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Microscopic Structure of the Iliac Artery in the Rabbit

Budowa mikroskopowa ściany tętnicy biodrowej u królika

A rapid increase in vascular diseases presents a challenge for researchers to investigate their causes, mechanism of pathogenesis, course and methods of treatment and prevention. This task requires carrying out various investigations on experimental animals, including rabbits (2, 3, 5, 9, 11, 12). We have recently investigated changes occurring in the structure of the walls of various peripheral arteries, including iliac arteries during the course of induced diabetes in rabbits. A thorough knowledge of morphology of the investigated arteries is a basic condition of proper interpretation of the obtained results; therefore, we have concentrated on microscopic structure of the wall of the iliac artery in rabbits.

MATERIALS AND METHODS

Investigations have been carried out on 130 rabbits bred at the Department of Genetics and Methods of Animal Improvement, Agricultural Academy in Cracow. Experimental material included animals of both sexes of white New Zealand breed (NZ) and black bay (CzP) and two-way cross-matching: female NZ x male CzP (NZX) and female CzP x male NZ (CzPX) aged 70 and 140 days. Rabbits were killed in a traditional way and bled. Iliac arteries, common and external, after washing in physiological saline

were fixed in 10% neutral formalin. Paraffin sections 5—10 μm thick were stained using the following methods: H + E, van Gieson's, Weigert's, Fraenkel's and alcian blue, and were argentated using the Bielchovsky and Meresch method (1).

RESULTS AND DISCUSSION

Iliac arteries, common and external, on preparations stained with H + E method reveal a typical trilaminar structure (Fig. 1). In the internal membrane a single layer of squamous cells of the endothelium situated on the folded, elastic internal membrane is visible.

The medial membrane consists of myocytes and fibres of connective tissue (Fig. 1). Muscular cells are situated in 6—9 circular layers in 70-day-old rabbits, and in 140-day-old rabbits their number is greater and ranges from 8 to 12. Between the myocyte layers laminae of elastic fibres are visible. They form a continuous elastic external membrane on the medial circumference membrane which is bilaminar in some places.

The adventitia is formed of cells and fibres of connective tissue (collagenic and elastic) — Figure 1. In all the investigated iliac arteries, common and external, the presence of vasa vasorum penetrating into adventitia has been revealed.

On preparations stained with alcyan blue the presence of glycosaminoglycans in all layers of the investigated vessel walls was demonstrated. In 70-day-old rabbits slightly larger accumulations were found in the internal membrane of the common iliac artery (Fig. 2) and in the internal and medial membranes of the external iliac artery. In 140-day-old rabbits more mucopolysaccharides were observed in the internal membrane and adventitia than in the middle membrane (Fig. 3).

On serial sections, stained alternatively using van Gieson and Weigert methods, the structure of the aorta wall at the level of its branching into the common iliac arteries, and the structure of the wall of the common iliac artery in the place, where it branches into external and internal iliac arteries, were studied.

On cross-sections of the terminal part of the aorta, a medially situated intussusception of its walls into the lumen of the vessel was observed (Fig. 4). In these places a dissection of internal elastic membrane into

