

## 12. FEMALE GENITAL ANATOMY:

### **Female external genitalia (vulva, pudenda):**

Mons pubis, labia majora, labia minora, clitoris.

The *vestibule*, derived from the definitive urogenital sinus and lined by mucosa (endoderm), is considered part of the *internal genitalia*.

### **Origin:**

*Mons pubis*: fat, areolar tissue (mesoderm) covered by skin epithelium (ectoderm)

*Labia majora*: fat, areolar tissue (mesoderm) covered by skin epithelium (labial folds-ectoderm)

*Labia minora*: urogenital/vestibular labial folds (ectoderm)

*Clitoris*: bicavernosal body, pars intermedia, glans clitoris (genital tubercle-mesoderm).

anterior section of the vestibule (endoderm)

dorsal hood, epithelium of glans clitoris (genital fold-ectoderm)

frenulum/labia minora (vestibular/urethral folds-ectoderm)

### **Labia majora:**

Longitudinal skin folds in the perineum. The prominent folds have a dartos layer with smooth muscle and a considerable amount of areolar tissue and fat.

The labia majora can arbitrarily divided into anterior 1/3<sup>rd</sup> and posterior 2/3<sup>rd</sup>. The clitoris emerges between the anterior parts of the labia majora. At the level of the dorsum of the clitoris, the anterior ends of the labia majora join the lower borders of the mons pubis.

The posterior 2/3<sup>rd</sup> of the labia majora are lateral to the pudendal space, which contains the perineal parts of the labia minora. The medial borders of the labia majora reflect on the outer surfaces of the labia minora in the interlabial sulcus.

The lateral borders of the upper 1/3<sup>rd</sup> of the labia majora reflect on the skin of the groin, while the lateral borders of the lower 2/3<sup>rd</sup> reflect in the thigh crease.

The posterior ends of the labia majora blend with the skin of the perineum lateral to the perineal/anogenital) raphe.

### **Labia minora in the perineum:**

Labia minora in the perineum are longitudinal skin folds about 4cm in length and variable width, attached to the medial borders of the posterior 2/3<sup>rd</sup> of the labia majora. The inner surfaces of the labia minora line the outlet of the posterior and middle sections of the vestibule. Upper borders of the *inner surfaces* meet mucosa of the posterior and middle sections of the vestibule. Upper borders of the *outer surfaces*, reflect on medial borders of the labia majora, in the *interlabial sulcus*. Posterior ends of the *labia minora* join in the *posterior commissure* (fourchette). Perineal (anogenital) raphe joins the fourchette to the anal verge.

**Clitoris:**

The clitoris (*dorsal hood and glans clitoris*) is homologous with the prepuce and glans penis in the male. The clitoris (~1.5-2.0cm length and ~3-4mm diameter) emerges from the perineum below the mons pubis, between the medial borders of the junction of the posterior and anterior 1/3<sup>rd</sup> of the labia majora.

**Development:**

The clitoris develops from the *genital swelling* (genital fold, genital tubercle) which grows forward from the lower abdomen and perineum

The *genital fold* (ectoderm) extends epithelium of the lower abdomen (mons pubis) and anterior 1/3<sup>rd</sup> of the labial folds (labia majora) to form the *dorsal hood*, and *epithelium of glans clitoris*.

The *vestibular/labial folds/labia minora* (ectoderm) from the posterior 2/3<sup>rd</sup> of the labial folds (labia majora), are continued as the frenulum/labia minora of the clitoris.

The *ventral border of the genital fold meets the upper border of the outer surfaces of the frenulum/labia minora at the level of the ventral surface of pars intermedia*.

Formation of the *genital tubercle* extends structures from the perineum through the dorsal hood, into the glans clitoris.

- the bicavernosal body and par intermedia (mesoderm) enter the dorsal hood and glans clitoris,
- pars intermedia (mesoderm), generates the (cap and roof of the) glans clitoris
- anterior section of the vestibule, is an extension of the mucosal *roof* (endoderm) of the middle section of the vestibule.

