Kinocilia in the developing stria vascularis of the rat pup

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Abstract The mammalian stria vascularis undergoes certain developmental changes in the postnatal rat. The present study was designed to examine the ultrastructure of the stria vascularis in rat pups from immediately after birth to 20 days postpartum. The cochlea were removed with the animals under xylazine (Rompun) anesthesia and were prepared for transmission electron microscopy. Each of the three cell types in the stria were found to contain kinocilia up until 12–17 days of age. The presence of kinocilia in the intermediate and basal cells has not been previously described. Findings suggest that these organelles may serve a motile and/or sensory function to assist in the maturation of cell functions, particularly ion transport, during early stages of development.

Key words Cochlea • Ultrastructure • Stria vascularis Development

Introduction

The stria vascularis of mammals is an important structure that occupies the lateral wall of the cochlea. In addition to strial capillaries, the adult stria vascularis is made up of three cell types: the marginal or dark cells facing the endolymphatic space; the intermediate cells, which interdigitate with the marginal cells and capillaries; and the basal cells, which form a continuous layer of cells separating the stria from the spiral ligament [8].

The stria vascularis of altricial mammals such as the rat [13], cat [6] and mouse [9, 16] undergoes dramatic postnatal ultrastructural and functional changes. Previous studies have reported that cells lining the cochlear duct, including marginal cells, bear kinocilia on their endolymphatic surface [2, 9]. To our knowledge, no previous studies have demonstrated the presence of kinocilia in the intermediate or basal cells of the stria vascularis. The purpose of the present study was to examine the stria vascularis of the developing rat in order to determine which cells of the stria vascularis have kinocilia at various stages of development.

Materials and methods

Sprague-Dawley rats were bred locally in our vivarium [13, 14]. Rat pups from immediately after birth up to 20 postnatal days of age were utilized for study. Three rats at each day of age were sacrificed and the cochleas were removed and placed immediately into a solution of 2.5% glutaraldehyde in 0.2 M phosphate buffer. The lateral wall of the first turn of each cochlea was dissected out, placed into 2.5% glutaraldehyde in 0.1 M phosphate buffer and refrigerated. This was next postfixed in 1.5% osmium tetroxide in 0.1 M phosphate buffer, dehydrated in graded concentrations of ethanol, and embedded in Spurr resin. Thin sections were made, stained with saturated uranyl acetate in 50% ethanol and Reynold’s lead citrate and examined and photographed in a Hitachi H7000 scanning transmission electron microscope.

Results

Rat pups were found to have a kinocilium present on the endolymphatic surface of marginal cells from immediately after birth until 12 postnatal days of age (Figs. 1–3). Kinocilia were located near the Golgi apparatus but then disappeared after 12 days of age. Basal cells and intermediate cells also had kinocilia from immediately after birth until 17 days of age (Figs. 4, 5). As with the marginal cells, there was no evidence of kinocilia in these cells after 17 days of age (Fig. 6).

Discussion

To our knowledge, no previous reports have described kinocilia in the intermediate and basal cells of the stria vascularis in the rat. Kikuchi and Hilding [9] studied the developing mouse cochlea and found that the marginal