CONSTRUCTIONS OF MICROVASCULAR COMPLEXES OF GLANDS AND MUSCLES IN THE PROSTATE OF MEN OF DIFFERENT AGE

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Abstract. The morphometry of the basic structural components and microvessels in sections of 200 prostates of different age is executed. Hemomicrocirculatory channel by protocapillars, formed networks of microvessels, microvascular complexes in fascicles of striped muscle fibres and myocytes are presented (20-22 weeks). There are stratified microvascular "baskets" around of glands (22 years).

Conclusions. 1. Intraorganic blood channel of the prostate is formed according to development of the basic structural components of an organ and is changed during transformation of structures. 2. The construction of microvascular-glandular complexes reflects morphofunctional condition of blood supplied glands and has age differences.

Key words: prostate, microvessel, development, glands, myocytes.

INTRODUCTION

Established selectivity of the localization of nodules of BPH and prostatic cancer in different lobules of the prostate [1] defines the interest to construction of all lobules and to their microenvironment.

Some autors[6, 7] have revealed the differences of the architecture of glands of central and peripheric zones of the prostate. The data about anteromedial lobules (mediate zone of **J.** E. McNeal) are not revealed in the literature [8]. There are no data about the differences in construction of microvascular networks around different glands of the prostate and in parts of muscular tissue with different orientation of myocytes and striped muscle fibres. Nevertheless an important role of character of the angiogenesis and condition of hemomicrocirculatory channel in the pathogenesis and in the prognosis of the prostatic cancer was fixed [3, 6]. There are data about higher specific volume of microvessels in nodules of BPH [2, 4, 5]. It was cause of our research, the purpose of which is revealing of features of construction of microvascular complexes of glands and muscles in the prostate of men of different age.

MATERIALS AND METHODS

The construction of microcirculatory channel and its microenvironments is investigated on material of autopsy of 200 prostates from 20-weeks fetuses to persons of the age of 83 years. Research is conducted on total and subtotal sections of the organ. Sections are executed in horizontal, frontal and sagittal planes concerning axis of the urethra. Universal histological stainings such as hematoxyline-eosine and gallocyanine-picrofuxine (van Giesone) are used. Collagenic and reticular fibres were imbued by azocarmine (Heidenhain). The revealing of glycosaminoglycans (proteoglycans) and glycoproteins is conducted by reactant of Schiff, by the method of Hale and combined Ritter-Oleson method. The activity of alkaline and acidic phosphatases was defined by the methods of G. Gomori (1950, 1952). Non-injective method of V. V. Kuprianov (1965) and adenosine-lead method of A. M. Chilingarjan (1977) were used for studying hemomicrocirculatory channel [9]. The definition of morphometrical parameters of the basic structural components and hemomicrocirculatory channel of various parts of the prostate was conducted on specimens impregnated by the method of V. V. Kuprianov, imbued by adenosine-lead method, by azocarmine's method of Heidenhain.

RESULTS

Fascicles of myocytes and myocytes like separately situated cells are revealed on periphery of the prostate of fetuses of 20-22 weeks. The layer of striped muscle fibres oriented in frontal plane is disposed in forward part of the organ.

Glandular tubules, epithelial cords are revealed laterally and dorsally from the urethra. Hemomicrocirculatory channel of the organ is presented by protocapillars and formed networks of microvessels. The degree of differentiation of wall of microvessels is higher on periphery of the organ.

Fetus of 38-40 weeks has formed inferolateral lobules, excretory ducts and terminal portions which have a lumen. Excretory ducts and epithelial cords are revealed closer to the urethra. During development of glands around them the nodular microvessels are shaped which have view of capillary ring with capillary germs emanating from him. Then monostratal at first capillary and capillary-postcapillary

networks are shaped (Figure 1). 1 he monostratal capillary networks oriented along axis of duct are revealed around growing excretory ducts (Figure 2). Microvascular complexes are formed in front of the urethra, in fascicles of striped muscle fibres and myocytes of other parts of the prostate. Capillary networks of these complexes are oriented along blood supplied fascicles of myocytes and fibres. The complication of formed microvascular complexes in the prostate of fetuses of 36-40 weeks occur like type of growth "capillar from capillar ".