**Dorsal hood of the clitoris:**

The dorsal hood is a fold of skin that originates from the genital fold (ectoderm) The fold emerges below the mons pubis and overlaps the dorsal and lateral aspects of the glans clitoris. Epithelium of the mons pubis reflects on the *outer surface of the fold* in the sulcus between the mons and dorsal hood.

The *lateral surfaces* reflect in the sulcus between the clitoris and anterior 1/3<sup>rd</sup> of the labia majora.

The *ventral borders* of the dorsal hood meet the upper borders of the outer surfaces of the folds of the frenulum/labia minora of the glans clitoris, at the level of the ventral surface of par intermedia. The *inner layer* of the dorsal hood reflects on the *sulcus* between the dorsal hood and the corona of the glans clitoris.

**Glans clitoris:**

The glans clitoris is composed of spongy tissue (mesoderm generated by the edges of pars intermedia). It is covered by a thin layer of smooth epithelium derived from the *genital fold* (ectoderm).

(Mesoderm of the) *glans clitoris* can be arbitrarily divided into a *cap and a roof* The *crescentic cap* is molded around the conical end of the bicavernosal body. The posterior border of the crescentic cap is naturally continuous with the roof of the glans clitoris. The *roof* of the glans wraps around the *dorsal and lateral surfaces* of the distal end of the bicavernosal body. The posterior border of the roof forms the *corona of the glans clitoris* (corona glandis).

The *ventral borders* of the roof of the (mesoderm) are the *lateral borders of pars intermedia*. The *ventral border* of the crescentic cap is the distal end of *pars intermedia*.

*Mesodermal connections of the glans clitoris:*

Ventral borders (*pars intermedia*) of the *roof* and *cap* of the glans clitoris, contact the minute amount of *mesoderm* in the (base of the) folds of the *frenulum/labia minora* and *anterior commissure* of the frenulum/labia minora.

*Epithelial reflections of glans clitoris:*

Epithelium of the *corona* reflects on the *sulcus* between the *corona* and *inner surface of the dorsal hood*. Epithelium of the *ventral borders* of the roof the glans, meets epithelium of the upper ends of the outer surfaces of the *frenulum/labia minora*, at the level of the *inferior surface* of *pars intermedia*. Epithelium at the *ventral point of the crescentic cap* of the glans, (which is *just ventral to the conical tip* of the glans) meets epithelium at the upper end of the outer surface of the *anterior commissure* of the frenulum/labia minora (at the level of the ventral surface of *pars intermedia*).

***Frenulum/labia minora of the clitoris:***

The labia minora of the perineum leave between the posterior 2/3<sup>rd</sup> and anterior 1/3<sup>rd</sup> of the labia majora, to become the folds of the frenulum/labia minora on the ventral aspect of the clitoris. The thin folds of the *frenulum/labia minora* unite in the *anterior commissure* of the frenulum/labia minora.

*Epithelium of the outer surfaces of the frenulum/labia minora:*

*Posteriorly*, epithelium at the upper borders of the *outer surfaces* of the frenulum/labia minora reflects on epithelium at the *ventral ends of the dorsal hood*, and the *cleft* between the dorsal hood and the *corona* of the glans clitoris, at the level of the ventral surface of *pars intermedia*.

*Anteriorly*, epithelium at the upper borders of the *outer surfaces* of the frenulum/labia minora reflects on epithelium of the of the roof and cap of the glans, at the level of the ventral surface of *pars intermedia*.

*Anterior commissure:* Epithelium of the *upper border* of the *anterior commissure* of the frenulum/labia minora, reflects on epithelium of the *ventral point of the crescentic cap* of the glans clitoris, at the level of the inferior surface of the distal end of *pars intermedia*, which is *just ventral* to the *conical tip of the cap* of the glans clitoris.

*Mesoderm of the frenulum/labia minora of the clitoris:*

The tiny amount of mesoderm in the *base of the thin folds* of the frenulum/labia minora and anterior commissure, contacts the *lateral borders of pars intermedia* in the dorsal fold, the cleft between the dorsal fold and the *corona* of the glans, the roof of the glans, and the *distal end* of *pars intermedia* in the ventral point of crescentic cap of the glans clitoris.

