: Diagnosis

## ► Definition

- Birth length and/or weight below -2 SDS
- About 80-85% of SGA infants catch up within 12 months
- 10-15% fail to show catch-up growth
- No catch-up by age 2: high risk of short stature at 18 years



# Small for Gestational Age: Dosing & Response



## ► Dosing

- Start 35-67  $\mu\text{g/kg/day}$ , continued to adult height (still debated)
- Younger age at initiation gives a better response
- Approved for children born SGA since 2001

## ► Expected response

- Aim to catch up to a normal height early, then maintain it
- Final adult height gain about 6 cm (+1 SDS) across three RCTs
- Monitor growth velocity and IGF-1 at regular follow-up

# Idiopathic Short Stature: Diagnosis

## ► Definition

- A clinical description, not a single disease
- Height below -2 SDS with no endocrine, metabolic, systemic or chromosomal cause
- FDA criterion: below -2.25 SDS plus a low predicted adult height
- Corresponds to adult height below 160 cm (male) or 150 cm (female)

## ► Assessment approach

- A diagnosis of exclusion - rule out other causes first
- GH secretory status does not predict the growth response
- PAEDS-SA: offer a 12-month trial of GH therapy
- Expect a clear rise in annualised growth velocity in responders



# Idiopathic Short Stature: Dosing & Response

## ► Dosing

- Start about 35-43  $\mu\text{g/kg/day}$
- Titrate to growth response and IGF-1 level
- Clinicians sometimes use up to 67  $\mu\text{g/kg/day}$

## ► Response & duration

- Continue while there is clear clinical benefit
- Benefit means ongoing catch-up or a normal growth velocity
- Response varies with individual GH sensitivity
- Reassess if the first-year velocity gain is poor



# Prader-Willi Syndrome: Diagnosis

## ▶ Clinical features

- ▶ Loss of the paternal copy of imprinted genes on chromosome 15
- ▶ Commonest syndromic cause of life-threatening obesity (1 in 10,000-30,000)
- ▶ Neonatal: severe hypotonia, poor feeding, failure to thrive
- ▶ Childhood: hyperphagia, food-seeking, progressive obesity
- ▶ Round face, almond eyes, small hands and feet; developmental delay

## ▶ Growth & assessment

- ▶ GH/IGF-1 axis dysfunction in the great majority
- ▶ GH testing is not required before starting therapy
- ▶ Measure length or height at least every 3 months
- ▶ Subnormal growth velocity is the first sign of growth failure



# Prader-Willi Syndrome: Dosing, Response & Risks



## ► Dosing & work-up

- Start rhGH 35 µg/kg/day; registered for PWS in 2000
- Polysomnography and OSA assessment before initiation
- Begin early - greatest benefit at 4-6 months of age
- Keep IGF-1 to upper normal (max +2 SDS); IGF-1-based dosing not advised

## ► Response & risks

- Benefits: linear growth, body composition, motor and neurocognitive gains
- Risk: type 2 diabetes and worsening scoliosis
- Risk: progression of obstructive sleep apnoea
- Adult benefits persist for body composition and metabolism

# Contraindications & Safety Monitoring

## ▶ Contraindications

- ▶ Active malignancy
- ▶ Critical illness (acute, e.g. post-surgery, trauma, respiratory failure)
- ▶ Closed epiphyses, when the goal is height gain

## ▶ Cautions

- ▶ Diabetes or impaired glucose tolerance (GH is diabetogenic)
- ▶ Prader-Willi syndrome with severe obesity or sleep apnoea
- ▶ History of scoliosis; intracranial hypertension

# Contraindications & Safety Monitoring

## ▶ **Monitoring on treatment**

- ▶ Children: height velocity and growth chart every 3-6 months
- ▶ IGF-1 to guide dose and keep within the age-related reference range : Aim for an IGF1 +2SD above mean.
- ▶ Fasting glucose / HbA1c for glucose tolerance
- ▶ Thyroid function; treat any coexisting hypothyroidism
- ▶ Bone age and scoliosis review in children

## ▶ **Adverse effects**

- ▶ Fluid retention, oedema, arthralgia and myalgia
- ▶ Insulin resistance
- ▶ Benign intracranial hypertension
- ▶ Slipped capital femoral epiphysis (report hip or knee pain, limp)

# Dosing & Monitoring Treatment Response

## ▶ Signs of a good response

- ▶ Children: rise in height velocity, catch-up crossing centiles
- ▶ IGF-1 moving into the mid-upper normal range for age
- ▶ Adults: better body composition, energy and quality of life

## ▶ Poor response - reconsider

- ▶ Check adherence and injection technique
- ▶ Review the diagnosis and any untreated hormone deficiencies

## ▶ Stopping therapy

- ▶ Children: at final height / epiphyseal fusion, then re-test as adults
- ▶ Doses and access criteria vary by local guidelines and funder

# Once-Weekly Growth Hormone

## ▶ Why long-acting GH?

- ▶ Daily somatropin has been the standard since the 1980s
- ▶ Daily injections are burdensome; non-adherence is common and worsens growth outcomes
- ▶ Once-weekly dosing cuts injections from ~365 to ~52 per year, improving adherence and preference

