Veterinary Pathology 17:6:773-776, Nov 1980



# Cytoplasmic Crystalloids in the Ovary of a Woolly Monkey

M. R. Elwell, A. DePaoli and G. D. Whitney

Bilateral ovarian interstitial cell masses have been described in the owl monkey (*Aotus trivirgatus*) and squirrel monkey (*Saimiri sciureus*) and are believed to be a normal developmental change in mature females of these species [1, 2]. A 6-year-old female woolly monkey (*Lagothrix logothrica*) had bilateral accumulation of interstitial cell masses in the ovaries. The ovaries were elipsoidal, 17 mm long, and 12 and 14 mm in diameter respectively. The cortical and medullary portions of both ovaries were indistinct, replaced by solid, yellow-orange tissue with a pale yellow-tan irregular trabecular pattern (fig. 1).

Light microscopy showed the cortical stroma to be compressed into a 200- to 500-μm layer covered by tunica albuginea and germinal epithelium. The medullary and hilar regions

**Fig. 1:** Cut surface of ovary: interstitial masses occupy medullary and cortical regions. Bar = 1.5 mm.

consisted of broad sheets of cells with an abundant capillary network. The expansile medullary tissue was of two distinct cell types. The more common cell formed broad sheets, particularly near the hilar area, and wide collars around larger vessels, producing the pale trabecular pattern visible grossly. This cell type, which morphologically resembled an adrenal cortical cell, was polyhedral to round, with generally distinct cytoplasmic borders and abundant pale eosinophilic foamy cytoplasm (fig. 2). Many cells contained an irregular, round to oval, 1- to 3-$\mu$m pale eosinophilic cytoplasmic inclusion. These inclusions were visible with hematoxylin and eosin (HE), but Masson's trichrome enhanced their identification. Some inclusions were rectangular and others had tapered ends (fig. 2, *inset*).

The darker, yellow-orange areas seen grossly were of a second cell type. These cells also were arranged in irregular sheets and occasionally in broad perivascular cuffs. Morphologically, they resembled ovarian hilar or interstitial cells and had granular, eosinophilic cytoplasm containing numerous 2- to 3-$\mu$m vacuoles (fig. 2). Cytoplasmic inclusions similar to those in the first cell type sometimes were seen in these cells, but were difficult to see without the trichrome stain. Oil red O- and osmium tetroxide-stained sections were strongly positive for lipid in both cell types.

Ultrastructurally, both cell types were polyhedral and contained many vesicles of smooth endoplasmic reticulum and round-to-oval mitochondria. Varied numbers of opaque membrane-bound lipid droplets were present in the cytoplasm of most cells, as were circular, osmophilic membrane-bound dense bodies. The hilar-type cell generally had more organelles, increased fibrillar density to the cytoplasm and an occasional myelin figure. Both cell types contained osmophilic cytoplasmic inclusions. Some cells contained one inclusion, others two or more (fig. 3). The inclusions consisted of a non-membrane-bound regular crystalline lattice. Smooth reticulum was associated with the inclusions, and in certain planes of section the continuity between the crystalline matrix and the adjacent reticulum was evident. The structural configurations seen depended upon the plane of section through the crystalline inclusion. Usually, a textured fabric-like pattern was seen, while in other planes either an alternating pattern of electron-dense and pale parallel lines, or tubules hexagonal in cross-section, were seen (fig. 3, *inset*). Although individual cells were close together, frequently there were interstitial spaces with many well-formed microvilli extending into these canalicular formations.

Steroidogenic cells found in the antebrachial organ of the skin in the ring-tailed lemur (*Lemur catta*) have been studied ultrastructurally [5]. These cells often contained crystalloid inclusions in the cytoplasm morphologically indistinguishable from those seen in the woolly monkey. The authors concluded that the crystalloid was an organelle of steroid synthesis. The Reinke crystal, found in the ovarian hilar cell and the testicular interstitial cell of man, resembles the crystalloid of the lemur and the woolly monkey, although there are several morphological differences; presently, no functional significance has been ascribed to the Reinke crystal [4, 5]. A study of the female genital tract of owl monkeys [1] described the proliferation of interstitial cell masses comprised of two cell types in the medulla and hilus of the ovary. The conclusion of this study was that the cells differentiated from cortical stroma and theca interna and the masses functioned as corpora lutea. The intercellular canalicular system and microvilli were not observed in those studies. This structural feature has been described in theca granulosa cells and virilizing lipid cell tumor of the ovary in a woman and was interpreted as a system for transport of steroid precursors [3].

The proliferation of interstitial cells in our case is probably a normal process similar to that described in other new world primates. The cytoplasmic crystalloids and the intercellular canalicular system have not been reported in the ovary of the woolly monkey or other nonhuman primate species. It is possible that these structures are associated with the proposed endocrine function of these interstitial cells.