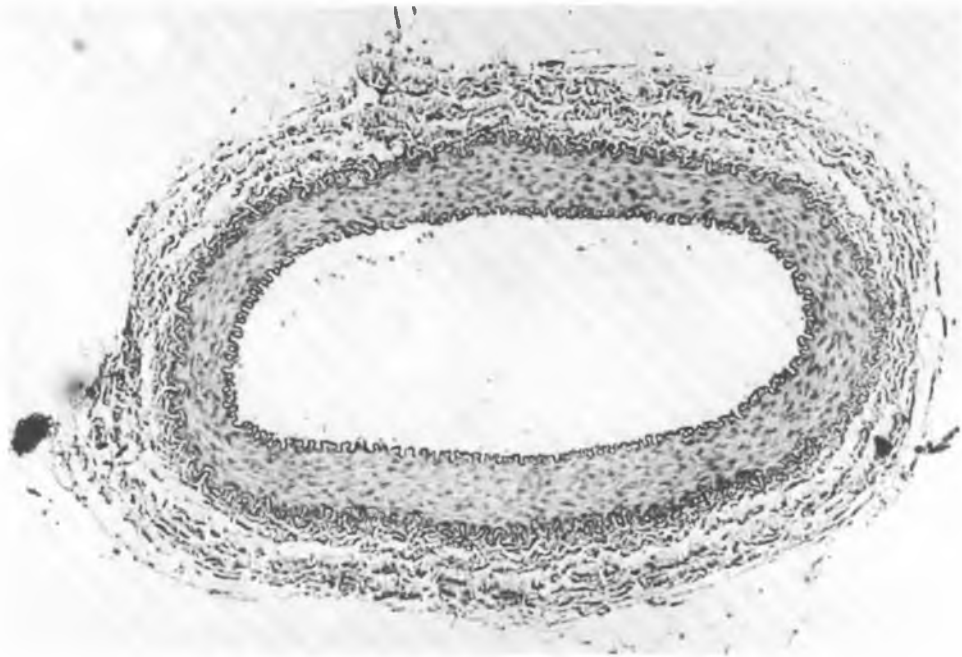

Fig. 1. A transverse section of the external iliac artery of the 140-day-old rabbit. H + E, magn. 100 ×

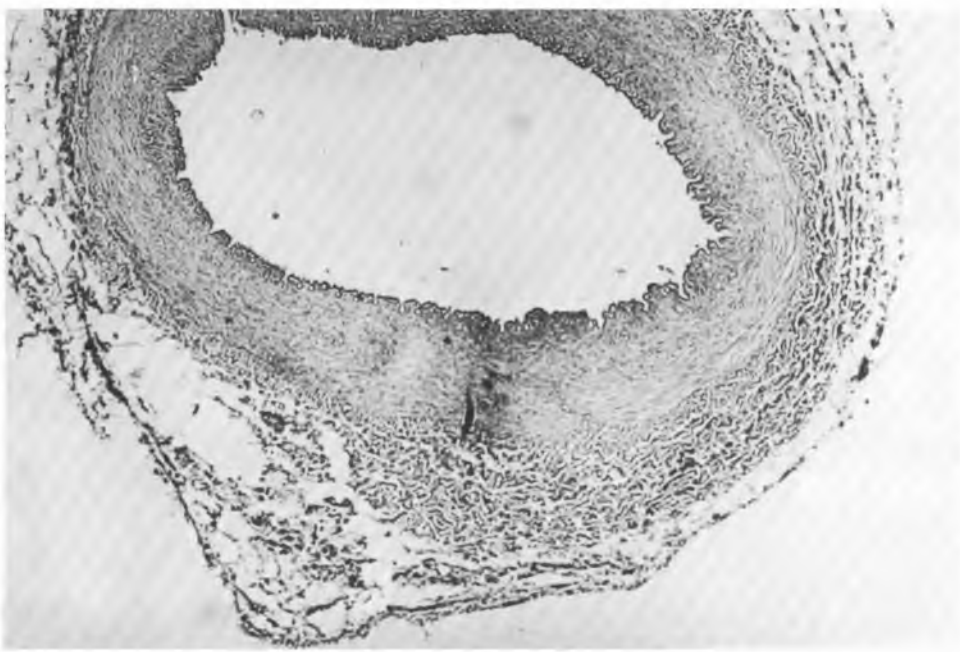

Fig. 2. A transverse section of the common iliac artery of the 70-day-old rabbit. Alcyan blue, magn. 200 ×