*Epithelium of the inner surfaces of the frenulum/labia minora:*

Epithelium (*ectoderm*) at the upper borders of the *inner surfaces* of the thin folds of the frenulum/labia minora and anterior commissure, meets mucosa (*endoderm*) of the *roof of the anterior section of the vestibule*, at Hart's line.

***Pars intermedia:***

*Pars intermedia* is a narrow band (dorsal plate) of tissue derived from the anterior ends of the vestibular bulbs at the level of the arcuate ligament of the pubic symphysis. The *dorsal surface* of *pars intermedia* is adherent to the ventral groove of the bicavernosal body of the clitoris. *Pars intermedia* and bicavernosal body enter the dorsal hood of the clitoris at the level of the suspensory ligament of the clitoris.

The ventral surface of *pars intermedia* is adherent to the flat roof, that forms the anterior section of the vestibule in the dorsal fold and glans clitoris.

Developmentally, *pars intermedia* generates the spongy tissue (mesoderm) of the (roof and cap of the) glans clitoris. The *lateral borders* of *pars intermedia*, form the *ventral borders* of the roof of the glans. The *distal end* of *pars intermedia* forms the *ventral point of crescentic cap* of the *glans clitoris*.

***Anterior section of the vestibule:***

The anterior section of the vestibule is a narrow triangular extension of the *mucosal roof* of the middle section of the vestibule, on the ventral aspect of the clitoris (dorsal hood and glans clitoris). The *dorsal surface* of the roof of the anterior section of the vestibule is adherent to the ventral surface of *pars intermedia*, in the dorsal hood, and glans clitoris.

The anterior section of the vestibule consists of a mucosal roof only, it has no side walls. The dorsal surface of the roof is adherent to the ventral surface of the dorsal plate/*pars intermedia*.

***Hart's line of the anterior section of the vestibule:***

The *lateral edges* of the narrow *mucosal roof* (endoderm) meet epithelium (ectoderm) of the upper borders of inner surfaces of the frenulum/labia minora, along the ventral ends of the dorsal hood, and roof of the glans clitoris, at *Hart's line*. Mucosa (endoderm) of the narrow angle at the *distal end of the* (roof of the) *anterior section* of the vestibule, meets epithelium (ectoderm) of the upper border of the inner surface of the *anterior commissure* of the frenulum/labia minora, at *Hart's line*.

***Outlet of the anterior section of the vestibule:***

The *inner surfaces of the fourchette* (*posterior commissure*), *folds of the labia minora*, *frenulum/labia minora* and *anterior commissure* of the frenulum/labia minora, form the *outlet of the anterior section of the vestibule*.

***Bicavernosal body of the clitoris:***

The bicavernosal body of the clitoris is formed by median fusion of the (tunica albuginea of the) corpora cavernosa at the level of the arcuate ligament of the pubic symphysis. The bicavernosal body of the clitoris (and *pars media* attached to its ventral groove), enters the dorsal hood of the clitoris, at the level of the *suspensory ligament of the clitoris*, which originates from the pubic symphysis. The conical end of the bicavernosal body and attached distal end of *pars intermedia*, enters the glans clitoris.

The *dorsal hood and sulcus* between the dorsal hood and corona of the glans clitoridis, wraps around the dorsal and lateral surfaces of the bicavernosal body (and lateral borders of pars intermedia).

The *roof of the glans* clitoridis wraps around the dorsal and lateral surfaces of the bicavernosal body (and joins the lateral borders of pars intermedia). The *crescentic cap* of the glans clitoridis, molds around the conical end of the bicavernosal body. Mesoderm at the *ventral point of the crescentic cap* of the glans clitoridis joins the distal end of pars intermedia.

*Epithelial connections of the clitoridis:*

Epithelium (*genital fold*) of the dorsal hood and glans clitoridis, meets the upper borders of the outer surfaces of the frenulum/labia minora and anterior commissure (*vestibular/labial folds*) at the level of the ventral surface of pars intermedia.

Epithelium (ectoderm) at the upper border of the inner surfaces of the frenulum/labia minora, and anterior commissure, meets mucosa (endoderm) at the lateral borders and anterior end of the roof of the anterior section of the vestibule, at *Hart's line*.

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