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Previously unreported «*hemidesmosomal junctions*» between folliculo-stellate cells and pituitary adenoma cells

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Summary. Thirty-eight non-functioning pituitary adenomas were ultrastructurally investigated with particular attention to the Folliculo-Stellate (FS) cells. A large number of FS cells were found in four cases, one of which disclosed a new type of intercellular junction between FS cells and surrounding adenoma cells. These junctions were characterized by 1) the presence of plasmalemmal attachment plaques only in FS cells, 2) the cytoplasmic filaments assembling in parallel to the attachment plaques, 3) the parallel plasma membranes being separated by the intercellular amorphous material and 4) the intercellular space of approximately 25nm width. They were similar to hemidesmosomes, but were quite different from hemidesmosome-like intercellular specializations which have been described in the normal meninges and human meningiomas. Accordingly, we designated these new junctions as «*hemidesmosomal junctions*» which appeared to be one of the ultrastructural features characterizing FS cells.

Key words: Hemidesmosomal junction, Folliculo-Stellate cells, Pituitary adenomas

Introduction

Farquhar (1957) described a new type of cell in the rat anterior pituitary, which were situated in groups around follicles or ductules containing colloid-like substance. Subsequently, these cells have been found in various species and also in human pituitary adenomas. As the cells surrounding follicles were often stellate in shape, Vila-Porcile (1972) proposed the term «*folliculo-stellate cells*». They usually contain few secretory granules and extend many microvilli and a few cilia towards the follicular lumen. The FS cells are usually connected to each other by desmosomes, tight junctions and intermediate junctions. However, junctional complexes connecting FS cells and surrounding adenoma cells still remain obscure. In the investigation of 4 cases of non-functioning pituitary adenoma with numerous FS cells, we confirmed various junctional complexes between FS cells. Furthermore, in one of the four cases we found a new type of intercellular junction between FS cells and surrounding adenoma cells. These new junctions were similar to hemidesmosomes, but were quite different from hemidesmosome-like junctions which have been described in the normal meninges and human meningiomas (Nabeshima et al., 1975; Copeland et al., 1978). This paper is to describe ultrastructural features of previously unreported junctions which have been designated «*hemidesmosomal junctions*» by us.

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Materials and methods

We investigated 38 non-functioning pituitary adenomas which were surgically resected. The cases were 21 males and 17 females with an age range of 20-76 years. The specimens were cut into small pieces, then fixed in 2.5% glutaraldehyde in 0.1M cacodylate buffer at pH 7.4 for 2h, and postfixed in 1% $0s0_4$ in the same buffer for 1h. After dehydration thorough a graded concentration of ethanol, the samples were embedded in Epon 812 and Araldite. Sections 1μm thick were stained with toluidine blue. Ultrathin sections were made of selected areas on an LKB ultramicrotome with a diamond knife and were stained with uranyl acetate and lead citrate. A Hitachi H-600 electron microscope was used.

Results

A large number of FS cells were found in 4 cases of 38 non-functioning pituitary adenomas. Ultrastructural features of FS cells were almost identical to those described previously. Briefly, the follicles contained

abundant fine granular material intermingled with some cell debris and were surrounded by FS cells. The nuclei of FS cells were ovoid or triangular with a marginal accumulation of heterochromatin. The cytoplasm contained numerous intermediate filaments and free ribosomes but no hormonal granules. There were many microvilli and a few cillia towards the follicular lumen. However, there was no basal lamina at the luminal surface of FS cells (Fig. 1). The latter were connected to each other by junctional complexes such as desmosomes, tight junctions and intermediate junctions. Slender cytoplasmic processes extended among the surrounding adenoma cells, which were connected by desmosomes and intermediate junctions.

A new type of intercellular junction was found in one of the four cases between FS cells and surrounding adenoma cells (Fig. 2). In these junctions the intercellular space was approximately 25nm in width and was filled with an electron-dense amorphous material. This intercellular material was separated from the plasma membrane of neighbouring adenoma cells with an intervening electron-lucent extracellular zone. But, there was no intervening space between the intercellular material and the adjoining plasma membrane of FS cells. Along the plasma membranes surrounding the intercellular material, there were a number of electron-dense plaques, 20nm thick, in the cytoplasm. These cytoplasmic plaques were present only

Fig 1. Various junctional complexes including «*hemidesmosomal junctions*» (arrows) around the follicle (F) × 7,000

