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FERGANA MEDICAL INSTITUTE OF PUBLIC HEALTH

Shermatov Rasuljon Mamasiddikovich

**ADAPTIVE CHANGES IN THE MICROFLORA OF THE
GASTRIC CONTENTS AND THEIR CORRECTION
UNDER THE CONDITIONS OF THE ADAPTIVE
ALTERED STRUCTURAL AND FUNCTIONAL STATE
OF THE GASTRIC MUCOSA AFTER TOTAL
RESECTION OF THE COLON**

(Monograph)

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Reviewers:

N.B. Zokirova - Associate Professor of the Department of Histology, Pathological Physiology TashPMI, doctor of medical sciences.

Yu.N. Nishanov - doctor of medical sciences, professor.

ANNOTATION

The monograph is devoted to a comprehensive dynamic study of compensatory-adaptive rearrangements of the mucous membrane, as well as the features of the motor-evacuation function and the state of the microbiocenosis of the stomach and their correction after total resection of the colon.

Total resection of the colon leads to the development of gastric dysbacteriosis, which worsens the general condition of the body and significantly limits the adaptive capacity of the stomach.

It is assumed that the identification of the structural foundations of the adaptive reactions of the gastric mucosa, as well as the features of the motor-evacuation function and microbiocenosis of the organ in dynamics after total resection of the colon, contributes to the disclosure of the mechanisms of possible postoperative complications and the development of effective methods for their prevention.

The development of dysbacteriosis in the stomach is shown, which adversely affects the adaptive changes in the gastric mucosa. It has been established that the correction of dysbacteriosis with bifidumbacterin and lactobacterin, and especially their combination, helps to restore the normal microbiocenosis of the stomach and accelerate the development of adaptive reactions of the body after total resection of the colon.

The paper presents an analysis of changes in the motor-evacuation function of the stomach and the quantitative ratio of the microbial landscape of the contents of the stomach. The effectiveness of complex treatment is shown, which is of great importance for the correction of postoperative dysbacteriosis.

The monograph is of great theoretical and practical interest, both for students of medical institutes and for general practitioners, especially surgeons, therapists, as well as for researchers, residents, masters, doctoral students studying the issues of compensation for body functions after the removal of an organ.

Scientific Secretary of the Scientific Council FMIOS, DSc., professor.

I. Iminahunova

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LIST OF CONVENTIONAL ABBREVIATIONS

ISC - intracellular secretory tubules

GC - the main cell

ZER - granular endoplasmic reticulum

cap - capillary

L - leukocyte

M - mitochondrion

MO - microorganism

Mu - mucocyte

MG - mixed - granule

PC - parietal cell

Pr - clearance

SG - secretory granule

TV - tubulovesicles

E - eosinophil

EC - endocrine cell

Er - erythrocyte

I am the core

INTRODUCTION

To date, mainly due to the work of Uzbek and Russian scientists, significant progress has been made in studying the issues of structural and functional rearrangements in the organs of the digestive system, its interorgan and intersystem relationships with other systems (21, 25, 26, 27, 28, 29, 30, 37, 91, 119, 120, 121, 133, 134, 135, 136, 137, 141, 142]. interference, regenerative capabilities of organs and age characteristics of experimental animals [10, 37, 133, 168]. It has been shown that subtotal and extensive resections of the small intestine and liver are accompanied by significant structural and functional changes in various parts of the gastrointestinal tract, which in general are adaptive character [14, 123].

However, despite the abundance of data on this problem, the structural and functional foundations of adaptive processes under conditions of total removal of the colon remain very little studied. At the same time, this problem is of great theoretical and practical importance, which is determined by the following circumstances.

First of all, it must be emphasized that total and subtotal resection of the colon in a number of diseases (ulcerative and granulomatous colitis, diffuse polyposis and colon cancer, idiopathic megacolon, Hirschsprung's disease, ischemic colitis, trauma) and some other pathological conditions has been and remains so far the only method of treatment [5, 9, 41, 46, 48, 50, 55, 60, 83, 84, 85, 106, 160, 165, 166, 179, 180, 183, 207, 213, 214, 216, 219, 220]. Further, the total removal of the colon naturally leads to complex anatomical, histological and physiological changes in the body. Knowledge of the mechanisms of these rearrangements seems to be extremely important from the standpoint of both theoretical and clinical medicine, since they are decisive when choosing further tactics for managing patients.

All of the above determines the relevance and scientific and practical significance of further research on this problem.

Literature data on the structural and functional restructuring of the stomach after total resection of the colon are scarce, they are mainly clinical and physiological, and their results are often contradictory. There is practically no information in the literature that reveals the structural foundations of the adaptive reactions of the gastric mucosa after removal of the colon. There are no data on adaptive changes in the motor-evacuation function of the stomach after the operation. The patterns of changes in the microbial landscape of the stomach after removal of the colon remain unclear, which does not allow the development of pathogenetic methods for correcting dysbacteriosis observed after surgery. The solution of these issues is of great theoretical and clinical importance.

The purpose of the study: to identify the structural and functional foundations of adaptive changes in the mucous membrane, as well as the features of the motor-evacuation function and the state of the microbiocenosis of the stomach in dynamics after total resection of the colon.

Research objectives:

1. To study the morphological, ultrastructural and morphometric features of the gastric mucosa in dynamics after total resection of the colon.

2. To study the motor-evacuation function of the stomach in dynamics after total resection of the colon.

3. Evaluate the qualitative and quantitative composition of the microflora of the stomach contents after total resection of the large intestine and study the effect of bifidumbacterin and lactobacterin on the state of gastric microbiocenosis.

For the first time, the development of an adaptive process in the gastric mucosa in response to a total resection of the colon was demonstrated, its sequence and staging were determined.

It has been established that the morphological substrate of the adaptive process after total resection of the colon is successive morphological, morphometric and ultrastructural rearrangements of the gastric mucosa.

For the first time, the state of the motor-evacuation function of the stomach after total resection of the large intestine was studied and the characteristic dynamics of its changes at different times after the operation was established. It is shown that in the early period (5-15 days) after total resection of the colon, the motor-evacuation function of the stomach is significantly accelerated, and more distant periods (60-120 days), on the contrary, it slows down.

The development of dysbacteriosis in the stomach is shown, which adversely affects the adaptive changes in the gastric mucosa. It has been established that the correction of dysbacteriosis with bifidumbacterin and lactobacterin, and especially their combination, helps to restore the normal microbiocenosis of the stomach and accelerate the development of adaptive reactions of the body after total resection of the colon.

The results of studies on morphological and morphometric changes in the gastric mucosa after total resection of the colon significantly expand the understanding of the structural and functional state of the organ after this operation. These data will contribute to an in-depth understanding of the mechanisms of adaptive changes in the stomach, and their significance in the pathogenesis of post-colonectomy conditions.

Data on changes in the microflora and the development of dysbacteriosis after total resection of the colon can serve as a scientific basis for the development

of rational methods for the prevention of complications and postoperative treatment of patients who underwent resection of the colon. The paper shows the high efficiency of the method of correcting the microflora of the stomach with bifidumbacterin and lactobacterin in combination. This method allows you to eliminate the developed postoperative dysbacteriosis, shortens the recovery period, improves the general condition and creates favorable conditions for faster adaptation of the body after total resection of the colon.

An analysis of the literature shows that by now a large amount of data has been accumulated on the adaptive reactions of the digestive tract after resection of a particular section. These works, carried out mainly by domestic scientists under the guidance of Academician K.A. Zufarov, are fundamental and reveal the structural patterns of development of adaptive processes not only in the digestive system, but also in other organs and systems. They convincingly showed that total or partial resection of one or another section of the digestive tract can serve as an excellent model for identifying patterns of structural changes aimed to some extent at compensating for lost functions.

At the same time, the problem of revealing the patterns of adaptive processes under conditions of surgical exclusion of one or another organ is still far from a final solution. This is especially true for particular issues of the development of adaptive processes in those organs that are anatomically and physiologically closely related to the resected organ. Those in our work are the stomach and the colon that is totally removed. The analysis showed that the literature data on the structural and functional reorganization of the stomach after resection of various volumes of the large intestine are rare, have mainly a clinical and physiological focus, and their results are often contradictory. There is practically no information in the literature that reveals the structural foundations of the adaptive reactions of the gastric mucosa after the total removal of the colon. There are no data on adaptive changes in the motor-evacuation function of the stomach after such an operation. The patterns of changes in the microbial landscape of the stomach after removal of the colon remain unclear, which does not allow the development of pathogenetic methods for correcting dysbacteriosis observed after surgery. The solution of these issues is of great theoretical and clinical importance, which necessitates further research in this direction.

Data on changes in the microflora and the development of dysbacteriosis after total resection of the colon can serve as a scientific basis for the development of rational methods for the prevention of complications and postoperative treatment of patients who underwent resection of the colon. The paper shows the high efficiency of the method of correcting the microflora of the stomach with

bifidumbacterin and lactobacterin in combination. This method allows you to eliminate the developed postoperative dysbacteriosis, shortens the recovery period, improves the general condition and creates favorable conditions for faster adaptation of the body after total resection of the colon.

CHAPTER 1. LITERATURE REVIEW

Adaptive rearrangements in the organs of the gastrointestinal tract with partial or total removal of its various departments

Currently, in a number of diseases of the colon (ulcerative and granulomatous colitis, diffuse polyposis and colon cancer, idiopathic megacolon, Hirschsprung's disease, ischemic colitis, injuries), its total and subtotal resection remains the method of choice, and often the only way to save the life of patients [5, 9, 46, 48, 50, 55, 60, 83, 84, 85, 106, 160, 165, 166, 179, 180, 183, 207, 213, 214, 216, 219, 220]. It is striking that, despite the vastness of the removed part of the intestinal tube, sick and experimental animals that have undergone total resection of the colon can live and maintain active life for a long time. This indicates that adaptive rearrangements are developing in the remaining part of the gastrointestinal tract, which, to a certain extent, can fulfill the lost function of the large intestine [103, 113, 120, 121, 208].

Despite the introduction of modern technologies into colorectal surgery, the modernization of the resuscitation service and the use of the latest drugs in clinical practice, the problem of surgical treatment of oncological and non-oncological diseases of the colon remains relevant. First of all, this is due to insufficient knowledge of the postoperative period, which is often accompanied by severe complications leading to death.

To date, quite extensive material has been accumulated on structural and functional rearrangements in the remaining organs of the digestive system during subtotal resection of the stomach [8, 25, 26, 27, 92, 169, 171], after 50-60% resection of the small intestine [2, 123], after resection of various volumes of the liver [42, 43, 49, 172], after partial resection of the pancreas [129], after total colectomy [120, 121]. At the same time, certain patterns of development of adaptive reactions in the remaining parts of the digestive system and other body systems were revealed. The nature and rate of development of these rearrangements depend on the extent of the surgical intervention, the regenerative

capacity of the organs, and the age characteristics of the experimental animals. In particular, subtotal and total resections of the small and large intestine are accompanied by significant structural and functional changes of an adaptive nature in various parts of the gastrointestinal tract [120, 121, 127, 174, 208].

However, compensatory-adaptive rearrangements develop not only in the affected area or the remaining part of the digestive tract, but also in its other organs, accompanied by strengthening or weakening of adaptive processes, as well as various structural and functional disorders of one or another organ [120, 149, 218, 221]. Due to the system nature of the adaptive reaction, a regular increase in functional activity is observed in those organs that are anatomically or functionally closely related to the main organ subjected to surgical intervention [71, 72, 209, 214, 216].

Issues of adaptation and compensation are components of the general problem - maintaining the constancy of the internal environment of the organism [58, 154, 213]. A.F. Bluger and L.A. Terenteva [45] note that ignorance of the mechanisms of adaptation in various pathological processes leads to inadequate interventions by the doctor in these processes, preventing recovery.

The study of adaptive processes in health and disease shows that homeostasis is maintained through several nonspecific reactions. These reactions are fundamentally the same for all organs and tissues, and for all levels of adaptation [11, 12, 16, 17, 57, 63, 64, 65, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 101, 132, 146, 147, 148, 154]. A necessary component of many of the most important adaptive reactions of the body is a long-term hyperfunction of the working organs. It manifests itself in the process of adaptation of the organism and serves to compensate for the functions lost as a result of the pathological process [45, 57, 149, 154, 211].

The best model for the study of compensatory-adaptive processes in the body is the resection of internal organs, carried out in experimental animals. Under such conditions, the dynamics of the process makes it possible to theoretically

predict the course of compensatory-adaptive rearrangements, the sequence of their deployment, and reveal the structural foundations of their development [11, 12, 78, 154, 161, 187].

The problem of studying the state of the stomach in intestinal pathology has long attracted the attention of researchers. In a number of patients with diseases of the small intestine, morphological signs of gastritis were detected, inhibition of gastric secretion and a violation of the motor-evacuation function of the stomach were noted. The occurrence of these changes is explained by disturbances in the functions of the stomach and deterioration of blood circulation in it under the influence of pathological viscerovisceral reflexes [18, 138, 152].

Usually, changes in the ultrastructural components of the cells of the gastric mucosa in various pathologies are evaluated as manifestations of the influence of a pathogenic factor. However, many of them may be associated with adaptive and compensatory reactions of this organ [25, 26, 27, 37, 58, 77, 115, 116, 128, 134, 135, 136, 137, 163, 164]. It is generally accepted that hypertrophy and hyperplasia of intracellular structures form the structural basis of compensatory-adaptive processes observed in various organs [11, 12, 74, 76, 104, 112, 146, 147, 148, 154, 193].

According to a number of researchers [43, 48, 117, 118, 120, 121], disruption of connections in the digestive tract leads to the development of a number of morphological and functional rearrangements in the body of operated animals. These rearrangements, in fact, are the basis of the adaptive process that occurs at regular intervals [28, 29, 30, 37, 38, 39, 49, 120, 121, 141, 142, 219, 220].

Compensatory-adaptive reactions are impossible without certain rearrangements of the vascular bed of organs and tissues [3, 23, 42, 43, 49, 56, 61, 62, 86, 87, 120, 121, 151]. Partial or complete removal of any section of the gastrointestinal tract leads to significant restructuring of intraorganic vessels in the remaining sections [42, 43, 49, 56, 61, 62, 66, 107, 120, 121, 141, 142, 171].

Total resection of the colon has a significant impact on various structural components of the vascular bed of all parts of the small intestine, from the duodenum to the jejunum [120, 121]. This process is accompanied by an adaptive restructuring of the microcirculatory bed of the entire small intestine and changes in the microscopic structure of all layers of the intestinal wall, primarily its mucous membrane.

The close anatomical and physiological relationship between the colon and stomach, the commonality of many main blood vessels (arterial and venous) determines the effect of total resection of the colon on the structure of the gastric circulatory system.

Violation of blood flow in the wall of the stomach as a result of total resection of the colon, changes in the state of the components of the microvasculature, at various times after surgery, cannot but have a certain effect on the state of the mucous membrane of the organ [141, 142, 219].

Yu.N. Nishanov [120, 121] notes that total resection of the colon affects various structural components of the vascular system of all parts of the small intestine. In particular, in the early stages (3-15 days after surgery) in the intramural blood vessels in all membranes of the jejunum and ileum, pronounced hemodynamic changes are noted, manifested by an uneven injection of all links of the microvasculature, changes in the caliber and density of the vessels, as well as violations of their integrity.

The study of the structure of blood vessels, their relationship to the structural components of the mucous membrane of various parts of the stomach contributes to the understanding of compensatory-adaptive processes in various pathological conditions [42, 43, 49, 56, 66, 87, 160]. Hemodynamic changes that occur in the digestive organs during total colon resection play an important role in the morphogenesis of compensatory-adaptive restructuring in the remaining organs of this system. One of the links in the pathogenesis of the compensatory-adaptive reaction is the disturbance of mesenteric blood flow [120, 121]. Abdurakhmanova

F. A. and Mirzaev Kh. M. [1] in a morphometric study of various parts of hemomicrovessels of the stomach wall at different periods of peritonitis, it was found that a statistically significant expansion of the diameter of microvessels of all membranes of the stomach wall occurs at different times - from 12 hours after the start of the experiment to 7 days.

However, despite the rather extensive information on the blood supply to the gastric mucosa, this problem is relevant, since the intraorgan angioarchitecture of the gastrointestinal mucosa during various surgical interventions has not been studied enough, especially after total resection of the colon [120, 121].

In the mechanism of occurrence of disorders after removal of the colon, changes in the motor function of the stomach and small intestine play an important role. Most researchers believe that with extensive resection of the colon, there is a decrease in the motor activity of the stomach [13, 51]. However, I.N. Siparov et al. [150] revealed an acceleration of food evacuation from the stomach and an accelerated promotion of contrast through the intestines in patients after colproctectomy.

It is known that each of the physiological systems of the body has common and specific features of the morphological and functional organization and regulation of the functions carried out [89, 195, 196, 219, 220]. Back in 1924 E.S. London [102], referring to the relationship between the stomach and intestines, wrote that the activity of the intestine is to a large extent a function of gastric evacuation, but gastric evacuation is, in turn, a function of intestinal work. In this regard, the motor-evacuation activity of the stomach after total resection of the colon is an essential component of adaptive reactions in the digestive system. The stomach is one of the main links and has certain features of motor-evacuation activity [89, 94, 96, 138, 155, 156, 173, 203, 215, 219, 220].

Experimental and clinical studies have suggested that the violation of the evacuation activity of the organs of the gastrointestinal tract is based on a violation of the coordination of motor activity due to damage to the nervous structures of

organs and tissues during surgery [4, 5, 13, 143, 144, 155, 156, 157, 205], as well as the volume of colon resection [40, 48].

A.P. Parpiev and Z.V. Malikov [122, 123], studying the motor-evacuation function of the gastrointestinal tract, found that if in intact animals the intake of a contrast suspension from the stomach into the duodenum is observed 15 minutes after administration, then when 80% of the caudal section of the small intestine is removed, including ileocecal angle, this process slows down significantly. According to the authors, a significant role belongs to the ileocecal apparatus, which is considered as one of the nodal sections of the intestine, affecting the function of the entire gastrointestinal tract.

There are only a few reports in the literature about changes in the motor-evacuation activity of the stomach in the process of adaptation to subtotal and total resection of the large intestine [53].

A number of authors in experimental studies have proved the role of cortico-visceral and neurohumoral relationships between different parts of the digestive system. Changes in motor-evacuation functions of the stomach play an important role in the mechanism of occurrence of adaptive rearrangements after total resection of the large intestine [118, 120, 121].

V.M. Velichenko et al. [53], A.N. Aripov et al. [14, 15], A.A. Ablyazov et al. [4] studying the motor-evacuation function of the gastrointestinal tract after operations on the small and large intestine, found various changes in the evacuation function of the stomach in both patients and experimental animals. After extensive resection of the small and right half of the colon, a significant acceleration of the motor function of the stomach and intestines was revealed. After ileorectostomy in animals, the evacuation of the contents of the stomach was carried out at the usual time, and the motor function of the small intestine was somewhat slowed down. After ileostomy (during the removal of the ileocecal angle and a significantly injured operation of the anal zone with complete exclusion of the rectum), an accelerated motor function of the stomach and intestines was

observed in the early stages, later it became slow. These data indicate the important role of the ileocecal angle, as well as the anorectal zone, in the regulation of motor function activity.

Stupin V.A. et al. [156, 157], studying the motor-evacuation function of the stomach after surgical treatment of gastric ulcer and duodenal ulcer, revealed accelerated evacuation only during the first 3 months after surgery.

The evacuation activity of the stomach provides a periodic supply of food gastric contents to the main digestion reactor - the small intestine, the rate of which is determined not only by the efficiency of the initial stages of digestion, but also by the rate of hydrolysis and absorption of nutrients in the small intestine [15, 152, 153, 204].

The large intestine is anatomically and functionally closely connected with all parts of the digestive system: the stomach, liver, pancreas and small intestine, which causes changes in these organs during pathological effects on the large intestine [120, 121, 123, 141, 142, 156, 157, 173, 219, 220].

M.I. Brusilovsky [48], studying the motor function of the stomach during subtotal resection of the colon, noted that the more time passes from the moment of the operation, the slower the evacuation of the contrast agent from the stomach. In addition, he discovered the expansion of the lumen of the stomach and portioned flow of barium suspension into the duodenum. In contrast, a number of authors did not reveal any persistent changes in the motor-evacuation function of the gastrointestinal tract after colectomy at all [150, 173, 203, 225]. Some researchers even believe that in patients with a preserved right colon, the recovery of motor function of the gastrointestinal tract occurs faster [205, 215].

According to some researchers, the motor-evacuation activity of the stomach and the speed of movement of the contrast suspension in the small intestine depend on the area of intestinal removal [143, 144]. So, according to R.I. Khudoiberdieva et al. [170] resection of 80% of the proximal part of the small intestine led to some slowdown in the motor-evacuation function of the stomach and passage of the

contrast agent through the small intestine, while the same amount of resection of the distal part led to an acceleration of the contrast evacuation.

One of the consequences of the removal of part or all of the colon is a pronounced change in the conditions for the existence of endogenous intestinal microflora. Autoflora, as part of the macroorganism system, on the one hand, reacts to the surgical intervention, and on the other hand, it affects the recovery of the body in the postoperative period [47, 48, 67, 81, 117, 118, 120, 121, 167, 217]. After a total resection of the large intestine, the small intestine becomes the habitat of colonic microorganisms, in which a significant increase in the number of microbes and a change in the microbial landscape as a whole are revealed [120, 121].

M.I. Brusilovsky [47], conducting a bacteriological study of the gastric and duodenal contents of patients operated on for diffuse polyposis and ulcerative colitis, found that almost all patients had infection of the contents of the stomach and duodenum with various "fecal microorganisms (staphylococci, proteus, fungi, enterococci, hemolytic enterobacteria, streptococci, aerobic bacilli, sarcins, etc.). The author explains the development of these changes, indicating dysbacteriosis, by a decrease in the overall immunological reactivity of the body, vitamin and protein deficiency due to surgical intervention.

Yu.N. Nishanov [120, 121], in animals with total resection of the large intestine, colonization of the upper part of the gastrointestinal tract (duodenum, jejunum, and ileum) with an unusual microflora for these parts was shown. Factors contributing to the colonization of the small intestine with pathogenic microbes, according to the author, are a change in the physicochemical properties of intestinal juice, a violation of its enzymatic activity, absorption capacity and motor function of the small intestine after total colectomy.

The question of the state of the microflora of the stomach during surgical interventions on the organs of the gastrointestinal tract is of great interest to a wide range of researchers [22, 97, 128, 199, 210].

The eubiotic state of the stomach is largely determined by the secretion of hydrochloric acid, which is one of the important barriers against microorganisms that come with food. At $\text{pH} < 3$, the contents of the stomach obtained on an empty stomach are practically sterile, or contain a small amount of microorganisms - 100-1000 colony-forming units per 1 ml (CFU / ml). In this case, lactobacilli *L. Acidophyllus*, type I, *L. Fermenti*, as well as microorganisms characteristic of the oral cavity (*Str. Salivaris*, yeast) are most often sown. At $\text{pH} > 3$, the spectrum of microorganisms expands, and *Staphylococcus epidermidis*, *Micrococcus*, *Neisseria*, and *Corinebacterium* can be sown along with them [44, 200].

According to modern data, the contents of the stomach in healthy people and higher animals are either sterile, or there are only a few types of acid-resistant bacterial flora of the oral cavity, referred to as cavitory or P-flora [19, 20, 27, 31, 38, 39, 47, 52, 59, 81, 105, 120, 121, 126, 134, 135, 136, 137, 184, 185, 186, 201].

It has been established that the microflora of the stomach in gastroduodenal pathology is represented by *H. pylori*, enterobacteria, staphylococci, enterococci, less often by non-fermenting gram-negative rods and anaerobes [20, 67, 97, 128, 130, 184, 185, 186, 197, 222, 224].

The role of changes in the microflora of the stomach in the pathogenesis of various diseases of the gastrointestinal tract has been noted by many researchers [19, 20, 39, 59, 67, 80, 82, 88, 93, 124, 128, 130, 134, 135, 136, 137, 158, 184, 185, 186, 192]. At the same time, a significant influence of microflora on the structural state of the digestive organs was established. At the same time, all authors are unanimous that the most important role in maintaining microbial balance in the gastrointestinal tract belongs to the morphofunctional state of their mucous membrane. B.Z. Kasymov, I.M. Baibekov [88], T.A. Sagatov et al. [141, 142], introducing pesticides into the stomach, found damage to the mucous cells of the stomach, as well as disturbances in the structure of enterocytes, which was accompanied by changes in the state of the parietal microflora. The authors believe that it is the structural state of the mucous membrane that is the most accurate

indicator of certain changes in the relationship of microbes with the macroorganism.

