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CADMIUM-INDUCED TESTIS INJURY IN *TILAPIA NILOTICA*

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ABSTRACT

Tilapia nilotica, exposed to 0.5 mgs. per liter cadmium chloride from hatching to eight weeks showed injury in the somatic and germinal tissues of the testes. Electron microscope analysis gives ultrastructural evidences of destruction of blood vessels, smaller size of the androgen-secreting cells, reduced number of mitochondria with globular cristae and unextensive smooth endoplasmic reticulum of these cells. Spermatogonia and primary spermatocytes, the germ cells already developed by this time, are affected by the concentration of $CdCl_2$ used for the duration of this study.

Introduction

Cadmium salts can cause injury to tissues of various vertebrate and invertebrate species causing histological alterations (Ward, 1982; Morselt *et al.*, 1986; Chung *et al.*, 1986). Histophysiological studies in vertebrates show that Cd accumulation occurs mainly in the kidney (Tokumaru *et al.*, 1980), liver (Morselt *et al.*, 1987), gills (Noel-Lambat *et al.*, 1978), hert, haemopoietic organs and gastrointestinal tract (Jennings and Rainbow, 1979). Considering that cadmium salts are common in industrial discharges and that ultrastructural effects on the testis are not well investigated, the present study was carried out.

Materials and Methods

Four-day old *T. nilotica* fry were obtained from the College of Fisheries, University of the Philippines. They were distributed to 40-liter tanks at 60 fry per tank. Cadmium chloride at a concentration of 0.5 mgs. per liter was mixed with the water. Total water replacement was done every 24 hours for the first week then every two days until the eighth week. The fish were fed with rice bran and ground fish.

Processing of the testes was done at the end of the eighth week. They were cut into small cubes, fixed with glutaraldehyde, postfixed with osmium tetroxide, dehydrated and embedded in resin. Observation was done on a Jeol U-100 electron microscope.

Results and Discussion

The testes from Cd-treated fish showed some brownish patches which were scattered randomly while the control fish had creamy-white testes. Sangalang and O'Halloran (1972) had the same observation in Cd-treated brook trout.

Electron microscope analysis of the treated and control testes revealed marked differences. Among the changes noticed were extensive haemmorhagic necrosis (Figure 1). The endothelial lining and oericyte cells of blood capillaries in the somatic tissues of the testis degenerate and are seen as detritus in the cavity of the blood capillary.