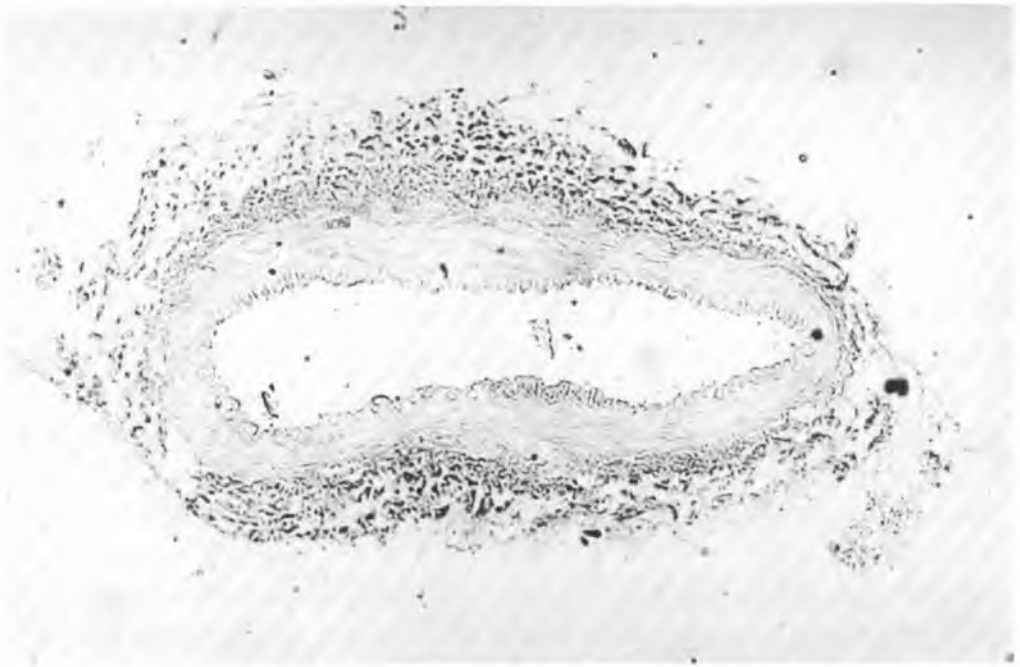

Fig. 3. A transverse section of the external iliac artery of the 140-day-old rabbit. Alcyan blue, magn. 100 ×

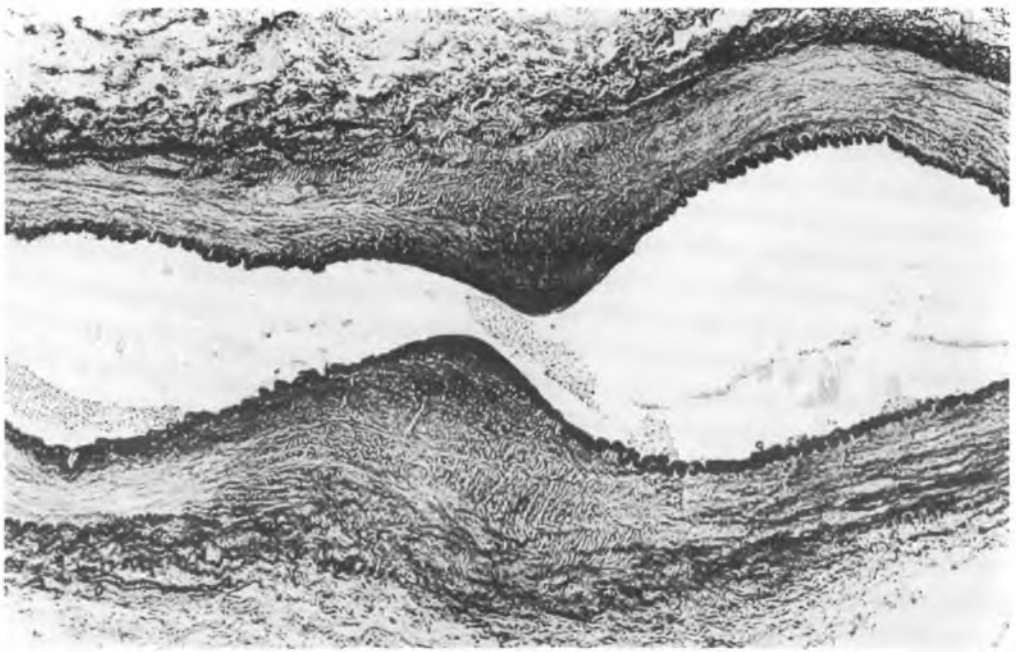

Fig. 4. A transverse section of the aorta bifurcation of the 140-day-old rabbit. Weigert, magn. 200 ×

