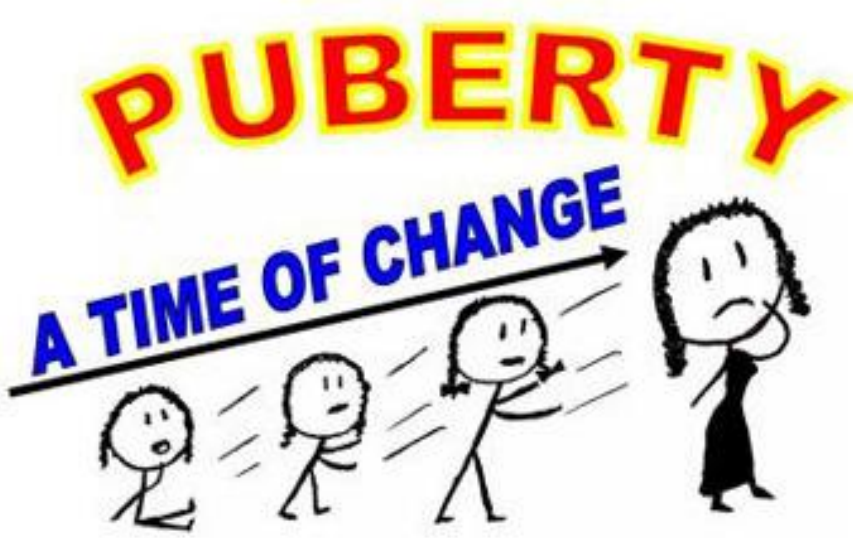
Puberty- Normal & Abnormal



Dr. NEHA GUPTA

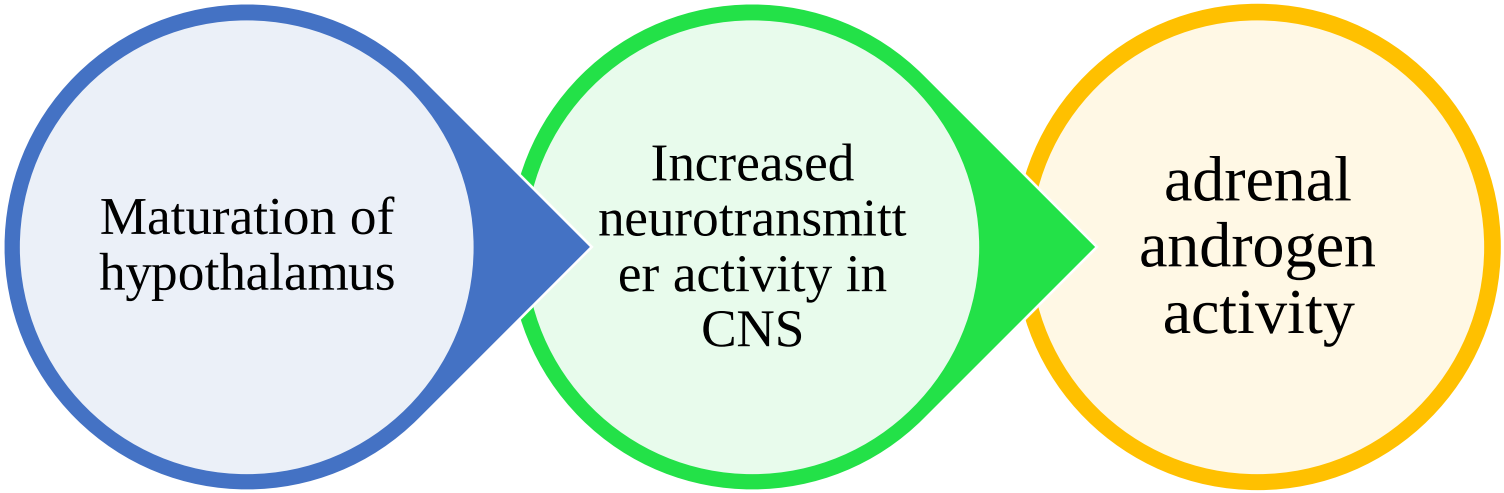
Associate Professor

Department of OBG,HIMSR

PUBERTY

It is a physiological phase lasting 2 to 5 years during which the genital organs mature

