AGE CHANGES IN THE BLOOD VESSELS AND THEIR ROLE IN THE NUTRITION OF BONE TISSUES

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An important role in the pathogenesis of atherosclerosis of the vascular system belongs to age changes in the vessels [1,3]. From this point of view, the study of age changes in the blood vessels of bone tissues is of considerable importance [7,8]. Various methods of contrast angiography are used widely for this purpose in clinical and experimental practice, and they are particularly valuable when combined with morphological investigation [10,19].

Age changes determined roentgenologically in the contrasted arteries are characterized by widening and bending of their shadows on account of the lengthening and dilatation of the vessels caused by a diminution of the elasticity of their walls [1].

During the study of atherosclerosis of different vessels by the method of contrast angiography, the main signs are narrowing of the shadows and uneveness of their outlines. The roentgenological changes in the vessels are due to plaques and areas of thickening of the vessel walls. Under these circumstances, funnel-shaped constrictions or interruptions of the shadows of the blood vessels may be seen [9,10,14].

The object of the present investigation was to compare the age changes in the blood vessels of the bone tissue of the mandible in dogs and the state of the mandibular arteries of these animals in experimental atherosclerosis.

EXPERIMENTAL METHOD

The age changes in the blood vessels were studied in two groups of healthy animals: young (five dogs) and older (five dogs). Group 3 consisted of five dogs with experimental atherosclerosis.

Changes in the lipids were produced by the use of experimental diets containing egg yolk and vitamin D_2; 6-methylthiouracil and vitamin D_2; or cholesterol, 6-methylthiouracil, and vitamin D_2 [11,12].

The blood vessels were contrasted by the method described by N. A. Bykov and co-workers [2].

Certain anatomical details of the preparations, including those of the contrasted blood vessels, were so fine that they could not always be detected clearly enough on ordinary roentgenograms. To reveal all the roentgenological details more fully, a method of roentgenography was used with direct enlargement of the image. As a rule, the linear image was enlarged twice, but in some cases a higher degree of enlargement was used [4,6,7,13,15,16-18,20].

Roentgenography with direct enlargement of the image consists essentially of the producing of roentgenograms with a greater distance between the test object and the film than is normally used. The degree of enlargement was calculated from the formula $d = H/h$, where d is the degree of linear enlargement of the image, H the distance from the focus of the x-ray tube to the film (from 0 to A) and h the distance from the focus of the x-ray tube to the object (from 0 to a). The enlarged image on the film is sharp enough only if fine-focus x-ray tubes are used, having a focus not greater than 0.3×0.3 mm in size. In the present investigations, the roentgenograms of the mandible with an enlarged image were obtained by means of the Tur DK 150 fine-focus tube and the Kontrastor-150 apparatus,

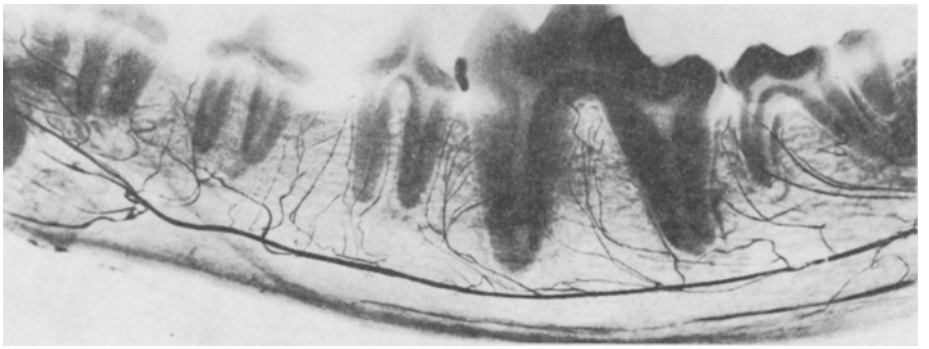

Fig. 1. Normal contrast angioroentgenogram of the mandible of a young dog. Direct enlargement of image 1 : 2.