CHAPTER 2. MATERIAL AND RESEARCH METHODS

The experiments were carried out on 235 adult outbred male rats with an initial body weight of 150–220 g, kept under the same vivarium conditions. Experiences were divided into 6 series:

In the first series of experiments, 90 animals underwent total resection of the large intestine according to the Ayletta method [188] to study morphological, ultrastructural, and morphometric changes in the gastric mucosa.

II series - control. In 9 animals, a laparotomy was performed, and after revision of the internal organs, the abdominal wall was sutured tightly (sham-operated).

III series - motor-evacuation function of the stomach was studied in 28 experimental animals after total resection of the large intestine.

In the IV series of experiments in 66 animals with total resection of the large intestine, the quantitative and qualitative state of the microflora of the stomach contents was studied.

In the V series of experiments in 33 animals after surgery, bacterial correction of the microflora of the contents of the stomach was carried out with the help of bifidumbacterin and lactobacterin or their complex.

VI series of the experiment - 9 animals after surgery instead of bacterial therapy received the appropriate volume of sterile saline. This group served as control for the fifth series of experiments.

Of the total number of experimental animals, for various reasons, 18 rats died, which were excluded from the experiments.

The experimental and control animals were slaughtered on the 3rd, 7th, 15th, 30th, 60th, 90th, 120th and 180th days in the morning, on an empty stomach, under light ether anesthesia.

To study the histological picture of the mucous membrane, pieces from different parts of the stomach with a size of 0.3–0.5 cm were fixed in Carnoy's solution and 12% neutral formalin. After appropriate treatment, the material was embedded in paraffin. Oriented sections 5-7 μm thick were stained with hematoxylin and eosin.

For electron microscopic studies, pieces of the gastric mucosa were fixed in 1.5% solution of glutaraldehyde, additionally fixed in 1% solution of osmium tetroxide, and after appropriate wiring, they were poured into a mixture of epon-araldite. Ultrathin sections were prepared on an LKV-4800 ultratome, counterstained with uranyl acetate and lead citrate, and viewed under a JEM-100SX electron microscope (electron microscopy studies were carried out at the Department of Histology of the TMA, for which the author is deeply grateful to Professor K.R. Tukhtaev). Some of the electron diffraction patterns, including those in a scanning electron microscope (SEM), were made by prof. V.A. Khoroshaev in the laboratory of pathological anatomy of the RSCS them. Academician V. Vakhidov of the Ministry of Health of the Republic of Uzbekistan in an electron microscope Hitachi S-405. For scanning electron microscopy, preparations after the above described fixation were subjected to dehydration in alcohol-acetone, then dried by the critical point method in an HCP-2 apparatus and sprayed with gold in an IB-3 apparatus. Photographs were taken with a Canon digital camera from an SEM monitor.

Stereomorphometric studies were carried out according to the method of G.G. Avtandilov [6].

Light-optical microphotographs were obtained on Biolam I, Biolam I-2 LOMO microscopes coupled to an HP Photosmart R 927 digital camera using a special adapter. The micrographs were computer processed on a Pentium IV - Windows Professional computer.

On preparations stained with hematoxylin-eosin, using an eyepiece micrometer, we determined the total thickness of the mucous membrane, the thickness of the epithelium and the lamina propria, the submucosa, and the depth of the gastric pits. At the same time, the number of fundic gland cells was counted, and the relative number of individual glandular cells was determined. To identify certain types of cells of the gastric mucosa, the staining method according to V.A. Samsonov was used [145].

On preparations stained according to Samsonov, the number of fundic glands per unit area, the total number of cells, as well as the relative number of cervical, main, parietal, and accessory cells in one gland were counted.

The motor-evacuation function of the stomach on the 5th, 15th, 30th, 60th, 90th and 120th days after the operation was studied using the X-ray method. For this, 1.5-2.0 ml of ready-made centrifuged barium suspension was injected into the stomach cavity of control and experimental animals using a probe. After 15, 30, 45 minutes, 1 hour 15 minutes, 2 hours, 3 hours, 6 hours and 24 hours after taking barium under ether anesthesia, a study was performed on the ROM-20 apparatus at a power of 150 kW, distance 80 cm., exposure time 0.16 s.

During X-ray examination, we determined and compared such data as the rate of passage of barium suspension through the stomach in control and experimental animals, the nature of the filling of individual sections of the stomach, the state of the walls of the stomach and the relief of the mucosa, the presence of gas in it and the removal of a contrast suspension from the stomach.

The microflora of the contents of the stomach was studied on the 7th, 15th, 30th, 60th and 90th days of the experiment by the method of R.V. Epstein-Litvak

et al. [178]. To calculate the number of microbes in 1 g of the studied contents, the statistical method of I.P. Ashmarin and A. Vorobyov [24].

In addition, we carried out a correction of the composition of the microflora of the contents of the stomach with the help of bacterial preparations. Bifidumbacterin and lactobacterin are available in dry form in 1-dose vials. The contents of the vial were dissolved in sterile saline at room temperature at the rate of 5 ml (1 teaspoon) per dose of the drug. After dissolution, the contents of the vial were transferred to the same beaker and mixed. Both prepared solutions were given per os at 0.25 doses (1/4 part) for each experimental rat 2 times a day for 15-30 days after the operation.

To study the effectiveness of the drugs used, all the studied experimental rats were divided into two groups. Animals of the first group received only bifidumbacterin; the second group - bifidumbacterin with lactobacterin in the complex. Animals of the control group received an appropriate volume of sterile saline instead of bacterial therapy.

This fragment of the work was carried out in the bacteriological laboratory of the Rep. SES of the medical and sanitary association under the Ministry of Health of the Republic of Uzbekistan (head of the laboratory S.N. Grigoryants).

Statistical processing of the obtained results was carried out using standard methods of variation statistics using Student's criteria. Differences satisfying $P < 0.05$ were considered significant.

CHAPTER 3 MORPHOLOGICAL AND MORPHOMETRIC STATE OF THE GASTRIC MUCOSA IN DYNAMICS AFTER TOTAL COLON RESECTION

3.1. Morphology of the gastric mucosa in dynamics after total resection of the large intestine

As noted above, different volumes of colon resections often occur in clinical surgery. They are performed for non-specific ulcerative colitis and Crohn's disease, for various types of intestinal obstruction, for its tumor lesions, as well as for necrosis due to various causes, and, first of all, thrombosis of the mesenteric vessels.

A special place in the study of the structural foundations of compensatory-adaptive changes in the digestive system is occupied by a set of works performed by morphologists of the Republic of Uzbekistan under the guidance of Academician of the Academy of Sciences of the Republic of Uzbekistan K.A. Zufarov [2, 42, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 120, 121, 136, 159, 162, 181]. These works show that in response to resection of one or another section of the digestive tract, structural changes take place in the remaining sections, aimed to some extent at compensating for lost functions. Nevertheless, as noted above, there is practically no information in the literature that reveals the structural foundations of the adaptive reactions of the gastric mucosa after total removal of the colon. Before proceeding to the presentation of the structural foundations of adaptive rearrangements of the gastric mucosa after total resection of the large intestine, we considered it necessary to briefly present data on the structure and ultrastructure of this membrane in control animals. It should be noted that the morphology of the gastric mucosa in sexually mature laboratory animals (rats, mice, etc.) is quite well studied and presented in some detail in the literature [40, 54, 74, 76, 78, 79, 115, 137, 181, 194, 202]. The results obtained by us in this regard were fully consistent with the literature data, which made it possible to use them as a control for the interpretation of structural rearrangements of the gastric mucosa under conditions of total colectomy.

It is known that the stomach of rats is composed of two parts - the esophageal and glandular - the stomach itself. Macroscopically, the first part has a whitish color and occupies almost $\frac{1}{2}$ of the stomach.

Light-optical studies show that the epithelial lining of the mucous membrane of the esophageal part is formed by a flat, partially keratinized epithelium. The stratified squamous epithelium of the stomach at the border of the esophageal and cardiac zones passes into a single-layer glandular epithelium of the cardiac zone. At the same time, the transition from stratified squamous epithelium to a single-layer integumentary-pit epithelium, which is characteristic of all departments of the stomach itself, is carried out immediately, without any intermediate forms (Pic. 3.1.1).

The epithelial lining of the mucous membrane of the cardiac section is characterized by rather deep dilated pits and the presence of cardiac glands. These are simple tubular glands, formed mainly by cylindrical glandular cells of the type of integumentary. Parietal cells do not occur in these glands.

The largest part of the stomach itself is represented by the fundic zone. Here are the fundic glands, which determine the functional specificity of the stomach. On the border of the integumentary-pit epithelium and the fundic glands proper, the so-called cervical cells are located. They constitute a zone of intensive proliferation of cells that are the precursors of all types of fundic gland cells. These are integumentary-pit, accessory, parietal and chief cells. The last two types are the most highly differentiated and specialized fundic gland cells. They determine the functional specificity of the stomach as an organ.

Fundic glands are simple tubular. They are distinguished by a heterogeneous composition of cells along their length (Pic.3.1.2). In the literature, it is generally accepted to divide each gland into three sections - the neck, body and fundus. For a more detailed analysis of these glands, in our studies, we divided the body of the gland into three levels - the upper, middle and lower thirds of the body of the

gland. Below the level of the neck is the upper third of the gland, where there are undifferentiated cells and fairly numerous parietal cells.

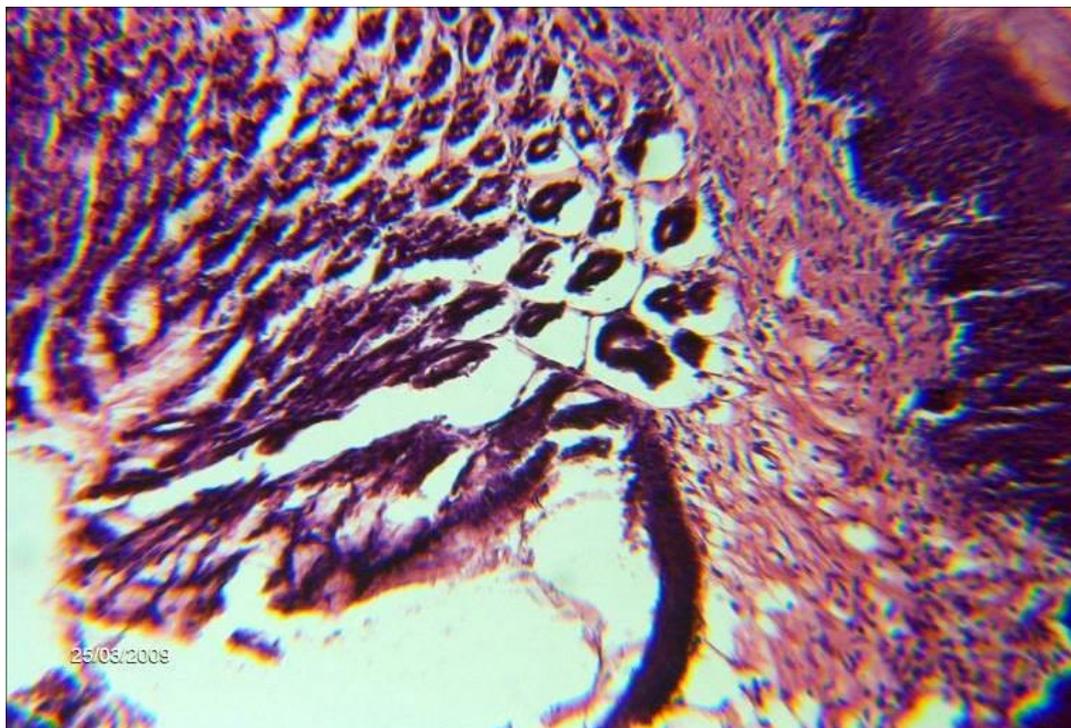
In the middle third of the gland, additional mucus-forming cells and individual parietal cells dominate.

In the lower third of the gland, chief cells predominate and parietal cells also occur.

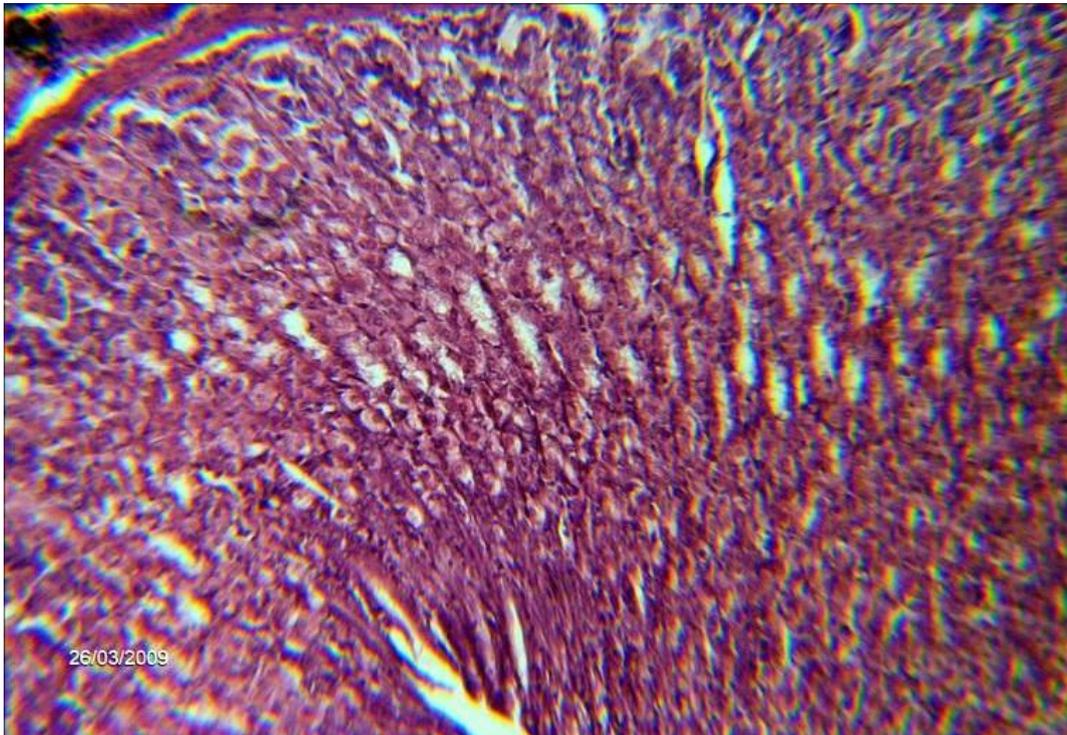
Parietal cells are thus found throughout the gland. They, as a rule, are located somewhat behind the main and additional cells, along the periphery of the gland. Hence their second common name - parietal cells. They are more or less rounded, with a centrally located nucleus and eosinophilic cytoplasm (Pic. 3.1.3).

Additional cells are concentrated mainly in the middle third of the body of the fundic glands. On light-optical preparations, they have a light, slightly eosinophilic cytoplasm, and a nucleus localized in the basal part (Pic. 3.1.4).

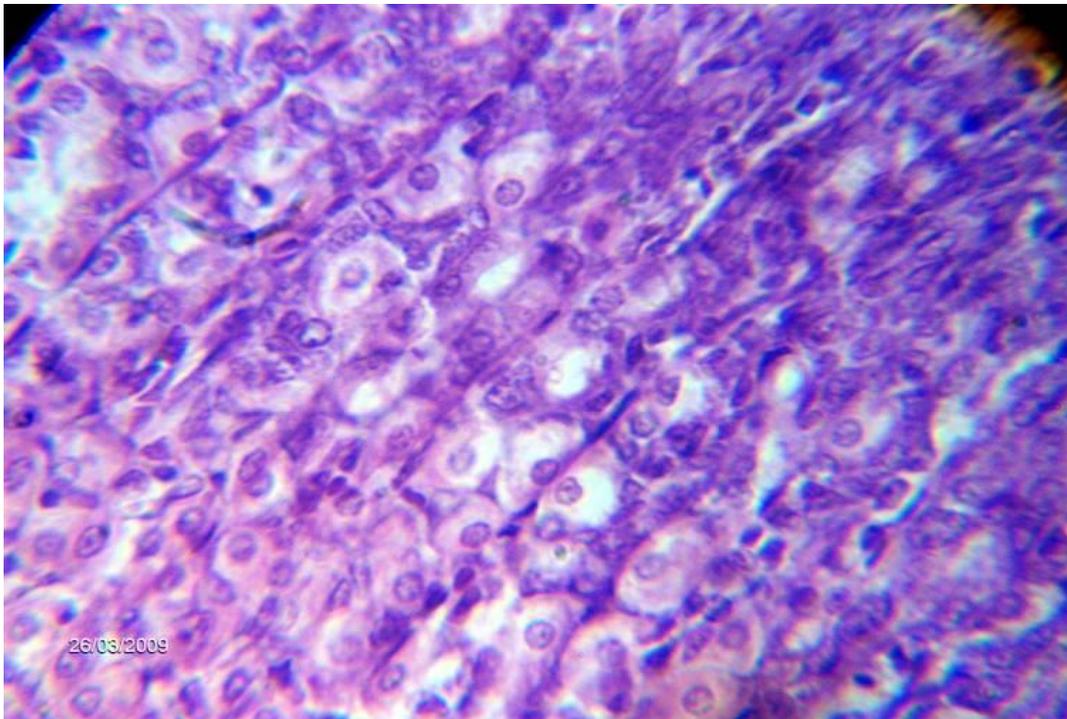
The main (peptic cells) are concentrated mainly in the lower third of the glands. They often come into contact with parietal cells. Chief cells are characterized by an intensely stained basophilic cytoplasm and a basally located nucleus (Pic. 3.1.5).



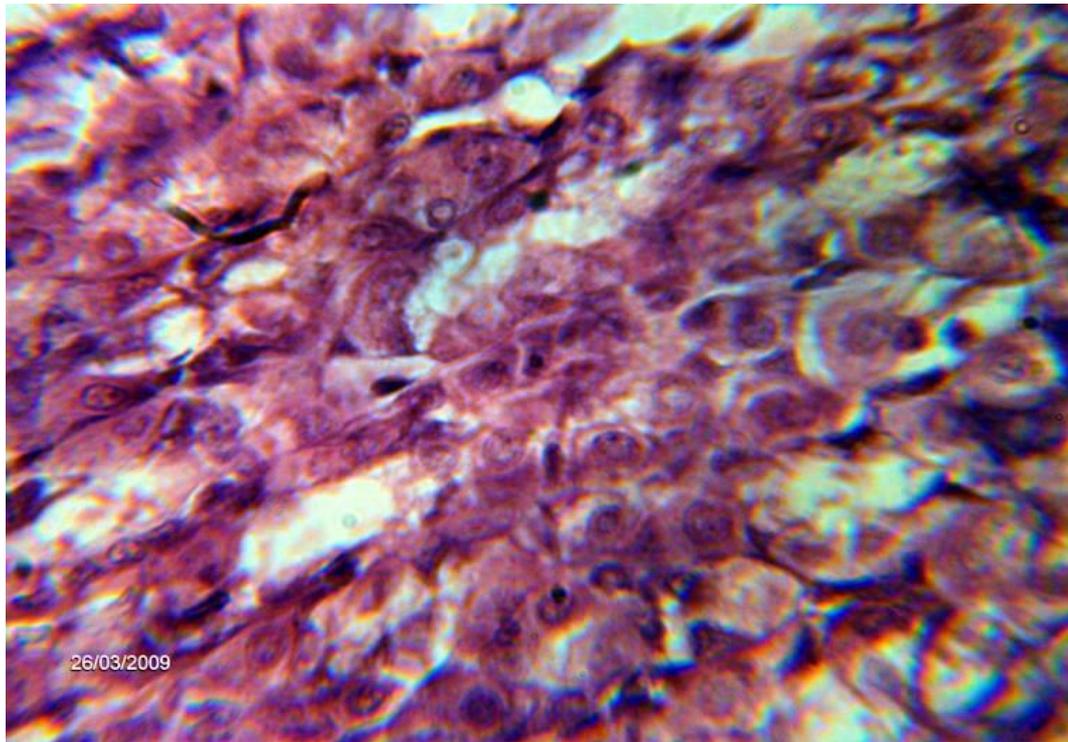
Pic. 3.1.1. The transition of the esophageal part of the stomach to the cardia.
Control. G-E. 10x10.



Pic. 3.1.2. Fundic glands of the stomach. Control. G-E. 10x10.



Pic. 3.1.3. Parietal cells of the upper 1/3 of the body of the fundic gland.
Control. G-E. 10x40.



Pic 3.1.4. Accessory and parietal cells of the middle third of the body of the fundic gland. Control. G-E. 10x40.

Electron microscopic examinations reveal some ultrastructural features of all cell types of the fundic glands.

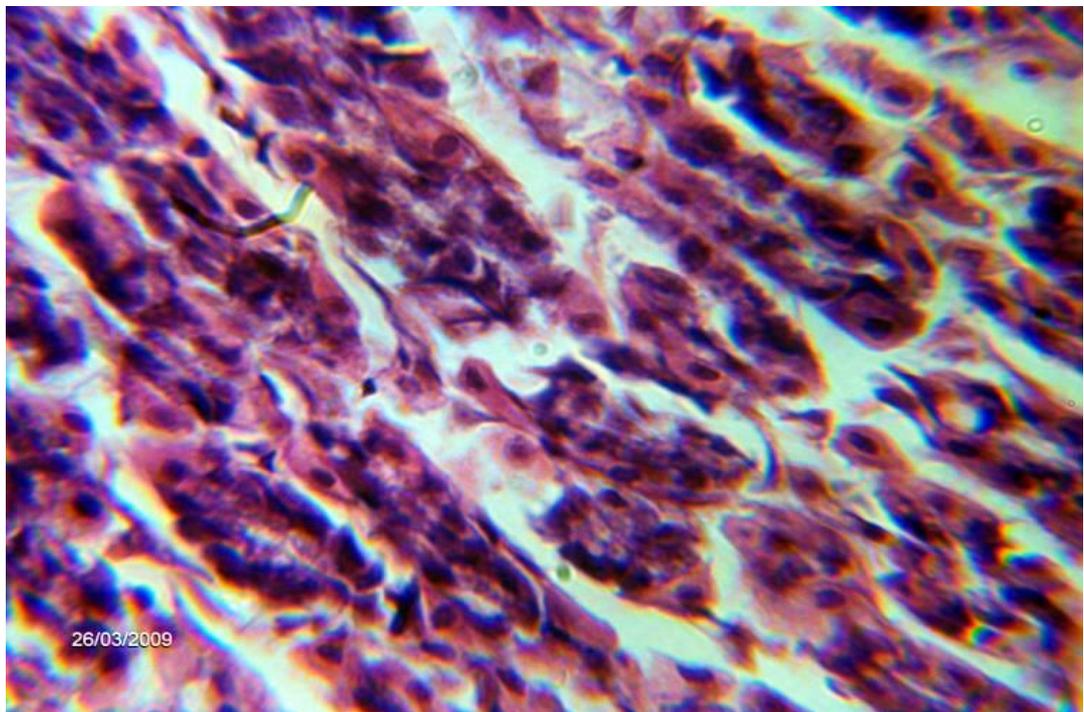
Integumentary - pit cells lining the pits and luminal surfaces of the mucous membrane have slightly domed apical parts with single short microvilli. In the upper parts of the cells, secretory granules are concentrated, which have a rather significant electron density (Pic. 3.1.6, 7).

It is sometimes difficult even at the ultrastructural level to distinguish superficial-pit cells from cervical ones. In both, the same type of secretory granules is located, however, in the dominant structures of the cytoplasm are polyribosomes. Both types of cells have elongated mitochondria, profiles of the granular endoplasmic reticulum and the Golgi complex (Pic. 3.1.6, 7).

It should be noted that on the surface of the integumentary-pit cells and in the lumen of the pits themselves, there are accumulations of mucus and individual microorganisms (Pic. 3.1.7).

Single microorganisms are found in the lumen of the glands at all levels, including the lower third, where the main cells are concentrated (Pic. 3.1.8).

In the region of the necks, mucus-forming cervical cells are often found, the cytoplasm of which is filled with rather electron-dense secretory granules. It is characteristic that differentiated parietal cells are also found in these zones. Moreover, unlike the cells located in the lower parts of the fundic glands, the parietal cells of the neck region have a distinct division into the basal and apical parts. The latter bear individual microvilli on the surface and exit directly into the lumen of the fossae (Pic. 3.1.9).