FACTORS INITIATING PUBERTAL DEVELOPMENT



- Nutrition
- Environment
- Genetics

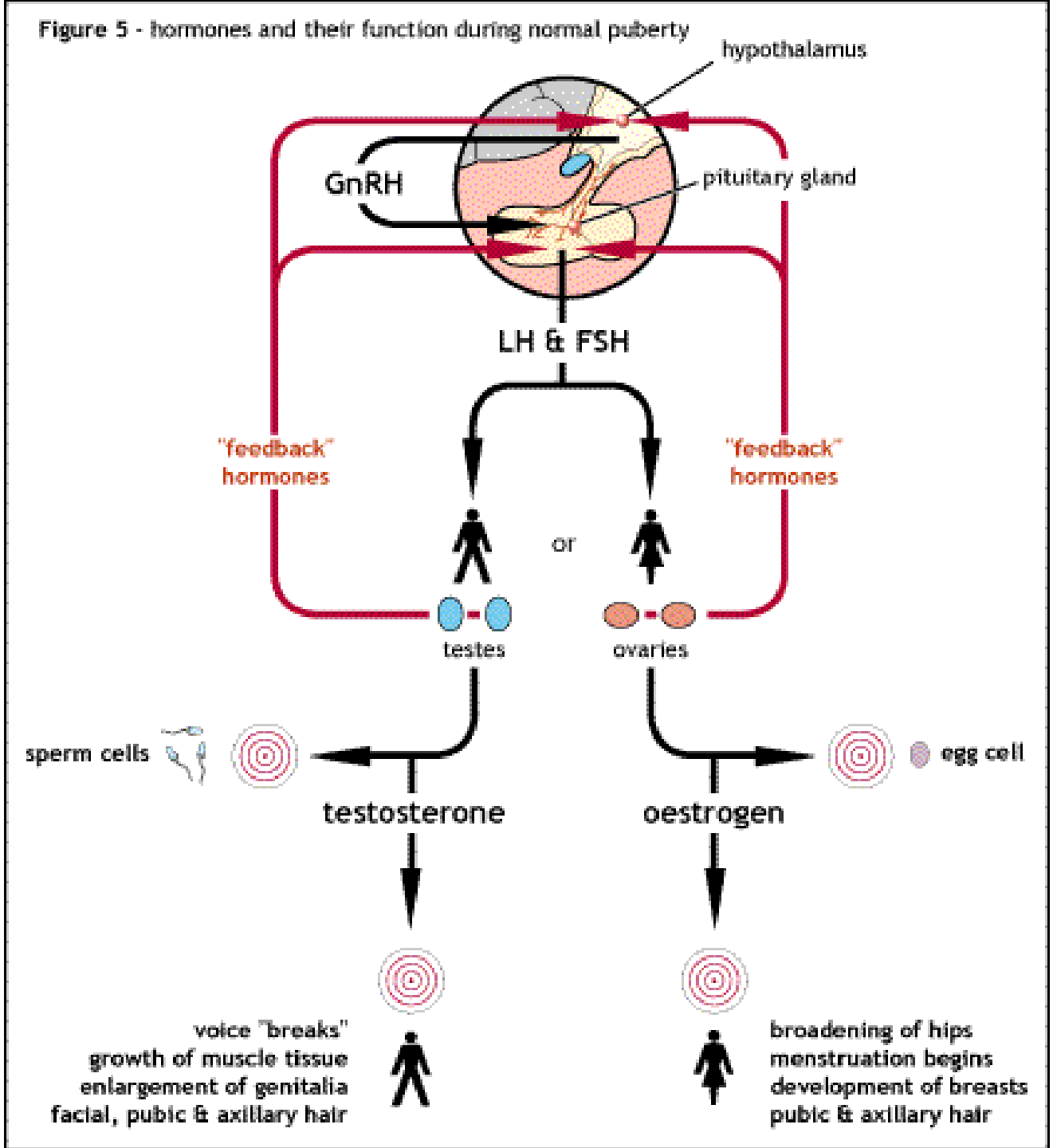


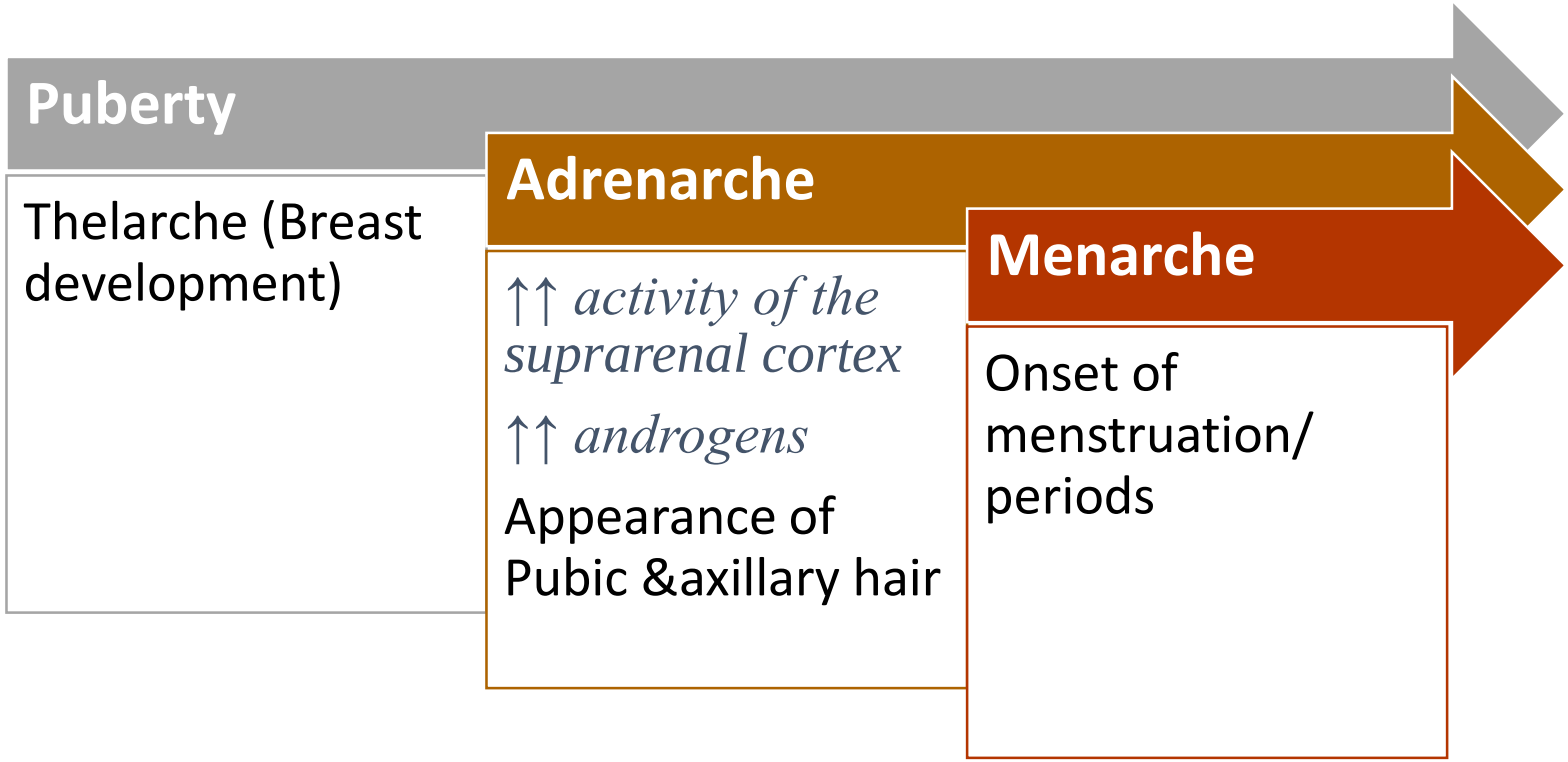
Figure 5 - hormones and their function during normal puberty
hypothalamus
GnRH
pituitary gland
LH & FSH
"feedback" hormones
"feedback" hormones
or
testes
ovaries
sperm cells
egg cell
testosterone
oestrogen
voice "breaks"
growth of muscle tissue
enlargement of genitalia
facial, pubic & axillary hair
broadening of hips
menstruation begins
development of breasts
pubic & axillary hair