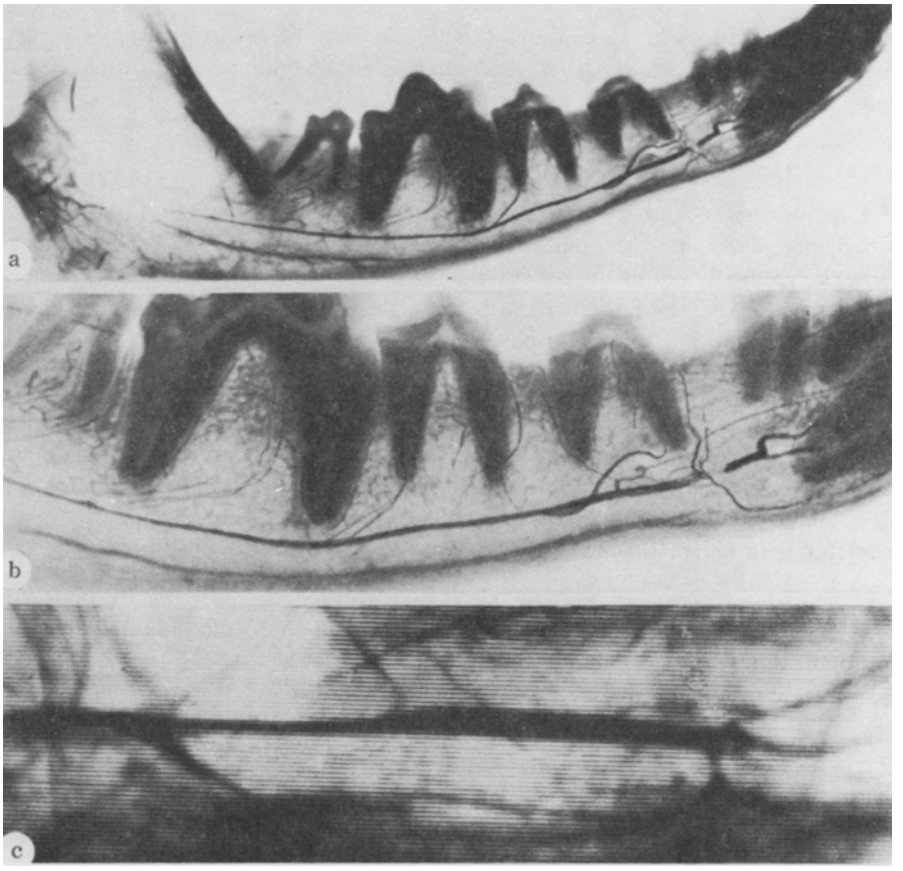

Fig. 2. Angioroentgenograms of mandibles of dogs with atherosclerotic changes in blood vessels: a) experimental angioroentgenogram; b) the same preparation. Direct enlargement of image 1 : 2; c) image of contrasted artery with atherosclerotic changes, enlarged six times.

operating under the following technical conditions: 50 kV, 20 mA, 0.4 sec, distance from focus to film 90 cm, preparation placed on a special plastic platform at a height of 45 cm above the film. The films were taken without intensifying screens. In this way a linear enlargement of the image twice was obtained. According to reports in the literature, films with an enlarged image have undoubted advantages over the indirect enlargement of ordinary roentgenograms by means of a loupe or by photographic enlargement, for more details can be seen per unit area of roentgenogram on films with direct enlargement of the image. The results of the present observations confirmed these findings.

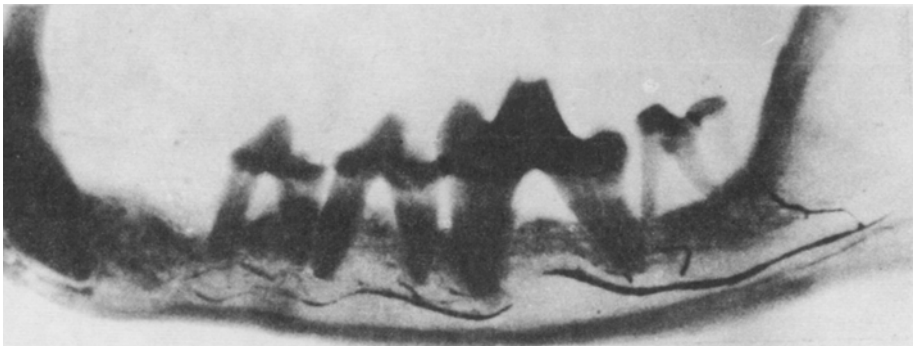

Fig. 3. Angioroentgenogram of the mandible of a dog with periodontosis. Direct enlargement of image 1: 2.

In practice, on roentgenograms with an enlarged image, not only the tiniest contrasted shadows of the blood vessels could be defined, but also very slight pathological changes in the great vessels, which are usually too indistinct on ordinary roentgenograms.

EXPERIMENTAL RESULTS

The study of the angioroentgenograms of the mandibles of the young animals revealed contrasting of the larger vessels and of their peripheral branches, uniformly distributed against the background of the mandibles. The lumen of the larger vessels, gradually narrowing towards the periphery, had clearly defined, smooth outlines (Fig. 1). With an increase in the animal's age, the larger vessels became tortuous, their lumen became dilated, and these changes were particularly marked in the peripheral portions.

On the angioroentgenograms of the mandibles of the animals with experimental atherosclerosis, the vascular pattern of the mandibles was less dense because of a decrease in the number of shadows of the contrasted vessels (Fig. 2a). Not only the smallest vessels failed to show up, but also some of the vessels leaving the main trunks (Fig. 2b). In some cases, the sign of a sudden interruption or narrowing of the shadows of the main trunk vessels and also of their branches could be clearly distinguished (Fig. 2c). The vessels were irregular in width; dilatations of their lumen were associated with funnel-shaped constrictions. In some cases the outlines of the main trunk vessels were irregular.

The roentgenogram of the bone tissue of the alveolar crests of the dogs with experimental atherosclerosis showed signs of resorption of the compact plate and the apices of the interdental and interradicular septa characteristic of periodonotsis, resulting from angiotrophic disorders of the bone tissue [5].

The results of the study of the angioroentgenograms of the mandibles in animals not subjected to the experimental procedures but with signs of periodontosis showed that the roentgenological pictures of the vascular disturbances in this disease (Fig. 3) were identical in principle with those described above in experimental atherosclerosis. Quantitatively and qualitatively the changes in the vessels corresponded to the severity of the periodontosis. In each individual case, the study of the roentgenograms revealed the areas most suitable for subsequent morphological investigation of the blood vessels of the mandibles, and in particular, of the periodontium. Microscopically, in the blood vessels of the mandibles of the animals with experimental atherosclerosis, sclerotic changes were found, in the form of hyperplasia of the fibers of all layers of the vessel wall, sometimes with fibrosis of the adventitia.

In the mandibles of the animals with marked periodontosis, besides fibrous changes in all layers of the arterial wall, signs of hyalinosis were found, and in some cases considerable calcification. In periodontosis, the arterioles of the medullary lacunae of the alveolar processes were particularly affected, for the gross constriction of the lumen of the vessels reached the degree of almost complete obliteration.

Hence, both in severe periodontosis and in experimental atherosclerosis, the results of the morphological investigations corresponded to roentgenological data.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of this issue.