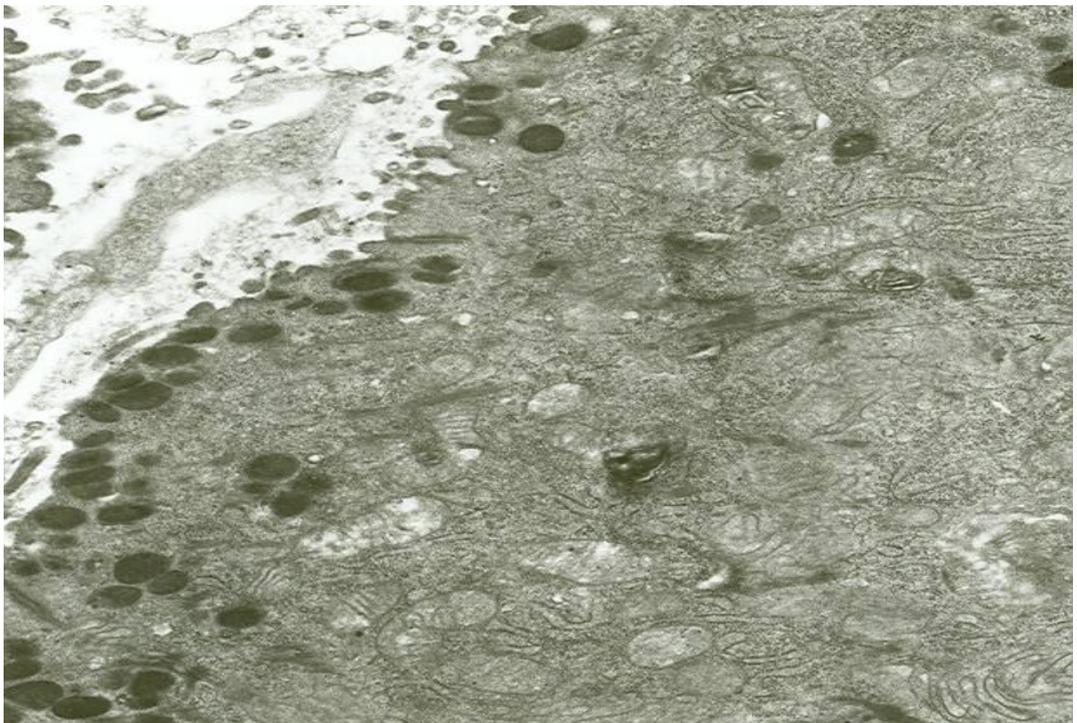


Pic. 3.1.5. The main cells of the lower third of the body of the fundic gland. Control. G-E. 10x40.

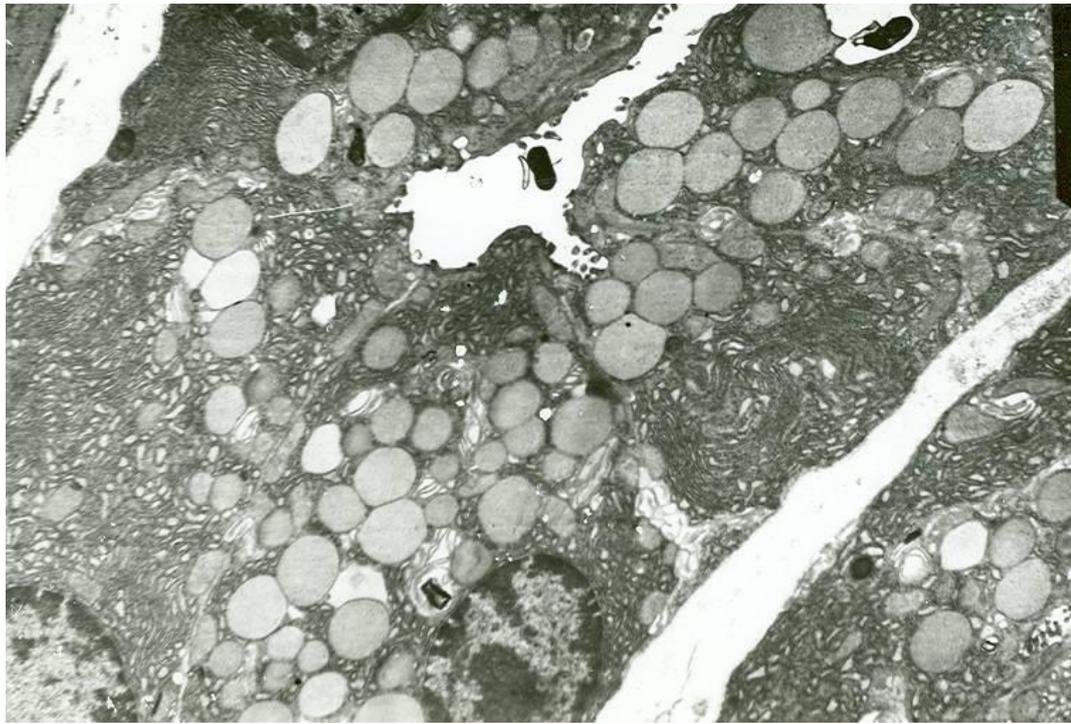


Pic. 3.1.6. Integumentary - pit cells of the fundic gland.

Control. TEM x 7500.



Pic 3.1.7. A small number of secretory granules and other ultrastructures in the cytoplasm of the pit-covering cells of the fundic gland. Control. TEM x 15000.



Pic. 3.1.8. The lower third of the body of the fundic gland. main cells. Single microorganisms in the lumen. Control. TEM x 7500.

These parietal cells have a large number of rounded mitochondria, which contain a large number of cristae and are the dominant structures of the cytoplasm. They contain single secretory tubules and tubulovesicles (Pic. 3.1.9), which are known to be structures that directly secrete hydrochloric acid components. The weak development of these formations in these parietal cells indicates their incomplete differentiation and, accordingly, low secretory activity.

In parietal cells, located in the middle third of the glands, where additional cells are concentrated, tubulovesicles and secretory tubules are much better developed (Pic. 3.1.10).

Structures for the synthesis and secretion of hydrochloric acid components (tubulovesicles and mitochondria) reach their maximum development in parietal cells located in the lower third of the body of the fundic glands. In them, tubulovesicles and mitochondria with a large number of cristae and a fairly dense matrix become the dominant structures of the cytoplasm. Here, the parietal cells often come into contact with the chief cells (Pic. 3.1.11).

Additional cells concentrated in the middle third of the fundic glands are located on the basement membrane and have a distinct division into the basal and apical parts (Fig. 3.1.10). They are distinguished by the presence of electron-bright secretory granules that have fuzzy boundaries and often merge with each other. The matrix of these granules has a delicate mesh-flake structure (Pic. 3.1.10).

The nuclei in additional cells, as well as the organelles responsible for the synthesis and secretion of the product - the Golgi complex and the profiles of the granular endoplasmic reticulum, occupy a small part of the cytoplasm. The dominant structures are mucus containing secretory granules. Mitochondria of small size are very few (Pic. 3.1.10).

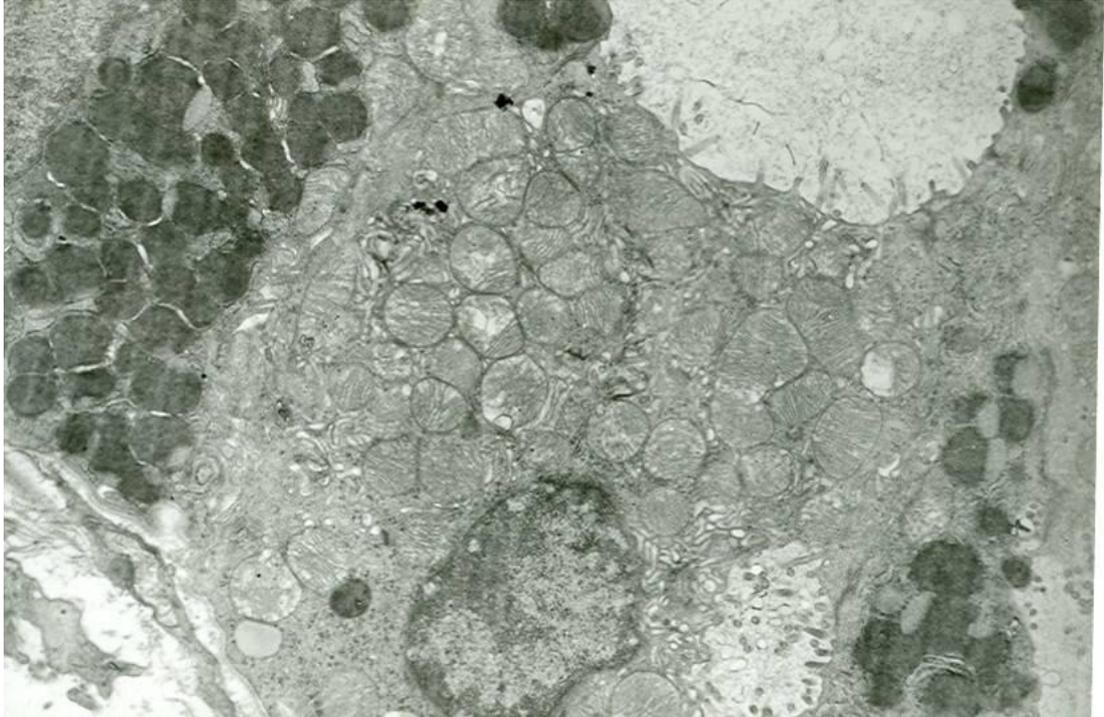
The chief cells got their name because they are the main type of cells that determine the functional specificity of the fundic glands and the stomach as a whole. They are also called peptic cells, since their main function is the production and secretion of pepsinogen, which, under the influence of low pH values, due to the secretion of parietal cells, passes into the active enzyme pepsin.

Thus, the main function of these cells is the secretion of a protein enzyme. This is what determines the ultrastructural originality of the main (peptic) cells. Under normal physiological conditions, the bulk of the cytoplasm in these cells is occupied by secretory granules of low electron density. Unlike the secretory granules of accessory cells, they have a homogeneous matrix and distinct boundaries defined by the membrane surrounding these granules. They, as a rule, have a fairly regular round-oval shape (Fig. 3.1.11). The nuclei of the chief cells are located in the basal parts of the cells. They have a rounded shape, with the dominance of heterochromatin in the karyoplasm, and the presence of rather large pores in the nuclear envelope (Pic. 3.1.12).

As in all types of protein-secreting cells, they have well-developed structures for synthesis and secretion - profiles of the granular endoplasmic reticulum and the Golgi complex (Pic. 3.1.11,12). These formations are closely related to each other,

both structurally and functionally. Single mitochondria are evenly distributed throughout the cytoplasm (Pic. 3.1.11,12).

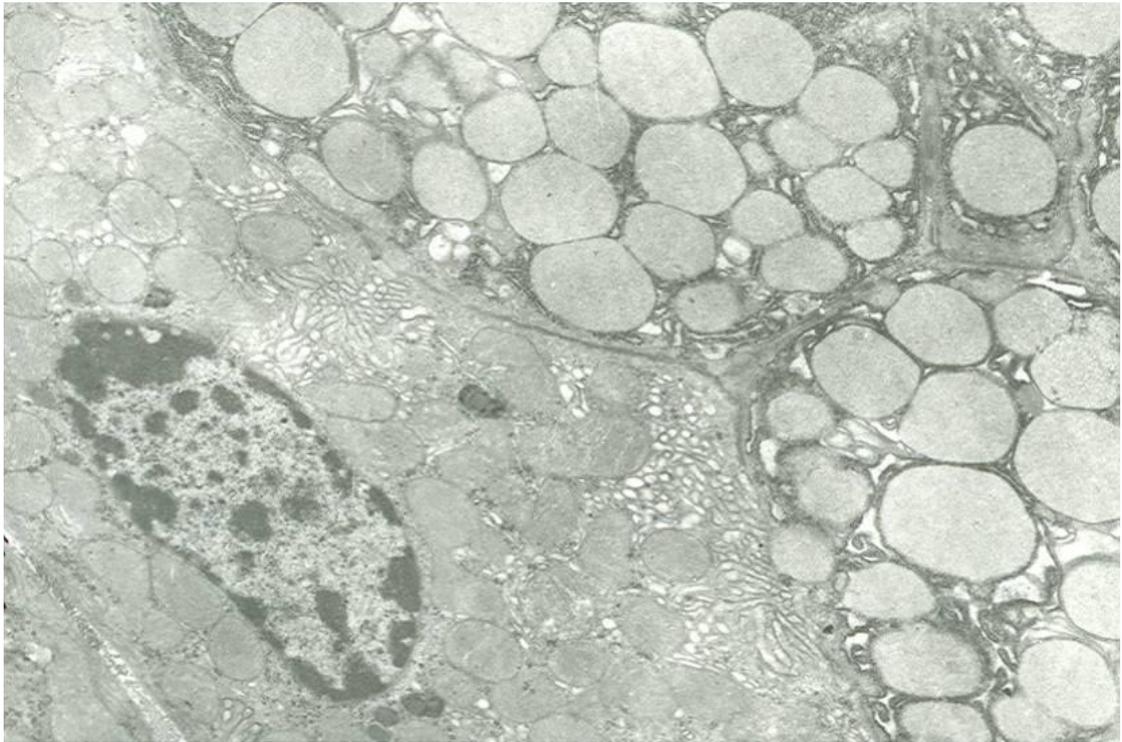
The chief cells located in the lower third of the glands are in contact with both parietal and endocrine cells (Pic. 3.1.11.13).



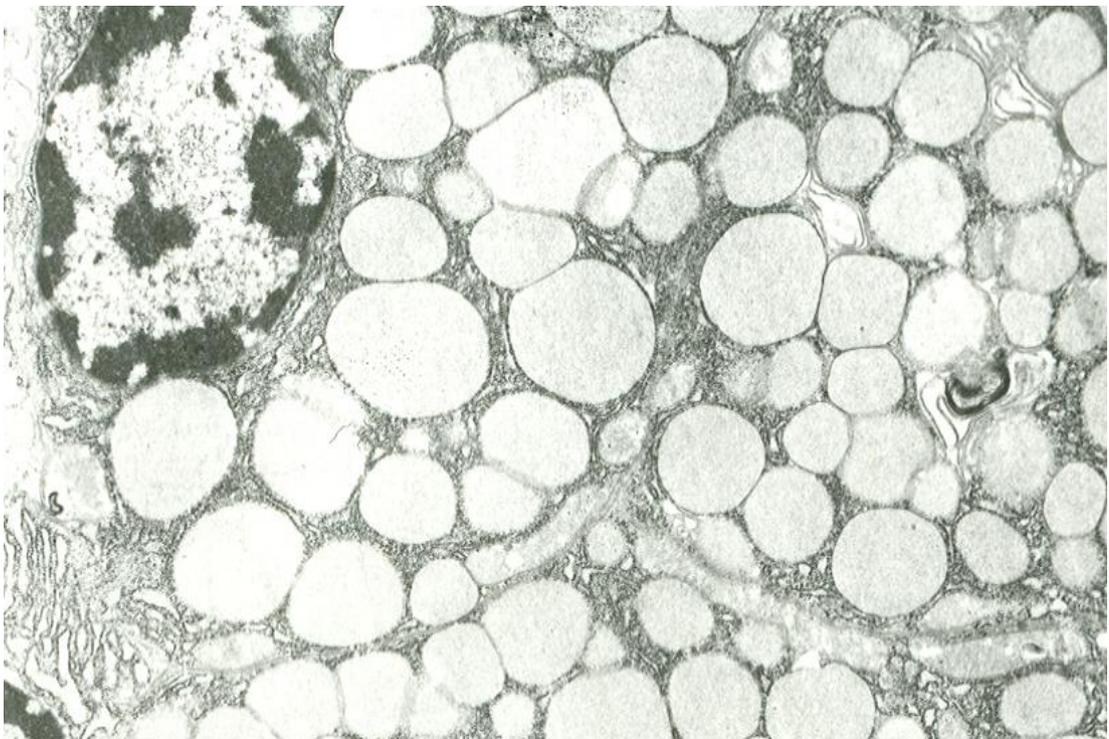
Pic. 3.1.9. Parietal and mucus-forming cells in the upper third of the body of the fundic gland. Control. TEM x 15000.



Pic. 3.1.10. Accessory and parietal cells of the middle third of the body of the fundic gland. Control. TEM x 15000.



Pic. 3.1.11. Chief and parietal cells of the lower third of the body of the fundic gland with developed structures for specific synthesis and secretion. Control. TEM x 15000.



Pic. 3.1.12. The main cells of the lower third of the body of the fundic gland with developed structures for synthesis and secretion. Control. TEM x 15000.

The cells of the pyloric glands, which in the rat have a tubular structure, are formed by prismatic cells, in which, as a rule, 2/3 of the cytoplasm is filled with rather electron-dense secretory granules. They are polygonal in shape. Quite large nuclei are located in the basal parts of the cells. In the supranuclear zone, the structures of the Golgi complex are concentrated, and around the nucleus, the profiles of the granular endoplasmic reticulum. Mitochondria with the usual ultrastructure are not numerous (Pic. 3.1.14). A characteristic feature of the pyloric glands is the presence of rather large intercellular spaces between epithelial cells (Pic. 3.1.14).

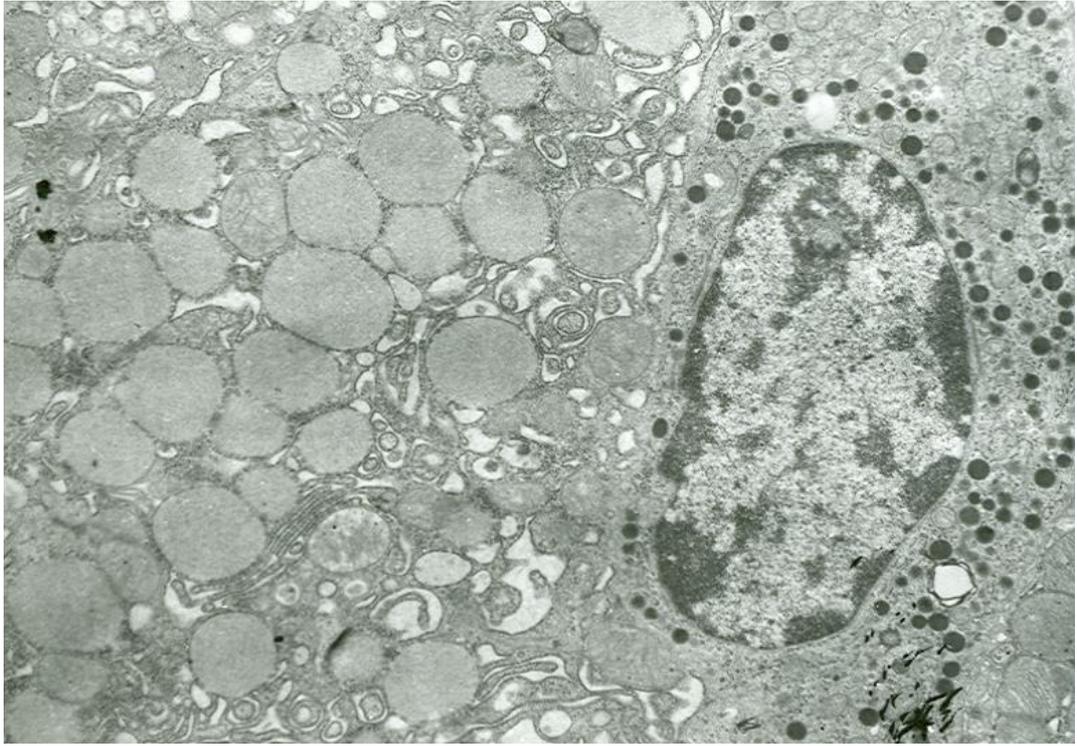
As noted above, the superficial pit epithelial lining has a stereotypical structure in all parts of the glandular part of the stomach.

Scanning electron microscopy shows that the microrelief of the luminal surface of the stomach is characterized by a certain rhythm of structural components. As a rule, each gastric fossa is surrounded by a roller of superficial pit cells. They have a fairly smooth rounded apex. The lumens of some fossae are enlarged to a greater extent. Rare inclusions in the form of rather large spherical formations are determined on the surface (Pic.3.1.15).

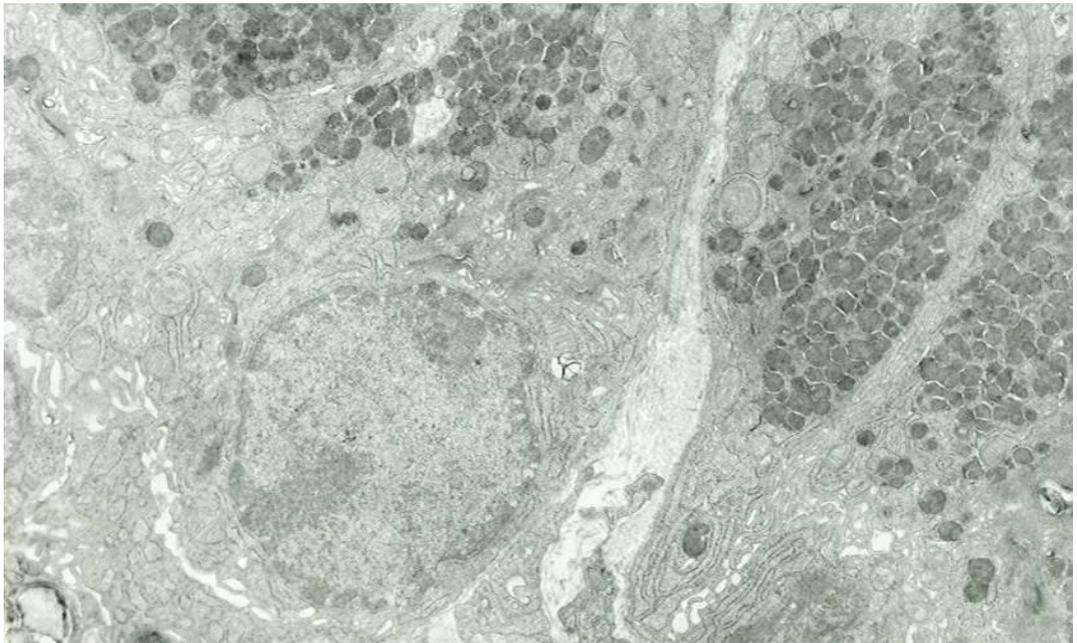
Thus, as our studies have shown, the main types of cells in the fundic glands are parietal and chief. This was also confirmed by stereomorphometric studies. Their volume fraction in iron is 25% each (Table 3.2.5).

Unlike all other cell types, parietal cells are distributed throughout the gland, with some dominance in the middle third of the gland body. The main cells are concentrated mainly in the lower third of the body of the gland.

Additional cells are grouped mainly in the middle third of the body of the gland.



Pic. 3.1.13. The main and endocrine cells of the lower third of the body of the fundic gland. Control. TEM x 15000.



Pic. 3.1.14. Pyloric gland cells with mucoid secretory granules. Control. TEM x 7500.

In the upper part of the gland there are parietal cells with a relatively low level of differentiation, in the lower part the most differentiated cells are concentrated.

According to modern views, in the gastric mucosa, the main and parietal cells determine the factors of aggression, and the integumentary - pit and additional cells - the protective factors. The cells of the pyloric department also provide a protective function.

The functional specificity of all cell types is determined by their ultrastructural organization.

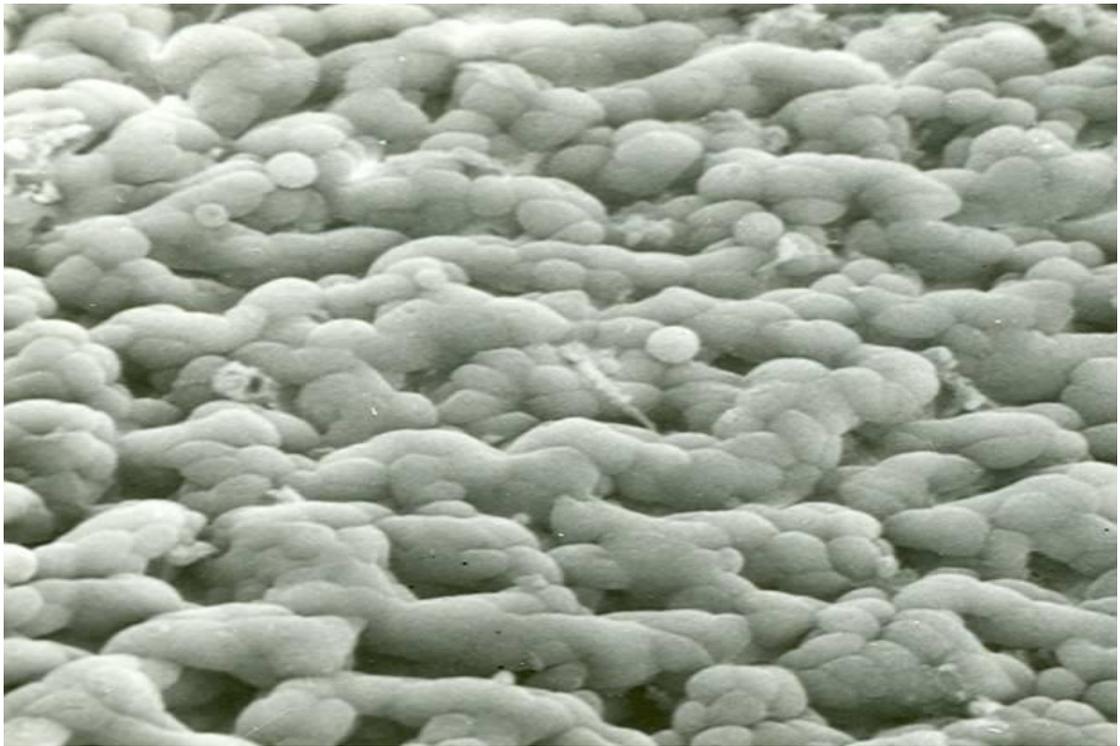
In the early stages (3-15 days) after total resection of the colon, all parts of the stomach undergo quite pronounced structural changes.