MANIFESTATIONS OF PUBERTY IN FEMALE

1. Menarche
2. Appearance of secondary sex characters
3. Physical development
4. Psychological changes.

Secondary sex characters

- development of the breast(***thelarche)***
- appearance of pubic hair (***pubarche)***
- appearance of axillary hair



Interval between breast budding & menarche is nearly 2.5 years

CAUSE OF PUBERTY

- During childhood , the hypothalamus is extremely sensitive to the negative feedback exerted by the small quantities of estradiol & testosterone produced by the child's ovaries.

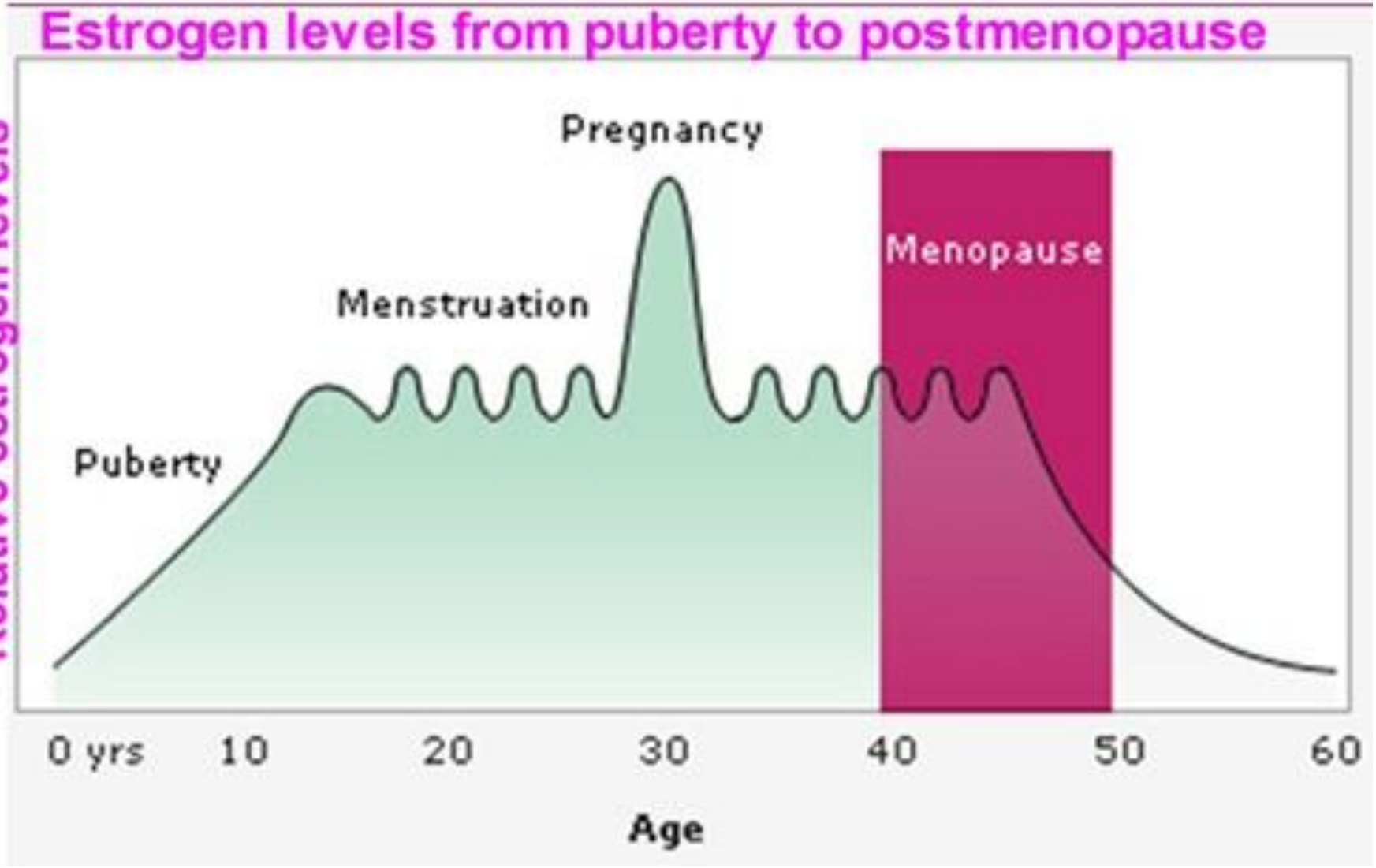
- As puberty approaches , the sensitivity of the hypothalamus is decreased and subsequently, it increase the pulsatile GnRH secretion .

The anterior pituitary responds by progressive secretion of FSH and LH associated with increased secretion of growth hormone .

The ovaries respond to the increase Gonadotrophin(LH & FSH) secretion by follicular development & estrogen secretion .

- Estrogen causes development of genital organs & appearance of secondary sexual characters .

