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NUCLEAR CYTOPLASMIC RATIO IN EPITHELIAL CELLS OF HUMAN OVIDUCT

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ABSTRACT

Nuclear cytoplasmic ratio (NCR) is a marker of cell differentiation relatively constant for every given kind of cell. In connection with the previous quantitative study NCR of basic cell types in human oviductal epithelium was studied. Samples of fimbriae, ampulla and isthmus were processed by a routine method for electron microscopy. Randomly chosen ultrathin sections with perpendicularly cut epithelium were photographed and used for evaluation of ciliated (CC) and secretory (SC) cells. Measurements of cellular and nuclear areas of CC a SC from all three parts of oviducts were performed by means of digitalized tablet and commercially available Sigma Scan 3.0 scientific measurement program. Nuclear cytoplasmic ratios (NCR) were calculated in cells which occupied the whole height of the epithelium. Obtained data were analysed using a Student s t-test ($p = 0.05$). Differences between CC and SC are significant in fimbriae only, contrary to both others oviductal segments. The NCR values of CC differ significantly in all three segments. The differences are nonsignificant for SC. Lower values of NCR-CC in fimbriae comparing with all other cells may be explained by structural changes of fimbrial CC during the late luteal phase.

Key words: epithelium, human oviduct, nuclear cytoplasmic ratio

INTRODUCTION

Oviducts are specialized organs for the fertilization of ovum, nutrition and transport of early embryo into uterus. Oviducts are lined with a simple columnar epithelium consisting of ciliated and secretory cells. Ciliated cells (CC) furnished with numerous cilia take part in the movement of ovum and spermatozoa. Secretory cells (SC) are nonciliated cells, their product is a kind of nutrient material for ovum as well as a substance involved in capacitation of spermatozoa.
Nuclear cytoplasmic ratio (NCR) is believed to be constant for every given cell type and is considered as a marker of cell differentiation (Kam and White, 1992). Numerous studies dealing with structural and functional changes of oviductal epithelium, whereas little attention was paid to the quantitative description. As we studied the relative number of ciliated cells in the epithelium of the human oviduct (Hach et al. 1986a, 1986b), we decided to follow NCR of both basic cell types in

the epithelium of three principal segments of the oviduct - in fimbriae, ampulla and isthmus.

MATERIAL AND METHODS

Five oviducts in late luteal phase (days 21 - 25 of menstrual cycle), obtained by surgical intervention, were used. Oviducts were cut transversally in 3 mm thick slices. Samples from fimbrial processes and from mucosal folds of ampulla and isthmus were taken out from every oviduct, cut into 1 - 2 mm pieces and processed for electron microscopy in a routine way (for details see Jirsová and Vernerová, 1990). Tissue blocks taken out from principal segments of every oviduct were processed in paralel for light microscopy to eliminate organs with pathological changes.
Double stained ultrathin sections were examined under a JEM 100 B electron microscope. Randomly chosen sections were photographed according to their position on the supporting grids (laying in the upper left corner of the grid square). Electron micrographs with perpendicularly cut epithelium were collected. Only cells which occupied the whole height of the epithelium, i.e. cells extending from the basal lamina up to the free luminal surface, were taken in account for the evaluation of NCR. All specimens used for quantitative measurements were free of pathological changes.

Morphometric procedures

Electron micrographs were analysed using a Sigma Scan 3.0 scientific measurement program. Images from electron micrographs were projected onto a digitalized tablet. A cursor and digitalized tablet were used to outline CC and SC and their nuclei (Fig. 1). The system was set up to provide files for handling nuclear areas (Anuc) and cellular areas (Acell). From each of 3 segments (fimbriae, ampulla and isthmus) of every oviduct, 50 CC and 50 SC were analysed.

$$\text{Nuclear cytoplasmic ratio (NCR)} = \frac{\Sigma \text{ Anuc}}{\Sigma \text{ Acell} - \Sigma \text{ Anuc}}$$

Final group means and standard deviations were calculated within each group. Statistical analysis of the data was performed using an analysis of variance followed by a Student s t - test ($p = 0.05$).

RESULTS AND DISCUSSION

The height of epithelium in the human oviduct and the structure of ciliated and secretory cells is modified during the menstrual cycle (Martínek et al. 1984). The cyclic changes of oviductal epithelium were described mainly qualitatively using microscopic, ultrastructural and cytochemical examination. Morphometric data deal only with length and width measurements of epithelial cells and size of their nuclei on smears of the