In the mucous membrane and submucosa on the 3rd day after resection of the colon, there is a pronounced expansion of microvessels and stasis of blood in them. This is accompanied by moderate swelling of the mucous membrane. Inflammatory infiltration of the interfoveal and interglandular stroma is rather moderately expressed (Pic. 3.1.16). There is an expansion of the lumen of the pits and fundic glands (Pic. 3.1.17).

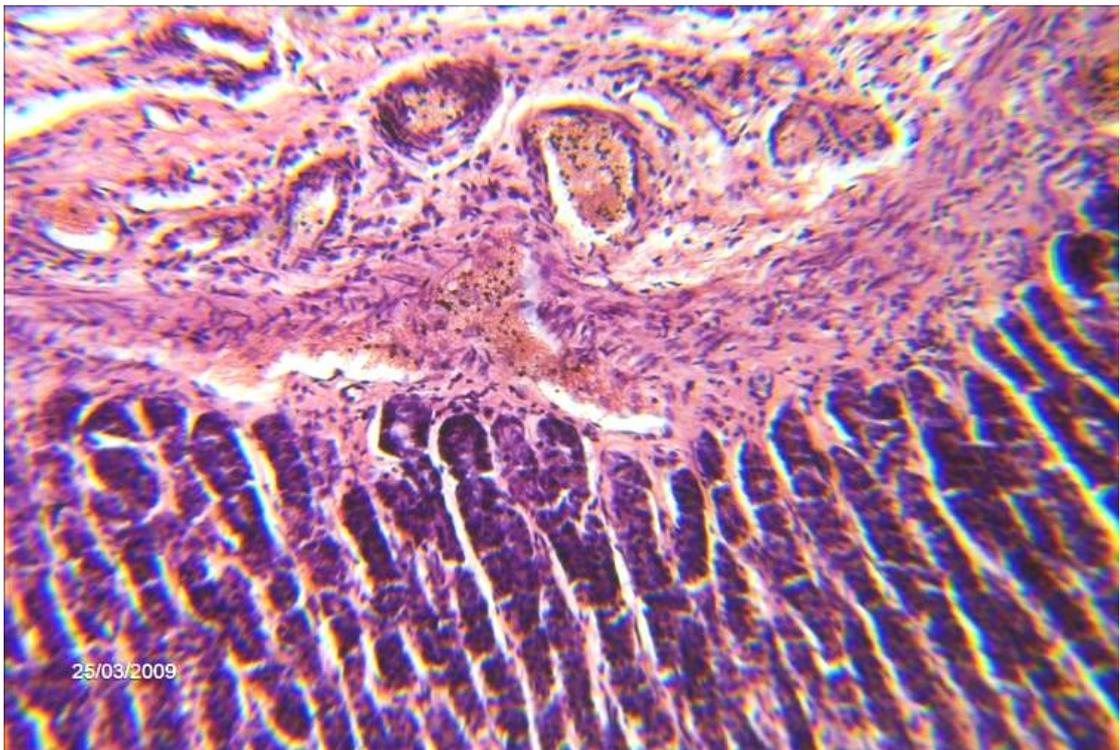
The expansion of the lumen of the gastric pits is especially pronounced in the pyloric part of the stomach (Pic. 3.1.18).

By day 15, the expansion of microvessels and stasis in them are not determined. Mild inflammatory infiltration of the interfoveal and interglandular stroma persists in the fundic region, with the expansion of the fossae and increased secretion in the integumentary - pit cells (Pic. 3.1.19).

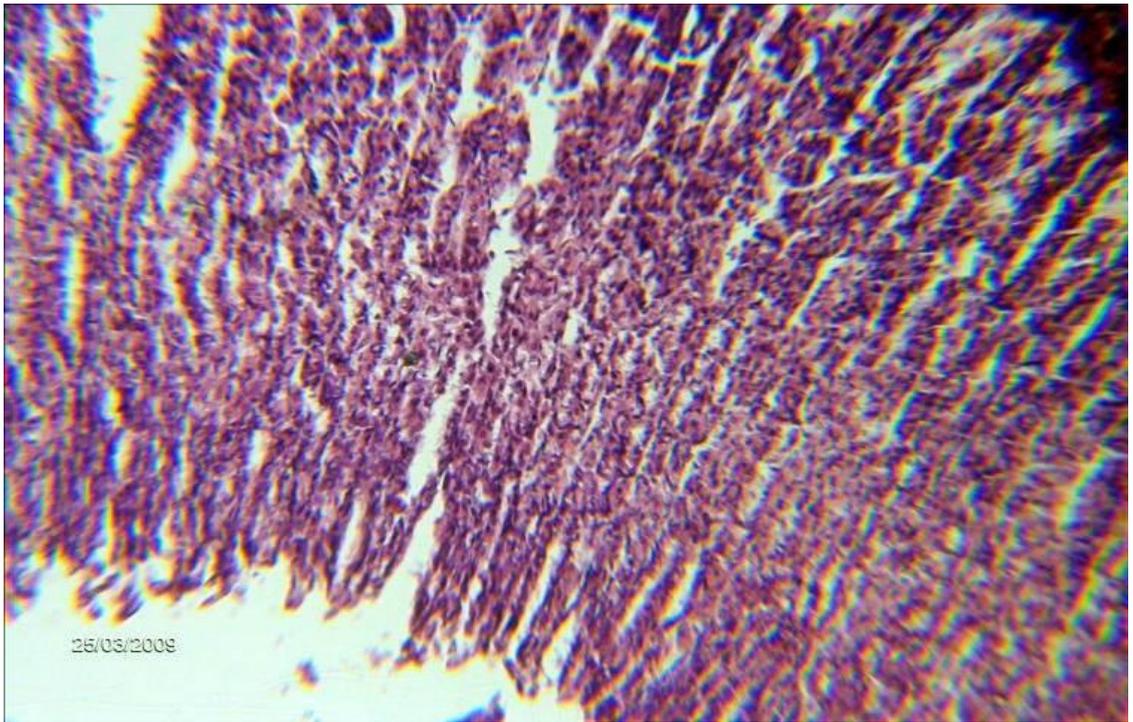
In the zone of accessory cells, most of the mucus-secreting cells look empty. However, there is accumulation of mucus in the lumen. This is accompanied by a decrease in the number and size of parietal cells (Pic. 3.1.20).



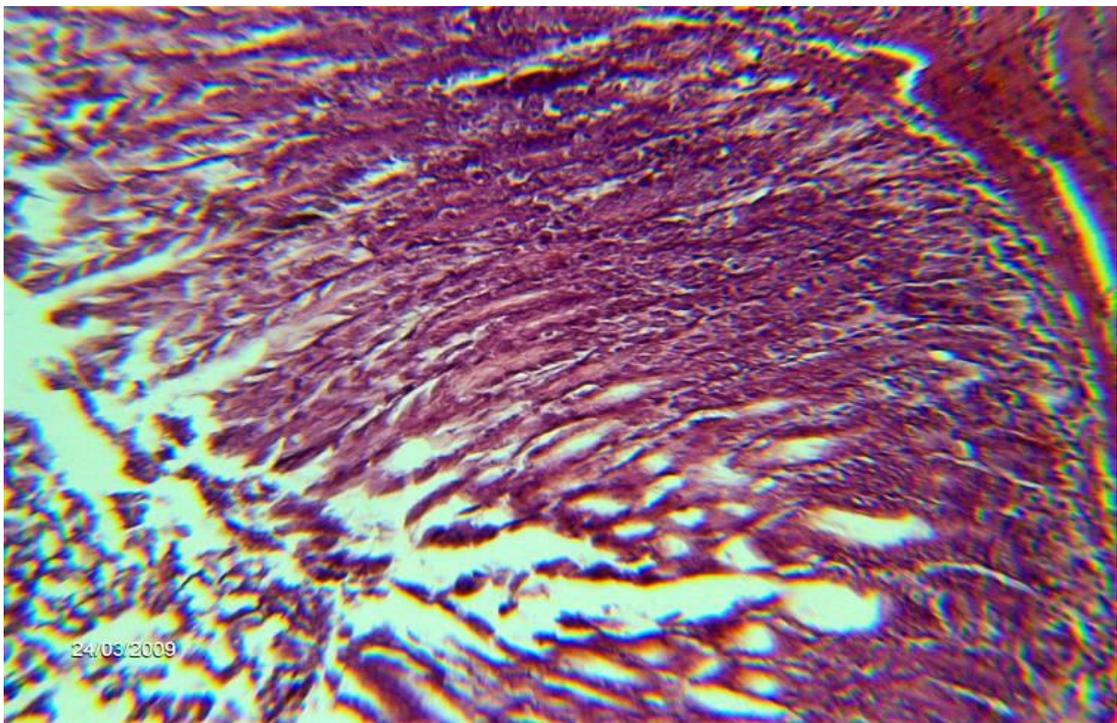
Pic. 3.1.15. Microrelief of the surface of the mucous membrane of the fundus of the stomach. Control. SAM x 1000.



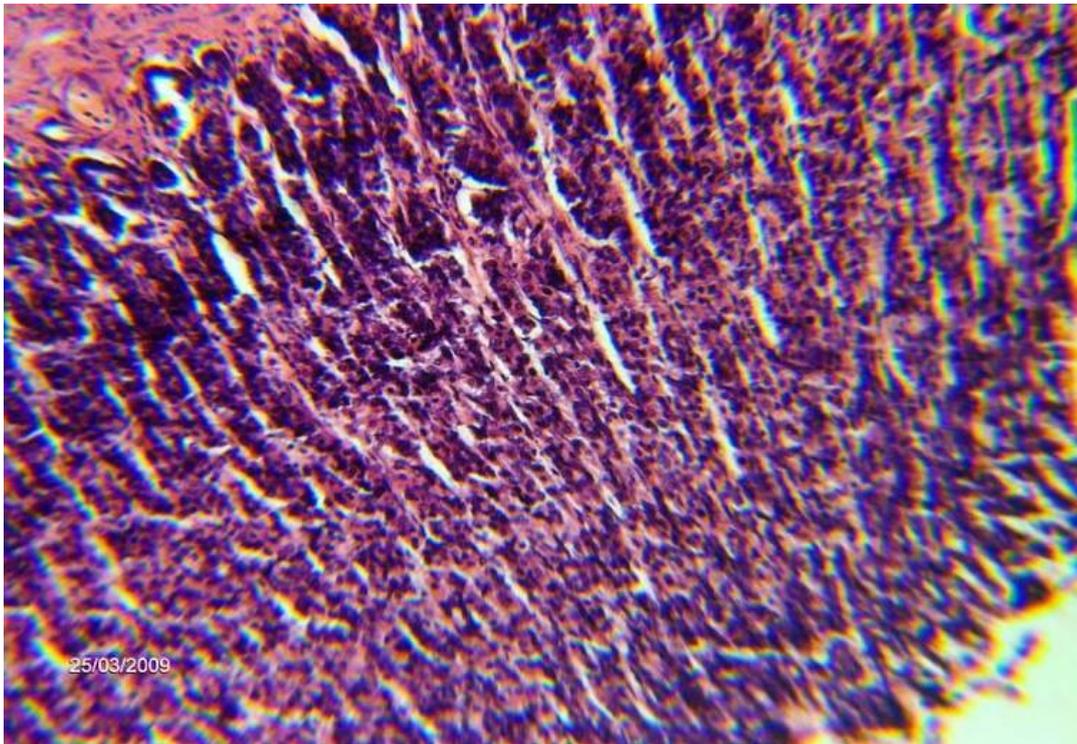
Pic. 3.1.16. Expansion of microvessels, moderate edema of the mucous membrane and submucosa of the fundus. 3 days after total resection of the colon. G-E. 10x10.



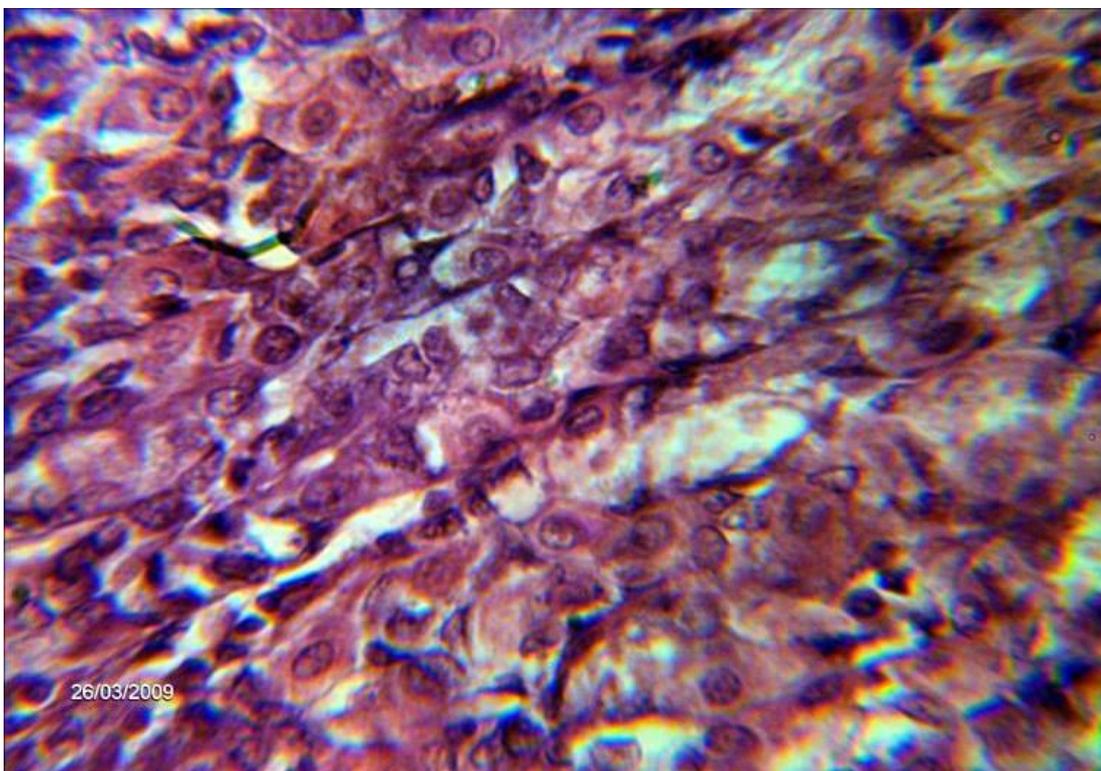
Pic. 3.1.17. Expansion of the gastric pits and the lumen of the fundic glands, moderate infiltration of the stroma. 3 days after total resection of the colon. G-E. 10x10.



Pic. 3.1.18. Expansion of the gastric pits and lumen of the pyloric glands, moderate infiltration of the stroma. 3 days after total resection of the colon. G-E. 10x10.



Pic. 3.1.19. Expansion of the terminal sections of the gastric pits and the lumen of the fundic glands, moderate infiltration of the stroma. 15 days after total resection of the colon. G-E. 10x10.



Pic. 3.1.20. Mucoïd and parietal cells of the middle third of the body of the fundic glands. 15 days after total resection of the colon. G-E. 10x40.

Electron microscopic studies show that after 3 days there is an accumulation of mucoid granules in the apical parts of the integumentary-pit cells, their cytoplasm is thickened (Pic. 3.1.21).

In the dilated lumens of the microvessels of the interfoveal and interglandular stroma there are sluggish erythrocytes, the stroma is edematous. Mast and plasma cells are often found (Pic. 3.1.22). There is a migration of lymphocytes into the epithelial lining of the fundic glands (Pic. 3.1.23). The appearance of these cells is probably associated with the inflammatory response observed in these periods after surgery.

On the 15th day of observation, eosinophils are often found in the interfoveal interglandular stroma. The release of their specific secretory granules into the intercellular space is noted (Pic. 3.1.24).

The lumens of the microvessels are enlarged, as in the previous periods, blood stasis is determined in them (Fig. 3.1.25). In the pit cells, especially at the border with the necks of the fundic glands, mucocytes contain electron-dense secretory granules. They are somewhat flattened. Intercellular cracks are expanded. However, in the cytoplasm of mucocytes, structures for synthesis and secretion are well developed. On the contrary, the parietal cells located in the area of necks are strongly flattened. Intracellular secretory tubules and tubulovesicles are practically not defined in them. The main part of the cytoplasm is occupied by mitochondria with an enlightened matrix (Pic. 3.1.26, 27).

The most characteristic changes in the cells of the fundic glands is the appearance in various types of cells of atypical secretory granules of a mucoid nature. In the upper sections of the fundic glands there are cells with a variety of polymorphic secretory granules in the cytoplasm. Cells with typical secretory granules inherent in additional cells can be found here. There are cells with secretory granules characteristic of the main cells, as well as with mucoid granules inherent in the integumentary-pit and cervical cells (Pic. 3.1.28).

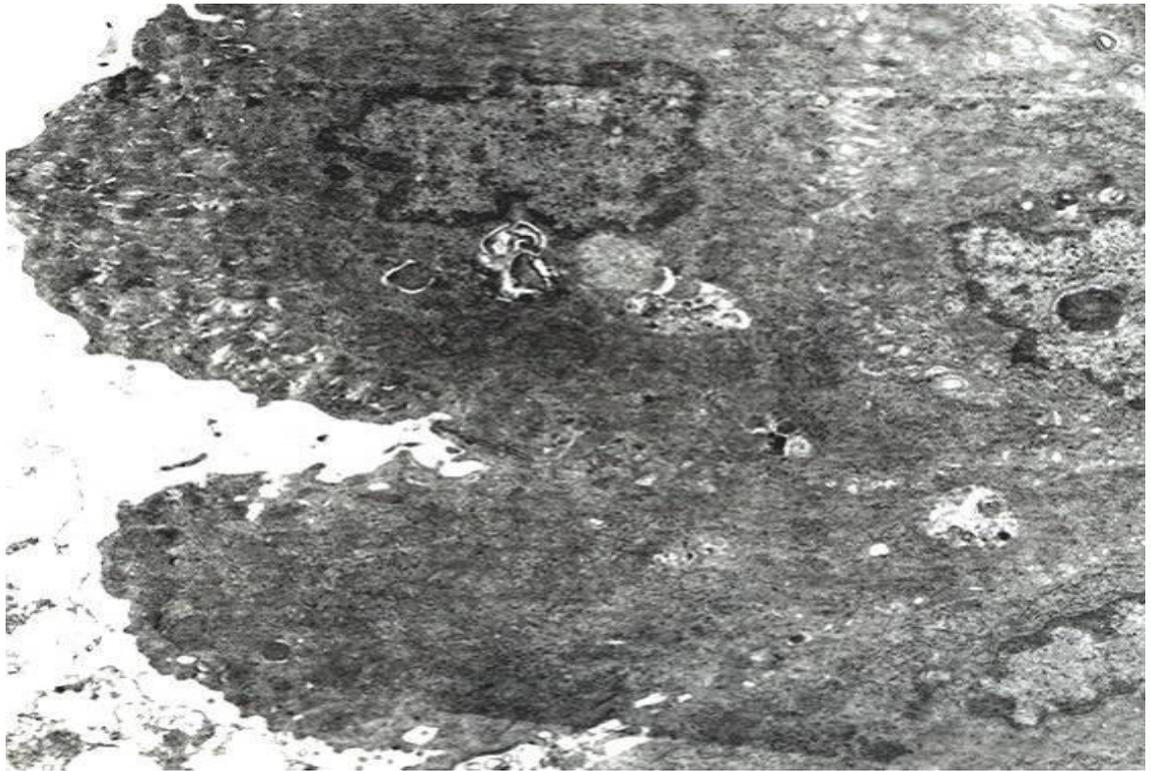
In cells with an ultrastructure characteristic of additional cells, secretory granules appear that have a heterogeneous structure. With a general low electron density of the matrix of granules, they contain rounded, more electron-dense cores (Pic. 3.1.29).

The appearance of secretory granules with an inhomogeneous density, giving these granules the appearance of an earring, is also noted in cells, which, by their ultrastructure, are most likely the main ones. This was also noted in more remote periods of observation - 30 days (Pic.3.1.30).

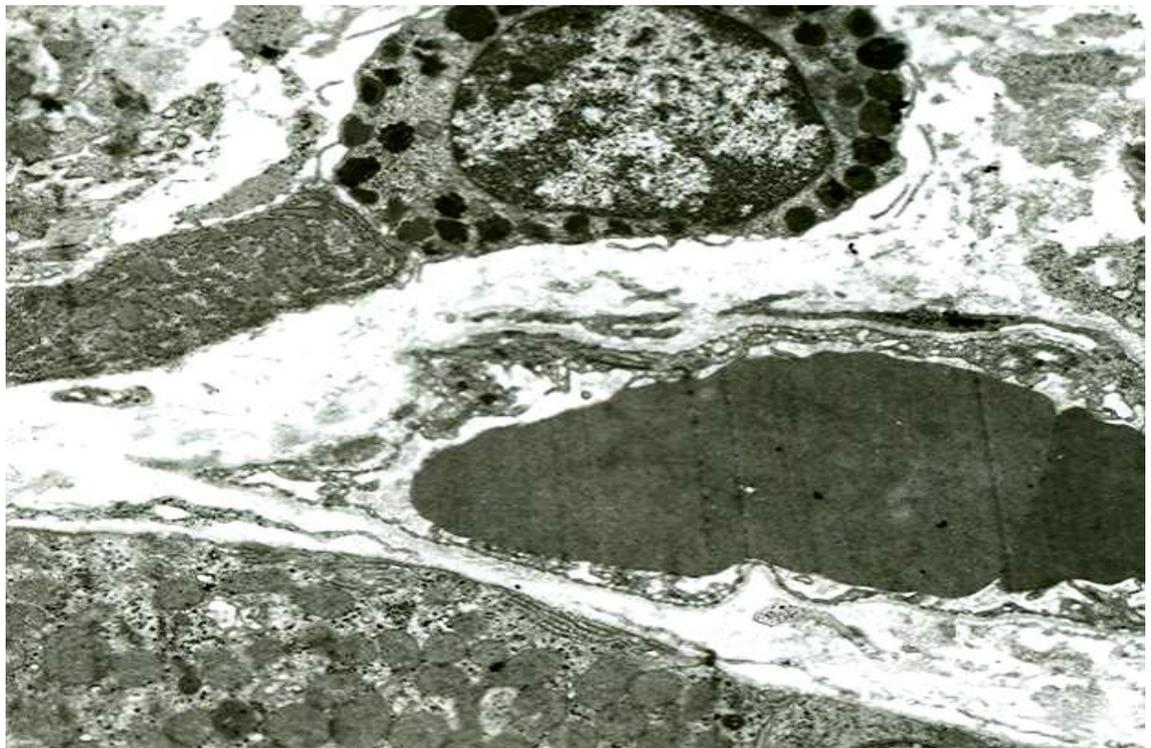
Secretory granules with an electron-dense core are also found at these times in typically chief cells located in the lower third of the body of the fundic glands. The ultrastructure of parietal cells in this zone indicates their high level of functioning. Their intracellular tubules are dilated, the vesicular component dominates in the tubulovesicles (Pic. 3.1.31).

The stroma of the pyloric glands during these periods is somewhat edematous, with moderate infiltration by polymorphic cells of the connective tissue. The lumen of the vessels is not dilated, there are no formed elements in them (Pic. 3.1.32).