- With increased estrogen secretion , menarche and cyclic estrogen secretion occurs .


Estrogen levels from puberty to postmenopause
Relative estrogen levels
Pregnancy
Menopause
Menstruation
Puberty
0 yrs
10
20
30
40
50
60
Age

GENITAL ORGANS CHANGES

- Mons pubis, labia majora & minora:

  Increase in size

- Vagina:

1. length: increase, appearance of the rugae
2. Epithelium: thick, stratified squamous., containing glycogen
3. pH: acidic, 4-5

GENITAL ORGANS CHANGES

- *Uterus:*

  enlarge, Uterus / Cervix :1/1 then 2 / 1

- *Ovaries:*

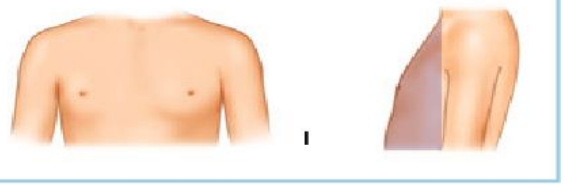
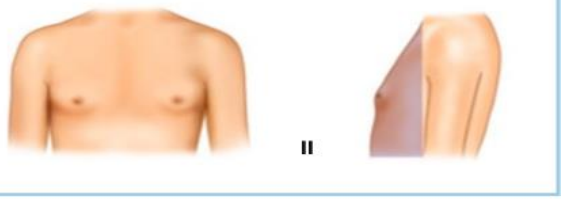
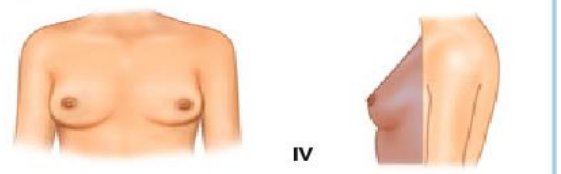
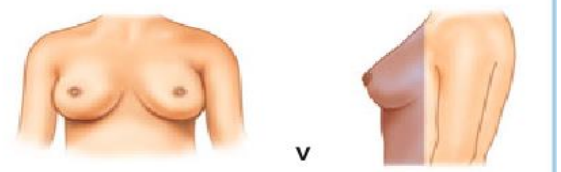
1.Increase in size, oval shape

2.300 thousands primary follicle at menarche (2 million at birth)

BREAST CHANGES

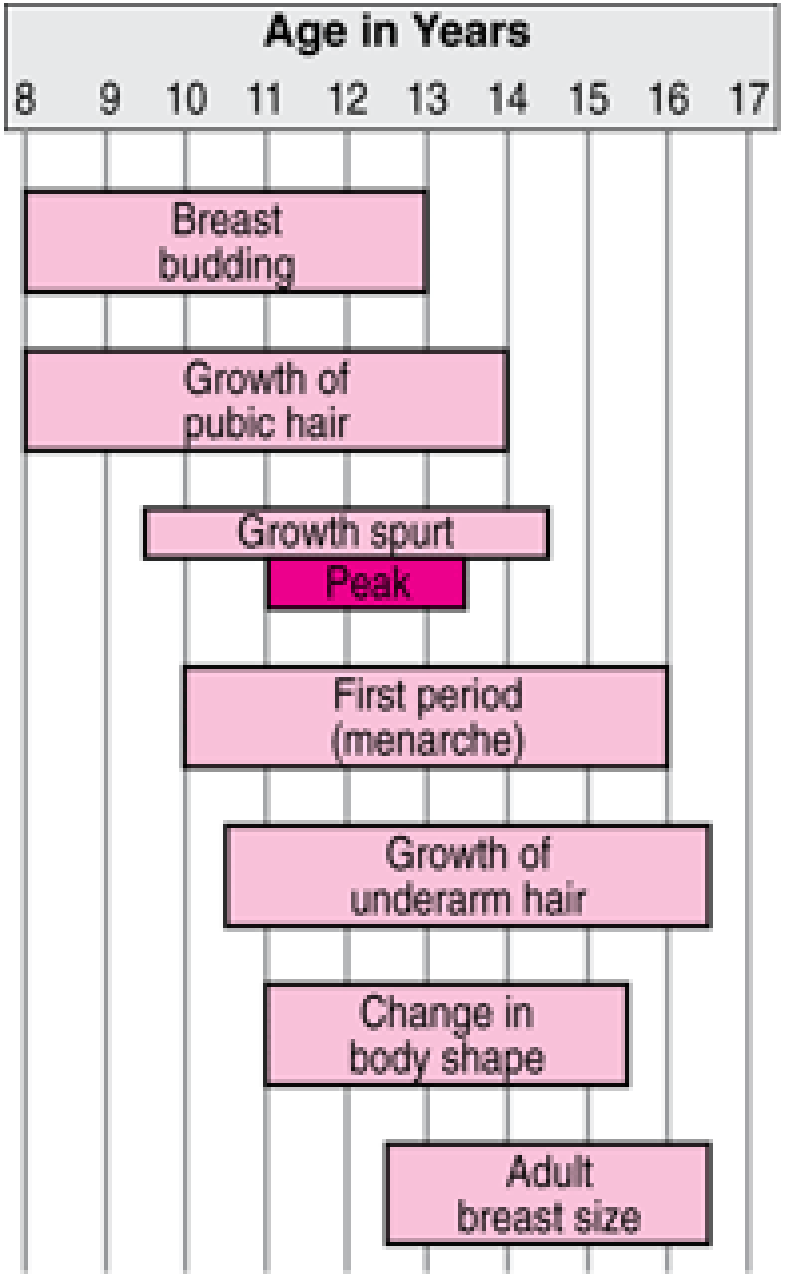
- *marked proliferation of duct system*
- *deposition of fat*
- *Acini develop under influence of progesterone*

