MORPHOLOGICAL CHANGES IN THE RAT TESTIS RESULTING FROM WRAPPING THE ORGANS IN CELLOPHANE FILM

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After isolation of the rat testis from contact with surrounding tissues by wrapping it in cellophane film, many tumors are formed, predominantly of epithelioid type. A study of the pretumor changes in the wrapped organ showed that the possible sources of formation of these tumors are interstitial tissue cells, Sertoli cells, spermatogonia, and primary spermatocytes.

Investigations [1-3, 6-9] have shown that wrapping the kidney and gastrocnemius muscle of rats in cellophane film leads to the formation of tumors in these organs. The writer's earlier investigations [4, 5] showed that in up to 30% of cases, there is a tendency for tumors to be formed in a wide variety of albino rat organs and tissues (bone, muscle, spleen, thyroid gland, intestine, nerve, blood vessel) when isolated from surrounding tissues by means of cellophane film. As a result of improvements in the technique of wrapping the organ in experiments to isolate the testis with cellophane, the writer obtained the development of tumors in 79% of cases. In that series of experiments, by contrast with isolation of other organs, as well as tumors of a predominantly sarcomatous type, containing only a few epithelioid cells, tumors of epithelioid type and of the interstitial cells of Leydig were found. The fact that tumors of epithelioid type developed made it necessary to study the possible sources of origin of these tumors.

Accordingly, the morphological changes in the testis, when wrapped in cellophane film, at various times after operation until the appearance of tumors were studied in rats.

EXPERIMENTAL METHOD

The left testis of noninbred albino rats weighing 100-110 g was wrapped in previously boiled cellophane film. The cellophane sleeve was attached by Lavsan thread to part of the capsule of the testis. The testes wrapped in cellophane were investigated from 6 to 11 months after implantation of the film. The right testes of the experimental animals and testes of intact rats, not wrapped in cellophane, were used as the control. The material was fixed in Zenker's fluid and treated by the usual histological methods. Sections were stained with Regaud's iron-hematoxylin and counterstained by Mallory's method, and stained with hematoxylin-eosin and by Giemsa's method.

EXPERIMENTAL RESULTS

Pretumor changes in the testes wrapped in cellophane could be subdivided into several stages which occurred at different times in individual cases. Six months after implantation of the cellophane film, some degree of destruction of the tubules of the testis were observed. Besides morphologically intact convoluted tubules, other tubules were seen with completely destroyed spermatogenic cells and filled with amorphous or granular material. Some degree of proliferation of the interstitial tissue of the testis also was seen.

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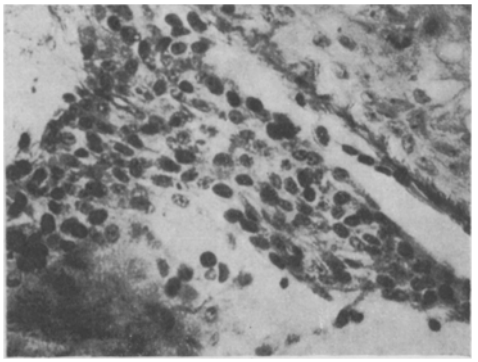

Fig. 1. Proliferation of interstitial tissue 9 months after wrapping the testis in cellophane. Here and in Figs. 2 and 3: stained with Regaud's iron-hematoxylin and counterstained by Mallory's method, 240 ×.

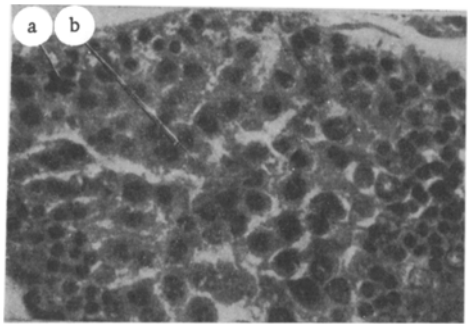

Fig. 3. Proliferation of spermatogenic cells 11 months after wrapping of the testis: a) cells resembling spermatogonia; b) cells resembling primary spermatocytes.

