Fine Structure of the Vestibular Kinocilium

Fine structure of the guinea pig utricular kinocilium was examined with transmission electron microscopy in the use of tannic acid staining. Inner dynein arms and central pair of microtubules were selectively lacking, meanwhile outer dynein arms were typically observed. These findings seem to support the concept that the vestibular kinocilium is nonmotile or weakly motile.

INTRODUCTION

The vestibular kinocilium has been considered to be predominantly nonmotile (1). Flock et al. (2) reported that kinocilia displayed continuing movement in the frog crista ampullaris. Recently this has been confirmed, consequently making the nonmotile hypothesis of the vestibular kinocilium controversial. In the present study, we describe the fine structure of the guinea pig vestibular kinocilium with special emphasis on its motility.

MATERIALS AND METHODS

Male albino guinea pigs were used in the present investigation. The utricular macula was fixed with 2.5% glutaraldehyde containing 1.0% tannic acid for 2h. The specimens were post-fixed with 1.0% osmium tetroxide for 2h. After dehydration, they were embedded in Epon 812. Ultrathin sections were examined under a transmission electron microscope.

RESULTS

In place of a central pair of microtubules, the center of the vestibular kinociliary axoneme was occupied by an electrondense amorphous substance, while the peripheral doublets were arranged in an orderly manner with typical protofilaments (Fig.1). The inner dynein arms were absent, whereas the outer dynein arms and radial spokes were well preserved.

DISCUSSION

It has been largely accepted that the vestibular kinocilium has the typical 9+2 composition (3). In the present study, we demonstrated that a central pair and inner dynein arms were lacking in the guinea pig vestibular kinocilium, confirming our preceding study (4).

Recently, many cases of immotilecilia syndrome, in which deficient cilia are devoid of the inner dynein arms, have been reported (5). In 1979, a unique Chlamydomonas mutant, similarly lacking the inner dynein arms, was isolated and found to be immotile (6). Accordingly, we deduce from the absence of the inner dynein arms that mammalian vestibular kinocilium is probably immotile or weakly motile.
LIST OF REFERENCES


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Fig. 1 TEM micrograph of a crosssection of kinocilium from guinea pig utricular macula. The inner dynein arms and the central pair of microtubules are absent; meanwhile, the outer dynein arms (O) and the radial spokes (R) are typically visualized.

The nexin links are inconspicuous or lacking.