TANNER & MARSHALL STAGES- BREAST

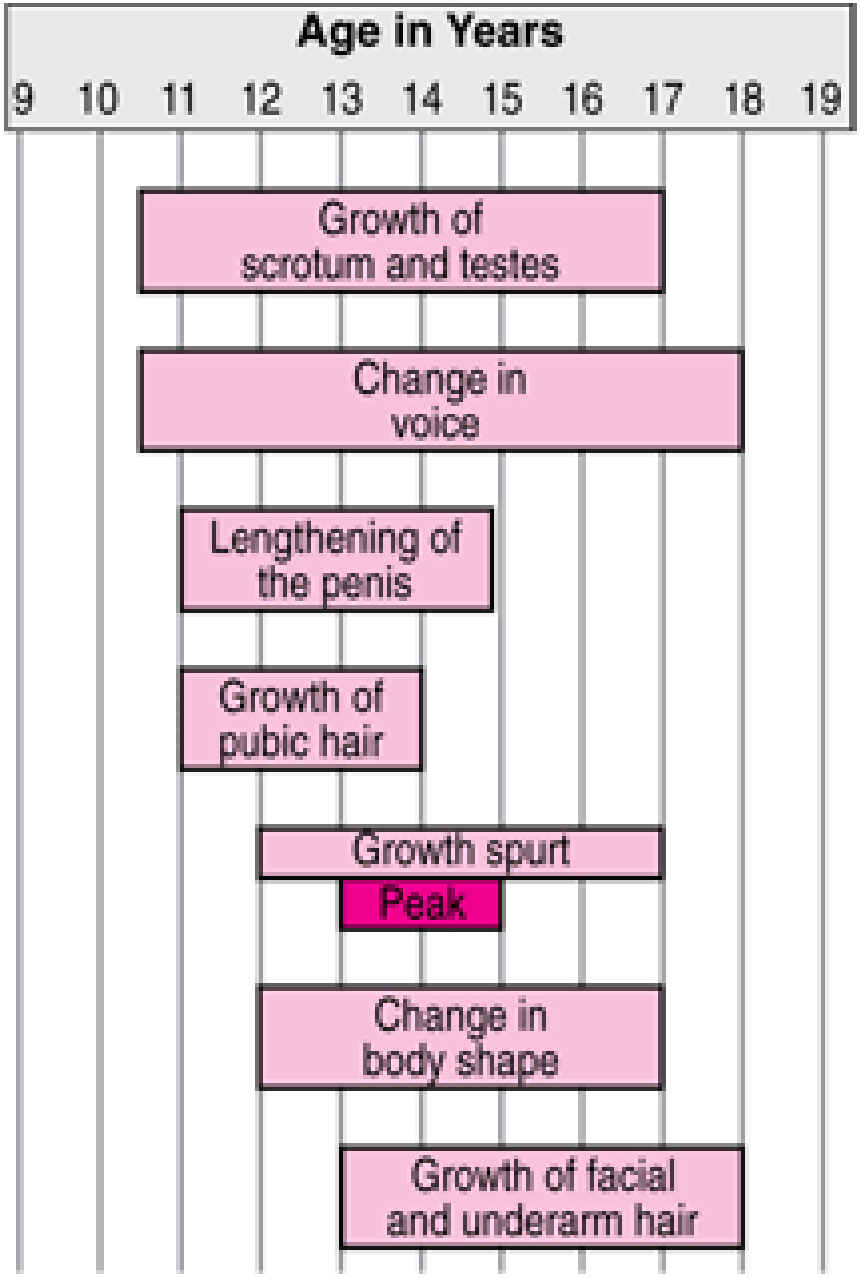
Tanner Stage1	Preadolescent	Only papilla is elevated	
Tanner Stage 2	Breast budding	Enlargement and widening of the areola and mound-like elevation of the breast and papilla	
Tanner Stage 3		Further enlargement of breast and areola with NO separation of contours	
Tanner Stage 4		Projection of the areola and papilla to form secondary mound above the level of the breast and further enlargement	
Tanner Stage 5	Adult Breast	Projection of the papilla only, as the areola recesses to the mature contour of the breast	

