REPORT ON THE STUDY OF SPATIAL ORGANIZATION OF THE HUMAN PROSTATE GLANDS

WYNIKI BADANIA PRZESTRZENNEJ STRUKTURY GRUCZOŁU KROKOWEGO U MĘŻCZYZN

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ABSTRACT

Introduction: In terms of the spatial organization human prostate is the complex organ due to the fact that it consists of several types of glands, localized in several histotopographic areas, characterized by the heterogeneous structure. On the other hand, most of the prostate glands are characterized by the high degree of adjacency to each other and quite complicated architectonics of both the external and internal contours of their acini and terminal ducts.

The aim: The paper was aimed at the study of steromorphological features of the tubuloalveolar secretory elements in the peripheral area of the human prostate.

Material and Methods: 10 isolated postmortem specimens of the prostate gland, urinary bladder, seminal vesicles, fragments of the seminal ducts and urinary tracts which were taken from adult patients, died for the reasons not associated with the pathology of the urogenital system, have been analyzed to study the features of spatial organization of the human prostate glands in its peripheral area. To analyze the secretory components of the prostate stereological and decomposition methods have been used, which allow visualization of its structural and functional elements in all three inter-perpendicular planes.

Results and Conclusions: The use of the suggested method enables to get the megascopic reconstruction of the acini and terminal ducts of the prostate gland which can be studied from all sides, getting a comprehensive idea about the shape and size, as well as allows to explore the inner topography of the organ's structure, the geometry of the lumen of the epithelial excretory ducts, to determine the changes in the thickness of the wall, to get a visual representation of microtopographic correlation between the different parts of blood microcirculatory flow with the acini and terminal ducts of the prostate gland.

KEY WORDS: prostate gland, stereomorphology, decomposition method, photo-reconstruction.

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INTRODUCTION

Human prostate is the complex organ in terms of the spatial organization. This is due to the fact that it consists of several types of glands, localized in several histotopographic areas, characterized by the heterogeneous structure [1, 2, 3]. On the other hand, most of the prostate glands are characterized by the high degree of adjacency to each other and quite complicated architectonics of both the external and internal contours of their acini and terminal ducts.

One of the factors hampering the differentiation of the prostate gland is the fact that exocrinocytes of the walls of both the acini and system of ducts in all areas are represented by one and the same kind of epithelial cells and, consequently, it is almost impossible to mark the border between them. In addition, it is very difficult to distinguish the structural elements in the glandular part of the human prostate, in contrast to many of the excretory glands [4]. Another disabling factor is the absence of clear anatomical boundaries inside the structure of the prostate gland. In this way, the capsule of the prostate does not form the septa to divide it into parts, particles or other structural elements. Generally, the prominent homogeneity of the structure and shape of the glandular components in the most of the volume of the prostate gland makes the micromorphological picture more complicated.

All the above mentioned allows to conclude that the "systemic" study of the spatial organization of the glandular components of the prostate gland, even within the small amount of tissue, is very complicated due to the fact that the elements will overlay each other. To solve this problem we used stereomorphological and decomposition methods of research [5].

THE AIM

The paper was aimed at the study of steromorphological features of the tubuloalveolar secretory elements in the peripheral area of the human prostate.

MATERIALS AND METHODS

10 isolated postmortem specimens of the prostate gland, urinary bladder, seminal vesicles, fragments of the seminal ducts and urinary tracts which were taken from adult patients, died for the reasons not associated with the pathology of the urogenital system, have been analyzed to study the features of the spatial organization of the human prostate

