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Ultrastructure of the congenital epulis

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Summary. This report presents the ultrastructural features of a congenital epulis. The granular cells of the epulis were packed with numerous membrane bound cytoplasmic granules containing particles, small vesicles, and electron-dense materials. These granules were negative in immunohistochemical reaction for CEA (DAKO PAP KIT). Cytoplasmic organelles such as mitochondria, rough surfaced endoplasmic reticulum, and Golgi apparatus, were absent. Nuclei were markedly indented. Occasionally, banded intracellular collagen fibrils were observed within the cytoplasm. Some of these fibrils were surrounded by a limiting membrane, whereas others appeared to lie free in the cytoplasm. The collagen fibrils were also seen within a deep invagination of the cell surface. There was no basal lamina around the granular cells. Sporadically, mast cells with many granules containing lamellar formations were found between the granular cells. These observations support the idea that granular cells of the congenital epulis are derived from mesenchymal cells, probably fibroblasts.

Key words: Congenital epulis – Ultrastructure – Granular cells – Intracellular collagen fibrils

The congenital epulis is a rare benign soft tissue lesion which occurs on the alveolar ridge in the anterior region of the maxilla or mandible of newborn infants. This lesion is most common in females. Since there have been a large number of histological studies on the congenital epulis, the histology of this lesion is well known (Custer and Fust 1952; Fuhr and Krogh 1972; Dixter et al. 1975; Henefer et al. 1979). The congenital epulis has been also studied ultrastructurally by several investigators, and its fine structure is well described (Kay et al. 1971; Regezi et al. 1979; Lack et al. 1981; Rohrer and Young 1982; Lack et al. 1982). However, none of these ultrastructural

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studies mentioned intracellular collagen fibrils within the cytoplasm of granular cells of the congenital epulis. The present investigation reports on ultrastructural features, including intracellular collagen fibrils, of a congenital epulis which occurred in a female infant. In this study, the presence or absence of carcinoembryonic antigen (CEA) in the congenital epulis was also examined using DAKO PAP KIT for the demonstration of CEA.

Materials and methods

A congenital epulis, measuring 7 mm in diameter, was excised from the anterior maxilla of a 20-day-old girl (Fig. 1). The epulis was divided equally into two parts immediately after excision. Half of the epulis was fixed in 10% formalin, embedded in paraffin, and sectioned at 4 μm. The sections were stained with haematoxylin and eosin, periodic acid-Schiff (PAS), and Luna's method for mast cells. They were also stained for CEA using DAKO PAP KIT (Dako Corporation, Santa Barbara, CA, USA). All of the sections were examined with the light microscope. The other half was cut into small pieces and fixed for 2 h in a mixed solution of 2% paraformaldehyde and 2.5% glutaraldehyde in 0.1 molar cacodylate buffer at pH 7.4. After a buffer rinse, all pieces were postfixed for 2 h in 1% buffered osmium tetroxide. The tissues were dehydrated through a graded series of ethanol and embedded in Epon 812. Thin sections were stained with both uranyl acetate and lead citrate and examined with a Hitachi HU-12 electron microscope.

Results

Histologically, the lesion showed the characteristic features of the congenital epulis. It consisted of large polyhedral cells with abundant granular eosinophilic cytoplasm (Fig. 2). The nuclei of these granular cells were small, round or ovoid, and centrally or peripherally located. The cell membranes were distinct. The granular cytoplasm was negative in both PAS staining and immunohistochemical reaction for CEA. Many capillaries and moderate number of mast cells identified by Luna's staining were seen among the granular cells, but Schwann cells and nerve fibers were not observed. A thin layer of fibrous connective tissue separated the mass of granular cells from the overlying epithelium. There was no pseudoepitheliomatous hyperplasia.