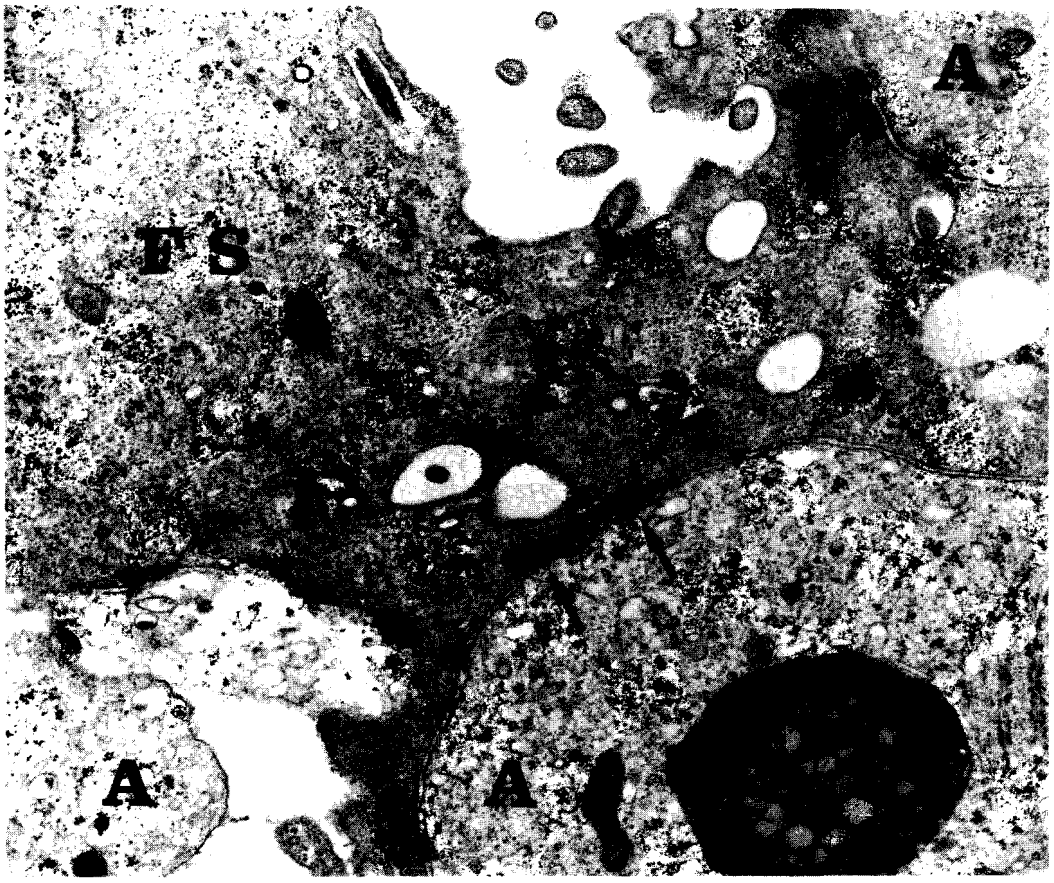

Fig. 2. Multiple *«hemidesmosomal junctions»* (arrows) between FS cells (FS) and adjacent adenoma cells (A). × 20,000

