Spontaneous and Induced Tumors of the Guinea Pig

Shields Warren, M.D., and Olive Gates, M.D.

(From the Pathological Laboratories of the Collis P. Huntington Memorial Hospital, the New England Deaconess Hospital, and the Department of Pathology, Harvard Medical School, Boston, Mass.)

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The occurrence of tumors in the guinea pig is apparently less frequent than in other laboratory animals. Spontaneous tumors are quite rare and only a few transplantable tumors of the guinea pig are available. Jackson (22) in his monograph on the incidence of tumors of domesticated animals made no mention of guinea pig tumors.

One of the best known guinea pig tumors is Murray's (44) transplantable liposarcoma, non-metastasizing, which was primary in the mamma. Mignonow (42) reported a non-metastasizing carcinoma of the breast in a male guinea pig. Two papillary cystadenomas of the breast were found by Aydant (3) and an adenocarcinoma of the breast by Sternberg (56) and one by Jones (23). Katase (24) mentioned a sweat gland carcinoma of the breast. A possibly induced, but probably spontaneous, tumor was the mammary adenoma studied by Anderson and Lumbroso (2). A female guinea pig injected with urine which was being tested for the presence of tubercle bacilli. Blumensaat and Champy (8) found an apparent carcinoma of the right breast in a four-year-old female guinea pig with ovarian cysts. There were no metastases and grafts were not successful.

Giordano (17) reported a spontaneous teratoma in the ovary of a pregnant guinea pig. The Gueirins (20) produced a malignant splenoma. Kroening and Wepler (28) found a spontaneous liposarcoma of the pons. Leader (36) reported an osteogenic sarcoma of the femur, and Roaff (47) mentioned a transplantable sarcoma. Rumschwig (9) reported a dermoid of the cornea. A teratoma of the pons was described by Lutz (39). Bablet and Bloch (5) reported a spontaneous tumor of the abdominal wall which they considered a schwannoma.

There were no metastases and they made no attempts to transplant it. Maurice's thesis (30) on tumors of the guinea pig is said to have emphasized their rarity, but it is not available to us.

A spindle cell sarcoma of the subcutaneous tissue of the back in a male guinea pig which metastasized to the spleen, and one of the subcutaneous tissue of the chest in a female which metastasized to lymph nodes, liver, spleen, lungs, ovaries, adrenals, and uterus were reported by Lubarsch (57). Both were transplantable. Bender (6) reported a round cell sarcoma of the adrenal of a guinea pig. Adenomas of the adrenal cortex developed after several years in guinea pigs castrated during the first days of life by Spiegel (53).

Two cases of adenoma of the bronchus were reported by Sternberg (55) and others by Spronck (54). Loeb (36) reported 23 benign lesions of the ovary resembling chorionic epithelioma among 250 animals. A probable lymphosarcoma was found by Miguez (41). Leukemia in the guinea pig was studied by Snijders (52).

The biliary tract of the guinea pig appears to be most susceptible to the development of induced malignancy. The earliest report of induced tumors of the guinea pig was that of Kazama (25). This report is not altogether clear as an unknown number of animals lived for only a short period of time. However, the frequency of development of tumors was very striking. When gall stones or pebbles were placed in the gall bladders of 20 guinea pigs, adenocarcinomas developed in 7 animals and metastasized in 4. Stones placed in the stomachs of 20 guinea pigs produced no carcinomas. String sutures placed in the gall bladders of 23 guinea pigs produced adenocarcinomas in 6 animals, one of which metastasized; and mucosa placed in the gall bladders of 2 animals produced carcinomas in both, one of which metastasized. "Pityrol" injected into the stomachs of 2 guinea pigs produced no tumors, and 3 of the 6 animals injected with the gall bladders of 16 guinea pigs produced carcinomas in 8 animals. Landin injected into the urinary bladders of 3 animals produced no carcinomas, but when injected into the gall bladders of 27 it produced carcinomas in 6 animals. Tar injected into the gall bladders of 2 guinea pigs and into the urinary bladders of 2 others produced no carcinomas. This high percentage of successfully induced tumors has not been achieved by other workers.

In 1924 Kazama (26) reported that various types of irritants in the gall bladders of 244 guinea pigs produced 30 papillomas, 49 heterotopic growths, 60 atypical growths, and 101 adenocarcinomas of which 23 metastasized. Leitch (31) confirmed Kazama's results, producing 8 carcinomas of the gall bladder in 40 guinea pigs by implanting gall stones, pebbles, or pitch pellets. Delbet and Godard (13) produced in 6 guinea pigs, by the implantation of human gall stones within their gall bladders, 1 probable adenocarcinoma and, in a second series of 10 guinea pigs, 3 probable adenocarcinomas. They obtained no metastases and made no transplants. They reported that the injection of tar was without effect. The injection of irradiated ergosterol into the gall bladder by Schmid (50) produced tumors.

Radiation has produced tumors. One of 20 guinea pigs, 15 months after X-ray radiation, developed a polymorphocellular sarcoma of the back which did not metastasize and could not be transplanted (19). A chondrosarcoma of the tibia was produced by repeated X-ray radiation (38).

