

Features of the Study of the Relief Pattern of the Rat Colon Mucosa Using the Graphic Reconstruction Method

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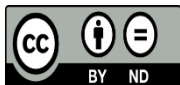


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graphic reconstruction, mucous membrane, colon, relief pattern, albino rats.

ABSTRACT

The paper was aimed at the study of the relief pattern of the albino rat colon mucosa using the graphic reconstruction method, which is the necessary prerequisite for planning and conducting specific experimental studies. 10 albino rats weighted $200,0 \pm 20,0$ g were involved into the study. The specimens of albino rat colon, fixed in 10% neutral buffered formalin solution, have been studied. Conventional anatomical preparation was carried out aimed at dissecting those organs or individual formations that complicate investigation of the object under study, namely the colon. Imaging of the studied objects was made using the digital camera. The use of the graphic reconstruction method to study the colon mucosa provides with clear analysis and visualization of the features of the relief pattern of the mucous membrane of the ascending colon of albino rats. The graphical reconstruction method can be recommended for widespread use in morphological studies of the hollow organs of laboratory animals.



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1. Introduction

Currently, no data have been found in the publications on the specific structure of the albino rat colon. And, the information reported by the authors in their work leaves many questions that cannot be ignored when planning experimental studies aimed at revealing the clinical aspects of pathological processes, the morphological substrate of which are the relevant sections of the human colon [1- 4]. In other words, without the sufficient morphological data it is impossible to count on the legitimacy of extrapolation of the results of experimental modeling to humans.

The relevance of the method of study is associated with the difficulties that arise when choosing the section of the intestine, both for the study in the normal condition compared with human, and for modeling various pathological conditions. Therefore, it is extremely important to develop the methods for modeling various

pathological conditions in the large intestine, namely the colon. At the same time, methods of more detailed study of the morphological structure of the relief pattern of the colon mucosa are neglected, thereby extrapolating the findings of experimental studies to humans in various pathological conditions [1], [2], [4-8].

Apparently, all known methods and scientific publications have certain shortcomings, which focus on obtaining data based on the findings of experimental studies in modeling various pathological conditions in the colon and the effects of chemicals on the latter and ignore the specifics of the structural organization of its mucous membrane and the validity of experimental studies on the colon of albino rats compared to human one.

To study the relief pattern of the albino rat colon mucosa using the graphic reconstruction method, which is the necessary prerequisite for planning and conducting specific experimental studies.

2. Materials and Methods

2.1 Study Population

10 albino rats weighted $200,0 \pm 20,0$ g were involved into the study. The specimens of albino rat colon, fixed in 10% neutral buffered formalin solution, have been studied. Before the experiment, all animals were kept in standard conditions of the experimental biological clinic (vivarium) at Poltava State Medical University in compliance with the regulations on keeping experimental animals, adopted by the European Parliament and Council Directive (2010/63 / EU), the Order of the Ministry of Education and Science, Youth and Sports of Ukraine as of 01.03.2012, No. 249 “On approval of the procedure for conducting tests, experiments on animals by research institutions” and “General ethical principles of experiments on animals”, adopted by the V National Congress on Bioethics (Kiev, 2013) [9- 11].

2.2 Examination Technique of the rat colon

First, after vivisection made by thiopental anesthesia overdose (75 mg / kg of animal body weight intramuscularly in the upper third of the thigh of the hind paw), conventional dissection of the anterior wall of the abdominal cavity was performed in all animals in turn with subsequent imaging its contents [12], [13]. After that, conventional anatomical preparation was carried out aimed at dissecting those organs or individual formations that complicate the examination of the object under study, namely the colon. Imaging of the studied objects was made using the digital camera.

3. Results

The development of the graphic reconstruction method facilitates detailed and accurate study of the anatomical features of the relief pattern of the albino rat colon mucosa, which is the necessary prerequisite for planning and conducting specific experimental studies.

The goal of the study was achieved by developing the method of graphic reconstruction of the relief pattern of the mucous membrane of the albino rat colon, in which graphical reconstruction of the interior of the ascending part of the rat colon was obtained by the following procedure: the ascending part of the colon, cut along the line of attachment of the mesentery and flatten out by its mucous membrane outwardly, reveals a corrugated surface in the form of thin folds that were marked on a polyethylene transparent film of the appropriate size, which was subsequently wrapped around the glass cylinder of the appropriate diameter.

The loops of the small intestine were removed to understand the peculiarities of the shape of the colon and

its topography (Fig. 1 B). It was revealed that the albino rat colon differs significantly from the human one by the simplified architecture.