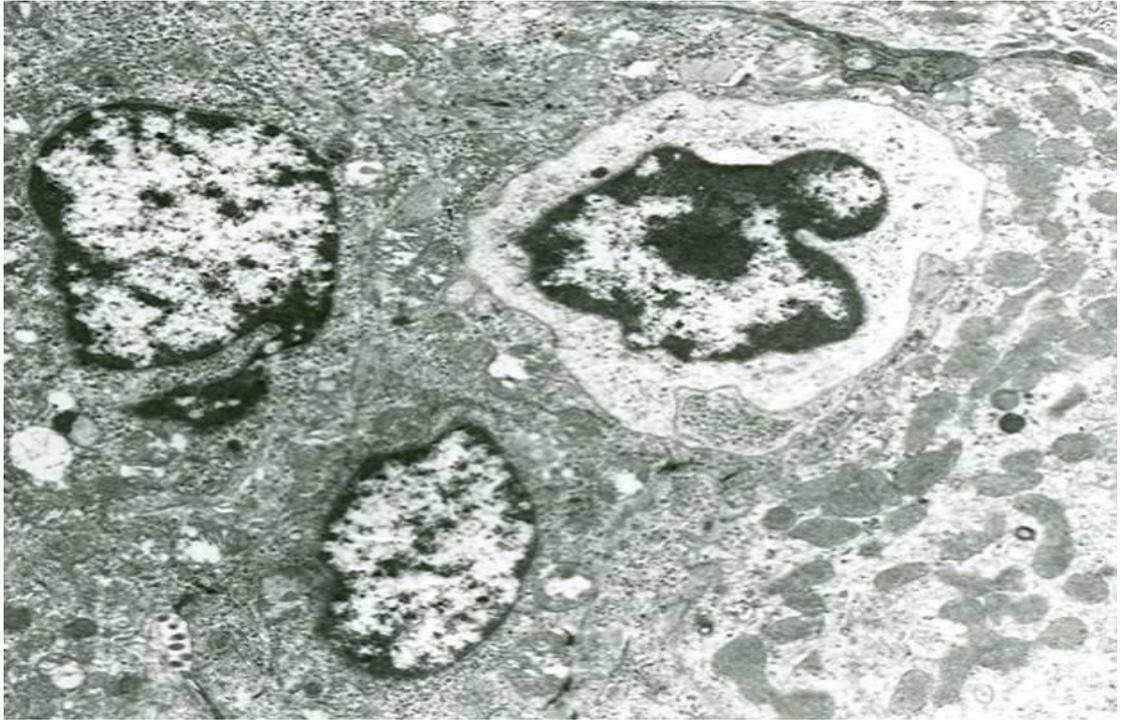
In terms of 30-60 days in the fundus of the stomach, the manifestations of edema and a mild inflammatory reaction, noted in the earlier periods of the study, are not determined. The gastric pits have a normal structure. Only the lumens of individual fundic glands remain dilated. The zone of the main cells is clearly distinguished - the lower third of the body of the glands. However, the zone of additional cells is not clearly identified - the middle third of the body of the glands (Pic. 3.1.33). In the upper third of the body of the fundic gland, parietal cells appear to be medium-sized, with mild cytoplasmic eosinophilia (Pic. 3.1.34).



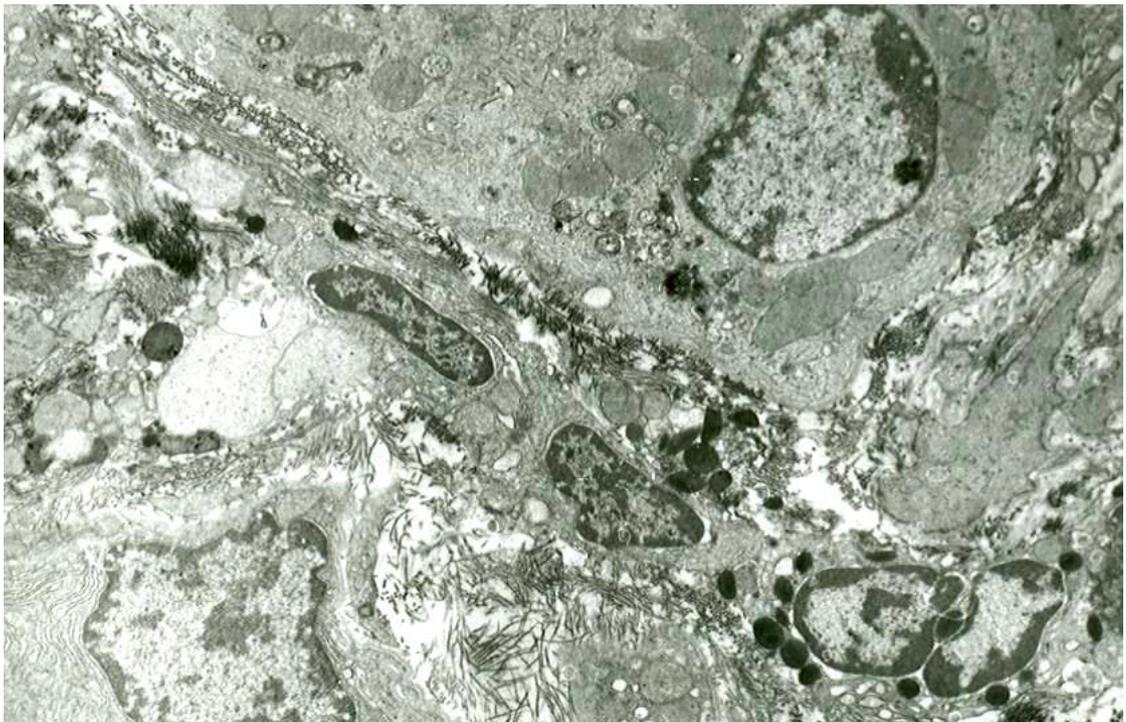
Pic. 3.1.21. Overflow with secretory granules of the apical parts of the integumentary-pit cells. 3 days after total resection of the colon. TEM x 7500.



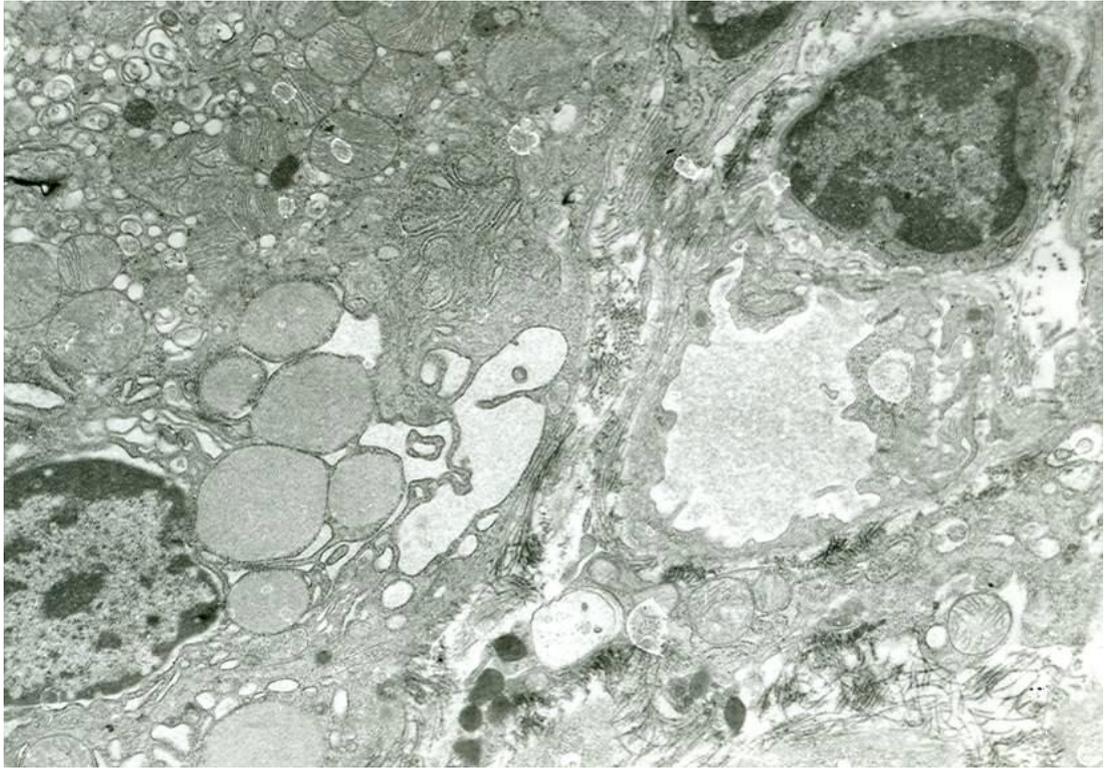
Pic. 3.1.22. Edema of the stroma, expansion of the lumen of the microvessel. 3 days after total resection of the colon. TEM x 7500.



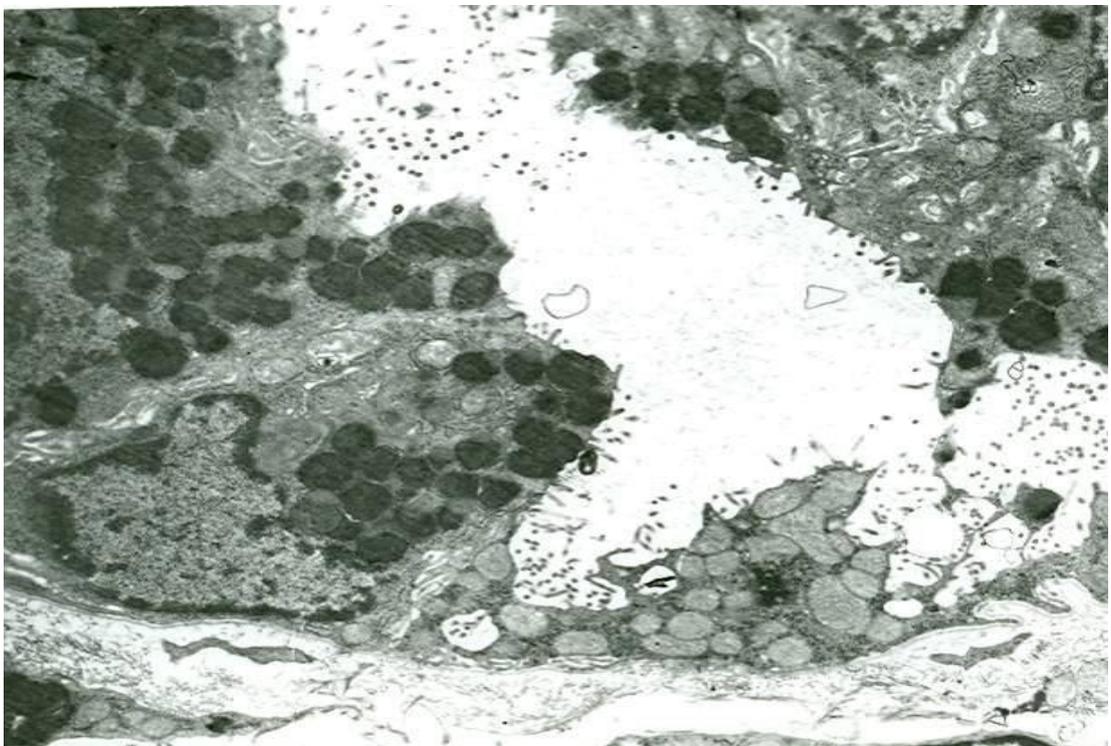
Pic. 3.1.23. Lymphocyte among the epithelial cells of the fundic glands. 3 days after total resection of the colon. TEM x 7500.



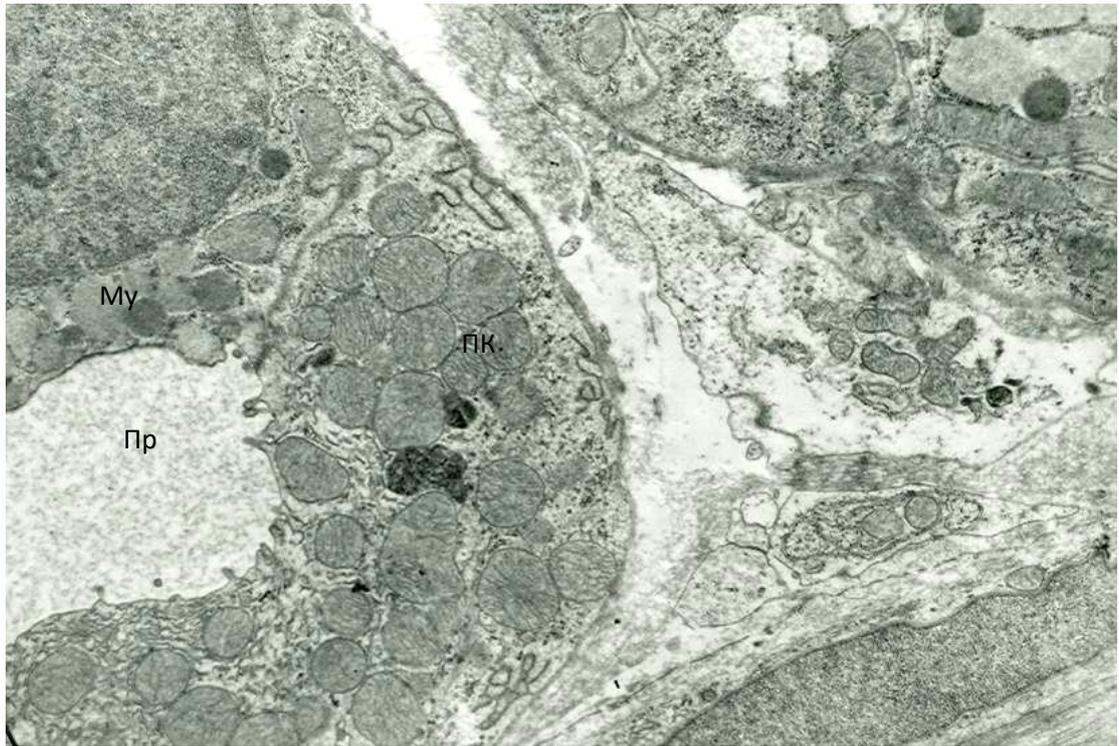
Pic. 3.1.24. Eosinophils of the connective tissue stroma, the release of their secretory granules into the stroma of the fundic glands. 15 days after total resection of the colon. TEM x 7500.



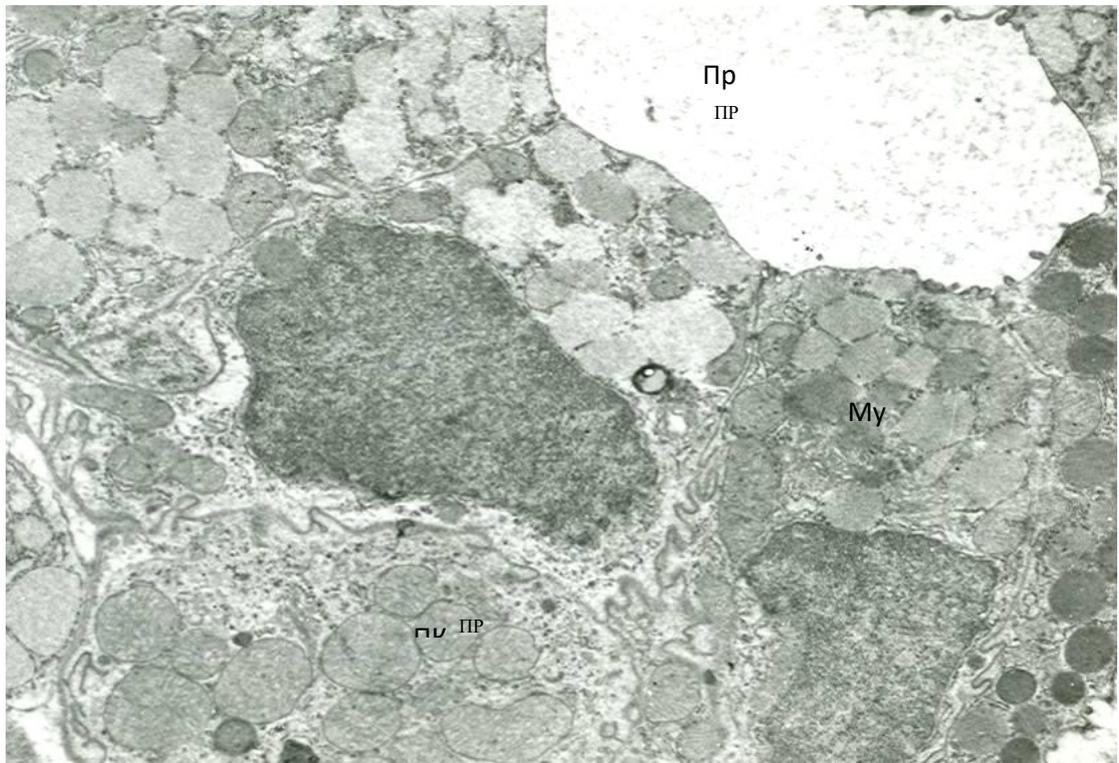
Pic. 3.1.25. Expanded lumen of the microvessel, secretory granules of eosinophils in the stroma of the fundic glands. 15 days after total resection of the colon. TEM x 7500.



Pic. 3.1.26. Mucocytes and parietal cells of the neck of the fundic gland. 15 days after colon resection. TEM x 7500.



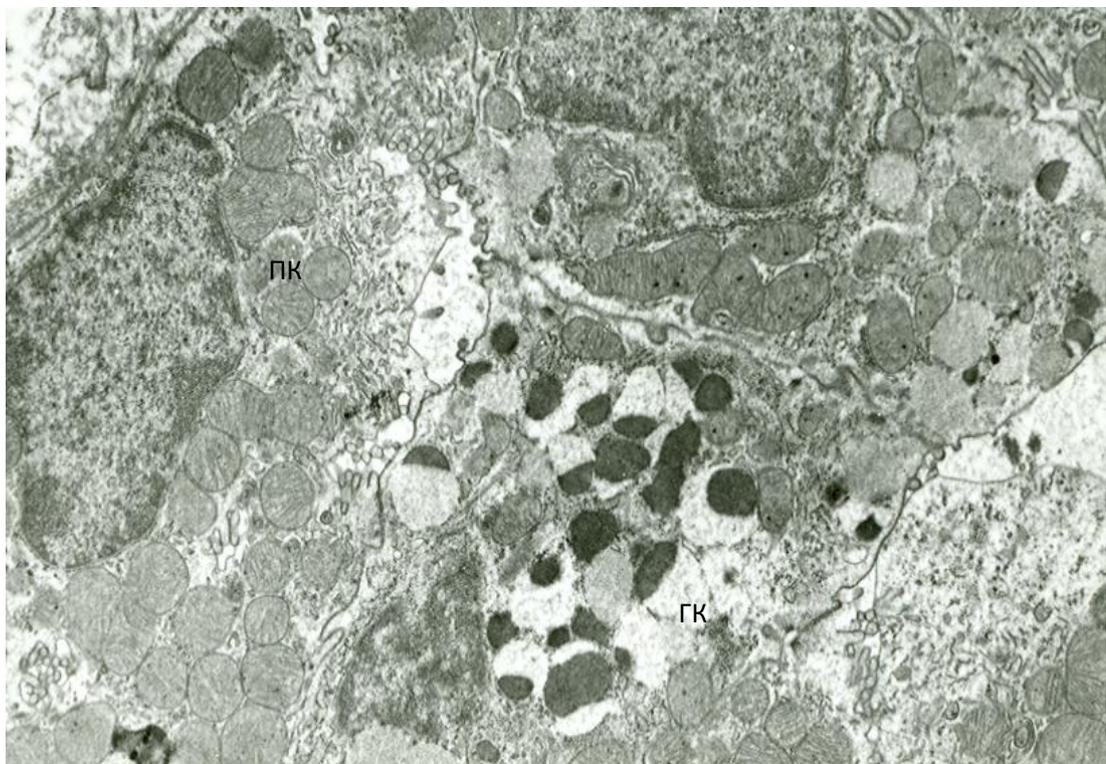
Pic. 3.1.27. Mucocyte and parietal cell of the neck of the fundic gland. 15 days after total resection of the colon. TEM x 15000.



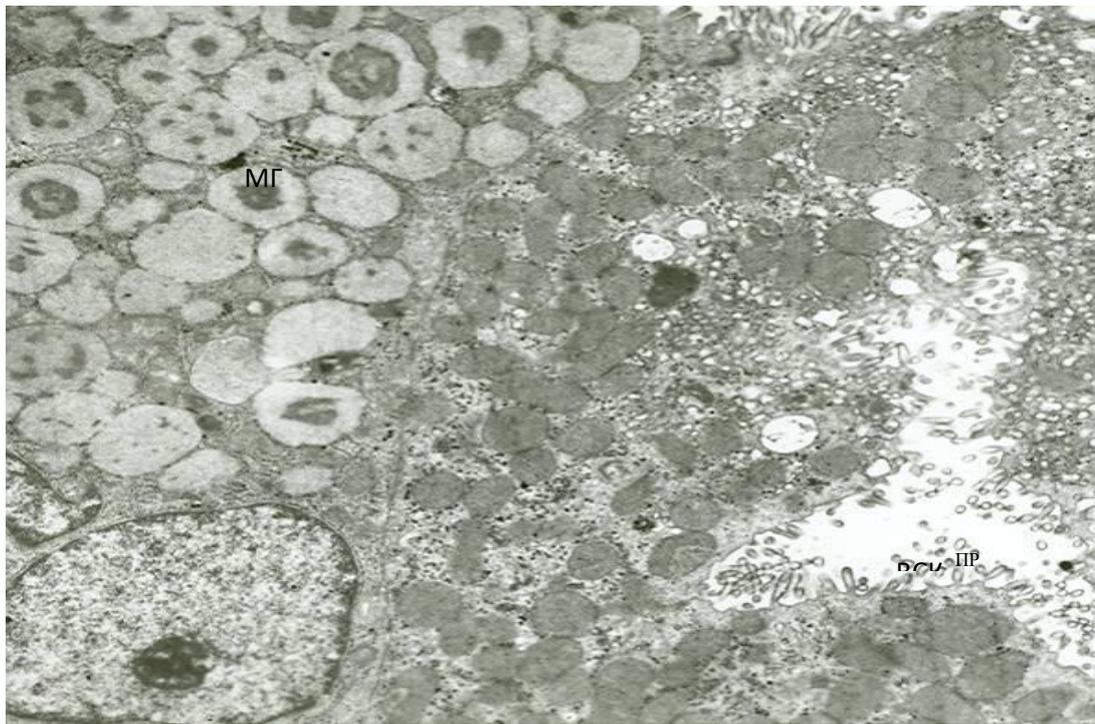
Pic. 3.1.28. Mucocytes and parietal cells of the upper third of the body of the fundic gland, polymorphism of mucoid granules. 15 days after total resection of the colon. TEM x 7500.



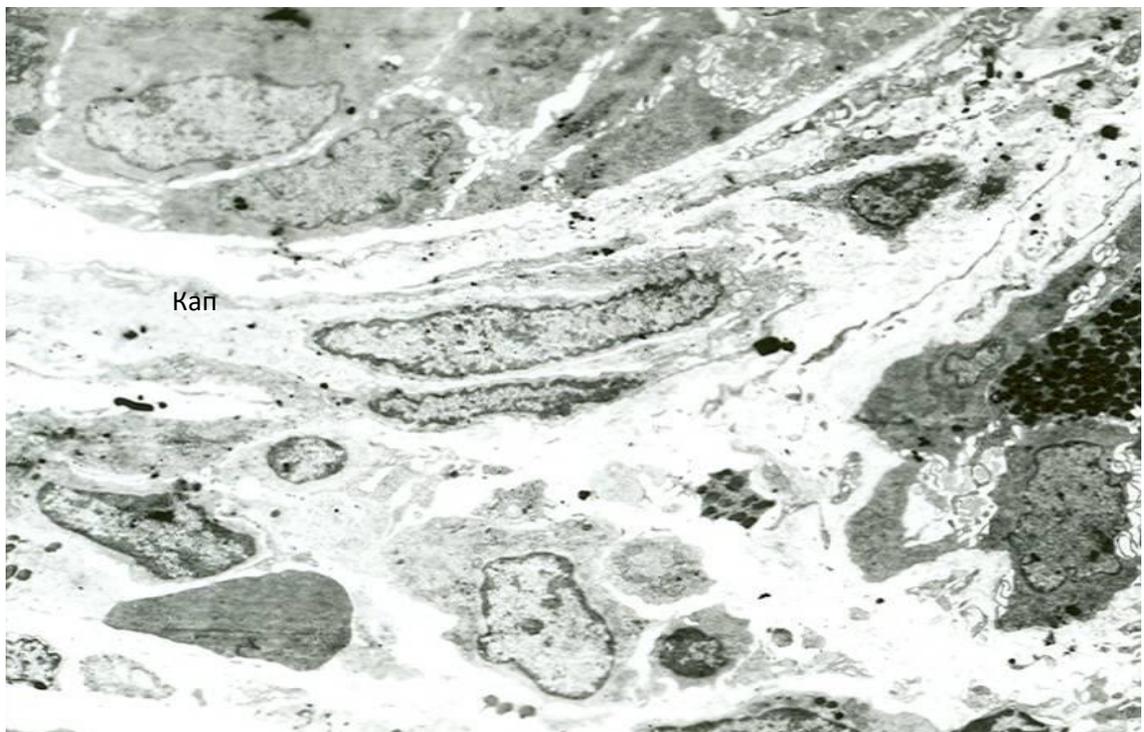
Pic. 3.1.29. Accessory cell of the middle third of the body of the fundic gland, polymorphism of mucoid granules. 15 days after colon resection. TEMx7500.