Ultrastructurally, the granular cells were packed with numerous membrane bound cytoplasmic granules containing particles, small vesicles, and electron-dense materials (Figs. 3, 4 and 5). Some of these granules appeared to be myelin-like structures (Fig. 5). Cytoplasmic organelles such as mitochondria, rough surfaced endoplasmic reticulum, and Golgi apparatus were not observed within the cytoplasm (Fig. 3). The nuclei were markedly indented. There were a moderate number of slender cytoplasmic extensions on cell surface. Occasionally, banded collagen fibrils were seen among the cytoplasmic granules (Figs. 6, 7). Some of these intracellular collagen fibrils were surrounded by a limiting membrane, whereas others appeared to lie free in the cytoplasm (Figs. 7, 8). The collagen fibrils were also seen within deep invaginations of the cell membrane (Fig. 8). The inner ends of some of these fibrils were located within the cytoplasmic granule, since the invagination continued with the cytoplasmic granule in its deepest portion. No

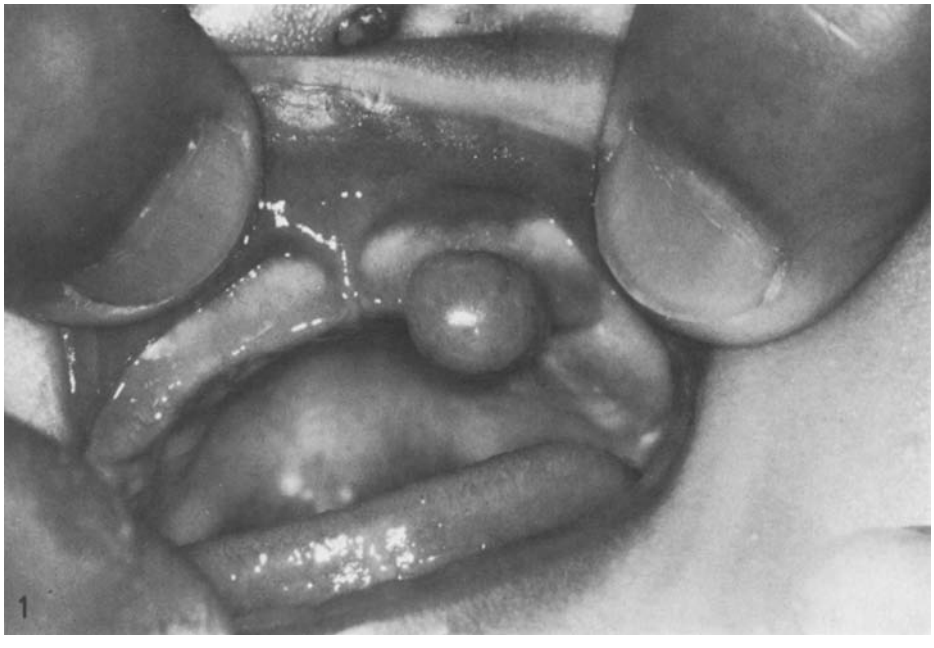

Fig. 1. A congenital epulis, measuring 7 mm in diameter, is located on the alveolar ridge of the maxilla

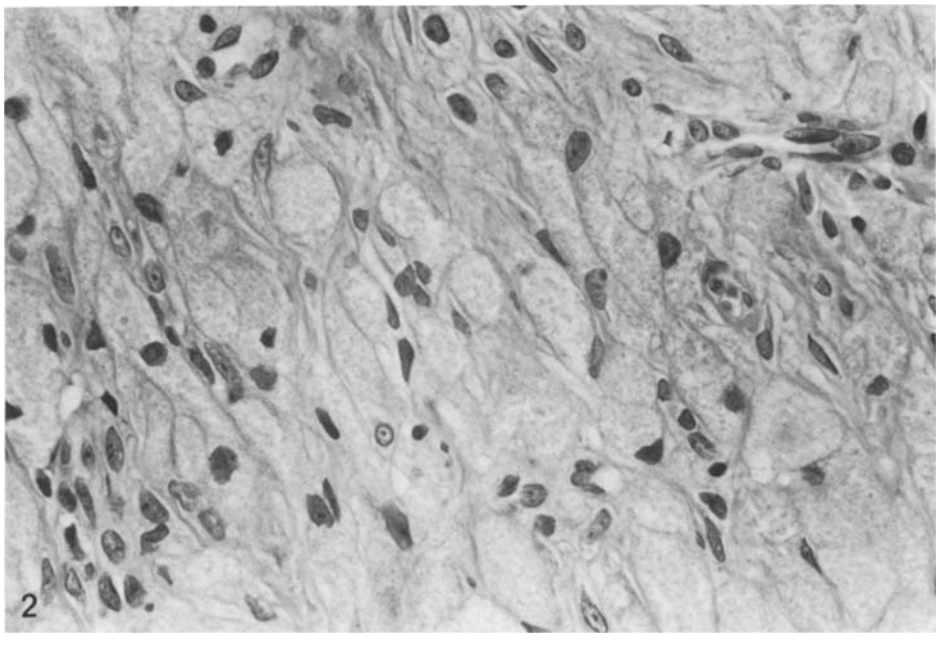

Fig. 2. The lesion is composed of granular cells. A few capillaries are also present. HE × 600