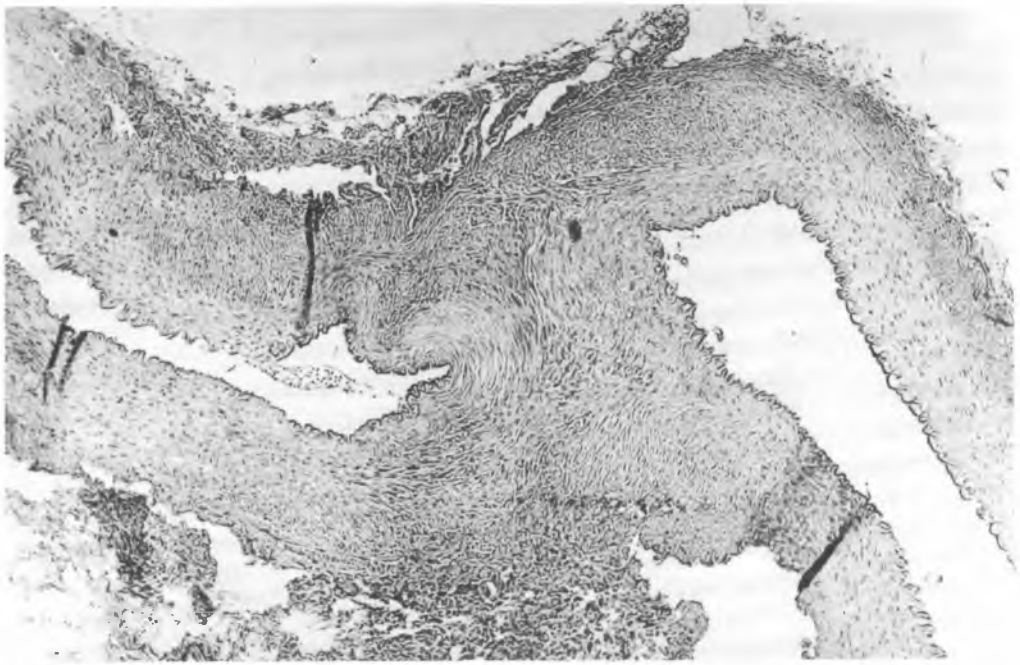

Fig. 5. A transverse section of the aorta bifurcation of the 140-day-old rabbit. Van Gieson, magn. 200 ×