TANNER AND MARSHALL STAGES-PUBIC HAIR

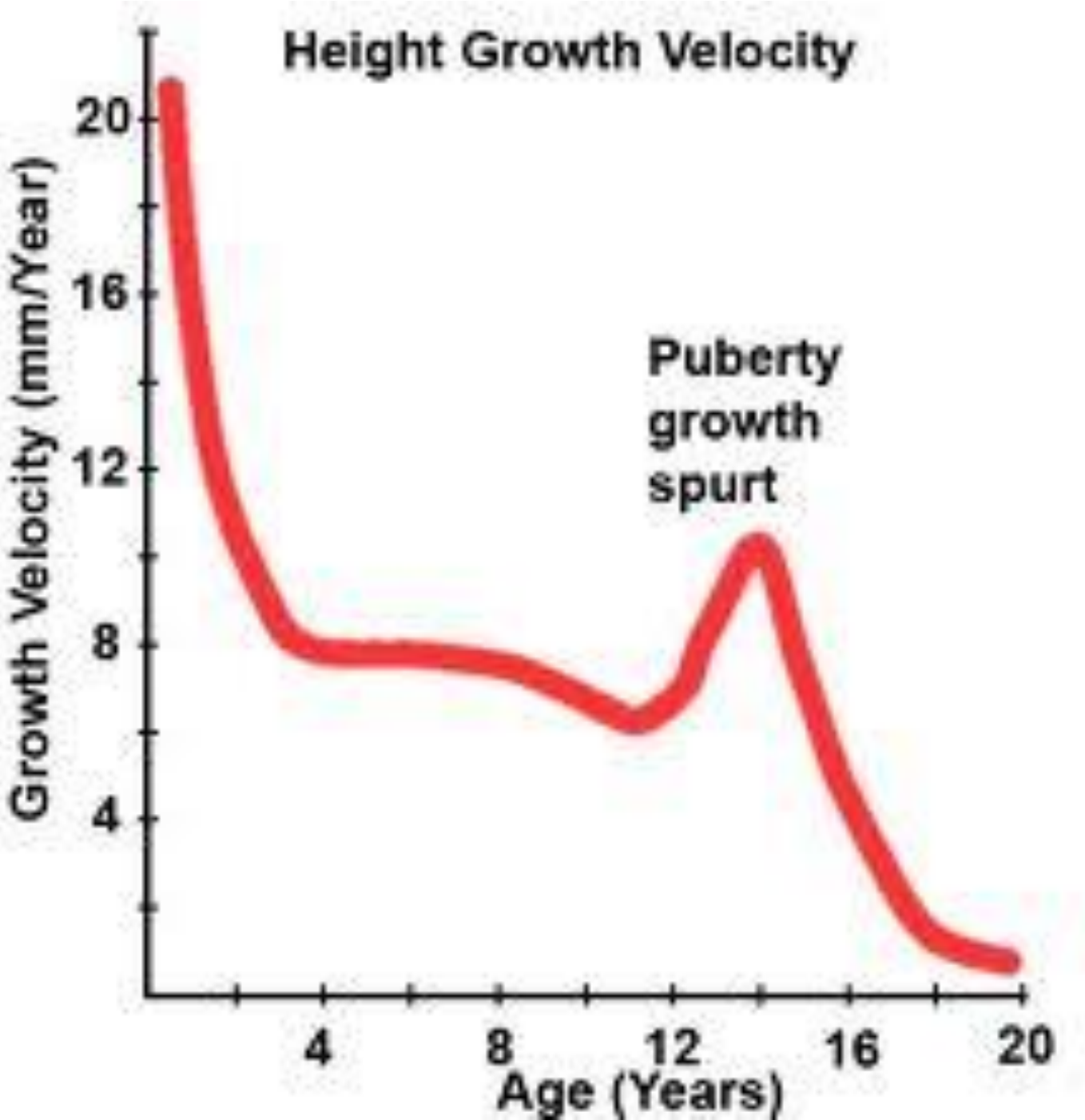
Tanner Stage1	Preadolescent	No discernable difference between vellus hair on the mons and anterior abdominal wall, no pubic hair	 I
Tanner Stage 2		Appearance of few, sparse, lightly pigmented hairs, with minimal curl on the labia	 II
Tanner Stage 3		Hair becomes darker, coarser and begins to spread over the junction of the labia	 III
Tanner Stage 4		Adult hair type emergens, covers mons pubis, but does not extend to the thighs	 IV
Tanner Stage 5	Adult hair pattern	Adult hair type in the classic female pattern	 V


Age in Years
8 9 10 11 12 13 14 15 16 17
Breast budding
Growth of pubic hair
Growth spurt
Peak
First period (menarche)
Growth of underarm hair
Change in body shape
Adult breast size

Girls


Age in Years
9 10 11 12 13 14 15 16 17 18 19
Growth of scrotum and testes
Change in voice
Lengthening of the penis
Growth of pubic hair
Growth spurt
Peak
Change in body shape
Growth of facial and underarm hair

Boys


Height Growth Velocity
Growth Velocity (mm/Year)
20
16
12
8
4
Puberty
growth
spurt
4
8
12
16
20
Age (Years)

Management

- Sex Education*
  - Esp. in schools girls
  - Knowledge about STD,HIV,Pregnancy
  - Contraceptive advise
- Menstrual hygiene education
- Nutrition –Adequate protein, increase demand of Calcium by 50% & Iron by 15%
- HPV vaccination

*In India, under IPC & POCSO Act a girl<18yrs cannot give consent for sex= it would be considered a statutary rape.

ABNORMALITIES OF PUBERTY

1 - Precocious puberty .

2 - Delayed puberty .

3 - Growth problems :

during adolescence e.g. short stature or tall stature , marked obesity and menstrual disorders at puberty .

FEMALE PRECOCIOUS PUBERTY

DEFINITION

Appearance of

any **secondary sexual characters**

<8 years

or

occurrence of **menstruation**

<10 years of chronological age

TYPES:

1 True precocious puberty

- GnRH Dependent (**Central, True or Complete**)
  - Premature maturation of hypothalamic-pituitary axis (HPO)

2 False (pseudo-precocious puberty)

& Incomplete precocious puberty

- GnRH Independent (**Pseudo, Peripheral or Incomplete**)
  - Gonadotropin secretion independent of HPO axis

Types

- **ISOSEXUAL**

  Features are due to excess production of estrogen

- **HETROSEXUAL**

  Features due to excess production of androgen (ovarian or adrenal neoplasm)

ETIOLOGY
TRUE PRECOCIOUS PUBERTY
GnRH dependent

- Constitutional – **MC**
- Juvenile primary hypothyroidism
- Intracranial lesions(TIN) –
  Trauma, Infection, Neoplasm

PSEUDO-PRECOCIOUS PUBERTY

GnRH Independent Varieties

OVARY

- Granulosa cell tm
- Theca cell tm
- Leydig cell tm
- Mc cune albright syndrome

LIVER

hepatoblastoma

ADRENAL

- Congenital adrenal hyperplasia
- Tumour

IATROGENIC

- Estrogen or androgen excess

History

- Timing of pubertal developmental signs
  - Normal tempo→central cause
  - Rapid tempo→Tumors
- Family history
- Medications
- ROS: pain, neuro symptoms, headaches, visual change

Exam

- Height and weight plots are CRITICAL!
- Visual fields
- Skin abnormalities?
- Thyromegaly?
- Tanner stage
- External genitalia normal?