## ▶ How the half-life is extended

- ▶ Different technologies each produce a once-weekly profile, but the released hormone differs

## ▶ Agents

- ▶ Somapacitan- albumin-binding GH analog; Novo Nordisk
- ▶ Lonapegsomatropin- prodrug releasing native somatropin (TransCon); Ascendis
- ▶ Somatrogon- GH with added peptide chains; Pfizer (for context)

## ▶ Shared principles

- ▶ All given once weekly by subcutaneous injection
- ▶ Titrated to IGF-1 and clinical response, as with daily GH
- ▶ Availability and funding vary by country

# Somapacitan

## ► Preparation & mechanism

- Human GH analog with a small albumin-binding side-chain
- Reversible albumin binding prolongs the half-life to allow weekly dosing

## ► Indications

- Children  $\geq 2.5$  years with GH deficiency
- Extended paediatric labelling: SGA, Noonan syndrome, idiopathic short stature (region-dependent)
- Adults with GH deficiency (replacement)

## ► Dosing

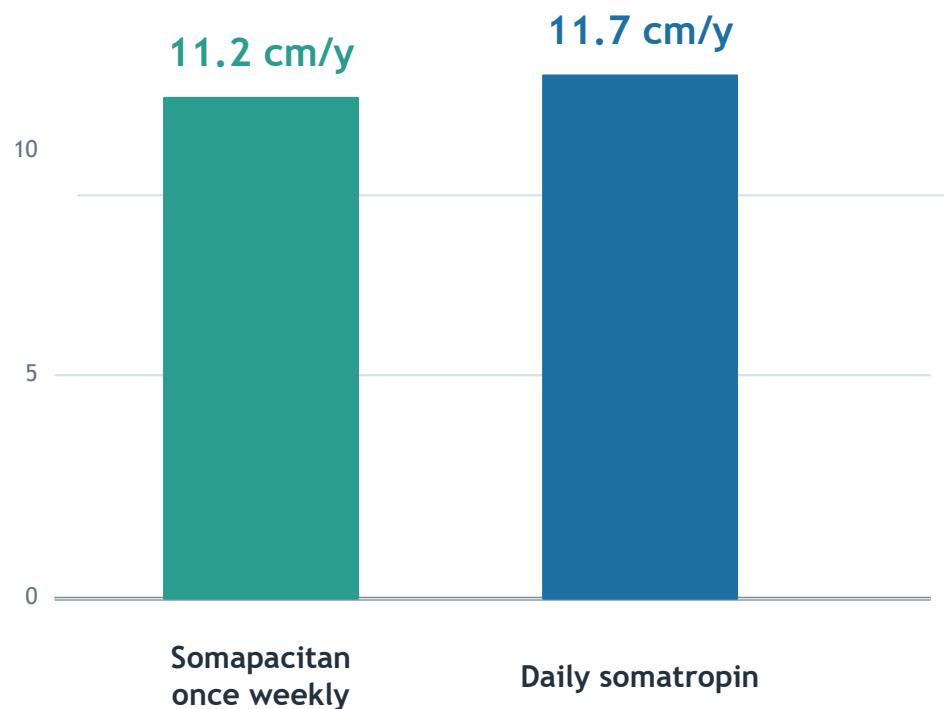
- Children: 0.16 mg/kg once weekly

## ► Administration

- Any time of day, independent of meals
- Rotate sites (upper arm, thigh, abdomen, buttock)

# Somapacitan : weekly efficacy and safety

REAL4: treatment-naïve prepubertal children with GHD, 52 weeks



## Efficacy

11.2 vs 11.7 cm/year at week 52; non-inferiority confirmed (estimated difference -0.5 cm/year; 95% CI -1.1 to 0.2).

## Longer follow-up

At year 3, growth remained sustained; mean height velocity during year 3 was 7.4 cm/year with continuous somapacitan and 7.8 cm/year after switching.

## Safety

Overall tolerability was similar to established GH therapy, with low injection-site reaction rates; monitor class effects and IGF-1 using product-specific guidance.

TREATMENT

# Lonapegsomatropin

## ▶ Preparation & mechanism

- ▶ Prodrug: unmodified (native) somatropin transiently bound to an inert carrier
- ▶ TransCon linker slowly releases active GH over about one week
- ▶ First TransCon product; the released hormone is identical to endogenous GH

## ▶ Formulation

- ▶ Weight-based, colour-coded single-dose cartridges (3.0 to 13.3 mg)
- ▶ Room-temperature storage up to 6 months; preservative-free; no reconstitution

## ▶ Indications

- ▶ Children  $\geq 1$  year and  $\geq 11.5$  kg with GH deficiency
- ▶ Also approved for adults with GH deficiency