The dissection of the segment of the ascending part of the colon along the line of attachment of the mesentery and outward flattening-out by its mucous membrane revealed its

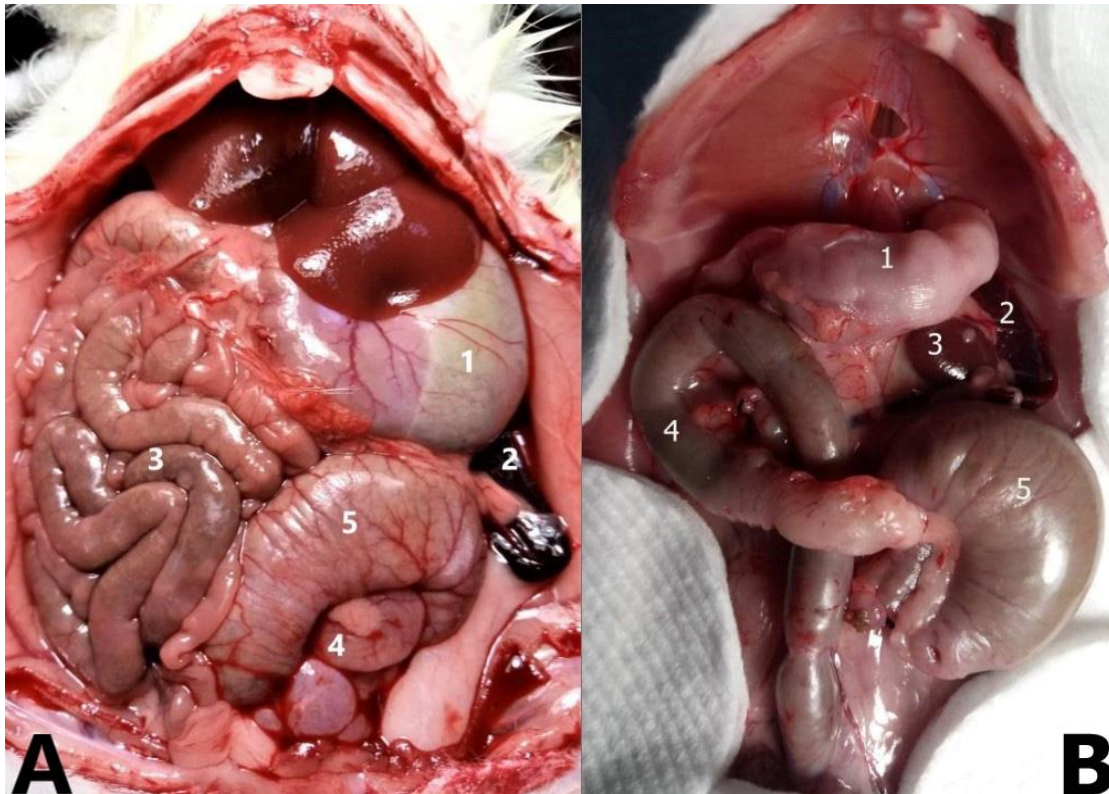


Figure (1). Organs of the rat abdominal cavity before (A) and after (B) removal of the loops of the small intestine.

1 – the stomach; 2 – the spleen; 3 – loops of the small intestine (A) / kidney (B); 4 – the colon; 5 – the cecum.

corrugated surface consisting of two oppositely oriented from the longitudinal line (at an angle of about 45°) thin folds with an interval of approximately 0.5 mm between them (Fig. 2 A). In general, this unfolded picture (upside down) resembles the shape of a palm branch. Given that this feature of the relief pattern of the mucous membrane of the ascending colon of albino rats was not found in the literature, it is proposed to call it a corrugated fold, and the folds themselves - corrugations. However, such picture is presented in the plane view. To represent it in a natural circular view that corresponds to the tubular shape of the colon, a corresponding transformation was made. To do this, the folds were copied by overlaying them with a marker to a polyethylene transparent film of the appropriate size, and then wrapped it around a glass cylinder of the appropriate diameter (Fig. 2 B, C). As a result, a clear image of the true shape of the corrugated fold of the ascending colon of albino rats was obtained. It was revealed that its individual corrugated folds did not form continuous spiral turns on the inner surface of the intestine, as can be seen from a certain angle, shown in Figure 2 B. In fact, they have the shape of oblique semicircles, closing on two opposite longitudinal lines almost at the right angle. At the same time on the one side of the intestinal tube they are open by the corners in the direction of natural movement of food residue, and on the other side - in the opposite direction (Fig. 2 C, D).

Thus, the above data indicate that the use of the method of graphic reconstruction of the relief pattern of the colon mucosa of albino rats in morphological studies for experimental modeling of various pathological conditions in the colon, allows not only quickly but also carefully, without damaging the macro- and microstructure of the colon to identify the relief elements of the structure of the mucous membrane of the colon.

