

Comparative Characteristics of Mucous Membrane of Various Parts of Rectum Of Rat

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ABSTRACT

It was found that the formation of the components of the mucous membrane of the rat anal canal occurs in different ways, depending on the age and division. By the 6th day, an increase in the thickness of the epithelial cover of the transition zone prevails. In the pre-sphincter section, by the 6th month, an increase in the thickness of the submucosa is expressed.

Keywords: membrane, sphincter, rectum, stomach, anatomy, epithelium.

Complex structure of the mucous membrane of the anal region is stipulated by the presence of different types of epithelium. As a result various diseases including cancer arise [1,2]. The study of the structural organization of the walls of the digestive tract and its sphincter apparatus offers not only theoretical but also practical interest [3,4].

In intestinal surgery particular importance is given to regions of sphincter muscles and its mucous membrane. According to some authors [5,6] in the rectal region in addition to fascicles of myocytes there are longitudinal folds of mucous membrane, which act as a support apparatus of sphincter. The published data do not fully disclose the morphofunctional value of structures of mucous membrane of intestine in the region of sphincters [7,8].

Objectives of the study: To study the structure of the mucous membrane of sphincter apparatus of the anal canal of rats at different stages of postnatal ontogenesis

As a material for this study served 56 preparations of the anal canal, taken together with the anal opening of the newborn rats at the age of 6, 11, 16 and 22 days, 3 months, 6 months, 12 months and 24 months. Slaughtering of animals was performed under ether anesthesia and after opening the pelvic cavity rectum and anus was withdrawn. The derived materials were fixed in Bouin's fluid, and then the organs were run through rising concentrations of alcohol and embedded in paraffin. Sections of 8 – 12 microns thickness were stained with hematoxylin - eosin according to Van Gieson, Veygert in the modification of Hurt. In order to identify the reticular fibers sections were impregnated with silver nitrate (Foot technique) in modification of N. A. Yurina

In the time of microscopic examination morphometric measurements were carried out by using the ocular ruler. The structure of mucous membrane and submucous basis in structural parts of anal canal in different periods of postnatal ontogenesis were studied. The direction of the fibrous structures of connective tissue in intersphincteric space and sphincters were determined.

Outcomes of the study and their discussion: The anal canal of rectum is divided into presphincteric part, the transition zone, the internal sphincter and external sphincter, intersphincteric zone and the space between sphincters.

As a boundary between presphincteric and transition zones serves the place where the fibrous structures of rectal connective tissue by changing their direction in the inner circular muscle layer, begin to surround the fascicles of myocytes. In the distal part and from outside the external sphincter is enveloped by internal sphincter. Intersphincteric zone is bounded by distal ends of internal and external sphincters.

In presphincteric zone of anal canal of newborn rat epithelial lining of mucous membrane is presented with single-layered columnar epithelium. In most cases, the nuclei of single-layered columnar epithelium are located in the basal part of cells.

In newborn rats under single-layered columnar epithelium lamina propria of mucous membrane is located. It is formed by fibrous structures of connective tissue. Fascicles of elastic fibers in comparison with the collagen fibers are arranged more friable.

Reticular fibers in lamina propria make up a network, loop of which in the areas close to the epithelium are large. By 22 day in lamina propria of mucous membrane enlargement of density of arrangement of the fibrous structures of connective tissue is revealed.

In presphincteric part in newborn rats the thickness of the mucous membrane is averagely 70.2 ± 1.4 microns. On 6th day of development the pace of growth of thickness of the mucous membrane was 26.0 %. By 22 day of age the pace of increase of the thickness of the mucous membrane is 22.0 %.

In 3 months aged rats the thickness of the mucous membrane in presphincteric part is averagely - 197.9 ± 5.0 microns. By 6 months of

age the pace of increase of the thickness of mucous membrane is 12.0 %. In the 12 months of age the pace of increase of thickness of the mucous membrane was - 6.0 %. In rats of 24 months of age the pace of increase of thickness of mucous membrane is equal to 6.0 %.