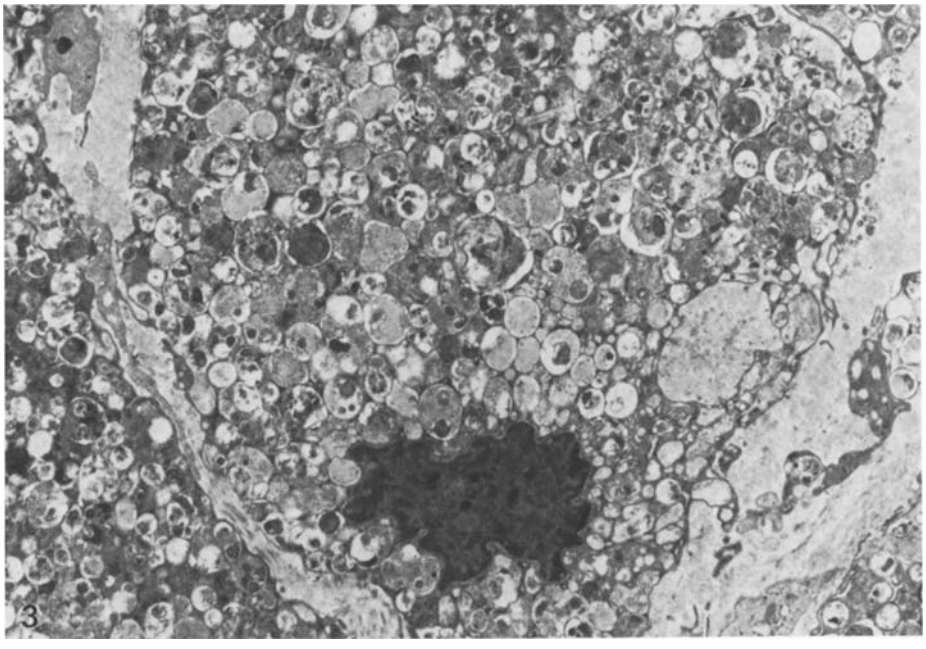

Fig. 3. A granular cell is packed with numerous cytoplasmic granules. The nucleus is indented and located peripherally. There are no cytoplasmic organelles. ×4,000