Another method of production of tumors by radiation was developed by Dael's and Biltris (12). These experiments were broadened by Biltris (7) who, by the implantation of small amounts of radium element in collodion, a spindle cell sarcoma of the kidney, a spindle cell sarcoma of the meninges, and an intra-abdominal spindle cell sarcoma arising from the abdominal wall which was successfully transmitted by grafting; 6 carcinomas of the biliary tract, 1 of which produced metastases; and 2 tumors of the spleen. Gavrilov, Denmoor, and Fester (15) found that no tumors could be produced by the injection of guinea pigs with the filtrate of the Dael's-Biltris sarcoma and that repeated injection of the animals with embryonic guinea pig juice increased the number of induced tumors from 75 per cent to 90 per cent. Gavrilov and Sillerfeld (16) reported that 11 of 74 guinea pigs injected with the Dael's-Biltris tumor developed metastases.

Foulds (14) produced both carcinoma and sarcoma in guinea pigs by injecting urine from a patient with a carcinoma of the urinary bladder into the gall bladders of guinea pigs.
pigs by injections of thorotrast. These tumors were transplantable and developed in 4 out of 9 guinea pigs given small injections of thorotrast in the breast tissue. Tumors comprised a carcinoma, 2 sarcomas, and a fibrosarcoma, of which only the first 3 were transplantable.

Petrov and Krotkina (46) placed radioactive glass in the gall bladders of 12 guinea pigs and produced metastasizing carcinoma in 2. They also placed glass without radioactivity in the gall bladders of 7 guinea pigs and produced metastasizing carcinoma in 2.

Lipschutz and others (33-35) have produced atypical uterine epithelium in guinea pigs by repeated injections of estradiol. Moricard and Cauchois (43) produced large fibromas in the female guinea pig by injection of a benzole of dihydrofolliculin. Nelson (45) reported in 1937 the production of fibromyomatous nodules in the uterus of guinea pigs by the prolonged administration of estrogenic hormones. While extreme growth of the cervical epithelium with metaplasia may be produced by administration of estrogens to the female guinea pig, Allen (1) found no instance of cervical carcinoma. Champy (10) produced adenomas and cysts in the ovaries of guinea pigs injected with folliculin.

The production of tumors in guinea pigs by injection of bacteria cultured from human carcinoma has been reported by Glover, and his views in this highly controversial field have been recently put forth (18).

Carcinogenic hydrocarbons have rarely been effective in producing tumors in guinea pigs. Instillation of tar into the bronchial tree produced adenocarcinoma of the bronchial epithelium (27). In 1936 Cirio (11) reported that he had painted guinea pigs with tar carcinogenic for mice and had obtained no tumors up to 2½ years. Latteri (39) succeeded in producing a sarcoma in the kidney of guinea pigs. Liberti (32) was unable to produce cancer with 1,2-benzpyrene (3,4-benzpyrene) in guinea pigs although it was carcinogenic for white mice and rats. A sarcoma of the heart, probably spontaneous, developed in 1 of 33 guinea pigs injected with methylcholanthrene (4). Liposarcomas were produced in 4 guinea pigs by 1,2-benzpyrene (3,4-benzpyrene) injected subcutaneously by Haagensen and Krehbiel (21), who also mentioned that only 2 spontaneous tumors of guinea pigs had been observed in 23 years at the Institute of Cancer Research of Columbia University. Painting of the skin of guinea pigs with 1,2-benzpyrene (3,4-benzpyrene) failed to produce tumors (49).1

Shear (51), in collaboration with Drs. P. R. Howe and M. Elliott, injected 23 guinea pigs subcutaneously with 5 mgm. of crystalline 3,4-benzpyrene. Nineteen lived for 20 months, 1 developing a tumor during the 14th month which killed the animal in the 23rd month, and 1 developing a tumor at 20 months.

We have encountered only 1 spontaneous tumor in a guinea pig. The animal was received from a dealer in 1935 and proved to have a fibrosarcoma, probably of neurogenic origin, which had developed over the skins of a number of guinea pigs three times a week for 5 years, the animals dying of old age without evidence of cancer. (Reimann, S. P. The Biology of the Cancer Cell. Am. J. Roentgenol. 43:275-281. 1940.)

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1 Reimann states he has rubbed with dibenzanthracene the skins of a number of guinea pigs three times a week for 5 years, the animals dying of old age without evidence of cancer.
of the guinea pig rarely take as well as do those of transplantable tumors in mice, rats, or rabbits. Possibly better results would be obtained if guinea pigs of pure strain were used. These experiments were carried out on heterozygous animals.

Table 1: Results of Subcutaneous Injection of Guinea Pigs with 3,4-Benzpyrene Suspended in Glycerine

<table>
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<th>Days after injection still alive</th>
<th>Tumor</th>
<th>No. of animals</th>
<th>Days after injection tumor found</th>
<th>No. of animals</th>
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<td>No tumor</td>
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Summary

1. Cases of development of tumors, both spontaneous and induced, in guinea pigs have been collected.
2. One spontaneous and 4 induced tumors are reported.
3. The guinea pig appears to be resistant to the development of spontaneous tumors; to transplantation, at least in heterozygous animals, of tumors spontaneous and induced; and to the production of induced tumors other than of the gall bladder.
4. Carcinogenic hydrocarbons are much less potent in guinea pigs than in mice.

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