Under lamina propria underlies muscular lamina of mucous membrane. In presphincteric region of anal canal submucous basis is presented with fascicles of collagen and elastic fibers and reticular fibers. Fascicles of collagen and elastic fibers in the submucous basis lie wavy parallel to each other. Fascicles of elastic fibers, adjoining the lamina propria of mucous membrane, are located in different directions.

In the submucous basis of presphincteric zone reticular fibers, lying next to the muscular membrane, change their direction and pass into the muscle layers, where are located between the fascicles of myocytes. Reticular fibers in the crypts make up a network, which are greater in size than in the submucous basis.

In presphincteric part thickness of submucous basis in newborn rats is averagely - 26.9 ± 1.7 microns. By 16 day of development of postnatal ontogenesis the thickness of submucous basis becomes greater for 23,0%. In 22 days of age the pace of growth of thickness of the submucosa is 15.0 %.

At 3 months of age in presphincteric zone thickness of submucous basis is averagely 63.8 ± 1.9 microns. In 6 months, aged rats the thickness of submucous basis becomes more for 14.0 %. By 24 months of age the pace of increase in thickness of submucous basis is equal to 8.0%.

Under the single-layered columnar epithelium lamina propria of mucous membrane is

located. It is formed by fibrous structures of connective tissue. Fascicles of elastic fibers in comparison with the collagen fibers are arranged more friable. Reticular fibers in lamina propria make up a network in areas adjacent to the epithelium, the cells have big size.

In the transitional zone epithelial lining of the mucous membrane of anal canal is presented with single - layered columnar epithelium. The thickness of the mucous membrane in the transition zone in a newborn rat made up on average – 72.9 ± 1.7 microns. On the 6th day of development the pace of growth in thickness of the mucous membrane is equal to 29.0 %. By 22 days of age the pace of increase in the thickness of mucous membrane was 18.0%.

In this zone the thickness of the mucous membrane 3 months aged rats in average is 212.1 ± 5.3 microns. By 12 months of age the pace of growth in thickness of the mucous membrane is 13.0 %. In 24 months of age the pace of increase in the thickness of the mucous membrane was 7.0 %. Here crypts are located more densely than in presphincteric part and are oriented longitudinally. From 11 day of development they lie in the form of ordered columns. In the 16 and 22 days of age crypts are located in the sagittal plane, obliquely and transversely with respect to the canal.

Anal columns, by increasing in height and width in the distal direction along with the sphincters are involved in closing of the anal opening. According to [8] in the sphincteric apparatus, they facilitate in better closing of supportive elements like folds of mucous membrane.

In newborn rats in the transition zone the thickness of the submucous basis in average is 30.7 ± 2.0 microns. On 11th day the thickness of

the submucous basis became increased for 23.0 %. At 22th day its thickness increased for 17.0 %. In 3 months aged rats the thickness of the submucous basis in average is 73.6 ± 1.9 microns. At 6th month of age the pace of growth of the thickness of the submucous basis is equal to 13.0 %. By 12 months of age the pace of growth of the thickness of the submucous basis was 14.0 %. In 24 months of age – 10.0 %.

Fibrous structure of connective tissue of submucous basis in the transition zone is presented with fascicles of collagen and elastic fibers and reticular fibers, which are clearly expressed in all parts of the wall than in presphincteric zone. In 22nd day of age in lamina propria of mucous membrane reticular fibers form a rare small loops (Fig. 1). Fibrous structures of connective tissue under the lamina muscularis of mucous membrane, have a greater density of location. Reticular fibers in the submucous basis form a network in the form of a spider's web with small loops.

The internal anal sphincter is covered with single-layered columnar epithelium, which changes into stratified squamous nonkeratinizing epithelium (Fig. 2.) and in this place there is a deepening.

In newborn rats deepening is not so big, here ends bundles of connective tissue, smooth muscle fibers of lamina muscularis of mucous membrane of the transition zone of anal canal. After the deepening the mucous membrane for a slight distance is covered by stratified squamous nonkeratinizing epithelium.