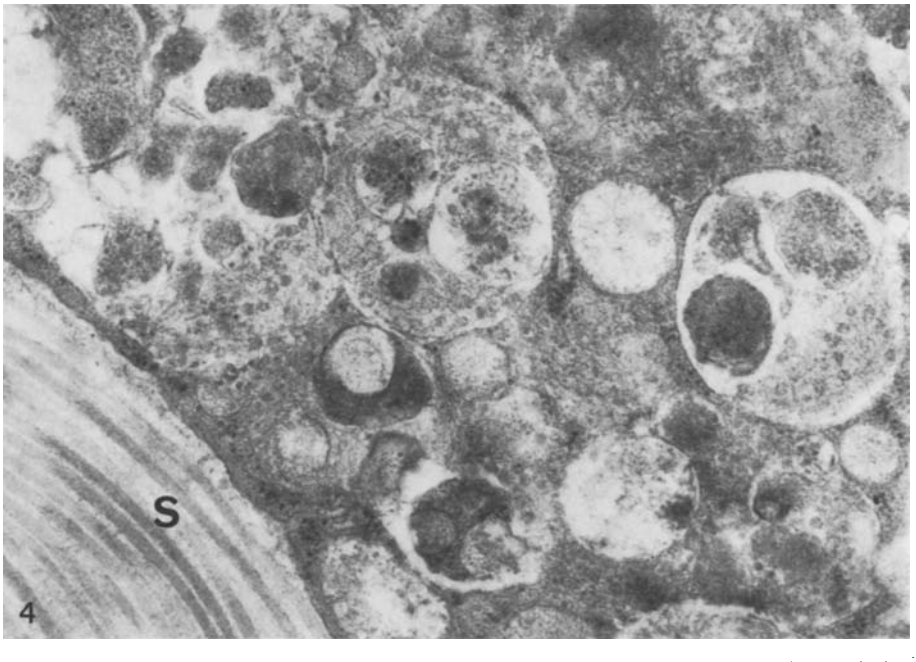

Fig. 4. The membrane bound cytoplasmic granules contain particles, small vesicles, and electron-dense materials. There is no basal lamina between the surface of the granular cell and the stroma (*S*). ×20,000