External Signs…

Café Au lait spots

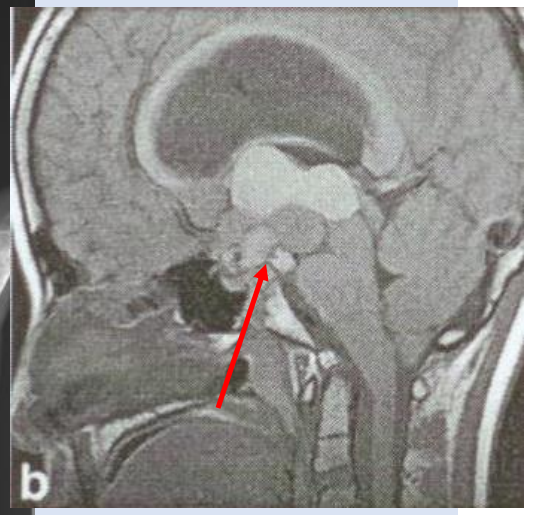
Clitoromegaly

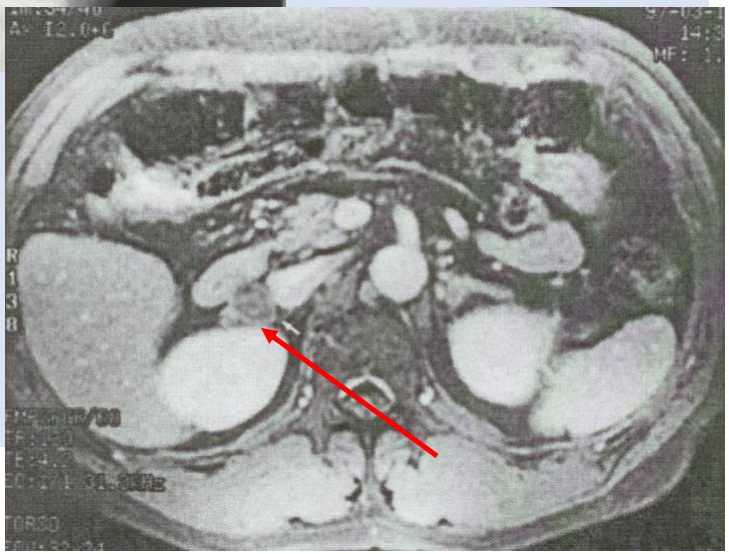
Labs

- Labs
  - LH, FSH,Estradiol
  - HCG
  - TSH
  - DHEAS, testosterone, 17OHP

Useful Imaging Studies

- X ray wrist-Bone Age
- Rule out tumor
  - MRI Brain
  - Pelvic Ultrasound
  - CT scan abdomen





Sorting it out…

Type of precocity	Gonadal Size	FSH/LH	Estradiol/ Testosterone	DHEAS	GnRH stimulation
Idiopathic	↑	↑	↑	↑	**Pubertal**
Cerebral	↑	↑	↑	↑	**Pubertal**
Gonadal	↑	↓	↑	↑	**Flat**
Albright	↑	↓	↑	↑	**Flat**
Adrenal	**normal**	↓	↑	↑	**Flat**

Treatment

- Explanation & Reassurance
- Following drugs which inhibit the secretion of gonadotrophins till appropriate age is reached

(a) **Gonadotrophin releasing hormone analogues** which are given as daily nasal spray, intramuscular, or subcutaneous injections every 4 weeks.

- **GnRH agonist therapy - administration for GnRH dependent cases**
- **Consult Endocrinologist**
  - **Weight-based-Intramuscular, subcutaneous or intranasal**
  - **Effects: can stop when reaches appropriate height, menses occur 1-2 years after cessation, puberty occurs at normal pace after cessation, no BMD diminishment, fertility unchanged**

Treatment

(b)Medroxyprogesterone acetate tablets (Provera tablets) or intramuscular injection (Depo-Provera);

(c) Danazol capsules;

(d) Cyproterone acetate tablets (Androcur).

Calcium & Vitamin D supplements

Isolated Pubertal Signs

- Precocious Thelarche
- Precocious Adrenarche
- Precocious Menarche

Precocious Thelarche

- Isolated development of breast tissue before age of 8 yrs
- Commonly idiopathic
- Unilateral or bilateral
- Requires no treatment