## References

1 HERTIG, A.T.; BARTON, B.R.; MACKEY, J.J.: The female genital tract of the owl monkey (*Aotus trivirgatus*) with special reference to the ovary. Lab Anim Sci **26**:1041–1067, 1976

2 HERTIG, A.T.; KING, N.W., JR.; BARTON, B.R.; JOHNSON, L.D.; MACKEY, J.J.; BATES, C.: Observations on the ovary of the squirrel monkey, *Saimiri sciureus*, using the light and electron microscope. *In: Medical Primatology 1970*, ed. Goldsmith and Moor-Jankowski, p. 472–503. Karger, Basel, 1971

3 ISHIDA, T.; OGAGAKI, T.; TAGATZ, G.E.; JACOBSON, M.E.; DOE, R.P.: Lipid cell tumor of the ovary: an ultrastructural study. Cancer **40**:234–243, 1977

4 NAGANO, T.; OHTSUKI, I.: Reinvestigation of the fine structure of Reinke's crystal in the human testicular interstitial cell. J Cell Biol **51**:148–161, 1971

5 SISSON, J.K.; FAHRENBACH, W.H.: Fine structure of steroidogenic cells of a primate cutaneous organ. Am J Anat **121**:337–368, 1967

Request reprints from A. DePaoli, Pathology Division, U.S. Army Medical Research Institute of Infectious Diseases, Frederick, MD 21701 (USA).

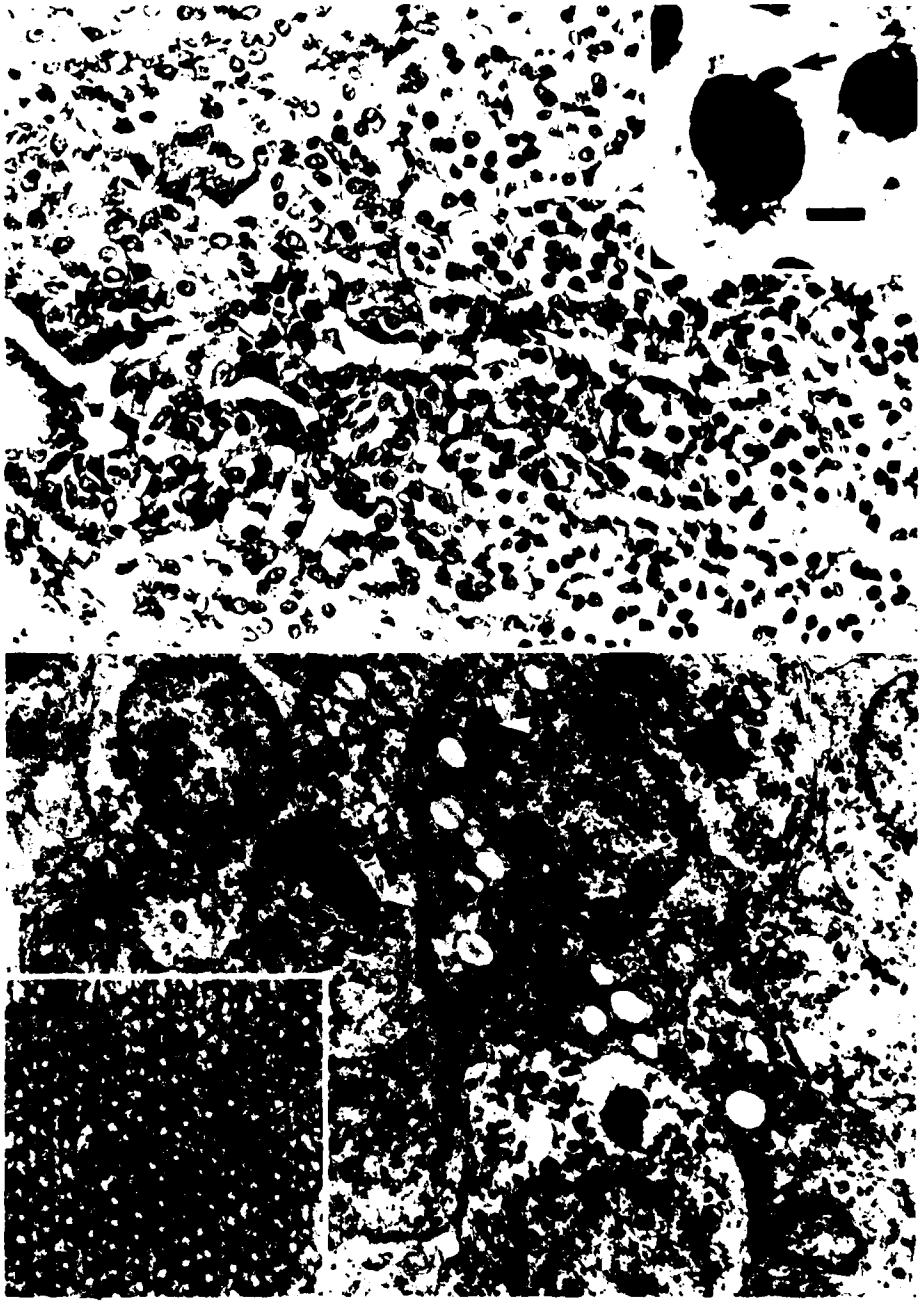

**Fig. 2:** Two cell types: adrenal cortical-like (upper right) and interstitial or hilar cell (lower left). *Inset:* Intracytoplasmic crystalloid inclusion (arrow). Masson's trichrome. Bar = 4 μm.

**Fig. 3:** Electron micrograph of interstitial cells containing electron-dense crystalloids (arrows). *Inset:* Higher magnification; crystalline lattice morphology.