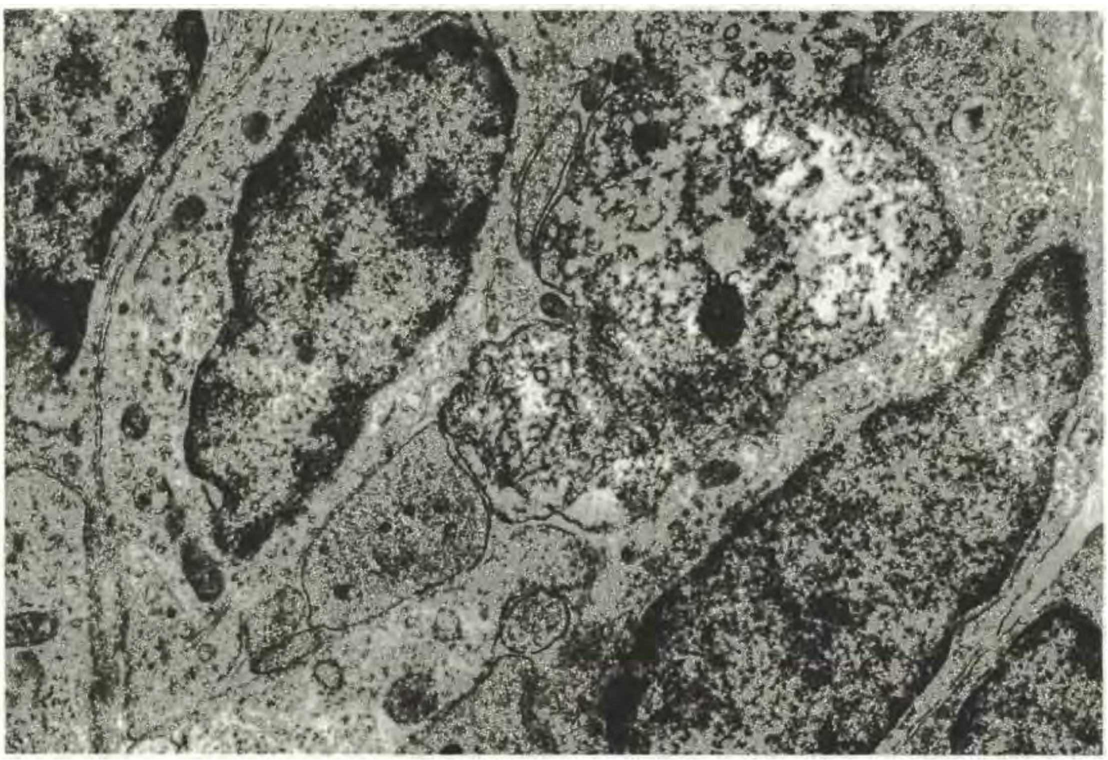

Figure 1. A degenerating blood capillary among the somatic tissues of Cd-treated fish. Debris fills the cavity. BC-capillary, x 20000.

In advanced stages of degeneration of blood vessels, empty vascular spaces are abundant in the testes (Figure 2).

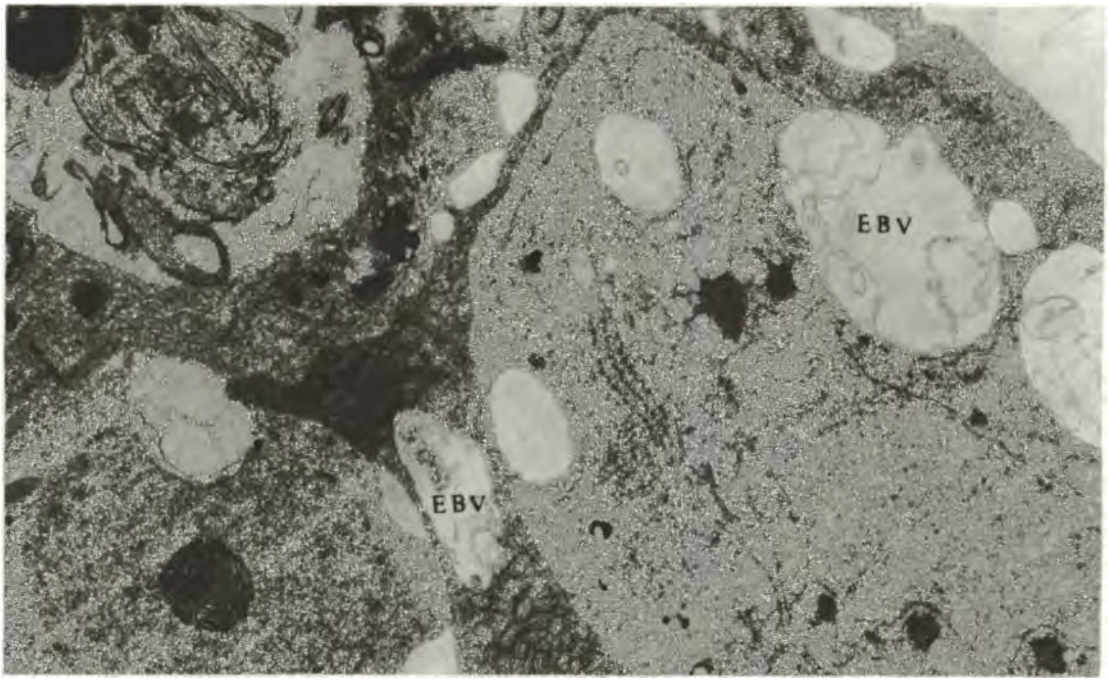

Figure 2. Empty vascular spaces are formed by the degeneration and sloughing off of lining cells. EBV-empty blood vessels x 10000.

Such structures are not observed in the normal *T. nilotica* testes (Herrera, 1987).

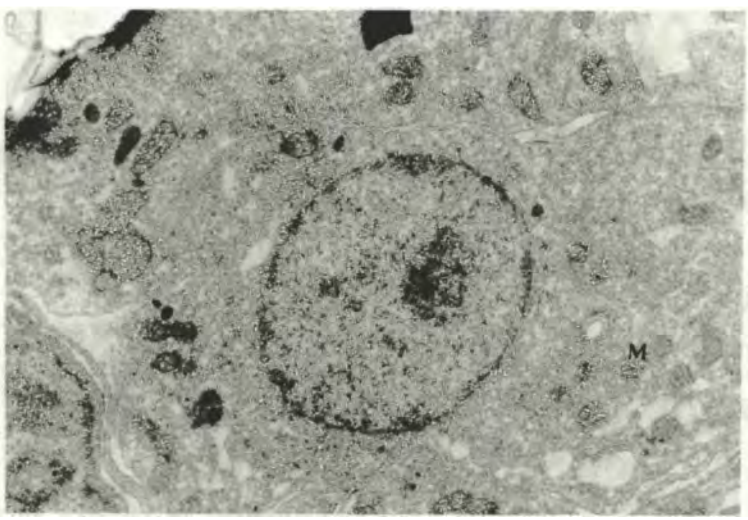

Figure 3. Leydig cells of the treated testis are relatively smaller, with unextensive smooth ER and small number of mitochondria having globular cristae. M-mitochondria x 13000.