Figure 1. Capillary nodes *(—>)* in parts of the of terminal portions of glands of superomedial lobules of the prostate of a fetus of 38 weeks. *Adenosine-lead method. Magnification x70*

Figure 2. Fragment of monostratal capillary network (2) around growing excretory ducts of gland (1). Inferolateral lobules lobules of the prostate of a fetus of 38 weeks. *Adenosine-lead method. Magnification x70*

With newborns the quantity of oriented fascicles of myocytes is enlarged. Around the glandular epithelium the capillars dispose circularly, monostratal capillary-postcapillary "basket form" networks arise near formed terminal portions (Figure 3).

Within the first year of life the secretory' function of epithelium increases gradually in all parts of the prostate. At that volume of blood channel (microvascular part especially ($p<0$, 01)) has 25% decrease. Such falloff of volume of hemomicrocirculatory channels has taken place at the expense of capillary-venular part, and the share of capillars in structure of the prostate decreased ($p<0,01$) not only in comparison with neonatal, but even w ith fetuses of last weeks of the prenatal period. The decrease of functional load on the hemomicrocirculatory channel promotes formation of arteriolovenular anastomoses in it.

The formation of glands of anteromedial lobules in parts adjoined to lateral surface of the urethra begins in the period of 4-7 years. This process is accompanied by certain ($p<0,01$) increase of specific volume of capillars near them.

Arterioles and venules get gyrose passage in front parts of the prostate in fascicles of striped muscle tibres and myocytes by age of 7 years. Their orientation and the orientation of precapillaries emanating from them are transversal or slanting to axis of the muscle bundle. Then precapillars get orientation along the axis of the fascicle and give the capillars having primarily the same orientation (Figure 4).

By 16 years typical branching alveolar-tubular glands are shaped. Quantity of myocytes and elastic fibres around formed and growing glandular lobules increases. A "muscle case" of the prostate is formed.

Cyclicity of secretory processes is characteristic for glands of the prostate of young men (17-21 years). The increase of the size of terminal portions of glands, high secretory activity of the epithelium is accompanied by formation of branching stratified microvascular networks. Branchings of microvessels on the surface of terminal portions with an awake secretion look like "arcades" due to a plenty of intercapillary communications between systems of different arterioles (Figure 5). Arterioloarteriolar, venulovenular and arteriolovenular anastomoses are revealed between capillary and "arcade-torm" networks with regulated blood flow (Figure 6). Capillars of internal (towards lumen of terminal portions of glands) layer of the stratified network can immediately contact the epithelium. Capillars "go" to all outgrowths of the epithelium, to lumen of gland and "move apart" basal layer of the epithelium.

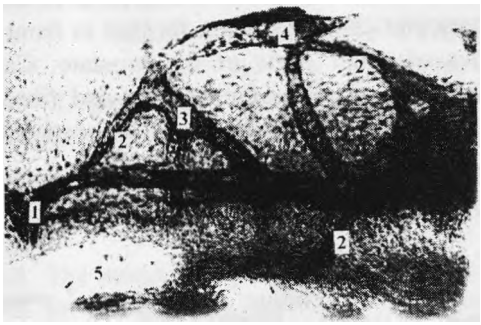

Figure 3. Fragment of microvascular network on the surface of terminal portion of gland of inferolateral lobules. Prostate of a neonatal boy at 40 hours after a birth. *Adenosine-lead method. Magnification: xl25.* 1-arteriole; 2-capillar; 3-postcapillar; 4-venule; 5-lumen of terminal portions of gland.

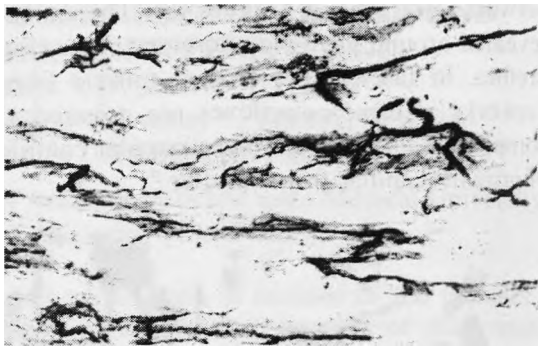

Figure 4. Higher level of detection of alkaline phosphatase in gyrose arterioles, precapillars,postcapillars, venules in comparison with capillars. Zone of location of fascicles of striped muscle fibres (6) in forward part of the prostate of a boy of 7.5 years. *Detection of alkaline phosphatase by the Gomori method. Magnification: x50.*

Figure 5. Fragment of hemomicrocirculatory channel ("baskets") around terminal portions of glands of anteromedial lobules. Connective capillars (1) between capillars (2) in systems of different arterioles (3) form microvascular "arcades" on the surface of glands. Prostate of a young man of 19 years. *Adenosin-lead method. Magnification: x100.* 4 - venule.