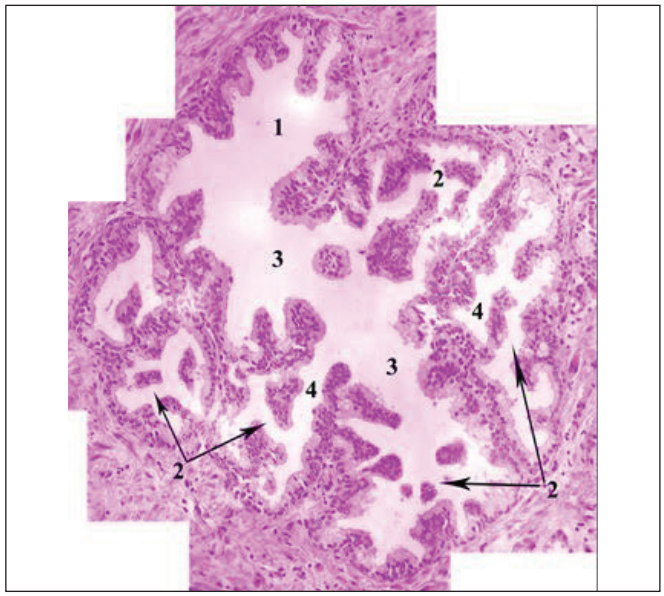

Figure 1. Photo reconstruction of the tubuloalveolar aggregations in the human prostate gland. Hematoxylin and eosin stain. Magnification: Lens ×40, Ocular lens × 10: 1 – lumen of the central duct, 2 – alveoli (acini), 3 – lumen of the lateral duct and its bifurcation, 4 – terminal duct.

Figure 2. Plastic 3D reconstruction of the glandular components of the human prostate.

glands in its peripheral area. To analyze the secretory components of the prostate stereological and decomposition methods have been used, which allow visualization of its structural and functional elements in all three inter-perpendicular planes. [6]. To gain the objective of the study the set of histological sections have been obtained and analyzed; two-dimensional photo reconstructions and 3D plastic reconstructions of the tubuloalveolar aggregations in the peripheral area of the prostate (both on the outer and inner contour) have been made [1].

RESULTS AND DISCUSSION

First, the obtained specimens of the prostate gland were fixed in 10% formaldehyde solution. Subsequently, the serial thin paraffin sections were stained with hematoxylin and eosin [7, 8, 9]. The loss of sections greater than 3% in a set is not allowed. Then, the photomicrography of certain structures on each section, keeping to the ultimate magnification for the whole set, has been made (Fig.1). After that contours of the investigated structures and additional coordinates have been selectively determined. At this stage we used graphical photo reconstructions. The next step was the copying of the desired structures and additional coordinates on the transparent plates for the preliminary evaluation, analysis and sequence for the next arrangement of the wax plates of 2 mm thick. The contours of investigated micro objects and additional coordinates have been obtained for correct arrangement of the workpieces on the wax plates. Thereafter the desired morphological structures have been cut out from the wax plates with a sharp scalpel. Since individual details of the section, including the additional coordinates, should keep the genuine correlation between themselves, the artificial joining bridges were temporarily kept. Then the sequential stacking of the obtained structures has been carried out, relying on the additional coordinates. Consequently, the maximum precise 3D frame of the primary model has been obtained as a result of the set of wax plates-templates stacking. The final stage of the creation of the 3D wax model of the prostate gland has been done: thin metal needles have been placed to the points of artificial wax bridges location and the bridges itself were removed by cutting out with a warmed scalpel (Fig.2).

Glands of urinogenital apparatus are of great importance in many vital processes, including the support of homeostasis in the human body. At the same time, they are involved into the development of many pathological conditions, being engaged into the acute and chronic non-specific processes, and serve as the anatomic substrate for the development of adenomas, adenocarcinomas, cysts [10, 11.12].

Over the last decade due to the improvements in the diagnosis of diseases, pollution of the environment, contributing to the development of inflammatory and autoimmune processes, the rate of occurrence and records of the gonads lesions, including prostate, has dramatically increased [10, 12]. Such a frequent involvement of the gland into pathological processes that lead to the disorder of numerous functions requires more detailed, up-to-date knowledge of its morphological features. Their evaluation, made on the basis of the available methods of research, is relevant to date. However, currently, the potential of morphological approaches to study the glands is not fully used. Even the latest publications on this issue do not reveal completely the whole range of possibilities of the state-of-the-art technologies. Apparently, the glands of this type have been of great interest not only for the clinicists, but also by morphologists, as well as pathologists. Currently, there is an understanding that the clinical interpretation of morphological factology should rely on the contemporary anatomical information. Therefore, the development of scientific area, which contributes to the accumulation of the specific facts about the gonads, the identification of

specific and common biological patterns of the structure, as well as the differences in their structure, is the urgent issue of the contemporary morphology.

CONCLUSIONS

The use of suggested method enables to get the megascopic reconstruction of the acini and terminal ducts of the prostate gland which can be studied from all sides, getting a comprehensive idea about the shape and size, as well as allows to explore the inner topography of the organ's structure, the geometry of the lumen of the epithelial excretory ducts, to determine the changes in the thickness of the wall, to get a visual representation of microtopographic correlation between the different parts of blood microcirculatory flow with the acini and terminal ducts of the prostate gland.

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