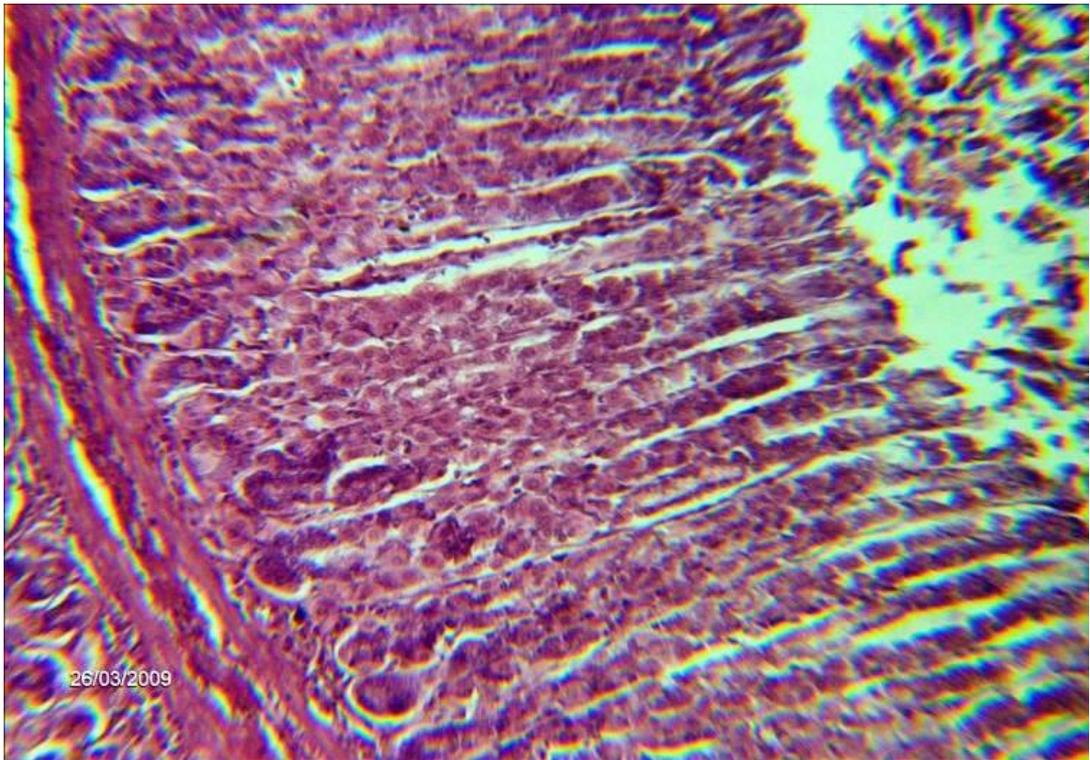
Pic. 3.1.30. The main cell of the middle third of the body of the fundic gland, mixed - granules. 15 days after total resection of the colon. TEM x 7500.



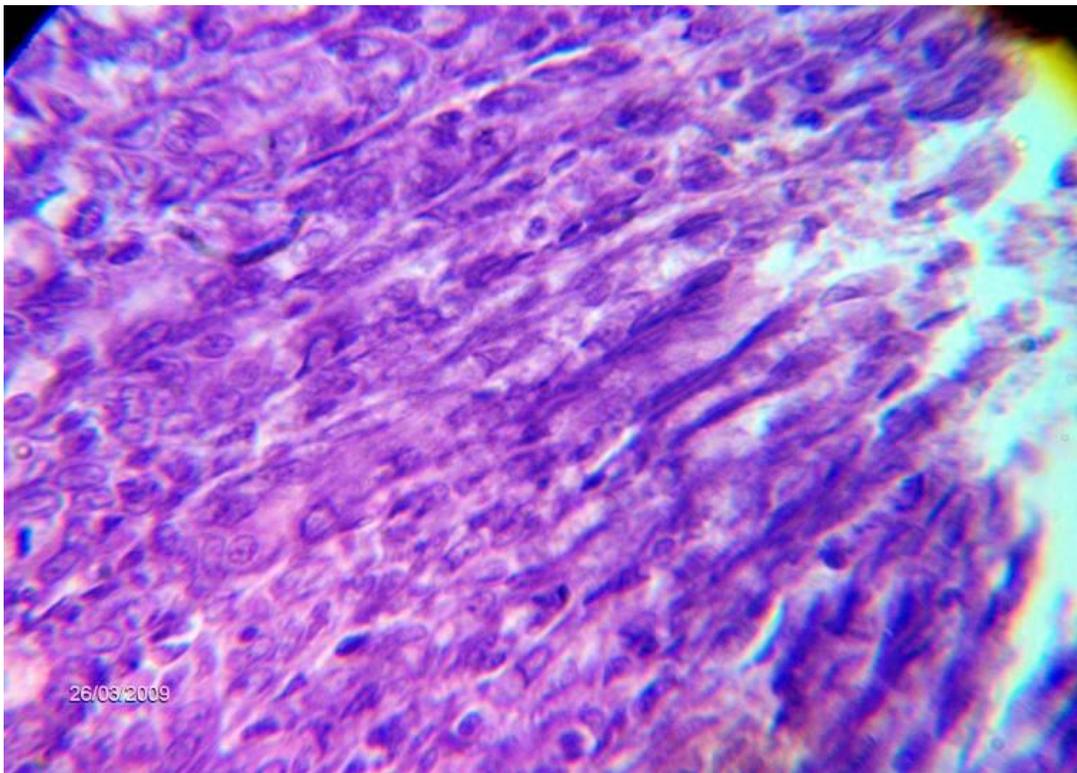
Pic. 3.1.31. The main cell with mixed - granules, parietal with dilated intracellular tubules in the lower third of the body of the fundic gland. 15 days after total resection of the colon. TEM x 7500.



Pic. 3.1.32. Swelling of the stroma of the pyloric gland, connective tissue cells. 15 days after total resection of the colon. TEM x 5000.



Pic. 3.1.33. fundic glands. 30 days after total resection of the colon. G-E. 10x10.

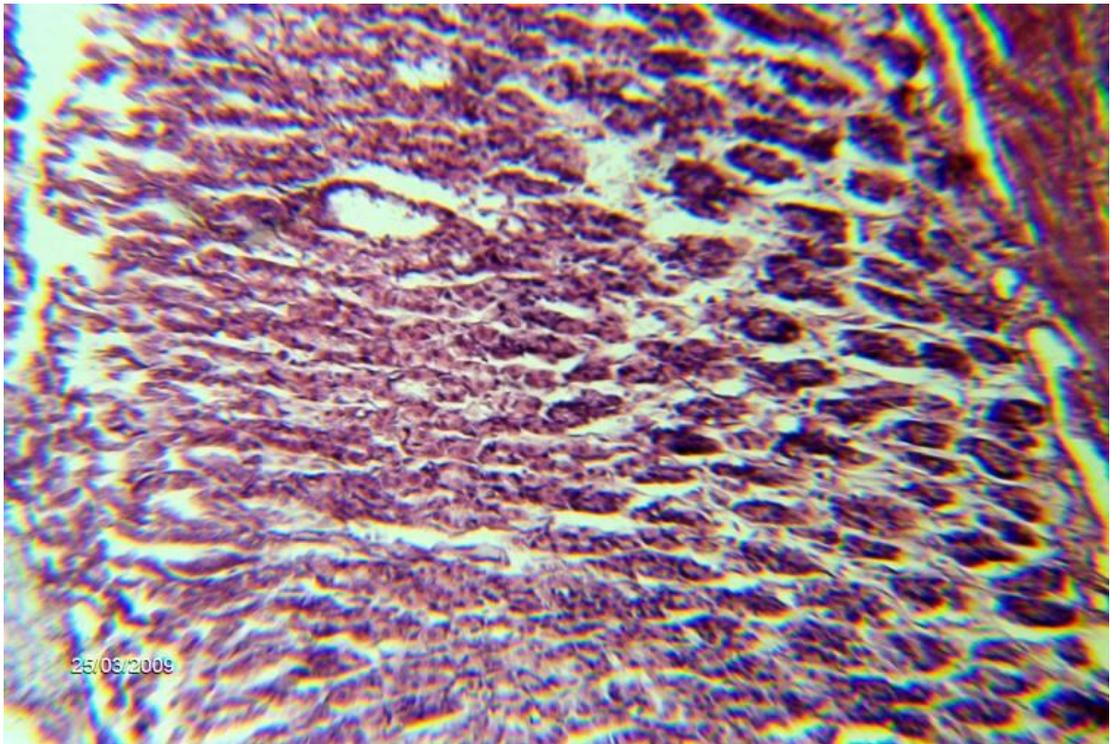


Pic. 3.1.34. Neck area and upper third of the body of the fundic gland. 60 days after total resection of the colon. G-E. 10x10.

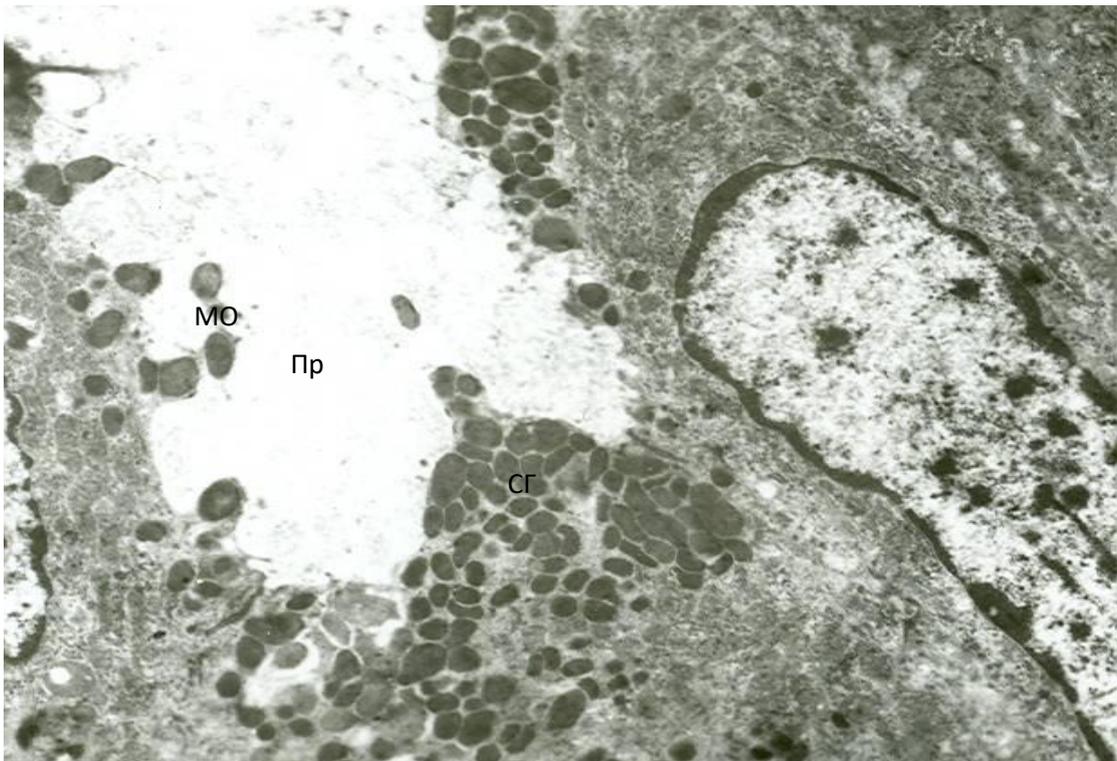
In the area of the pyloric glands, manifestations of a moderate inflammatory reaction are noted. The lumens of the pits and pyloric glands, especially in the terminal sections, are dilated. In the lower part of the fossae are individual parietal cells. The pyloric glands appear somewhat atrophic (Pic. 3.1.35).

Electron microscopic studies of the fundus of the stomach of the glands 1-2 months after resection of the colon reveal a significant increase in the number of so-called parietal microorganisms, that is, microbes located in the immediate vicinity of the plasma membrane or directly on its surface. In this case, the apical parts of the cells, in direct contact with microorganisms, undergo pronounced alteration. Their surface becomes uneven. Protrusions and depressions are noted (Pic. 3.1.36).

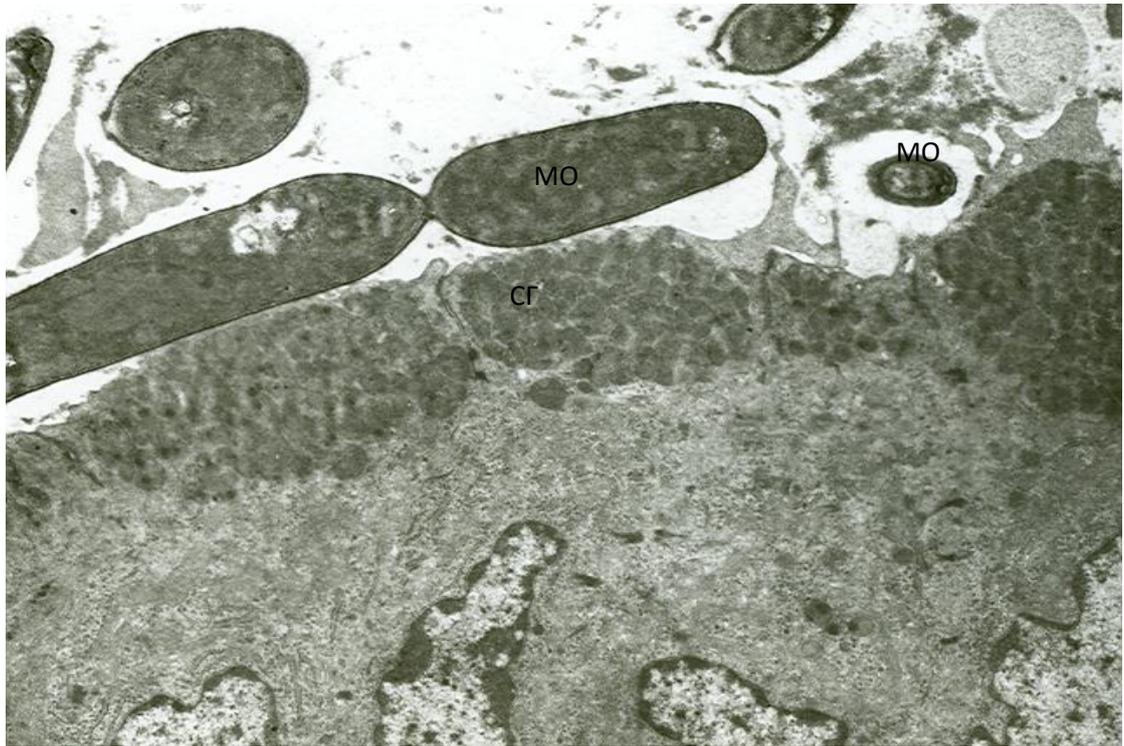
Microorganisms located both in the lumen (luminal microflora) and on the cell surface have different shapes and sizes. Along with large microorganisms, comparable in size to cell nuclei (fungi of the genus *Candida*), there are small microorganisms, most often cocci (Pic. 3.1.36,37). Often microorganisms are in a state of division (Pic. 3.1.37,38). Occasionally, intracellular localization of parietal microorganisms also occurs (Pic. 3.1.38). At the same time, the microbial bodies that have penetrated the cell are surrounded by an enlightenment zone, which is apparently formed due to surfactants on the outer shell of the microbe. An inflammatory reaction in the cytoplasm of cells in response to the penetration of microbes was not detected (Pic. 3.1.38).



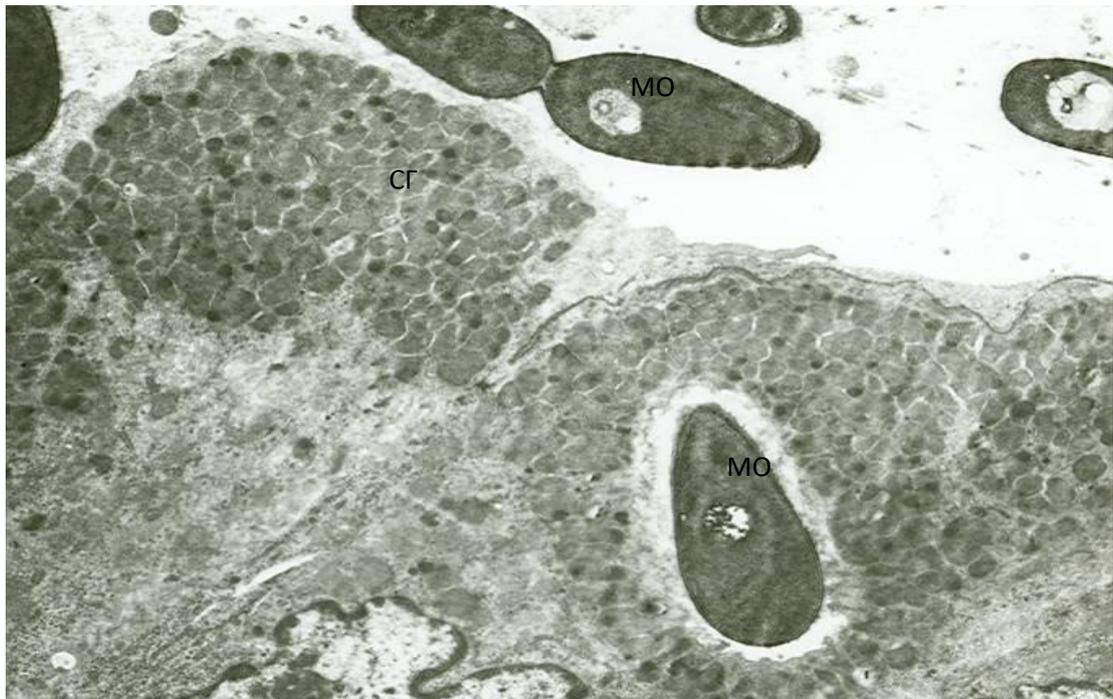
Pic. 3.1.35. Expansion of the lumens of some pyloric glands. 30 days after total resection of the colon. G-E. 10x10.



Pic. 3.1.36. Microorganisms in the lumen of the stomach and on the surface of mucocytes. 30 days after total resection of the colon. TEM x 7500.



Pic. 3.1.37. Microorganisms (fungi such as *Candida*) on the surface of mucosocytes. 60 days after total resection of the colon. TEM x 7500.



Pic. 3.1.38. Microorganisms (*Candida* type fungi) on the surface and in the cytoplasm of mucocytes. 60 days after total resection of the colon. TEM x 7500.

On the 60th day after resection of the colon in the cytoplasm of the main cells, a large number of characteristic secretory granules are located, structures for

synthesis and secretion are well developed. The parietal cells located in the lower third of the body of the fundic glands have well-developed secretory tubules, many mitochondria and tubulovesicles (Pic. 3.1.39, 40).

At the same time, chief cells with the granules described above with a heterogeneous structure are also found here (Pic. 3.1.40).

Scanning electron microscopy also revealed round-oval bodies on the apical parts of the superficial pit cells, which are apparently Candida-type fungi (Pic. 3.1.41).

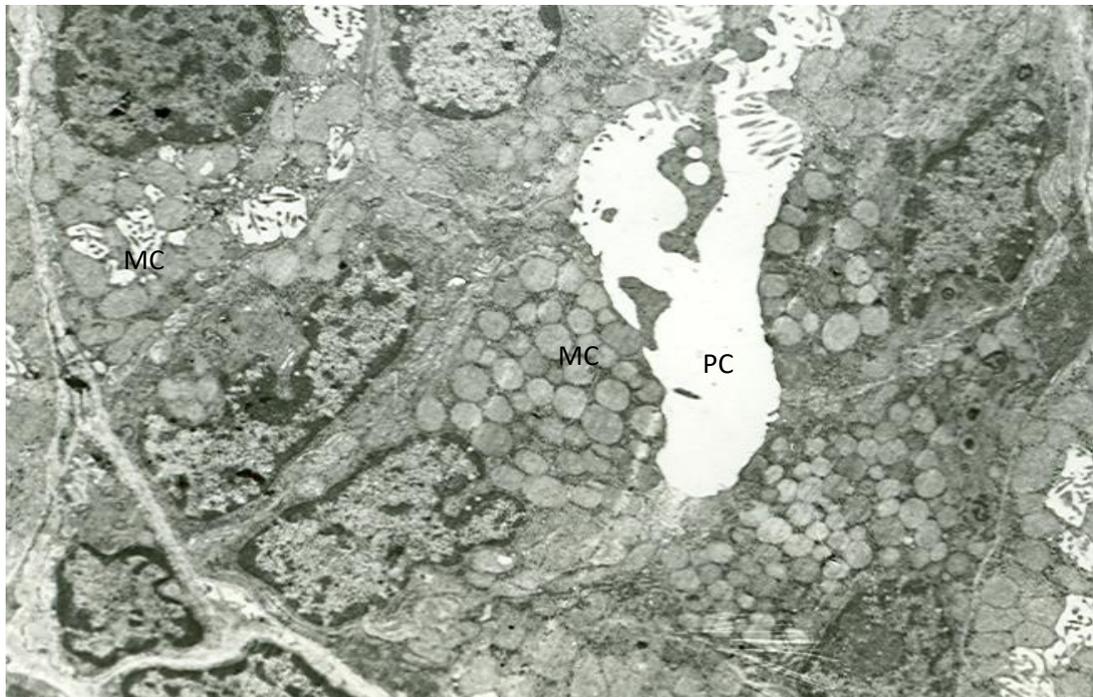
On days 90-180 after resection of the colon, the mucosa of the fundus appears to be thickened with clearly defined zones of the necks, additional cells and dominance of the main cells (Pic. 3.1.42.43). In the region of the necks, rather large cells with eosinophilic cytoplasm are determined (Pic. 3.1.44). At the bottom of the glands, there is a slight increase in the number of chief cells and very numerous large parietal cells (Pic. 3.1.45).

Electron microscopic studies show that 3-6 months after resection of the colon, at the bottom of the fundic glands, chief cells with large secretory granules concentrated in the apical part of the cytoplasm are located. Developed profiles of the granular endoplasmic reticulum surround large rounded nuclei, located in the basal part of the cell. The Golgi complex is usually located in the supranuclear zone (Pic. 3.1.46). At the bottom of the fundic glands, endocrine cells of various types are often found. The lumen of the glands is somewhat dilated (Pic. 3.1.46).

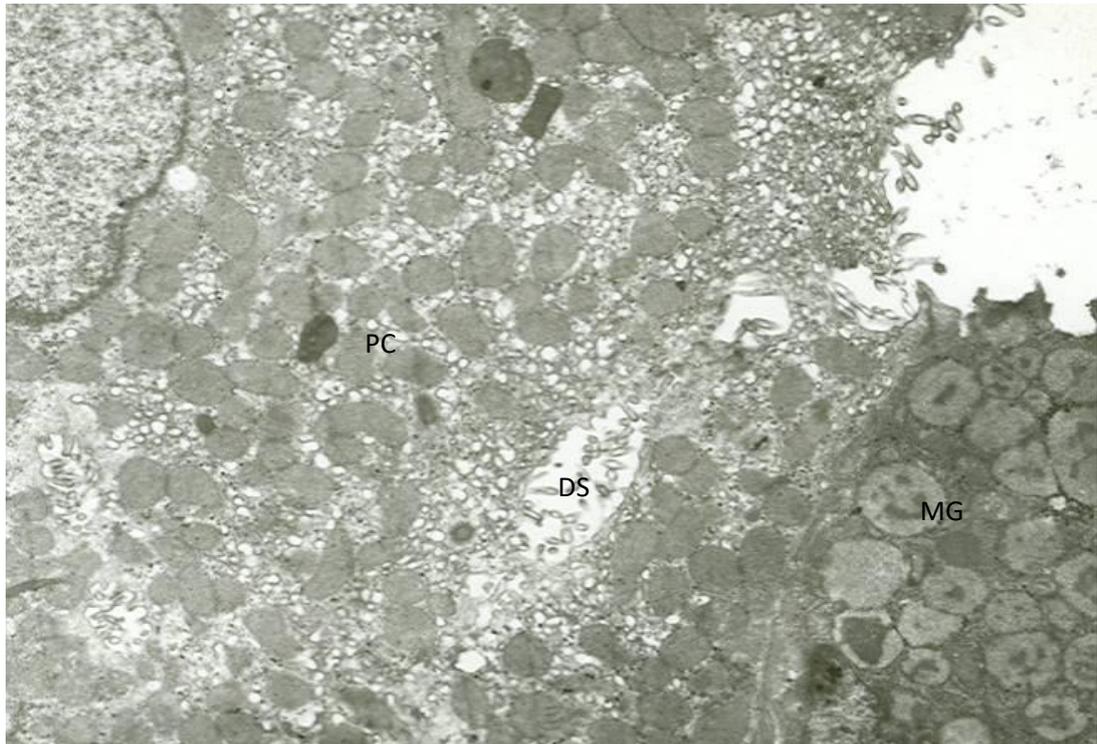
In the stroma of the fundic glands, signs of inflammation are not determined during these periods. Endotheliocytes of the vessels of the microvasculature have a normal ultrastructure. Often their surface is uneven, due to numerous processes of the inner surface of the endothelium (Pic. 3.1.47). In some chief cells, the basally located profiles of the granular endoplasmic reticulum are expanded and filled with a characteristic electron-light flocculate (Pic. 3.1.48). All this is a morphological sign of high secretory activity of chief cells.

