

## Divided Naevus of the Penis: A Hypothesis on the Embryological Mechanism of its Development

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Sir,

Congenital divided naevus usually involves opposite sides of the upper and lower eyelids (1). About 34 cases of divided naevus of the eyelids have been reported, but it is relatively rare in other locations. Hayashi & Soma reported an epidermal naevus in a divided form on the fingers (2). Sonoda reported the first divided naevus on the penis in 1978 (3) and, since then, only two further cases have been reported (4, 5). We present three new cases of divided naevus of the penis and hypothesize a mechanism for its embryological development.

### CASE REPORTS

#### Case 1

A 9-year-old boy who was referred to our department presented with melanocytic naevi on his penis (Fig. 1). The pigmented lesions were located on the glans penis (15 × 9 mm) and on the inner surface of the prepuce (13 × 8 mm) on the right side of the dorsum of the penis at almost symmetric locations on each side of the coronal sulcus. In a resting position, the size of the preputial lesion seemed smaller than the glanular lesion because of the primary contraction of preputial skin. When the skin of the prepuce retracted, the lesions appeared as mirror images of each other relative to the coronal sulcus. Histologic examination of the biopsy specimen



Fig. 1. Divided naevus of the penis located on the each side of the coronal sulcus (Case 1).

taken from the prepuce revealed a compound naevus with no sign of malignancy.

#### Case 2

A 21-year-old male had two melanocytic naevi on his penis. His family history was negative, and there was no difference in the borders or colour of the naevi. On examination, the lesions were located on each side of the coronal sulcus, and affected the prepuce (12 × 10 mm) and the adjacent glans penis (12 × 10 mm). A biopsy specimen obtained from the prepuce showed intradermal naevus with no sign of cellular atypia.

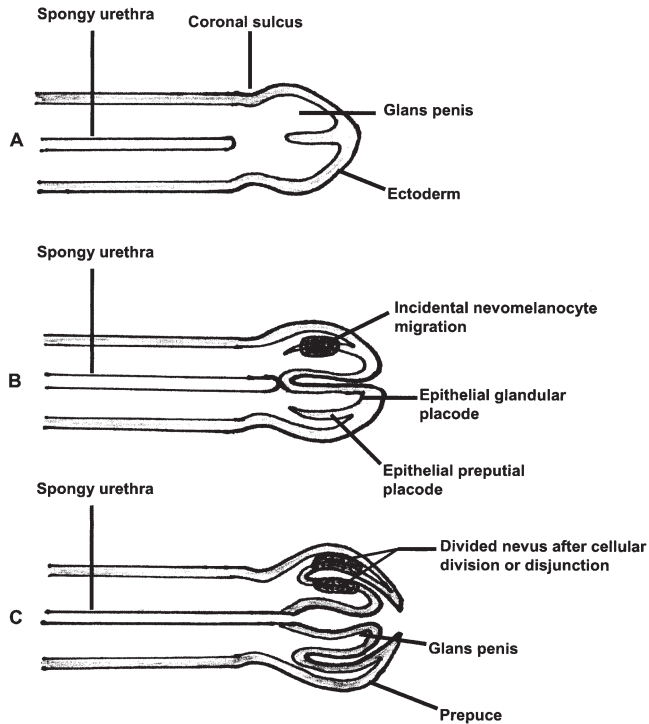
#### Case 3

A 12-year-old boy presented with divided naevus of the penis. It had first been detected by his parents when he was 12 months old. The lesions involved both the inner surface of the prepuce (5 × 5 mm) and the glans (6 × 5 mm) on the dorsal side of the penis, with mirror image symmetry. The coronal sulcus was exempt from melanocytic pigmentation.

### DISCUSSION

When all of the reported cases are taken into account, the divided naevi have the following similar and prominent features. (i) The divided naevus locates on the dorsal or dorsolateral aspect of the glans penis and the inner surface of the prepuce. (ii) The coronal sulcus is not involved in melanocytic pigmentation. (iii) The size and shape of all naevi are the same, and in some cases represent mirror-image symmetry relative to the coronal sulcus. These observations led us to hypothesize about the possible embryological mechanism of this uncommon naevi. As with the mechanism of embryological development of divided naevus of the eyelids (1), previous investigators suggested that the precursors of naevus of the penis are present at the coronal sulcus when ingrowth of the preputial epithelium begins to encircle the glans. They proposed that the migration of melanoblasts precedes the embryological separation, and that the divided naevus forms from the 11th to 14th week of gestation (3–5).

From the 9th week of gestation onwards, the external genitalia develop a male configuration, and the genital tubercle elongates to form the phallus. This elongation is accompanied by the appearance of the coronal sulcus, which delineates the glans from the shaft of the developing penis at the 11th week of gestation, but the prepuce has not yet formed (Fig. 2A). From the 12th to the early part of the 14th week, a circular ingrowth of ectoderm occurs at the periphery of the glans penis and gradually grows from the dorsal to the ventral side to



*Fig. 2.* Schematic depiction of the distal part of the developing penis and our suggested mechanism of development of the divided naevus on the penis. *A.* Development of the distal part of the penis accompanied by the appearance of the coronal sulcus at the 11th week of gestation. *B.* Circular ingrowth of ectoderm and invaginations from the developing prepuce that are formed by lamellar ingrowth of epithelial cells from a terminal tag at the tip of the glans, and incidental migration of naevomelanoblasts into the epithelial preputial placode after completion of epithelial invagination at the 12th week of gestation. *C.* Following the migration of melanoblasts, embryological separation or disjunction of the epithelium at opposite sites by the 13th week of gestation, and final presentation.

circumferentially enclose the glans, fusing with the glans epithelium. The preputial and urethral folds fuse on the ventral aspect of the glans as the fraenum (6, 7). By the 12th week of gestation, the developing prepuce gives two invaginations that are formed by the lamellar ingrowth of epithelial cells from a terminal tag at the tip of the glans (6, 8) (Fig. 2*B*). Canalization of a cord of epithelial cells of the epithelial glandular placode forms the glandular urethra, and the breakdown or cellular cleavage of the epithelial preputial placode severs the glans from the prepuce (9) (Fig. 2*C*). Melanoblasts appear first on the scalp by the 8th week of gestation and complete their migration by the 12th gestational week (10). These cells penetrate the skin of the penis around the 12th week of gestation. The faulty maturation and migration of melanocyte stem cells due to some abnormalities result in the ectopic population of cells that is seen in the naevus (11, 12).

Considering these embryological processes, it is likely that the incidental migration of melanoblasts forms not before, but just after completion of the invagination of the preputial epithelial placode at the 12th week of gestation. Hence, the cellular division of the melanoblasts at this location occurs when the epithelial disjunction between the glans and prepuce begins at opposite sites by the 13th week of gestation. This explains why all divided naevi of the penis have the same size and shape with mirror-image symmetry relative to the coronal sulcus. The predilection site of divided naevus of the penis is almost always the dorsal or dorsolateral aspect (Fig. 1). Because circular ingrowth of ectoderm at the periphery of the glans penis gradually grows from the dorsal to the ventral side, and the epithelial invagination first begins on the dorsal side (6, 7), it seems likely that the incidental migration of naevomelanoblasts occurs at the dorsal or

dorsolateral side of the preputial epithelial placode at this critical stage.

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