

## 16. DEVELOPMENT EXTERNAL GENITALIA – indifferent stage

### *Terminology:*

Embryonic folds are derived from ectoderm. An *embryonic fold* usually overlies an embryonic swelling, tubercle, or plate.

### **INDIFFERENT STAGE OF DEVELOPMENT OF THE EXTERNAL GENITALIA:**

Horizontal *cloacal fold* surrounds the *cloacal groove*. The floor of the cloacal groove is formed by the *cloacal membrane*. The *cloacal membrane* has an *external layer of ectoderm* and *internal layer of endoderm*, with *no intervening mesoderm*. The cloacal membrane will be divided into the *anal membrane* and *urogenital membrane*

*Downwards growth* of the coronal *urorectal septum* divides the cloaca into the rectum, posteriorly, and *primitive urogenital sinus*, anteriorly.

*Perineal plates* grow medially, fuse in the midline and form the perineal raphe. The *perineal raphe* joins the anal verge (opening of the anus), to the *posterior end of the urogenital fold*.

The *perineal plates* divide the cloacal fold into a *circular anal fold*, posteriorly, and an *ellipsoidal urogenital fold*, anteriorly. Midline fusion of the *folds of the perineal plates*, form the *perineal or anogenital raphe*, which joins the opening of the anus (anal verge) to the posterior end of the urogenital fold.

The *anal fold* surrounds the *anal pit*, and its floor is the *anal membrane*. When the anal membrane disintegrates, mucosa (endoderm) of the rectum, meets epithelium (ectoderm) of the anus, at the *pectinate/dentate line*.

The ellipsoidal *urogenital fold* extends forwards ventral to the genital fold and genital swelling, it surrounds the *urogenital groove*, and its *floor is the urogenital membrane*. When the urogenital membrane disintegrates, mucosa (endoderm) of the *definitive urogenital sinus/ vestibule*, meets epithelium (ectoderm) of the urogenital fold, at *Hart's line*.

The *genital fold (ectoderm)* covers the genital tubercle. (mesoderm). The ventral border of the genital fold joins the lateral borders of the urogenital fold (ectoderm).

### *Genital fold: (m)*

The genital fold and underlying mesoderm will form the skin of the penis, the prepuce, skin of the coronal sulcus and body (cap, roof, wings) of the glans penis.

### *Genital fold: (f)*

The *genital fold and underlying mesoderm* will form the skin of the dorsal hood of the clitoris, abbreviated coronal sulcus and cap and roof of the glans clitoris.

### *Urogenital fold: (m)*

Fusion of the urogenital/vestibular/urethral folds will form the *genital raphe* (scrotal raphe, penile raphe, preputial raphe, the frenulum, and navicular raphe. The distal unfused segment of the urogenital fold will form the *labia and dorsal commissure of the labia of the glans penis*.

*Urogenital fold: (f)*

The urogenital/vesibular/labial fold will form the posterior commissure (fourchette), labia minora, frenulum/labia minora of the clitoris, anterior commissure of the frenulum/labia minora of the clitoris.

*Genital swelling:*

*The genital swelling* forms a conspicuous prominence in the genital region of the embryo. It consists of the *genital fold* (ectoderm with an underlying layer of mesoderm), the genital tubercle (mesoderm), and the urogenital fold.

*Genital tubercle: (m)*

The *genital tubercle (mesoderm)* emerges from the ischiopubic arch beneath the pubic symphysis. The *genital tubercle* contains forward extensions of the *corpora cavernosa* (bicavernosal body), *corpus spongiosum* with the penile vestibule/urethra, fossa navicularis, *dorsal plate of the fossa navicularis*, and (cap, roof, and wings of the) *glans penis*.

The genital tubercle is covered by the genital fold.

The genital fold joins the lateral borders of the fused segments of the urogenital fold (penile/preputial raphe, frenulum, navicular raphe), and proximal borders of the outer surfaces of the distal unfused segment of the urogenital fold (labia and dorsal commissure of the labia of the glans penis (external urethral meatus).

Mucosa (endoderm), at the distal end of fossa navicularis, joins epithelium (ectoderm), of the proximal borders of the inner surfaces of the labia, and dorsal commissure of the labia, of the glans penis, at *Hart's line*. In the ventral midline, mucosa of fossa navicularis joins medial borders of distal split end of navicular raphe (unfused urogenital/vesibular/urethral fold).

*Genital tubercle: (f)*

The *genital tubercle* contains forward extensions of the *corpora cavernosa* (bicavernosal body), anterior section of the vestibule (under the glans clitoris), dorsal plate/pars intermedia of the anterior section of the vestibule, and (cap and roof of) glans clitoris.

The genital tubercle is covered by genital fold.

The genital fold joins the upper borders of the outer surfaces of the urogenital fold (frenulum/labia minora of the glans clitoris).

Mucosa (endoderm), at the lateral borders of the anterior section (roof) of the vestibule, joins the upper border the frenulum/labia minora, and anterior commissure of the frenulum/labia, of the glans clitoris, at *Hart's line*.

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