By 6th day in the basal layer of stratified squamous nonkeratinizing epithelium, the cells mostly have oval or round shape. From 11th day of epithelial cells lie densely, and are colored darker,

have round and oval-cubic shape, their nuclei have rounded or elongated – oval shape.

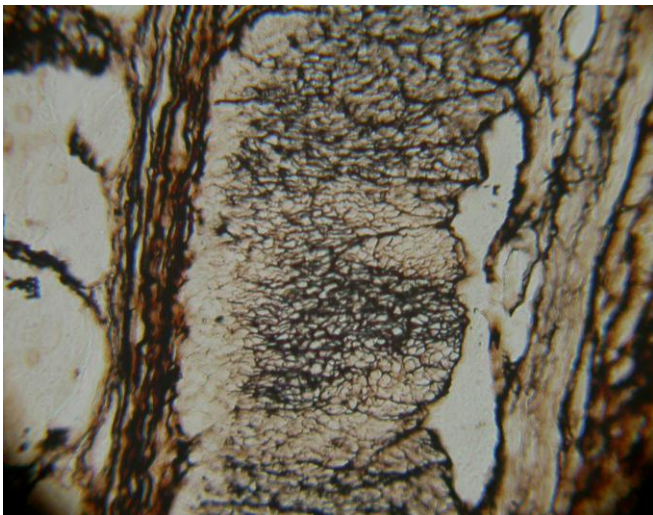


Fig. 1. Reticular fibers of transition zone of anal canal in rat 22 days aged rat. Staining according to Foot in modification of N. A. Yurina. Ob. 20x oc. 7.

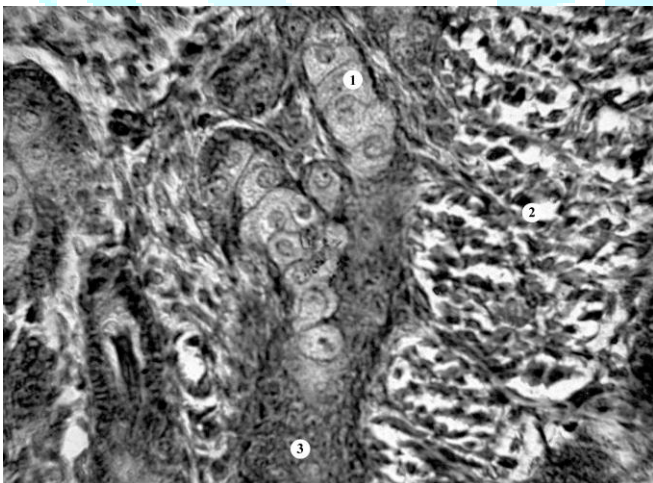


Fig. 2. Changing of a single-layered columnar epithelium to stratified squamous nonkeratinizing epithelium at the level of the internal sphincter of anal canal in newborn rats. 1. Single-layered columnar epithelium. 2. Internal sphincter.

3. Stratified squamous nonkeratinizing epithelium. Staining with hematoxylin and eosin: Ob. 40 x oc. 7.

In 3 month aged rats, in the basal layer of stratified squamous nonkeratinizing epithelial cells are located densely, they are colored darker, have round and oval - cubic shape, and their nuclei have round or elongated – oval shape. In the interstitial and apical layer cells are round and oval in shape, they are bigger than the cells of the basal layer, and their nuclei are round shaped. By 6 months of age cells in the epithelium are dense located, are colored in a darker color, have round and oval-cubic shape, their nuclei have rounded or elongated – oval shape.

Cells in the interstitial and apical layer often have an oval shape. By 16 days of age in the interstitial and apical layer cells usually have oval shape. In 22 days of age cells are rounded and oval-shaped, they are bigger than the cells of the basal layer, their nuclei are rounded. The internal sphincter is covered with single-layered columnar epithelium, it changes into stratified squamous nonkeratinizing epithelium (Fig. 3) and at this point there is a deepening. At the level of deepening bundles of collagen and elastic fibers, reticular fibers are located close to each other and bound the basal layer of epithelial lining (Fig. 4).