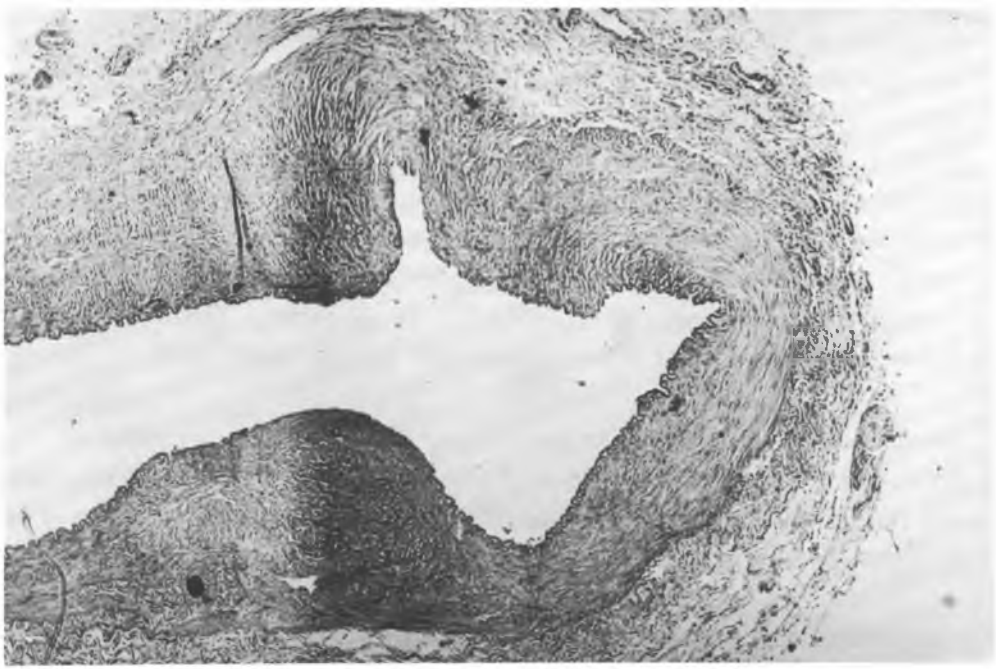

Fig. 6. A transverse section of the common iliac artery division of the 140-day-old rabbit. Van Gieson, magn. 200 ×

regular, unfolded laminae of elastic fibres is visible. In the medial membrane, at the point of further bifurcation, elastic elements occur distributed separately in high density, whereas myocytes gather in the external part of the medial membrane. Within the bifurcation of the aorta itself, elastic fibres do not form distinct laminae characteristic of arteries of elastic type. Between the layers of myocytes, a flaccid connective tissue begins to penetrate forming an adventitia which separates the two newly formed vessels (Fig. 5).

At the point of branching of the common iliac artery, a protrusion of the arterial wall situated closer to one of its circumferences is observed and, therefore, the lumen of newly-formed arteries is not uniform (Fig. 6). In the wall of such a protrusion great accumulations of myocytes located longitudinally and stretched elastic fibres are found. These protrusions unite forming an arterial wall characteristic of arteries of the elastic type, which separates the lumens of the external and internal iliac arteries.

In the light of our observations, it appears that the common and external iliac arteries in rabbits are vessels of the elastic type and the structure of their walls does not differ greatly from the structure of the wall of the aorta (7, 8, 10). No qualitative changes in the histological structure of the walls of investigated arteries were noticed during the period of the most intensive physical development of rabbits between the 70th and 140th day of their lives, when sexual maturity is achieved. Only in 140-day-old rabbits, in preparations stained with alcyan blue, a higher accumulation of glycosaminoglycans in adventitia of arteries were observed than in younger rabbits, which is in accordance with observations of other arteries (4, 11, 12). No differences in the microscopic structure of the iliac arterial wall associated with breed and sex were noticed.

In extra-uterine life of humans and experimental animals some changes in the histological structure of peripheral arterial walls take place (e.g. migration of myocytes to the internal membrane or changes in the structure of elastic internal membrane), both of which are considered by some authors to be early symptoms of atherosclerosis (6).

No changes of this type have been found in the investigated animals apart from delamination of the internal elastic membrane in the

place of branching of abdominal artery. On the basis of these results it may be assumed that 140-day-old rabbits may be used for experiments including, inducing and examining the course of atherosclerosis of the iliac artery.

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STRESZCZENIE

Badania przeprowadzono na 130 królikach różnych ras i obu płci w wieku 70 i 140 dni. Opisano budowę mikroskopową ścian tętnic biodrowych wspólnych i zewnętrznych. Wykazano, że naczynia te są tętnicami typu sprężystego. Nie stwierdzono zachodzenia zmian jakościowych w obrazie histologicznym ścian badanych tętnic w okresie najintensywniejszego rozwoju fizycznego królika pomiędzy 70 a 140 dniem życia, tj. do momentu uzyskania dojrzałości płciowej. Jedynie u osobników 140-dniowych zaobserwowano nagromadzenie glikozaminoglikanów w przydance tętnic większe niż u królików młodszych. U wszystkich przebadanych zwierząt nie stwierdzono w budowie mikroskopowej tętnic biodrowych zmian uważanych za wczesne objawy miażdżycy.