## ▶ Dosing

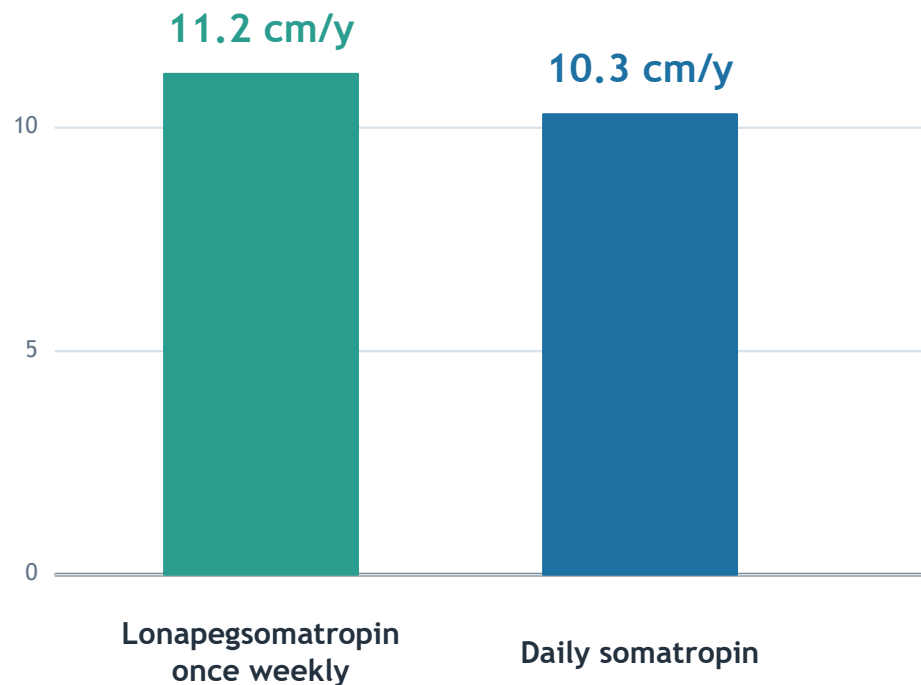
- ▶ 0.24 mg/kg once weekly, subcutaneously
- ▶ When switching from daily somatropin, wait  $\geq 8$  hours after the last daily dose
- ▶ Rotate injection sites (abdomen, thigh, buttock)

## ▶ Contraindications

- ▶ Acute critical illness, active malignancy, closed epiphyses, hypersensitivity

# Lonapegsomatropin : weekly efficacy and safety

heiGHt: treatment-naïve prepubertal children with GHD, 52 weeks



## Efficacy

Mean annualised height velocity was 11.2 vs 10.3 cm/year; treatment difference 0.9 cm/year (95% CI 0.2 to 1.5).

## Mechanism

A transient carrier releases unmodified somatropin over the week; dosing and device instructions are product-specific.

## Safety

Trials and extension follow-up found a safety profile broadly consistent with daily somatropin. Continue surveillance for GH-class effects, injection reactions, glucose effects and raised IGF-1.

# Once-Weekly GH: Efficacy & Safety

## ► Efficacy

- Lona pegsomatropin (heiGHt, treatment-naïve children): height velocity ~11.2 vs 10.3 cm/yr for daily GH - non-inferior, trending superior<sup>1</sup>
- Somapacitan (REAL 4, children): 0.16 mg/kg/week non-inferior to daily GH, sustained to 2 to 3 years
- Long-term paediatric data (REAL 3, up to 7 years) show maintained growth and safety<sup>2</sup>
- Adults (somapacitan): improved body composition, e.g. reduced truncal fat vs placebo

## ► Adherence

- Most patients and caregivers prefer the once-weekly regimen

## ► Safety - broadly similar to daily GH

- Class effects: fluid retention, oedema, arthralgia / myalgia, headache
- Impaired glucose tolerance / insulin resistance
- Benign intracranial hypertension; slipped capital femoral epiphysis
- Injection-site reactions

## ► Monitoring

- Titrate to IGF-1 (mind timing relative to the weekly dose) and growth response
- Glucose, thyroid and fundoscopy as for daily GH
- Access and registration vary locally - confirm availability and funding

1. J Clin Endocrinol Metab. 2026 May 19;111(6):1640-1650. 2. Fleseriu, M., Biller, B.M.K., Webb, S.M. et al. Efficacy and safety of once-weekly somatropin in adults with growth hormone deficiency: a randomized phase 3 study. Pituitary 29, 59 (2026).

# Summary & Conclusions

- ▶ Short stature is height below  $-2$  SDS or the 3rd centile - but serial growth velocity, not a single measurement, drives the assessment
- ▶ Accurate measurement and plotting on the correct growth chart are the foundation; a falling velocity is the earliest sign of growth failure
- ▶ Work up systematically to separate normal variants from pathology - history, examination, auxology, bone age and targeted investigations
- ▶ Confirm GH deficiency with provocative testing plus IGF-1 / IGFBP-3, then image the hypothalamic-pituitary region
- ▶ GH therapy extends beyond GHD - Turner, SGA without catch-up, ISS, Noonan and Prader-Willi - each with its own dosing and expected response
- ▶ Start early and titrate to growth response and IGF-1; monitor for condition-specific risks such as OSA, cardiac disease and scoliosis
- ▶ Screen contraindications and watch GH-class effects; once-weekly GH (somapacitan, lonapegsomatropin) matches daily therapy with better adherence

Thank You!!

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