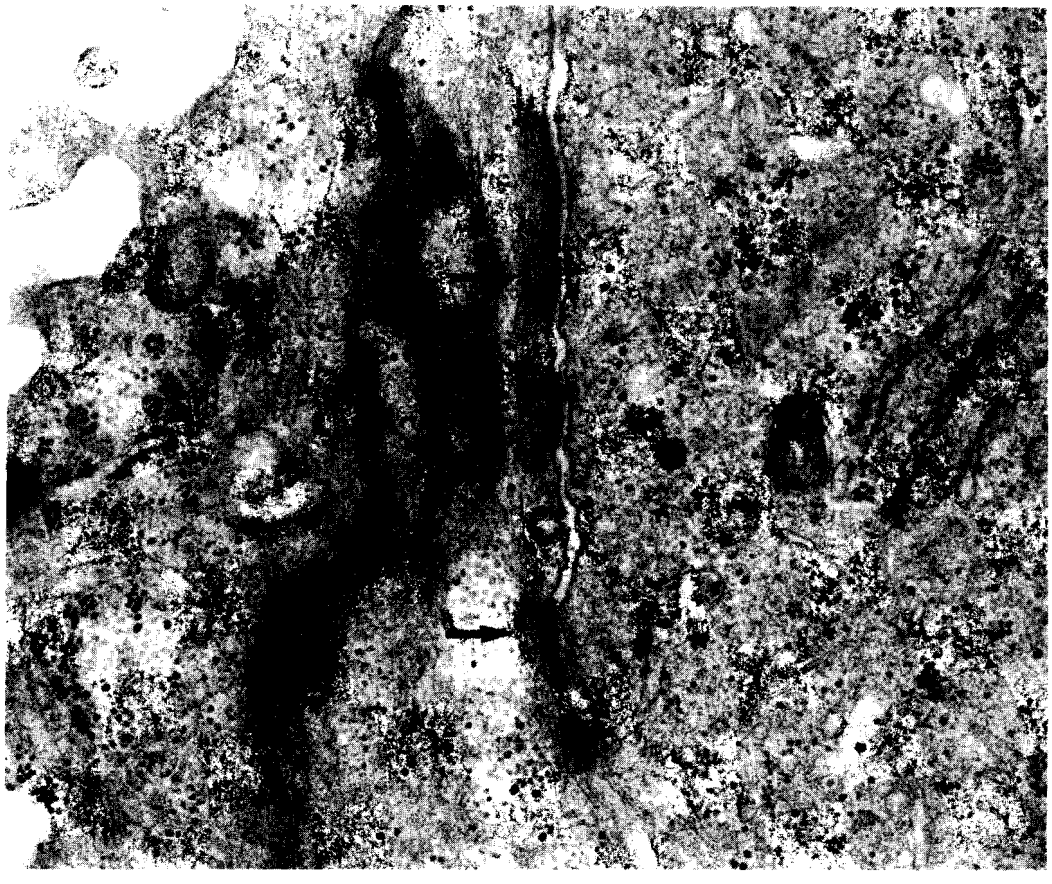

Fig. 3. Cytoplasmic filaments (arrows) parallelly assembling to the attachment plaque of *«hemidesmosomal junctions»*. × 40,000

in the FS cells but not in the surrounding adenoma cells. The cytoplasmic filaments of FS cells assembled in parallel to the attachment plaques (Fig. 3). These new junctions were similar to hemidesmosomes but were quite different from hemidesmosome-like intercellular specializations which have been described in the normal meninges and human meningiomas. Accordingly, we designated them as *«hemidesmosomal junctions»* which appeared to be one of the ultrastructural features characterizing FS cells.

Discussion

FS cells are usually connected to each other by desmosomes, tight junctions and intermediate junctions. However, intercellular junctions between FS cells and surrounding adenoma cells have not been clearly defined. Nakajima et al. (1980) and Yagishita et al. (1984) could find no junctions between both cells, whereas Fukuda (1970) indentified desmosomes in chromophobe adenomas. In the present study of non-functioning adenomas, desmosomes were frequently found between FS cells in 4 cases. The most striking finding in one of them was the presence of *«hemidesmosomal junctions»* between FS cells and surrounding adenoma cells.

Hemidesmosomes are responsible for the firm fixation of epithelial cells to the underlying connective tissue. They are frequently observed in the cornea, epidermis, mouth and vagina etc., where the epithelium is exposed to considerable mechanical force. Hemidesmosomes are usually seen at the basal surface, but on rare occasions at the intercellular sites near the basal surface (Briggaman and Wheeler, 1975). An invagination of the basal surface into the intercellular space is suggested from the extension of basal lamina between the neighbouring cells. *«Hemidesmosomal junctions»* are not applicable to these rare occasions, as there was no basal lamina at the luminal surface of FS cells.

Nabeshima et al. (1975) found hemidesmosome-like intercellular specializations in the normal meninges. Later, Copeland et al. (1978) reported the same junctions in human meningiomas. These specializations were characterized by 1) no intracytoplasmic filaments assembling to the cytoplasmic plaque, 2) only rarely parallel plasma membranes and 3) the electron-lucent extracellular zone. The present *«hemidesmosomal junctions»* were quite different from the hemidesmosome-like intercellular specializations in every respect.

It is generally accepted that junctional complexes can develop and change structurally under different conditions (Farquhar and Palade, 1963; Loewenstein, 1967). FS cells elongate cytoplasmic processes among the surrounding adenoma cells with resultant intercellular connections. The latter might be necessary to increase the mechanical strength or might be associated with the transport or some regulations. It is conceivable that *«hemidesmosomal junctions»* developed naturally between the quite different types of cells; ones are FS cells with numerous cytoplasmic filaments and the others are surrounding adenoma cells with scarce filaments.

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