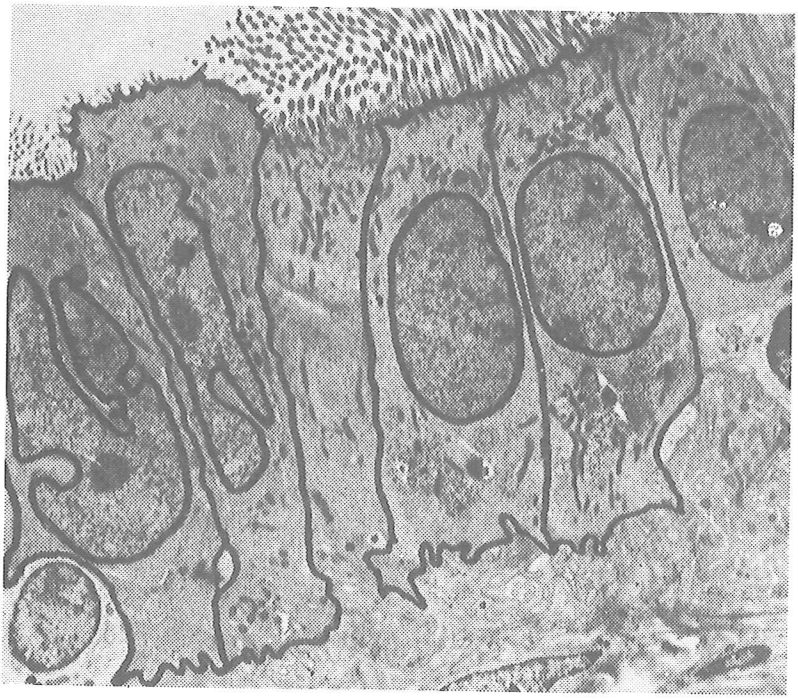

Fig.1. Epithelium of human oviduct (day 23 of the menstrual cycle). Borders of ciliated (C) and secretory (S) cells and their nuclei (N) are outlined (black line). x10 000.

oviduct (Dudkiewicz, 1970). NCR has not yet been determined in the epithelium of oviduct. Electron microscopy methods allow more precise classification of cell types, analysis of cell structure and measurement of different cellular details. In the present study, we tested the method of estimation of the NCR in CC and SC of principal segments of oviduct during the luteal phase of the menstrual cycle. The results are summarized in Table 1. and Figs. 2. and 3.

Table 1. Nuclear cytoplasmic ratio in ciliated and secretory cells of human oviduct.

	CILIATED CELLS			SECRETORY CELLS		
	n	mean	±SD	n	mean	±SD
FIMBRIAE	250	.397	.167	250	.517	.168
AMPULLA	250	.652	.124	250	.628	.140
ISTHMUS	250	.493	.102	250	.532	.146

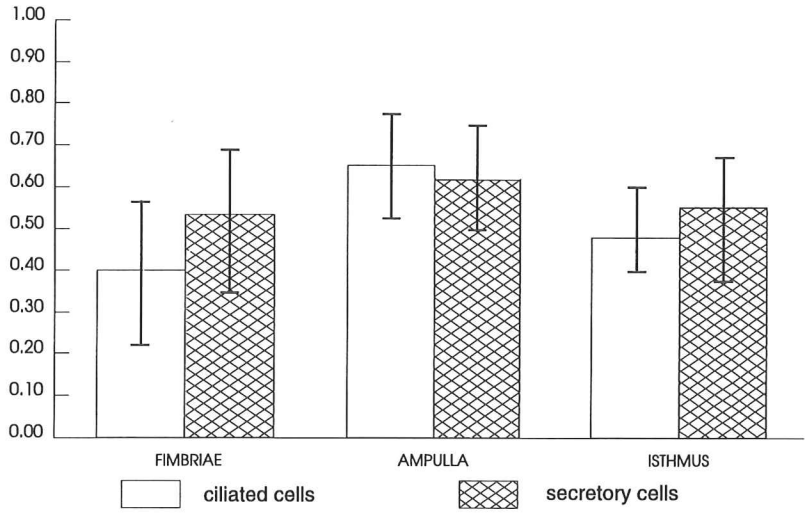

Fig. 2. Nuclear cytoplasmic ratio of epithelial cells in human oviduct

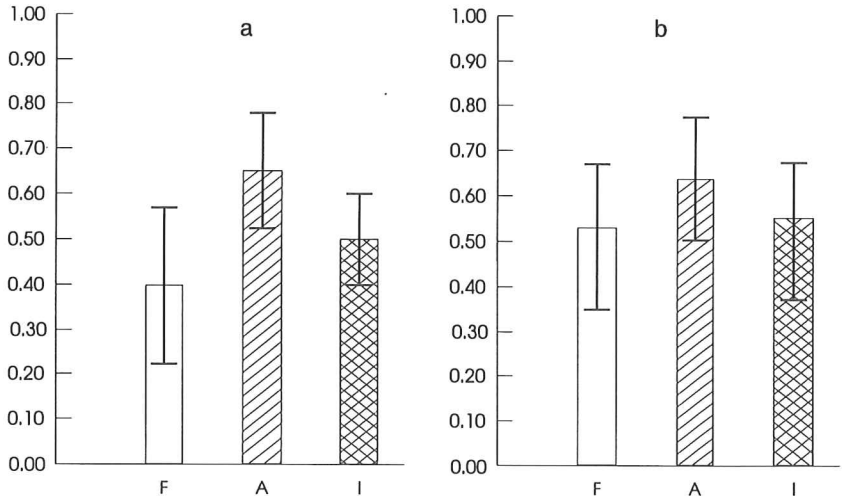

Fig. 3. Nuclear cytoplasmic ratio of ciliated (a) and secretory (b) cells in principal segments of oviduct fimbriae, ampulla, isthmus.

The results of all measurements vary in limits of random variation. The analysis of NCR values proved that the mean values of NCR in SC and in CC change in the same way along the oviduct, being the lowest in F and the highest in A. NCR differs in CC in all segments of oviduct (F, A and I) significantly, contrary to nonsignificant differences of NCR in SC. When comparing both cell types (CC and SC) with another in the same segment of oviduct, the significant difference of NCR was found in F only. Higher NCR in A, when compared with those in F and I may be related to a special function of A during fertilization and early embryo development. Lower values of NCR found in F as well as the significant difference of NCR in CC / SC in F may be connected with structural changes of fimbrial CC during the late luteal phase.
This method of NCR determination on electron micrographs of the human oviduct epithelium provided satisfactory results and seems to be suitable for further studies following the NCR in epithelial cells in the course of the menstrual cycle.

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