Sensory Development

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KEYWORDS

• Neonate • Sensory • Vision • Hearing • Oral development • Taste • Smell

KEY POINTS

- Sensory development begins in early fetal life responding to in utero stimulation.
- Sound transmission from the mothers speech, heartbeat, and external noise stimulates fetal hearing development prior to birth.
- Color vision is absent in babies less than 34 weeks gestation and the first color perceived by newborns is red.
- Taste and smell in the newborn correlates with maternal dietary components in amniotic fluid.
- Primary care providers are poised to detect anatomic and sensory abnormalities and coordinate early intervention.

INTRODUCTION

Sensory development is complex, with both morphologic and neural components. The senses begin to develop well before birth based on in-utero stimuli. They all mature rapidly in the first year of life. This article focuses on the cranial senses of vision, hearing, smell, and taste. Tactile development and pain perception are not addressed. Sensory function, embryogenesis, external and genetic effects, and common malformations that may affect development are discussed, along with the corresponding sensory organ examination and evaluation.

VISION

Eye Development

The eye is derived from an outgrowth of neuroectoderm of the forebrain.[1,2] By the 32nd embryonic day, a distinct optic cup with a ventral groove is detectable. The optic cup further invaginates to form the globe with anterior and posterior chambers.

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Surface ectoderm is pulled in to form the lens, iris, and other associated structures to separate the 2 chambers. The cornea is formed from surface ectoderm and a fine layer of mesoderm between the neuroectoderm and surface ectoderm. The eyelids and lacrimal glands are formed from surface ectoderm. The retina forms from the internal walls of the optic cup. A thick neuroepithelium differentiates into rods and cones. Myelination is incomplete before birth at term but, after light exposure for approximately 10 weeks, myelination is complete. This process is markedly delayed in babies born prematurely and may be disrupted significantly in retinopathy of prematurity.[3]

Examination of the Eye

The eyelids meet and adhere by the tenth week of gestation.[2,4] They remain adherent until approximately 26 weeks' gestation. Although uncommon, babies born vaginally with a face presentation may have everted eyelids, which readily reduce with few complications and normal eyes otherwise (**Fig. 1**). An eyelid coloboma (notched lid) is a rare defect limited to the upper eyelid that requires surgery to protect the cornea and conjunctiva.

Conjunctival hemorrhage, often associated with a difficult delivery, is absorbed within several weeks. The sclera may be discolored yellow with significant jaundice and may appear bluish in inherited collagen vascular diseases because of scleral thinning and visualization of the underlying retina. Newborn eye prophylaxis to prevent bacterial infection often produces a transient chemical conjunctivitis. Conjunctival discharge may be caused by an infection, with gonorrhea and chlamydia being the most serious infections (**Fig. 2**). Obstruction of the nasolacrimal duct results in excessive tearing. Cloudy or protruding cornea indicates glaucoma (**Fig. 3**). The increased pressure of the aqueous humor in the anterior chamber is an emergency requiring immediate consultation and intervention by a pediatric ophthalmologist.

The iris color at birth is bluish in most infants. Pigmentation often progresses to a darker color, with the final iris color achieved by 4 months. Lack of pigmentation with a pink iris is a primary feature of albinism. Aniridia, complete lack of irises, is caused by an arrest of development of the rim of the optic cup at the eighth week. A failure of the ventral groove to fuse in early development leads to an iris coloboma, seen as a keyhole defect of the iris, which may extend into the ventral retina. The ciliary body is similarly affected, resulting in the inability to constrict the pupil and subsequent photophobia.

Fig. 1. Everted eyelids.