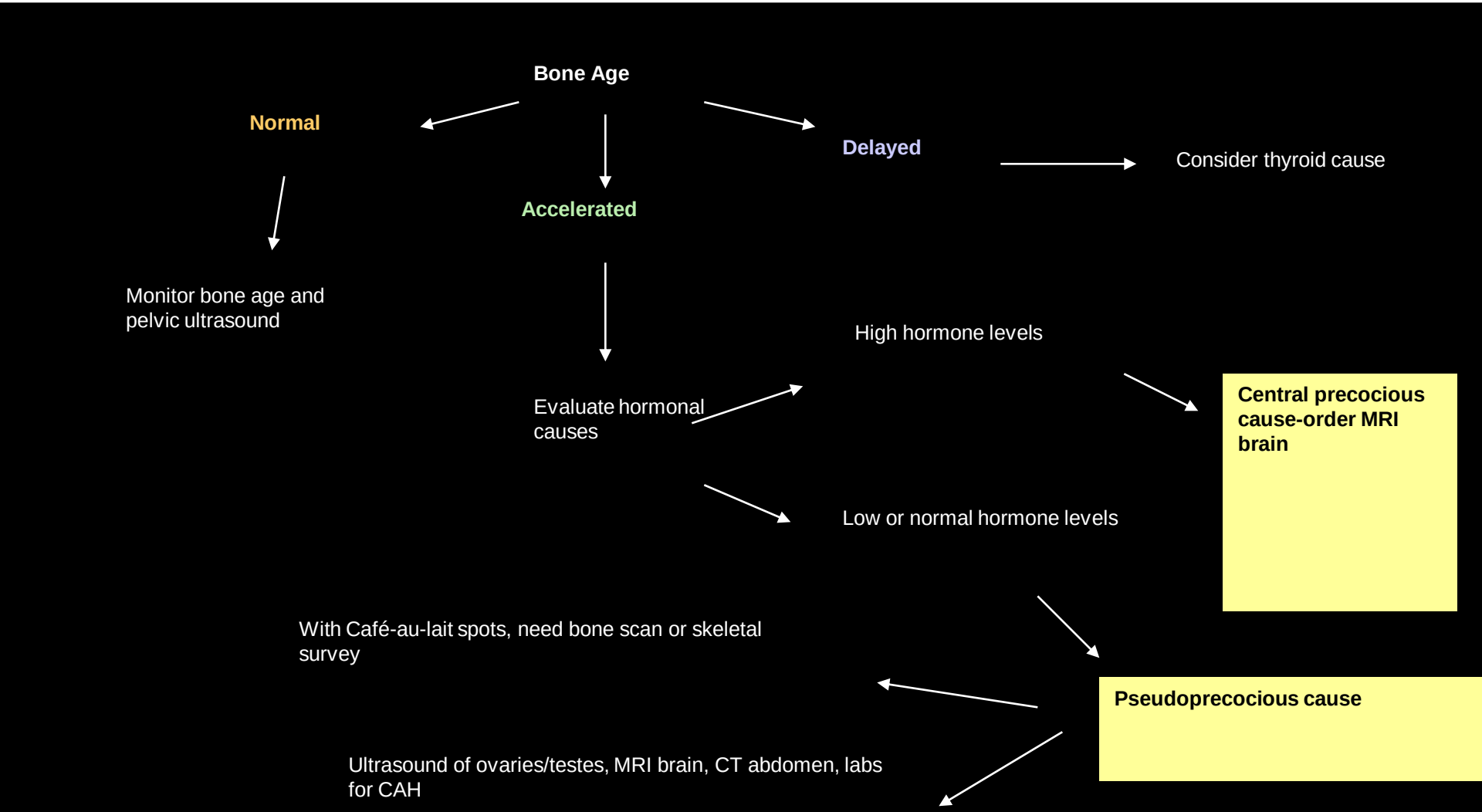
Precocious Adrenarche

- Due to early androgen activation
- Seen in certain ethnic groups, children with neurological sequelae, obese kids
- Increased risk for PCOS

Precocious Menarche

- A diagnosis of exclusion!
  - Rule out: infection, trauma, tumors, foreign body
- True cases thought to be idiopathic similar to precocious thelarche

Evaluation of Precocious puberty



DELAYED PUBERTY

No Secondary Sexual Characters 14y

or

No menstruation till age of 16y

DELAYED PUBERTY

- 3 classifications
  - **Hypergonadotropic hypogonadism**
  - **Hypogonadotropic hypogonadism**
  - **Eugonadism**

HYPERGONADOTROPIC HYPOGOANDISM

- LH & FSH are raised .
- What **causes** it?
  - Ovarian failure
  - Gonadal dysgenesis
  - Karyotypic abnormalities-Turner(XO)=MC
  - Chemotherapy
  - Radiation
  - Surgery
  - Galactosemia

HYPOGONADOTROPIC HYPOGOANDISM

- LH & FSH are decreased
- Reversible
  - Constitutional delay (most common)
  - Central suppression
    - **Weight loss, chronic disease, anorexia**
  - Prolactinoma
  - Primary Hypothyroidism
  - CAH

HYPOGONADOTROPIC HYPOGOANDISM

- Irreversible
  - Kallman's syndrome (most common)
  - Hypo pituitarism
  - CNS lesions

EUGONADISM

- Normal levels of LH & FSH
- Structural abnormalities
  - Mullerian agenesis
  - Transverse Vaginal Septum
  - Imperforate Hymen
- Karyotypic abnormalities
  - Androgen Insensitivity syndrome/testicular feminization synd.

History

- Age of pubertal initiation, if any
- Neonatal history
- Medical conditions
- Surgical history
- Medications/chemo/radiation
- Family history
- ROS: ie., inability to smell, rapid weight change, athlete, neuro symptoms, pain

Exam

- Presence of neck webbing?
- Tanner stage-breasts and genitalia
- Galactorrhea?
- Normal external genitalia?
- Rectal-e/o mass or bulging effect
- Thyromegaly?

Labs and Imaging

- Labs
  - FSH (if high, need a karyotype)
  - TSH
  - PRL
- Imaging
  - Pelvic ultrasound(ovary, uterine malformation)
  - MRI +/-
  - Bone Age

Evaluation

- High FSH (>10)
  - **Send Karyotype, then address underlying cause**
  - **If Turner's, may need HRT to enter puberty**

Evaluation

- Low to Normal FSH (<5)
  - **Exclude systemic condition**
  - **Rule out CNS Tumor (MRI Brain)**
  - **May need GnRH stim. test for confirmation**
  - **May include watchful waiting**
  - **Beginning hormones to enter puberty may be necessary (cyclic estrogen)**

TREATMENT OF DELAYED PUBERTY

Constitutional : Reassurance .

- Treatment of the cause (if treatable)
- or cyclic estrogen-progesterone hormone replacement therapy if the cause is not treatable ,
- for 3 cycles: Norethistrone acetate 5 mg twice daily for 21 d or OCP

* Patient with **Y chromosome cell line** : Gonadectomy + hormone replacement therapy

Questions

Short notes

- Describe endocrine changes at puberty.
- How will you counsel an adolescent girl who just attained menarche?
- Define delayed Puberty & enumerate its causes.
- Define Precocious puberty. How will you evaluate a case of precocious puberty?

Suggested reading

- Shaw's textbook of Gynecology, 16th edition