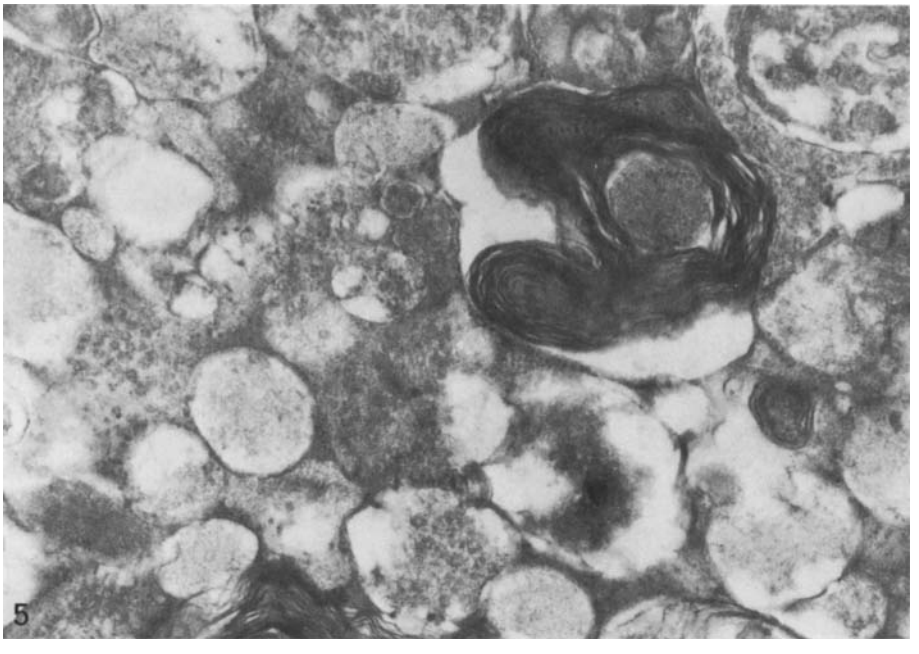

Fig. 5. A myelin-like structure is seen among the cytoplasmic granules. × 20,000

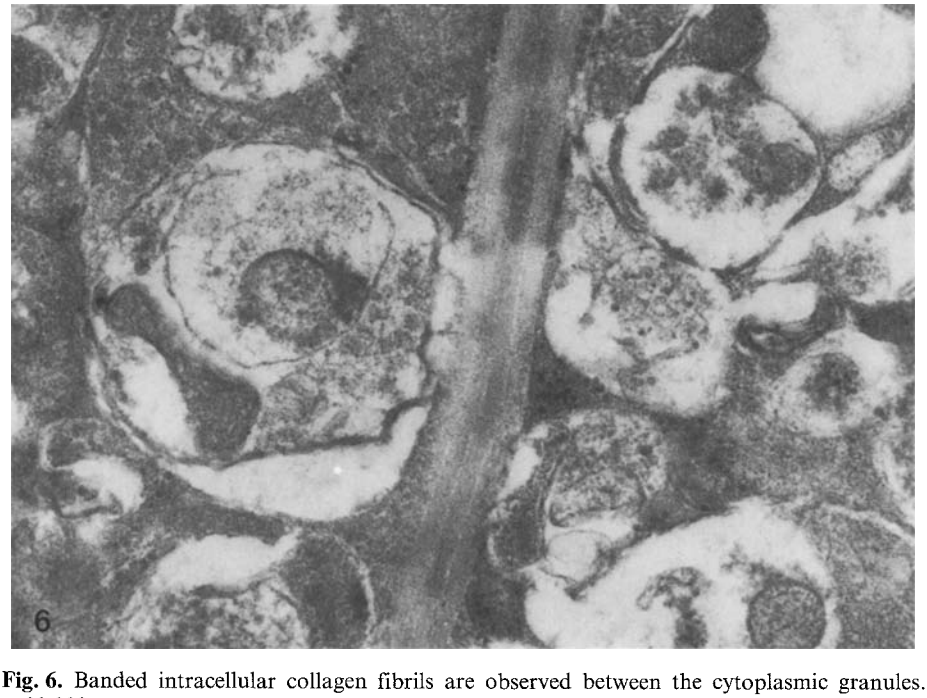

Fig. 6. Banded intracellular collagen fibrils are observed between the cytoplasmic granules. × 30,000

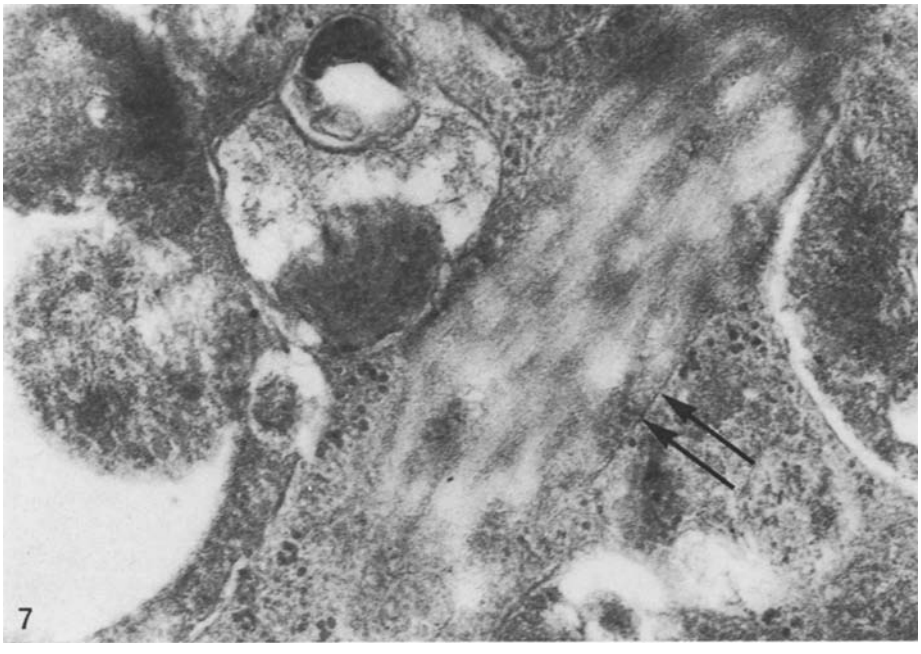

Fig. 7. Aggregation of intracellular collagen fibrils is seen. The collagen fibrils are covered partly by the limiting membrane (*arrows*). ×35,000