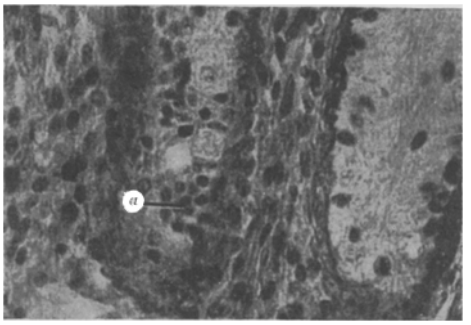

Fig. 2. Proliferation of interstitial tissue and Sertoli cells (*a*).

At later stages (7-8 months after implantation) more severe morphological changes occurred in the isolated testis, and two types of development could be distinguished. In one group of animals, complete reduction of the spermatogenic elements of the convoluted tubules was observed. The lumen of the tubule was filled with amorphous contents. Later still (9-11 months), these changes evidently led to cloudy swelling of the convoluted tubules and slight proliferation of the interstitial tissue. As a result of these changes, the testis shrank and became very much smaller. In the other group of animals incomplete reduction of the spermatogenic cells was observed. The changes occurred in several directions. In some cases there was marked reduction of the spermatogenic cells in the tubules, with preservation of solitary spermatogenic cells and Sertoli cells, accompanied by marked proliferation of the interstitial tissue (Fig. 1). Initially the interstitial tissue proliferated in isolated parts of the testis, but later, (after 10-11 months) it proliferated throughout the organ, as a result of which the seminiferous tubules were compressed and destroyed. In other cases definite reduction of the cells in the tubules also took place, but some of the remaining Sertoli cells began to proliferate (Fig. 2). After 9-10 months, intensive proliferation both of the Sertoli cells and of the cells of the interstitial tissues surrounding the tubules was observed. Later (after 11 months) the fibrous layer of the tubules was destroyed. The cells of the tubules were mingled with the surrounding tissue, and the resulting foci of proliferation contained numerous cells of epithelioid type.

In some cases, however, reduction of the spermatogenic cells in the tubules of the testis had not progressed so far. Between 7 and 8 months after implantation of the film, spermatogenic cells, arranged in 1-3 layers, still remained in the tubules. Evidently under these circumstances the more highly differentiated cells were destroyed. In the residual spermatogenic cells, mitoses were frequent. After 9 months, in some cases giant cells were formed. These cells were either in the lumen of the tubule or between the spermatogenic cells. Morphologically they resembled giant cells like those previously observed in the wrapped spleen and liver. The times of their appearance were the same. After 10-11 months, proliferation of the residual spermatogenic cells could be seen. Cells resembling spermatogonia and primary spermatocytes were proliferating. In the case of proliferation of the spermatogenic cells, the lumen of the tubule was considerably contracted, and sometimes it was completely filled with cells. The tubule filled with proliferating cells showed a great resemblance to the seminiferous tubule of the rat in the embryonic or late postembryonic period of development. The cells filling the central zone of the tubule were similar to follicular cells of the embryonic testis.

Changes which, on the basis of the appearance of a high percentage of tumors in this experiment, can be regarded as pretumor in character, were thus found in the rats testes wrapped in cellophane.

The results show that the changes in the testis developed in several directions. In the case of complete reduction of the spermatogenic cells, collapse of the tubules, and contraction of the entire organ, no tumors evidently appeared. Proliferation of different cells of the testis, leading to the formation of tumors took place in three directions: 1) proliferation of interstitial tissue; 2) proliferation of cells of the interstitial tissue and Sertoli cells; 3) proliferation of spermatogenic cells (cells resembling spermatogonia and primary spermatocytes), with only slight proliferation of the interstitial tissue.

The signs of proliferation in the tissues of the testis when wrapped with cellophane can thus be observed in four types of cells: Sertoli cells, cells of the interstitial tissue, cells resembling spermatogonia, and primary spermatocytes.

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