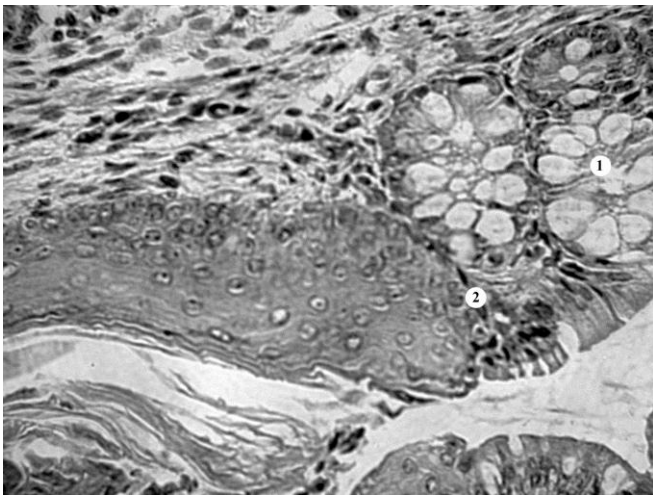


Fig. 3. Stratified squamous nonkeratinizing epithelium of internal sphincter in a 22 days old rat. 1. Single-layered columnar epithelium. 2. Place of transition of single - layered columnar epithelium into stratified squamous nonkeratinizing epithelium. Stainig according to Van Gieson. Ob.40 x oc.7.

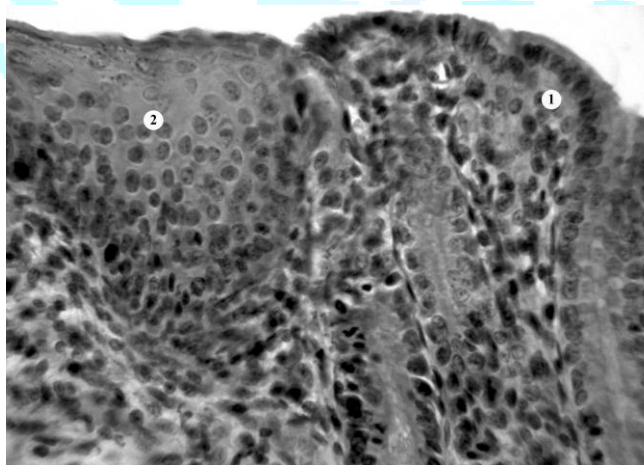


Fig. 4. The epithelial lining throughout the internal sphincter in a 3 months old rat. Single-layer columnar epithelium. 2. Stratified squamous epithelium. Stainig according to Van Gieson. Ob. 40x oc.7.

At the level of the internal sphincter of anal canal in epithelial lining single-layered columnar epithelium changes into stratified squamous nonkeratinizing epithelium and stratified squamous keratinizing epithelium. The other opinion holds [8] which asserts that throughout the sphincters of human rectum in addition to single-layered columnar and stratified squamous epithelium a transitional epithelium is revealed.

Intersphincteric zone has a small extent and occupies the space between the rear ends of the internal and external sphincter. In the basal layer of this zone of stratified squamous keratinizing epithelium cell's nuclei are small and round shaped. In a 6 and 11 days old newborn rats, they have round or somewhat elongated shape. At 16th and 22nd day of development cells lie close to each other and have one nucleus.

In newborn rat in the interstitial layer of stratified squamous keratinizing epithelium cell nuclei are oval in shape. From 11th day of development, they become oval-elongated and are located at the top. In the keratinizing layer cells nuclei are flattened. In this layer of stratified squamous keratinizing epithelium of newborn and 6-day old rats in some areas one can see solitary desquamation of cells, by the age appear areas where the cells desquamate as entire tapes.

Thus, the study found that during early postnatal ontogenesis higher pace of growth of mucous membrane of anal canal is marked from 11th to 16th day of development, in our opinion this is related with the transition from breastfeeding to the definitive nutrition. During the late postnatal ontogenesis higher pace of increase of the mucous membrane of canal is detected by 3 months of age.

Perhaps this is due to the onset of puberty, when the body undergoes structural changes.

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