

## HEPATOMA AND ARTERIOSCLEROSIS IN A WOODCHUCK

Tumors in woodchucks have been rarely reported. Ratcliffe (Ratcliffe, Herbert L. 1933 *Amer. J. Cancer* 17: 116-136) reported an adenoma of the liver in a woodchuck at the Philadelphia Zoo. Haberman et al. (Haberman, R. T., Williams, F., and Eyestone, W., 1954, *J. Amer. Vet. Med. Assoc.* 125: 295-8) described hepatomas in 2 wild woodchucks.

Arteriosclerosis has been reported in many captive wild animals, including rodents but not in the woodchuck (Fiennes, R. N. T-W. 113-126 in: Roberts, J. Jr. and Straus, R.: *Comparative Atherosclerosis*. 1965. Harper & Row).

The following case report deals with a woodchuck which had a hepatoma and arteriosclerosis:

A female woodchuck (*Marmota monax*) was received at the Berg Institute in May, 1965. Its age was estimated at 1 month. It was kept in a cage 18 in. x 22 in. x 16 in. high on a wire screen bottom. It was fed Purina monkey chow and water ad libitum.

It was found dead in December, 1968 and refrigerated. The post mortem interval before necropsy was about 18 hours. The chest cavity revealed slightly congested lungs, except for a few small hemorrhages 0.5-1 cm. on the surface of the lung. The heart showed prominent coronary arteries which contained white spots. The aorta was prominent. It was tubular, translucent, brittle, with white streaks running longitudinally. Both the anterior and posterior aortas were similarly affected. The posterior aorta was involved down to the bifurcation.

The liver had attached to it a tumor equal in size to the rest of the organ. In one lobe, there were a few nodules of the same tissue, 3-4 cm. in diameter. The tumor was cream in color and of the same consistency as the liver. On cross-section it contained darker yellow necrotic areas. The kidneys were normal in appearance, as were the adrenals. The gastro-intestinal tract had no lesions. The spleen was overlooked and discarded by mistake. The ovaries and uterus were in the anestrus stage.

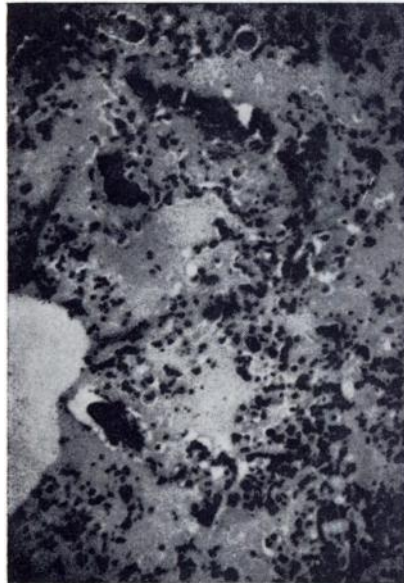
### Histopathology

Tissues were fixed in 10% formalin buffered with 2% sodium acetate, embedded in paraffin and stained with hematoxylin and eosin, azure-eosin, Von Kossa stain, elastic Van Gieson stain and Masson's trichrome stain.

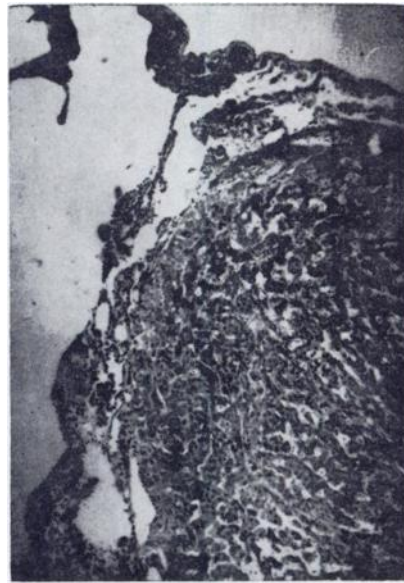
The lungs were edematous and hemorrhagic in large areas. Macrophages were seen in the alveoli. The alveolar walls were sometimes thickened, some with congested capillaries, polymorphonuclear leukocytes, macrophages, and plasma cells. There were calcifications in the alveolar walls, usually at the partition of the alveolar duct with the alveoli. These calcifications were also seen in the walls of blood vessels within the alveolar walls, but often no vessel could be identified in the calcified mass (Fig. 1). Foreign body giant cells were sometimes seen near these calcifications. A few small tumor metastases were seen (Fig. 2).

The main changes in the heart were seen in the coronaries and deeper vessels. The internal elastic lamina was calcified with very little extension into the media. Some arteries showed intimal proliferation with foam cells. Other arteries deep in the myocardium were normal. There were a few small areas in the myocardium where round cell foci were seen with mild fibrosis and loss of myocardial fibers.