The ultrastructure of most parietal cells also indicates their high functional activity. This manifests itself in dilated secretory tubules with a large number of microvilli, dominance of the vesicular component in tubulovesicles, and a large number of mitochondria (Pic. 3.1.49). However, even during these periods, there are individual chief cells containing granules of a heterogeneous structure (Pic. 3.1.50).

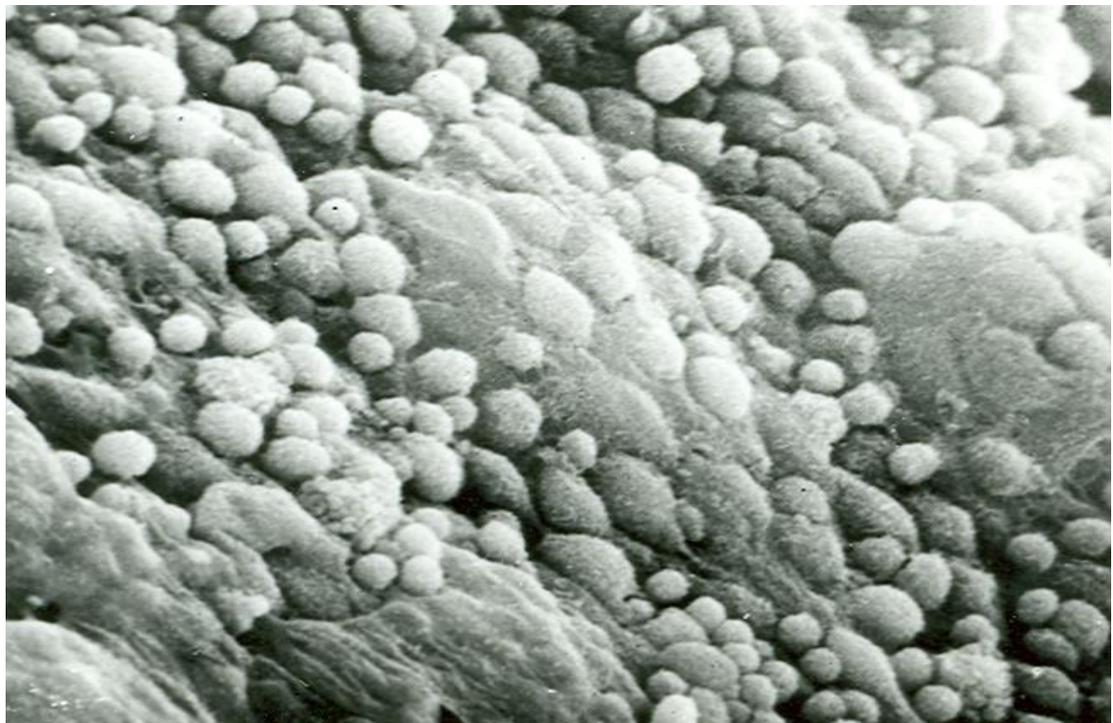
In the middle third of the body of the fundic glands, the cytoplasm of most additional cells contains a characteristic secret in the form of secretory granules merging with each other. These granules in individual cells may differ in their electron density (Pic. 3.1.51).



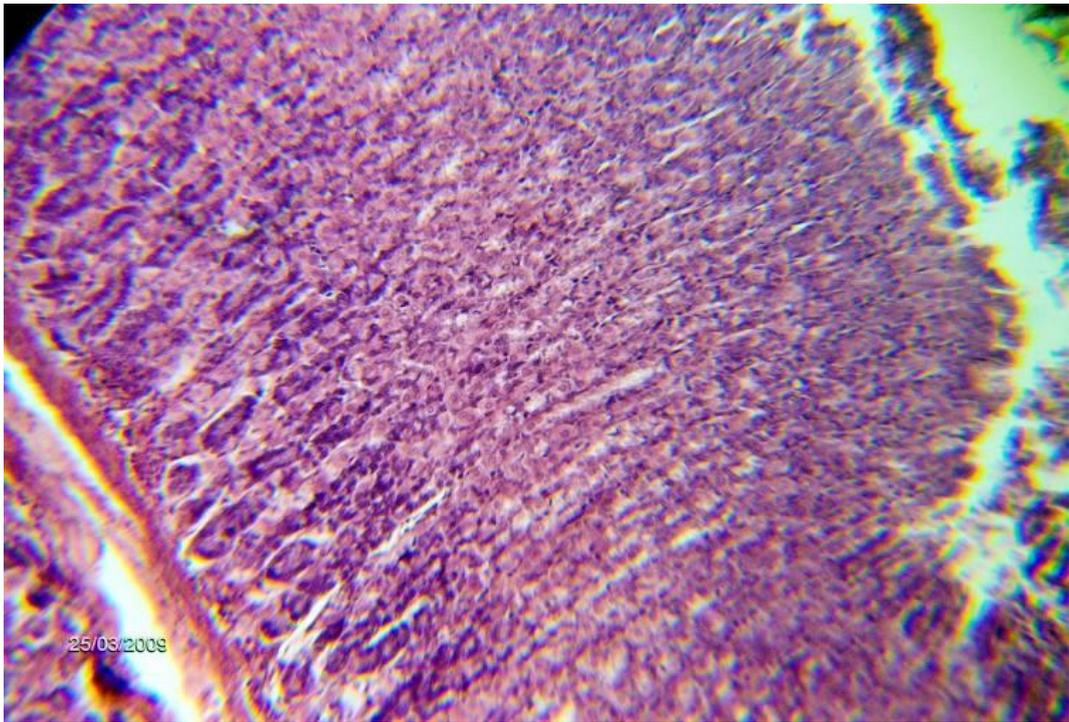
Pic. 3.1.39. The main and parietal cells of the lower third of the body of the fundic gland with developed structures. 60 days are after total resection of the colon. TEM x 5000.



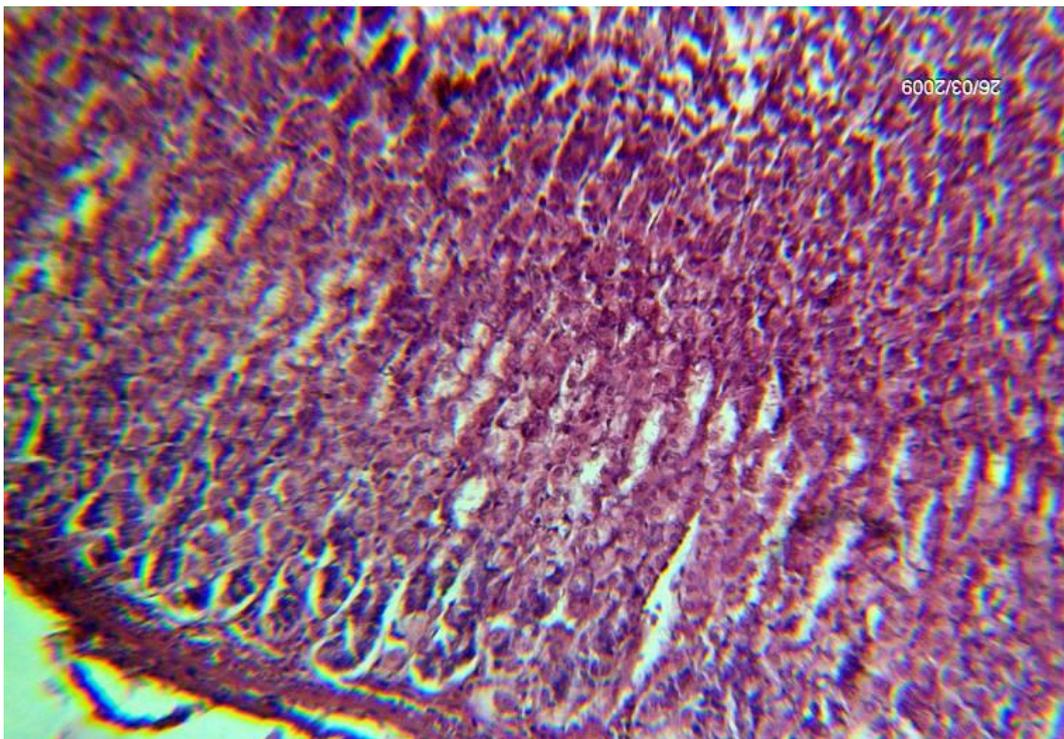
Pic. 3.1.40. Parietal cell with developed structures and the main one with mixed granules in the lower third of the body of the fundic gland. 60 days after total resection of the colon. TEM x 5000.



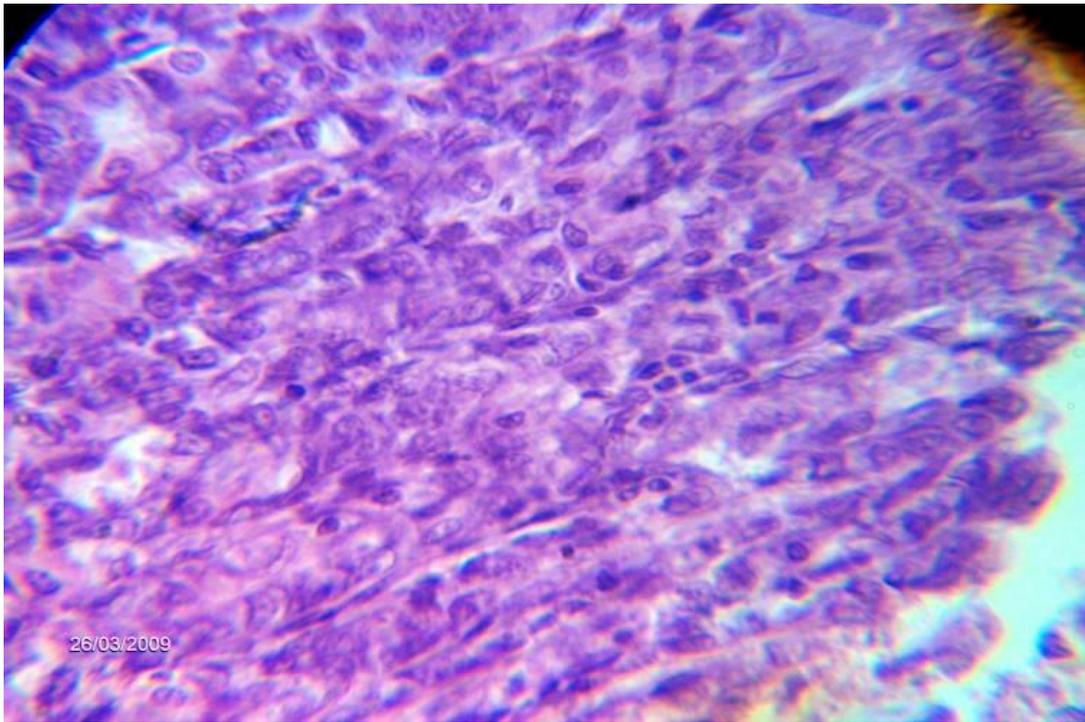
Pic. 3.1.41. Microorganisms on the surface of mucocytes of the fundus of the stomach. After 60 days resection of the colon. SAM x 1000.



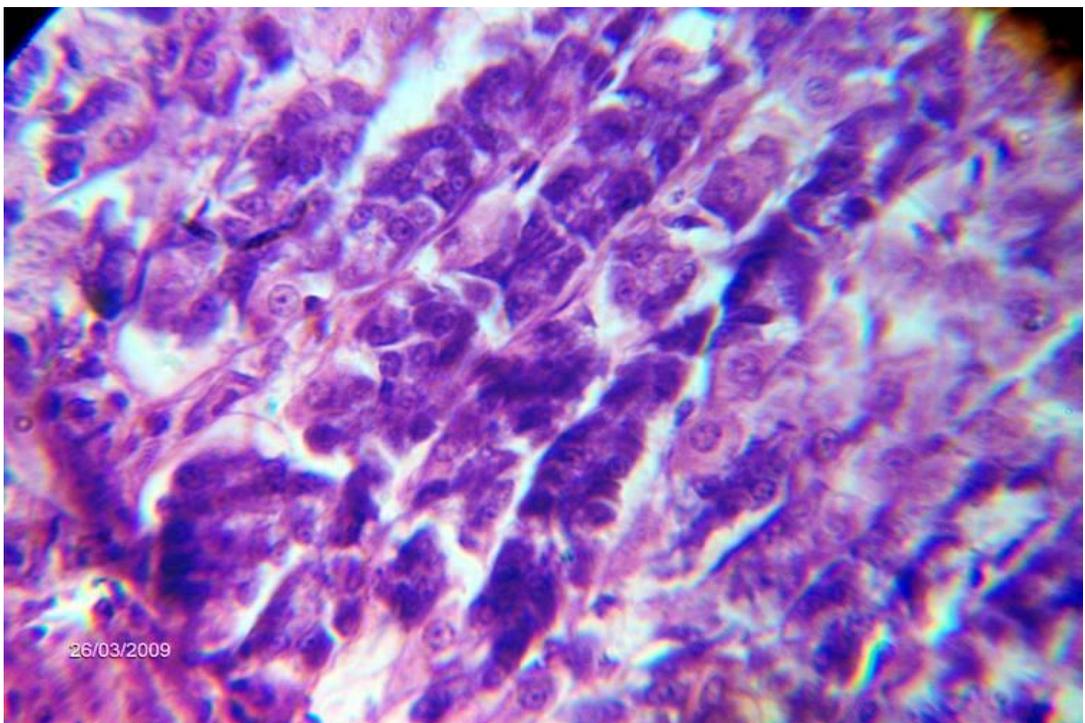
Pic. 3.1.42. Hypertrophic mucosa of the fundus of the stomach. 90 days after total resection of the colon. G-E.10x10.



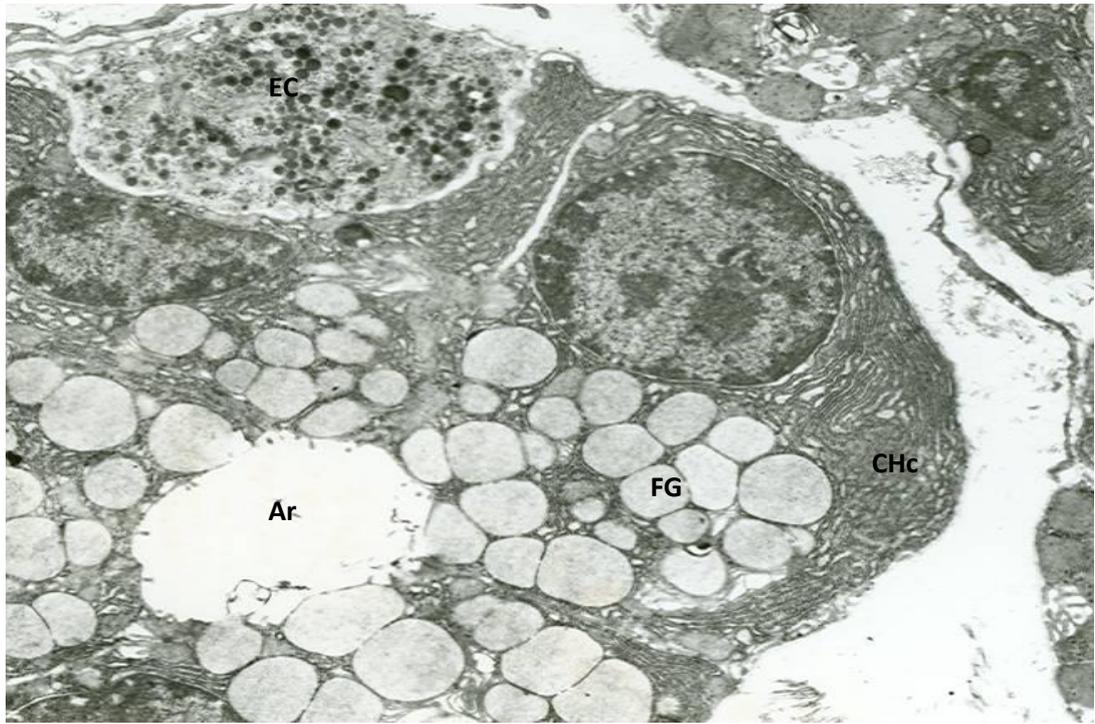
Pic. 3.1.43. Hypertrophied mucosa of the fundus of the stomach with a distinct zone of additional cells. 180 days after total resection of the colon. G-E. 10x10.



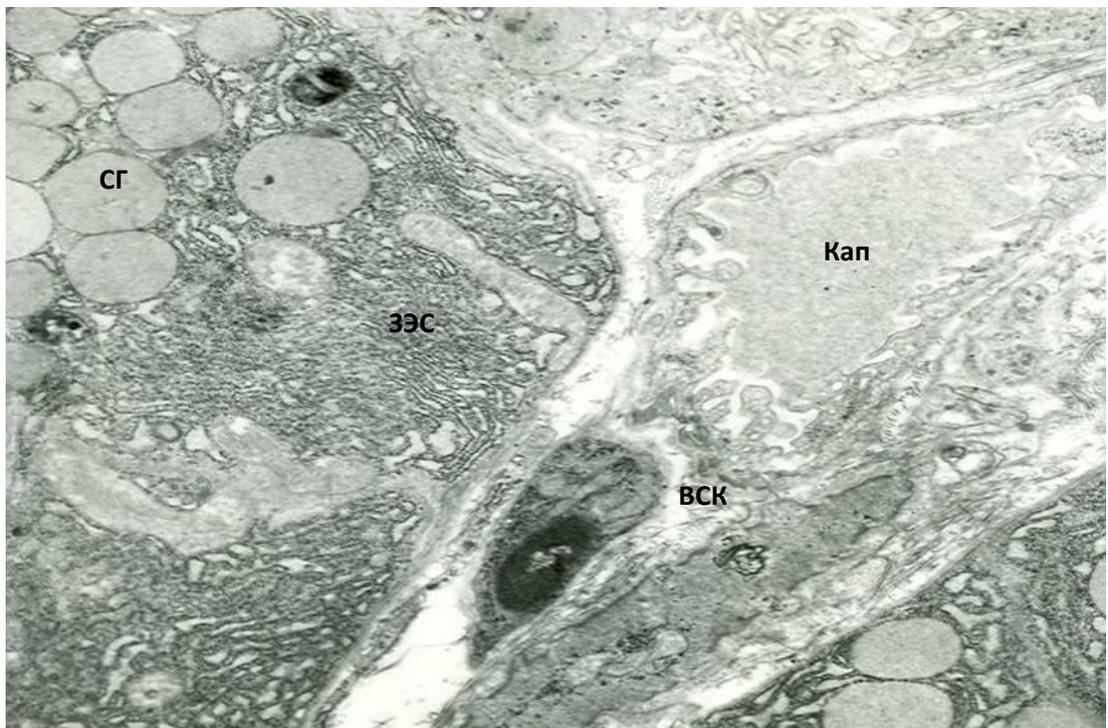
Pic. 3.1.44. Neck of the fundic gland with large parietal cells. 180 days after total resection of the colon. G-E. 10x10.



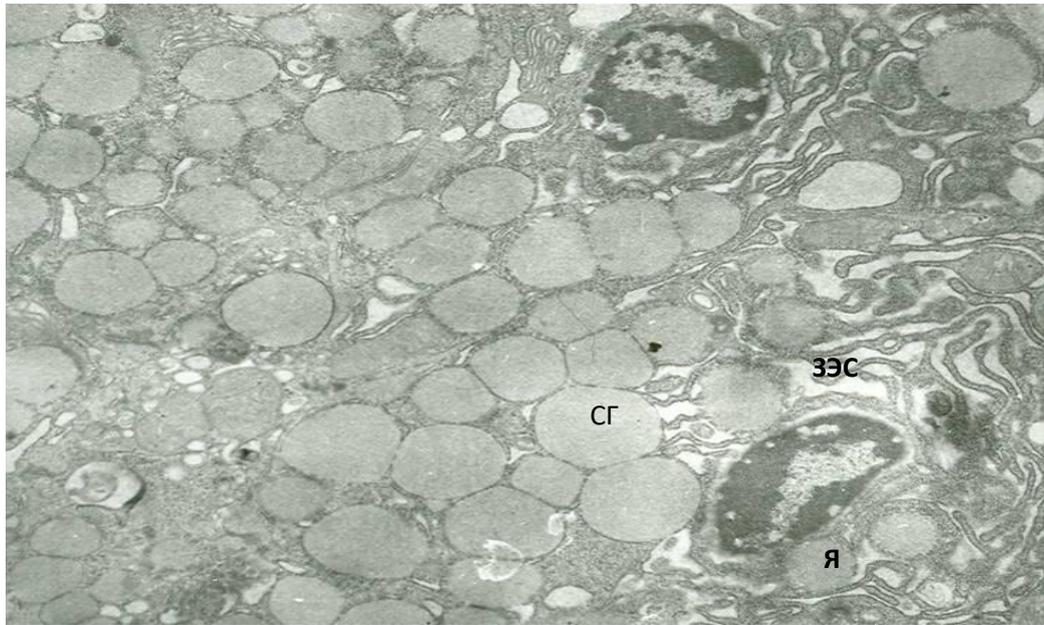
Pic. 3.1.45. The bottom of the fundic gland with large chief, parietal cells. 180 days after total resection of the colon. G-E. 10 x 10.



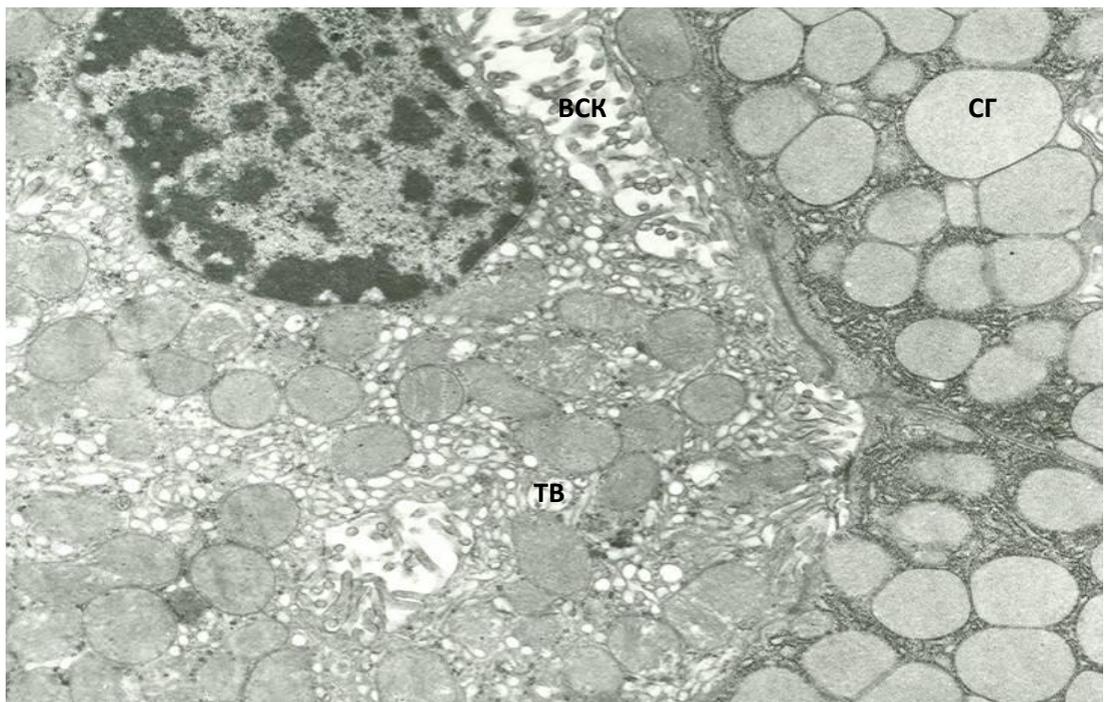
Pic. 3.1.46. Chief cells with developed structures for synthesis and secretion. endocrine cell. The bottom of the fundic gland. 180 days after total resection of the colon. TEM x 7500.