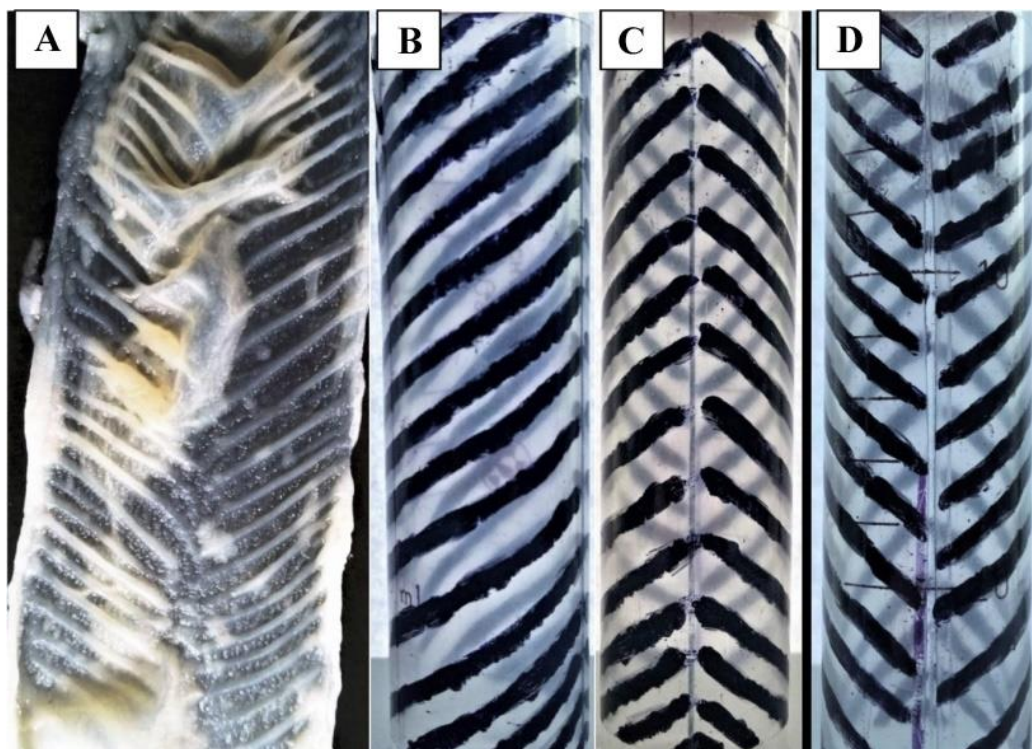


Figure (2). The relief pattern of the mucous membrane of the ascending colon of albino rats. Macro image. 3×magnification.

A – intestinal mucosa, inward view; B, C and D – stereomodel of the corrugated fold of the mucous membrane of the ascending part of the colon in three angles.

4. Discussion

Currently, one of the most significant problems of contemporary gastroenterology is inflammatory bowel diseases [14], [15]. Very often these diseases become chronic and affect any part of the gastrointestinal tract, accompanied by numerous disorders of the physiological function of the gastrointestinal tract [16].

Consequently, experimental modeling of the gastrointestinal tract diseases, as close as possible in etiology and pathogenesis to the corresponding disease in humans, is an urgent problem of the up-to-date medicine [17], [18].

In the human body the following sections of the large intestine are distinguished: the cecum, colon (ascending, transverse, descending), sigmoid colon, rectum, anal canal. Rats have similar sections, except for the sigmoid colon, which they lack [19- 21]. In humans, the colon is normally located around the loops of the small intestine in the form of an open loop, occupying a frontal position in the abdominal cavity. The loops of the jejunum are located mainly to the left of the midline and above, and the ileum - right and below, the cecum - in the right ileal fossa or directly above it. The shape and topography of albino rat colon are insufficiently described in the literature. The attention is mainly paid to the small length of the colon, the absence of the sigmoid colon and the appendix [22].

The albino rat colon differs significantly in shape, structure and topography from the human colon. In rats, the colon resembles a stretched spiral, immersed in the loop of the small intestine. If we exclude the two loops along the rat colon, it is, as in human and rat embryogenesis, has an angular shape and occupies a sagittal position in the abdominal cavity [23].

The dissection of the albino rat abdominal cavity shows, first of all, its difference from the human one. After removal of the anterior abdominal wall the outer loops of the small intestine were mainly exposed, which are not, as in humans, in the frame of the colon (Fig. 1 A) [20], [24- 27].

An absolutely unique formation of the albino rat gastrointestinal tract is the ascending part of the colon. This is a special configuration of the relief pattern of its mucous membrane, which is represented by a strictly ordered arrangement of constant, hard to the touch, low folds, which, externally, look like spirally oriented circles.

With such bilateral opposite corrugation of the intestinal mucosa, in the process of peristaltic contraction of its muscular layer, there should be regular mixing of food residue and the formation of granular feces.

5. Conclusion

Thus, the use of the graphic reconstruction method for the study of the colon mucosa provides with clear analysis and visualization of the features of the relief pattern of the mucous membrane of the ascending colon of albino rats. Previously, this method was not used; its application enables obtaining data not only on the typical principle of the organization of the relief pattern of the colon mucosa of albino rat, but also to conduct its stereological analysis. The graphical reconstruction method can be recommended for widespread use in morphological studies of the hollow organs of laboratory animals.

Therefore, given the findings of the study of the mucous membrane of the initial section of the large intestine, namely the colon, it is evident that this part of the colon of albino rats cannot serve as an adequate model in the experimental simulation of corresponding human diseases.

6. References

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