Leydig cells do not have the typical ultrastructural features of steroidogenic cells. They show several large vacuoles, less extensive smooth ER and decreased number of mitochondria with globular cristae as compared with the untreated testes. These androgen-secreting cells are also much smaller than those of the untreated testis (Figure 3 and 4, Herrera, 1987).

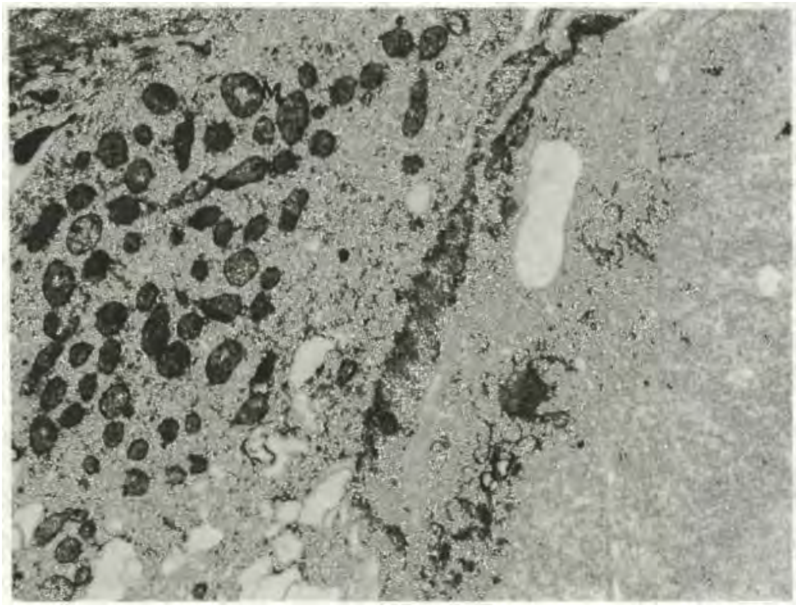

Figure 4. Untreated Leydig cells have the ultrastructural features of typical steroidogenic cells x 9200.

Germ cells appear to be affected by cadmium (Figure 5). Some primary spermatocytes which are already developed at this stage (Figure 6) show signs of degeneration, such as discontinuity of the cell membrane and the clumping of chromosomes.

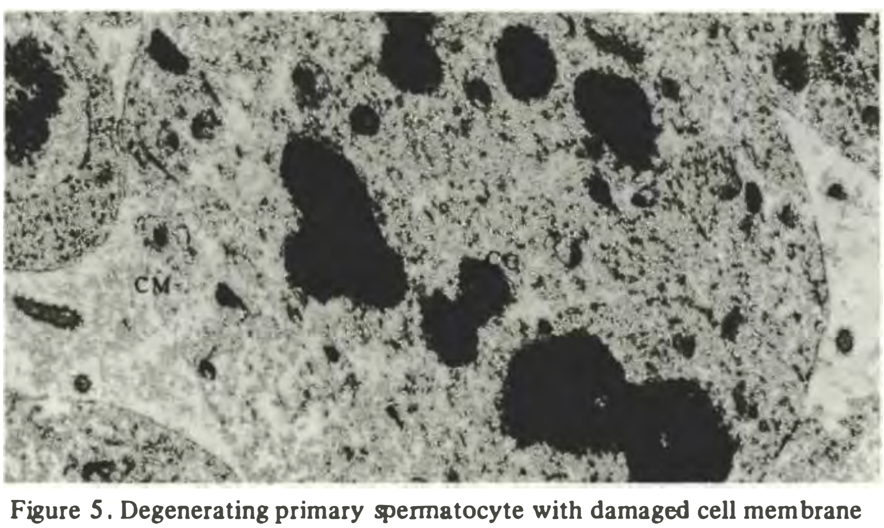

Figure 5. Degenerating primary spermatocyte with damaged cell membrane (CM) and clumped chromosomes (CC). x 16500.