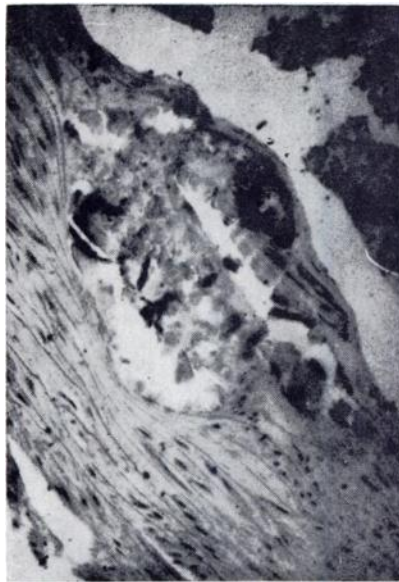
The aorta showed calcification of the center of the media (Fig. 3). The intima was not involved, but some calcification extended up to the intima. The mesenteric arteries showed swelling of the endothelial cells of the intima with the internal elastic lamina fragmented. There was subintimal calcification in these arteries but the calcification did not go deeply into the media (Fig. 4). Other arteries showed the subintimal calcifica-



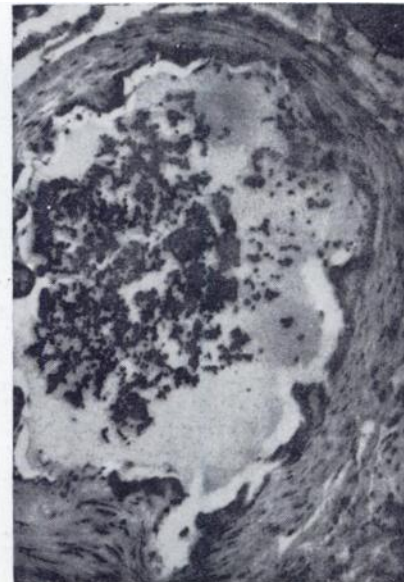
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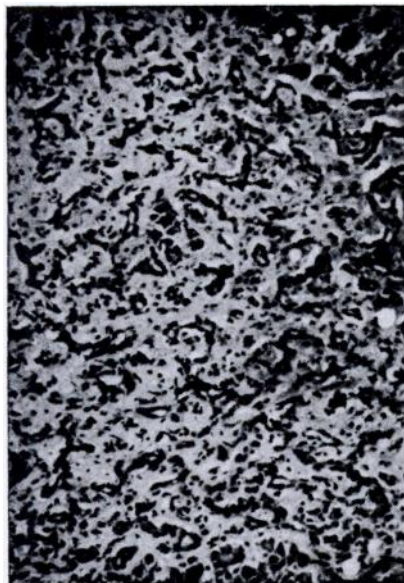
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FIGURE 1. Lung. Dark masses are calcium in alveolar wall. *H. and E. X400.*

FIGURE 2. Lung. Hepatoma metastasis. *H. and E. X100.*

FIGURE 3. Aorta. Calcification in media. *H and E. X400.*

FIGURE 4. Mesenteric artery. Subintimal calcification. *H. and E. X100.*



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FIGURE 5. Liver. Proliferation of bile ducts in connective tissue. H. and E. X400.

FIGURE 6. Hepatoma. Sinusoid-like formation. H. and E. X400.

tion which appeared as droplets and then seemed to coalesce into longer areas.

The liver, apart from the tumor, showed fatty changes, mainly in midzonal areas. One portal area contained a large focus of inflammatory cells, mainly plasma and lymphoid cells. Adjacent to the tumor, the liver was sometimes separated from the tumor by connective tissue, in which was seen many small bile ducts; this bile duct hyperplasia in one area was almost neoplastic in appearance (Fig. 5). In other areas, the liver cells were compressed, with cells further away from the tumor undergoing marked fatty changes. Other areas contained markedly distended sinusoids, increase of bile ducts in portal areas, and an increase of plasma and lymphoid cells in the periportal areas. There was little evidence of bile stasis.

In the tumor, the cells resembled hepatic cells, some with large vesicular nuclei and very prominent nucleoli. Some areas

showed sinusoid-like formation (Fig. 6). Areas of tumor cells had undergone fatty changes. Large areas of necrosis were present, with islands of tumor cells surrounding a sinusoid-like space that contained a blood vessel. Some other areas contained cells distended with a green-staining granular material.

In the kidneys the glomeruli were enlarged, some with an increase in collagen and others with an increase in cells. Some had thickened Bowman's capsule. Scattered throughout the interstitial area were aggregates of plasma cells, macrophages and lymphoid cells. Most tubular cells were swollen. Some tubules had cellular casts, others contained casts of calcium material. The epithelium of most of the collecting tubules in the medulla was hypertrophic. The arteries did not contain calcium except in rare instances. One of the adrenals contained a metastasis of the hepatoma.

### Discussion

The type of arteriosclerosis seen was the Mönckeberg type and not the atherosclerosis seen in humans. Except in the coronary arteries, there was no intimal proliferation. The calcium deposited in the arteries was always in the media. The calcium sometimes involved the entire circumference of the artery; in the aorta, the calcification was focal, pushing the intima into the lumen.

The cause of arteriosclerosis has been linked with diet and stress. Ratcliffe (Ratcliffe, H. L., and Snyder, R. L. 127-128 in: Roberts, J. Jr., Straus, R. *Comparative Atherosclerosis*. 1965. Harper & Row) has reported a decrease in the incidence of arteriosclerosis at the Philadelphia Zoo after improving the diet.

The monkey chow fed the woodchuck contained protein 15.2%, fat 5.2%, fiber 2.5%, nitrogen free extract 62.3% and water 9%. The natural diet of the woodchuck probably would contain much more fiber and less fat.

How much stress is involved is questionable. Certainly a woodchuck caged in an animal facility is not in its normal surroundings.

Hepatomas rarely metastasize, however this case had pulmonary and adrenal metastases, although few in number. The few tumors reported in woodchucks all have been in the liver. It will be interesting to find out after more investigations of neoplasia in woodchucks, what percentage are liver tumors.

### Summary

A four year old female woodchuck had a metastasizing hepatoma and Mönckeberg type of arteriosclerosis.

### Acknowledgment

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ELIHU BOND

*Berg Institute*

*New York University Medical Center*

*New York, N.Y. 10016*

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