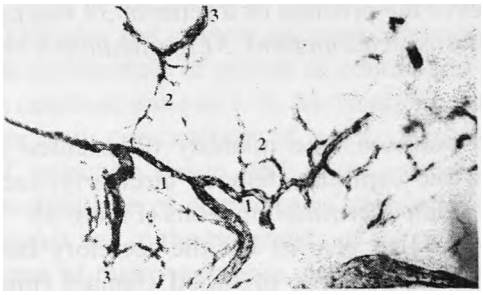

Figure 6. Fragment of hemomicrocirculatory channel("baskets") around terminal portions of glands. Venulovenular anastomoses (1) in external layers of microvascular plexuses of glandular-microvascular complexes of inferolateral lobules of prostate of a young man of 19 years. *Adenosin-lead method. Magnification: x802* - capillars 3 - venule.

Microvascular "baskets" around of glands get more branching view by 22 years. Microvascular plexuses of excretory, ducts have construction like vascular arcades. The presence of 2-3 series of precapillary-capillarv-postcapillary arches oriented on passage of duct is typical for them.

During age involution with its specific features the increase of the size of cysticly dilated lumens of terminal portions of glands under parallel decrease of share of the epithelium takes place which is connected with its atrophy. Thus specific volume of muscle tissue decreases. Muscle cells get chaotic situation arrangement in the greater degree on periphery of lobules. Specific volumes of capillars and hemomicrocirculatory channel decrease which is caused by rarefaction of microvascular networks under increase of diameters of microvessels, but still "basket-form" structure of glandulomicrovascular complexes is kept. They resemble those peculiar to children, that is they become more monostratal. Rarefaction of microvascular networks causes statistically trustworthy ($p < 0.001$) decrease of specific quantities of all kinds of microvessels.

DISCUSSION

The data received by us about structural transformations of glands, muscular elements and components of connective tissue in the human prostate have shown that non-uniformity of processes of growth and a differentiation of various structures, constant changes of mutual relations of basic components of an organ and parts of its blood channel of the organ are observed during the different age periods in the prostate.

Glands of the central zone of the prostate before other sites attain functional maturity. The secretum of small terminal portions of glands of the peripheric zone appears with adolescents after 13 years, and glands of the transitional zone begin to be formed at the age of 7-8 years. At 16-17 years the active secretion is inherent for all glands of the prostate, both formed and growing. Morphological differences of glands of the central and peripheric zones of the prostate begin to be defined from 12 years.

The blood channel of the prostate develops and transforms adequately to requirements of blood supplied structures. At 20-22 weeks of embryogenesis it is presented by veins and solitary arteries disposed on periphery of the organ, by protocapillars and formed networks of microvessels inside organ. At the end of embryogenesis the process of development and re-orientation of microvascular networks around formed glands and muscular fascicles in the prostate results in formation of modular constructions of hemomicrocirculatory channel: micro vascular-glandular and micro vascular-muscular complexes.

Processes of age involution in the prostate and its blood channel pass outside of strict fixity to the age of the man. These changes have individual character. The general tendency of involutional changes of histological structure of the prostate allows us to assume that the involution of the organ goes from paravascular zones. The reason of it is the increase of the hydrodynamical load on venous bed of the prostate. All further transformations of structures of the organ correspond to the picture of development of proof chronic venous congestion.

CONCLUSIONS

On the base of our results and the data of the literature it is possible to mark the basic laws of the structural organization of the intraorganic blood channel of the human prostate.

1. The intraorganic blood channel of the prostate is formed according to the development of the basic structural components of the organ and is changed during transformation of the structures.
2. The construction of microvascular-glandular complexes reflects morphofunctional condition of blood supplied glands and has age differences.

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