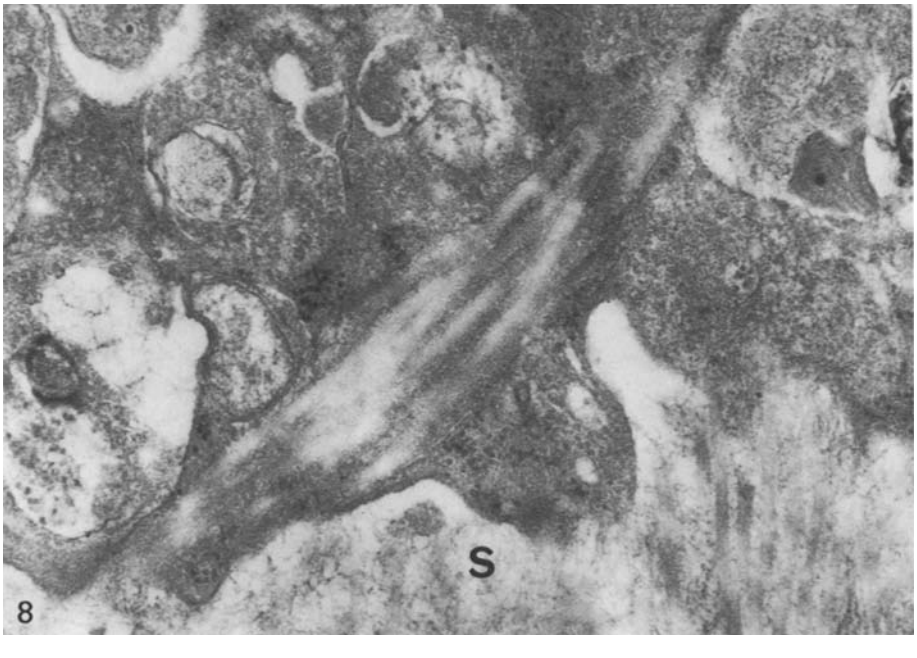

Fig. 8. Collagen fibrils are located in the deep infolding of the cell membrane. There is no basal lamina between the surface of the granular cell and the stroma (*S*). ×25,000

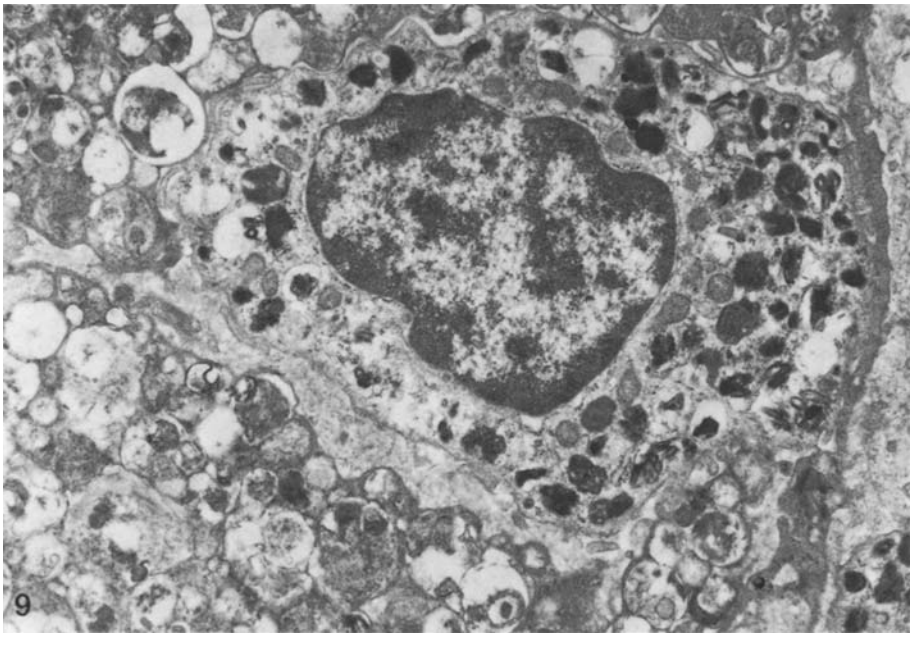

Fig. 9. A mast cell is seen between the granular cells. ×8,000

angulate bodies were seen within the cytoplasm of granular cells. There was no basal lamina around the granular cells (Figs. 4, 8). Sporadically, the mast cells, with many granules containing lamellar formations, were found among the granular cells (Fig. 9). Although the fibroblasts and the endothelial cells forming small vesseles were present among the granular cells, neither Schwann cells nor neural elements were found.

Discussion

The histological features of the congenital epulis in this study were similar to those described previously (Custer and Fust 1952; Fuhr and Krogh 1972; Dixter et al. 1975; Henefer et al. 1979). Although most of the previous studies reported that the granular cells of the congenital epulis were PAS-positive, the present granular cells displayed a negative reaction for PAS. The reason for this was unknown.

Shousha and Lyssiotis (1979), studying the granular cell myoblastomas using an immunoperoxidase technique for CEA, reported that all of these tumors showed a positive reaction for CEA though the reason for that was not clear. Similar results were also obtained in the immunohistochemical study of granular cell myoblastomas by Matthews and Mason (1982). In the present study, the congenital epulis did not exhibit a positive reaction for CEA. This result coincided with the immunohistochemical observations by Lack and his associates (1981) on the granular cells of the congenital

epulis. It appears, therefore, that the origin of the congenital epulis differs from that of the granular cell myoblastoma.

Ultrastructurally, the granular cells of the present congenital epulis did not exhibit any cytoplasmic organelles such as mitochondria, rough surfaced endoplasmic reticulum, and Golgi apparatus, but they contained numerous cytoplasmic granules. These granules appeared morphologically identical to those observed in granular cell myoblastoma cells (Moscovic and Azar 1967; Carstens 1970; Sobel et al. 1971 and 1972; Miller et al. 1977). Although the exact nature of the cytoplasmic granules of granular cells in the congenital epulis and granular cell myoblastoma is still not clear, most studies support the concept that they represent the lysosomes. The presence of numerous cytoplasmic granules and the absence of organelles in the granular cells in this study and in others may suggest that the cells were degenerative rather than neoplastic in nature.

A number of ultrastructural studies have documented the presence of intracellular collagen fibrils within the cytoplasm of fibroblasts, macrophages or mesenchymal tumor cells in humans and animals. Melcher and Chan (1981), reviewing the literature, stated that there were two concepts concerning the origin of these intracellular collagen fibrils. The first concept is that they result from phagocytosis of collagen and the second, that they represent a consequence of precipitation of newly synthesized collagen macromolecules into or onto fibrils either intracellularly or extracellularly in deep recesses in the fibroblast surface. Melcher and Chan (1981) supported the former concept on the basis of their study in which serial sections and reconstructions of rat gingival fibroblasts containing intracellular collagen fibrils were examined. These collagen fibrils were considered to undergo digestion. Yamazaki et al. (1981) reported that the human gingival fibroblasts exhibited phagocytosed intracellular collagen fibrils in their cytoplasm. Since the congenital epulis arises on the alveolar ridge of the maxilla or mandible, it is interesting that gingival fibroblasts can phagocytose and degrade collagen fibrils.

Renteria and Ferrans (1976), studying the atrioventricular valves in Hurler syndrome, found that the granular cells had intracellular collagen fibrils within membrane bound cytoplasmic dense bodies. They suggested the possibility that the granular cells were degenerated or inactive fibroblasts and that the dense bodies and associated collagen fibrils represented the residues of previous synthesis and abnormal precipitation of collagen. Costanzi et al. (1980) described how the granular cells of subcutaneous granular cell myoblastomas contained intracellular collagen fibrils. They assumed that the granular cells were fibroblasts and that these fibrils represented the intracellular formation of collagen fibrils. All of the cells which exhibit intracellular collagen fibrils in their cytoplasm have been considered to be of mesenchymal origin. Recently, however, Birek et al. (1980) revealed ultrastructurally that the epithelial rests of Malassez which had phagocytosed collagen in vitro showed the intracellular collagen fibrils.

In the present study, the banded intracellular collagen fibrils were observed among the cytoplasmic granules in the granular cells. Some of these

fibrils were surrounded by the limiting membrane, whereas others were not. Collagen fibrils were also found in the deep infolding of the cell surface. These findings, together with the observation that there was no basal lamina around the granular cells, may signify that the granular cells phagocytosed the collagen fibrils and that they were derived from mesenchymal cells, probably fibroblasts.

Mast cells were seen among the granular cells of the present congenital epulis both histologically and ultrastructurally. The significance of these mast cells in the congenital epulis was not clear from the present observations. However, if the granular cells arised from the mesenchymal cells, it would be possible that these cells were intermingled with granular cells during the development of the congenital epulis. Whitten (1968) and Aparicio and Lumsden (1969) demonstrated ultrastructurally that mast cells were frequently present in the granular cell myoblastomas. Whitten (1968) postulated that these mast cells might have some causal role in the development of the granular cell myoblastoma.

Rohrer and Young (1982), examining the congenital epulis ultrastructurally, reported that the cells which appeared to be in a transitional state, not yet true granular cells, were found juxtaposed to the vessels in the position of pericytes. The congenital epulis in this study contained many capillaries. However, the transitional cells as described by Rohrer and Young (1982) were not observed around the small vessels ultrastructurally. It seems unlikely that the granular cells of the present lesion were of neurogenic origin, since neither Schwann cells nor neural components were observed histologically or ultrastructurally.

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