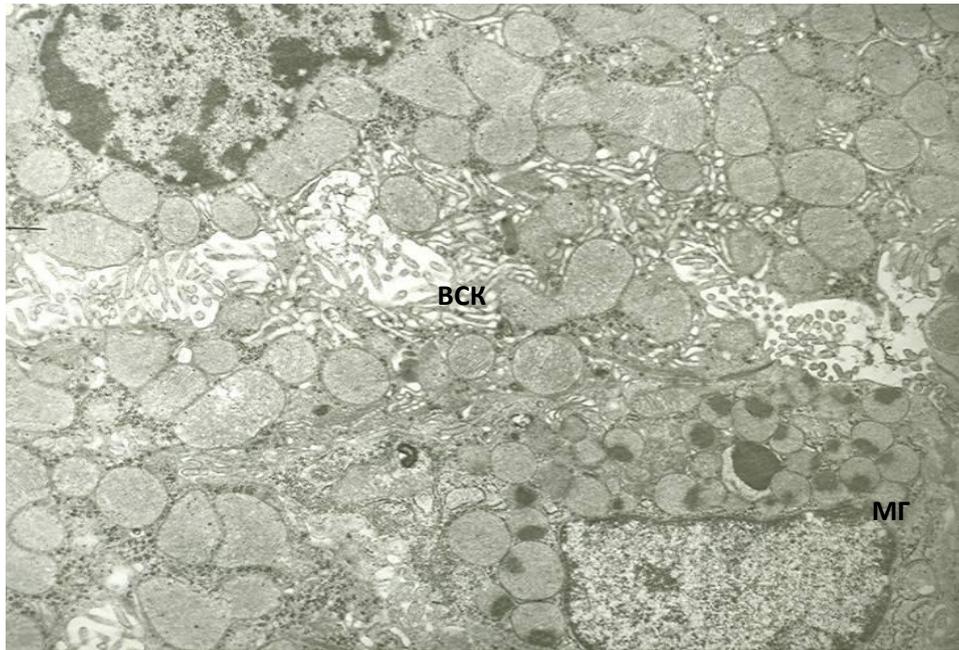
Pic. 3.1.47. Chief cells with developed structures for synthesis and secretion. Microvessel. The bottom of the fundic gland. 180 days after total resection of the colon. TEM x 10000.



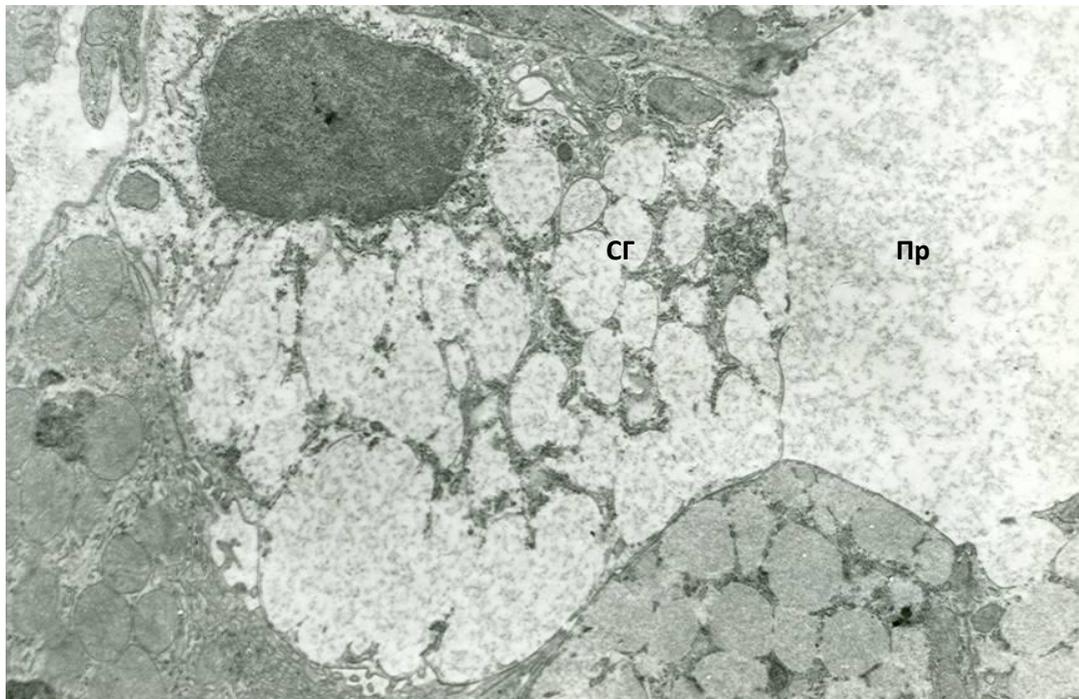
Pic. 3.1.48. Chief cells with developed structures for synthesis and secretion. The bottom of the fundic gland. 180 days after total resection of the colon. TEM x 10000.



Pic. 3.1.49. Chief and parietal cells with developed structures. The lower third of the body of the fundic gland. 180 days after total resection of the colon. TEM x 10000.



Pic. 3.1.50. Parietal cell with developed structures, the main cell with heterogeneous granules of the lower third of the body of the fundic gland. 180 days after total resection of the colon. TEM x 10000.



Pic. 3.1.51. Additional cells with polymorphic mucoid granules in the middle third of the body of the fundic gland. 180 days after total resection of the colon. TEM x 10000.

3.2. Morphometry of the gastric mucosa in dynamics after total resection of the large intestine

Microscopic studies have shown that after resection of the colon, the fundus plays the main role in the development of adaptive reactions in the stomach. This is quite logical, since this section determines the functional specificity of the organ. The morphometric studies of the linear dimensions of the fundic section of the gastric mucosa showed that in the control its thickness is 572.1 ± 3.3 microns. At the same time, the thickness of the proper connective tissue plate is 484.6 ± 3.8 μm , the muscular and submucosal layers are 78.9 ± 1.1 and 147.8 ± 1.7 μm , respectively. The depth of the gastric pits is 53.1 ± 0.8 μm (Table 3.2.1).

In control rats (normal) the total number of cells in the gland and pits is 120.7 ± 1.7 , in the fossa 30.2 ± 0.4 , in the gland 90.5 ± 1.3 . At the same time, the neck contains on average 5.7 ± 0.2 cells. Additional cells - 18.9 ± 0.3 , main - 38.2 ± 0.5 , parietal - 27.7 ± 0.4 (Table 3.2.2).

3 days after the operation, there is a thickening of the mucous membrane of the fundus of the stomach, which reaches 645.9 ± 2.8 μm , while the control is 572.1 ± 3.3 μm , $P < 0.05$. At the same time, the thickness of its own connective tissue plate, muscle and submucosal layers increases (Table 3.2.1). This thickening, as shown by light-optical studies, is mainly associated with edema of these layers.

The gastric pits deepen significantly, with a slight change in the length of the glands (Table 3.2.1).

The average number of cells in the fundic gland is 94.0 ± 1.1 . At the same time, the number of cells increases mainly due to an increase in the number of cervical (almost two times) and additional (1.5 times), that is, mucus-forming cells. The number of the main and parietal cells, on the contrary, decreases (Table 3.2.2).

7 days after the total resection of the colon, the thickness of the mucous membrane of the fundus of the stomach slightly increases due to a moderate

thickening of all layers. The increase in the length of the fundic glands occurs mainly due to the deepening, almost 1.5 times, of the gastric pits.

This trend increases 15 days after resection (Table 3.2.1). The calculation of the number of cells showed that the number of cervical cells increased to the greatest extent (almost three times). The increased number of additional cells is preserved, while the number of main and parietal cells remains reduced (Table 3.2.1)

Fifteen days after the operation, the trend towards an increase in the thickness of the mucosa (mainly due to edema of all layers) continues to persist. This is especially clearly reflected in the thickness of the own connective tissue plate and the depth of the gastric pits. (Table 3.2.1). Quantitative cell count showed that the deepening of the glands occurs mainly due to an increase in the number of cervical and accessory cells, with a decrease in the number of main and parietal ones (Table 3.2.2).

Morphometric studies on the 30th day after the operation showed that the progressive increase in the thickness of the mucous membrane stops, and the thickness of the proper connective tissue plate even tends to decrease (Table 3.2.1). The depth of the fundic glands is continuing to increase.

Counting the cells of the fundic glands and pits showed that 30 days after resection of the colon, there is a tendency to reduce the number of cervical and additional cells in the pits, that is, mucus-forming cells. At the same time, there is an increase in the number of main and parietal, that is, specialized cells of the fundic glands (Table 3.2.2).

60 days after the operation, the thickness of the mucous membrane of the fundus of the stomach decreases and approaches the control values. This is mainly due to the disappearance of edema, which ultimately leads to a decrease in the thickness of its own connective tissue plate. The gland depth indicators, as in the previous observation period, remain high. There is a further trend towards an increase in the number of parietal and, especially, chief cells (tab. 3.2.1, 3.2.2).

90 days after resection, there is a tendency to a further decrease in the total thickness of the mucous membrane. At the same time, the depth of the gastric pits decreases, but the depth of the fundic glands increases significantly (Table 3.2.1). The quantitative ratios of cells in the gastric pits and fundic glands remain practically the same as in the previous period. At the same time, the number of chief and parietal cells remains elevated compared to the control. All this suggests that the adaptive rearrangements in the gastric mucosa by this time after the operation are largely stabilized.

Further observations on the 180th day after the operation confirm the idea of stabilization of adaptive rearrangements. During this period, the general morphometric parameters of the mucous membrane of the fundus of the stomach almost do not differ from those in control animals.

The conducted stereomorphometric studies showed that in control animals the main mass of parietal cells is concentrated in the middle third of the body of the fundic gland and their relative volume fraction is 11.6%. The main cells are concentrated mainly in the lower third of the body of the gland, where their relative volume fraction is 17.7% (Table 3.2.5).

3 days after resection of the colon in the fundic glands, the relative volume fraction of parietal cells in the upper third of the body of the gland (almost 4 times) and in the lower third is significantly reduced. In the middle third, the relative volume fraction of the chief cells is almost halved. Their volume also decreases in the lower third of the body of the glands (Table 3.2.5).

During this period, there is an increase in the volume fraction of all mucus-forming cells: the volume of integumentary-pit cells increases from 16.7 to 26.4%, cervical - from 8.4 to 14.2%. (tab. 3.2.6). In other words, there is a shift towards an increase in the proportion of mucus-forming cells due to a decrease in the relative volume fraction of the main and parietal cells (Table 3.2.5).

After 15 days, the relative volume fraction of parietal cells in the upper and lower thirds of the glands increases. The relative volume fraction of the main cells also increases, especially in the middle third of the glands (Table 3.2.5).

An increase in the volume fraction of the main and parietal cells is accompanied by a tendency to a decrease in these indicators of mucus-forming cells (Table 3.2.5, 3.2.6).

30 days after the total resection of the colon in the fundic glands, there is a significant increase in the relative volume fraction of parietal and chief cells. The volume fraction of parietal cells especially clearly increases in the middle and lower third of the body of the glands, where these figures exceed the corresponding data in the control. Similarly, the volume fraction of chief cells increases (Table 3.2.5). In parallel with this, there is a decrease in the volume fraction of mucus-forming cells in various parts of the body of the fundic glands (Table 3.2.6).

The revealed trend persists in the more distant periods of the study - 60-180 days after the operation (Table 3.2.5, 3.2.6).

Thus, the data obtained by us made it possible to establish a certain dynamics of rearrangements in the gastric mucosa, which are associated with the absence of the colon after its resection. We have found that under the new conditions, with an increase in the functional load, the main and parietal cells of the stomach, which perform its specific function, undergo the greatest restructuring. This is preceded by hyperplasia and high functional activity of mucus-producing cells in the early stages after colectomy, which is a kind of protective reaction of the organ to surgery.

Table 3.2.1

Morphometric parameters of the mucosa and submucosa of the fundus of the stomach in rats in dynamics after total resection of the large intestine (in microns).

G	Thickn	Thickn	Thi	Thi	Dep	Hei
roups of animals	ess of the mucous membrane	ess of the lamina propria	ckness of the muscular lamina	ckness of the submucosa	th of the gastric pits	ght of the integumentary cells

Control	C	572,1±	484,7±	78,9	147,	53,1	8,5
n = 9		3,3	3,8	±1,1	8±1,7	±0,8	±0,2
3 days	3	645,9±	551,0±	87,4	154,	88,2	7,5
n = 15		2,8*	2,9*	±0,9*	3±1,5	±1,1*	±0,1
7 days	7	673,1±	576,0±	89,3	160,	89,8	7,8
n = 12		4,0*	3,9*	±1,2*	0±2,1*	±1,2*	±0,1
15 days	15	681,6±	582,1±	90,6	157,	92,1	8,9
n = 12		2,8*	2,8*	±1,2*	9±2,0*	±1,3*	±0,1
30 days	30	681,5±	582,3±	88,6	161,	88,3	10,
n = 15		2,9*	2,9*	±1,1*	3±1,5*	±1,1*	6±0,1*
60 days	60	651,4±	553,4±	87,6	161,	90,5	10,
n = 12		3,3*	3,1*	±1,2*	7±1,5*	±1,2*	4±0,1*
90 days	90	631,8±	539,9±	82,1	162,	63,7	9,8
n = 12		4,1	2,7	±1,1	5±1,1*	±0,8	±0,1*
180 days	180	627,4±	538,2±	80,0	160,	61,2	9,2
n = 12		3,1	2,7	±0,8	8±1,8*	±0,8	±0,1

Note: * - Differences are significant in relation to control (P<0.05).

n - Number of animals.

Table 3.2.2.

The number of epithelial cells of the mucous membrane of the fundus of the stomach in rats in dynamics after total resection of the colon (M±m).

Groups of animals	Number of cells in one fossa and Integumentary pit cells	Cells of the fundus gland	Cells of the fundic gland					Glandular pit index (PPI)
			Total number	Cervical	Accessory	Main	Parietal	
Control n = 9	120, 7±1,7	30,2 ±0,4	90, 5±1,3 (10 0%)	5,7± 0,2 (6,3 %)	18, 9±0,3 (20 ,9%)	38, 2±0,5 (42 ,2%)	27,7 ±0,4 (30, 6%)	3 ,0
3 days n = 15	132, 5±1,5	38,5 ±0,3*	94, 0±1,1 (10 0%)	10,1 ±0,2* (10, 7%)	27, 7±0,3* (29 ,5 %)	32, 7±0,4 (34 ,8%)	23,5 ±0,2 (25, 0%)	2 ,4
7 days n = 12	135, 9±1,8	37,2 ±0,4*	98, 7±1,2 (10 0%)	15,3 ±0,3* (15, 5%)	29, 4±0,3* (29 ,8%)	31, 5±0,3* (31 ,9%)	22,5 ±0,3* (22, 8%)	2 ,6
15 days n = 12	140, 4±1,7*	42,0 ±0,5*	98, 4±1,3 (10 0%)	13,7 ±0,3* (13, 9%)	28, 1±0,3* (28 ,6%)	34, 3±0,3 (34 ,8%)	22,3 ±0,3* (22, 7%)	2 ,3
30 days n = 15	139, 7±1,7*	34,1 ±0,4	105, 5,7±1,3* (10 0%)	9,2± 0,2* (8,7 %)	23, 3±0,3 (22 ,0%)	42, 9±0,5 (40 ,6%)	30,3 ±0,3** (28, 7%)	3 ,1
60 days n = 12	148, 7±1,7*	35,2 ±0,4	110, 3,5±1,5* (10 0%)	10,5 ±0,3* (9,3 %)	24, 2±0,3 (21 ,3%)	46, 2±0,5* (40 ,7%)	32,4 ±0,4** (28, 6%)	3 ,2
90 days n = 12	145, 6±1,8*	33,3 ±0,4	110, 2,3±1,5* (10 0%)	9,2± 0,2* (8,2 %)	22, 2±0,3 (19 ,8%)	47, 0±0,4* (41 ,8%)	33,9 ±0,4** (30, 2%)	3 ,4
180 days n = 12	141, 6±1,7*	32,2 ±0,4	105, 9,4±1,4* (10 0%)	8,4± 0,2 (7,7 %)	22, 3±0,3 (20 ,4%)	46, 7±0,4* (42 ,7%)	32,0 ±0,3** (29, 2%)	3 ,4

Note: * - Differences are significant in relation to control (P<0.05).

** - Differences are significant in relation to the previous term ($P < 0.05$).

n - Number of animals.

Table 3.2.3.

Morphometric parameters of the mucosa and submucosa of the cardia of the stomach in rats in dynamics after total resection of the large intestine (in microns).

Animal groups	Thick ness of the mucosa	T hickness of the lamina propria	Thick ness of the muscularis lamina	Thickn ess of the submucosa	Dep th of the gastric pits	Heig ht of the tectorial cells
Control n = 9	428,2 ±4,3	34 8,2±4,6	72,9± 0,8	,3±2,2	84,4 ±1,0	7,1± 0,1
3 days n = 15	504,5 ±5,1*	41 7,7±4,1*	80,7± 1,0	157,3± 1,7	78,6 ±1,0	6,1± 0,1
7 days n = 12	504,2 ±6,9*	40 9,3±5,1*	88,3± 1,1*	161,2± 1,9*	74,2 ±0,8*	6,6± 0,1
15 days n = 12	500,8 ±6,3*	40 7,7±4,4*	85,8± 1,2*	158,3± 2,0	79,2 ±1,1	7,3± 0,1
30 days n = 15	518,7 ±7,5*	42 6,3±4,9*	82,7± 1,0*	162,0± 1,5*	80,7 ±0,9	9,7± 0,1
60 days n = 12	526,7 ±5,0*	44 3,9±5,9*	73,3± 1,0	164,2± 1,5*	83,3 ±0,9	9,5± 0,1
90 days n = 12	523,3 ±4,3*	44 9,2±4,9*	65,8± 0,8	160,0± 1,5*	81,6 ±0,9	8,3± 0,2
180 days n = 12	527,5 ±4,2*	45 3,3±5,0*	66,7± 0,7	163,3± 1,6*	85,8 ±1,0	7,5± 0,1

Note: * - Differences are significant in relation to control ($P < 0.05$).

n - Number of animals.

Table 3.2.4.

Morphometric parameters of the mucosa and submucosa of the pyloric stomach in rats in dynamics after total resection of the large intestine (in microns).

Animal groups	Thickness of the mucosa	Thickness of the lamina propria	Thickness of the muscular lamina	Thickness of the submucosa	Depth of the gastric pits	Height of the tectorial cells
Control n = 9	593, 5±6,3	505,1± 4,9	80,1± 1,2	145,0±1, 9	216,4± 3,4	8,3±0, 2
3 days n = 15	709, 7±4,4*	612,5± 3,4*	90,0± 1,1*	149,5±1, 7	110,3± 1,3*	7,2±0, 1
7 days n = 12	718, 4±6,2*	620,5± 4,3*	91,6± 1,3*	151,1±1, 6	108,3± 1,1*	6,3±0, 1
15 days n = 12	697, 8±5,7*	597,2± 4,4*	92,2± 0,8*	149,4±1, 4	113,3± 1,3*	8,4±0, 1
30 days n = 15	626, 8±5,0*	535,5± 4,8	80,0± 0,8	150,5±1, 2	118,5± 1,1*	11,3± 0,1*
60 days n = 12	641, 9±5,4*	548,3± 4,9	82,8± 1,1	153,9±1, 9	126,2± 1,3*	10,8± 0,2*
90 days n = 12	645, 3±6,4*	550,0± 6,2	84,4± 0,8	155,5±1, 8	176,6± 2,0*	10,9± 0,1*
180 days n = 12	645, 9±6,4*	551,1± 5,0	85,5± 1,1	153,3±1, 7	186,6± 2,5*	9,3±0, 1

Note: * - Differences are significant in relation to control (P<0.05).

Table 3.2.6

Relative volume (in %) of mucus-forming mucosal cells membranes of the stomach at various times after total resection of the colon

GRO	CELL TYPE		
	Integumenta ry pit	Cervical	Accessory
Contr ol	16,7±0,3	8,4±0,2	18,9±0,3
3 days	26,4±0,3*	14,2±0,2*	20,8±0,3

15 days	24,2±0,4*	12,4±0,2*	18,6±0,2
30 days	17,3±0,3	10,1±0,1	17,8±0,3
60 days	17,1±0,3	9,9±0,2	16,3±0,2
90 days	16,4±0,3	10,4±0,3	18,2±0,3
180 days	16,2±0,2	12,2±0,2*	19,6±0,3

Note: * - Differences are significant in relation to control (P<0.05).

CHAPTER 4 The motor-evacuation function of the gastrointestinal tract is one of the most important mechanisms in the compensatory-adaptive reaction after total resection of the colon.

The process of adaptation in various sections of the digestive tract after total resection of the colon largely depends on the restructuring of the motor-evacuation function of the remaining sections (Yu.N. Nishanov, 1995, 1997). However, the literature data on changes in the motility of the gastrointestinal tract after resection of the colon are very contradictory, and most researchers believe that with extensive resection of the colon, the motor activity of the stomach decreases (O.P. Amelina, 1977). At the same time, some authors (Lupal'tsov V.I., Iagniuk A.I., 1999) revealed an acceleration of the evacuation of food from the stomach and the promotion of contrast through the intestines in patients after colectomy and vagotomy. A number of researchers after colectomy did not note any persistent changes in the motor-evacuation function of the gastrointestinal tract at all (E.I. Kropacheva et al., 2002; G.K. Zherlov et al., 2005).

An X-ray study of the motor-evacuation function of the stomach in control animals revealed the following picture. After giving a barium suspension after 15 minutes, the stomach is tightly filled and the stomach cavity is well contrasted. The shape of the stomach is bean-shaped, its position is normal, the reliefs of its mucosa are clearly defined. After 30 minutes, 45 minutes and 2 hours, a small amount of barium suspension is contrasted in the stomach, and after 3-6 hours the stomach is not contrasted.

Thus, in control rats, the contrast suspension begins to flow into the duodenum after 15 minutes. The stomach is completely freed from the contrast suspension within 3 hours.

5 days after total resection of the large intestine, on a survey radiograph taken 15 minutes after the introduction of X-ray contrast, the latter is contained in a very small amount in the stomach, the fundus of the stomach, as well as the initial part of the duodenum, is well contrasted. The volume of the stomach is reduced and the shape is loop-like. After 30, 45 minutes, a gas bubble is noted in the fundus of the stomach, the relief of the mucous membrane of the pyloric part of the

stomach is well contrasted, and 2 hours after the administration of the contrast agent, the stomach is no longer contrasted.

Thus, 5 days after the operation, according to X-ray data, there is a sharp acceleration of the passage of barium suspension through all parts of the stomach, in particular, the transition of barium suspension from the pyloric region to the duodenum is noticeably accelerated than in control animals.

15 days after the operation, the evacuation of barium suspension from the stomach into the duodenum was still markedly accelerated. On a survey radiograph taken 15 minutes after giving barium, a significant part of the barium suspension is already in the duodenum. The stomach is unevenly filled with a contrast suspension, and the duodenum and loops of the jejunum are contrasted. After 30 minutes, the contrast agent still unevenly fills the stomach, and after 45 minutes, an insignificant amount of barium suspension was found in the fundic and pyloric sections of the stomach, gas bubbles were noted in places. Complete evacuation of the contrast agent from the stomach into the duodenum is completed after 2 hours.

Thus, 5-15 days after the total resection of the colon, the evacuation of the contrast mass from the stomach into the duodenum is more accelerated than in the controls. So, the motor-evacuation function of the stomach during these periods was characterized by a hyperkinetic type of motility and an accelerated rate of evacuation of the contents of the stomach.

Thus, our X-ray studies of the motor-evacuation function of the stomach after total resection of the large intestine showed that already on the 7th day after the operation, a more rapid movement of the barium suspension from the stomach into the duodenum was observed. Fifteen days after the operation, the residence time of the barium suspension in the stomach of the operated rats became even shorter (by 1.5–2 hours on average compared to the control). 10 minutes after the introduction of barium suspension in the stomach, only traces of a contrast agent were found.

The mechanism of the accelerated passage of barium suspension through the gastrointestinal tract, presumably, depends on the change in the relationship between the tonic and rhythmic components of the motility of the gastrointestinal tract (K.V. Smirnov, 1990).

30 days after the operation on the radiograph, the evacuation of barium suspension from the stomach into the duodenum is somewhat different than in the previous periods. 15 minutes after giving barium, the stomach is evenly filled with a contrast mass, and the loops of the duodenum are not yet contrasted.

On a radiograph taken 30 minutes after the injection of a contrast mass, the stomach is unevenly filled with a barium suspension with a high gas content. Reliefs and folds are poorly contrasted and the stomach itself has a spherical shape. The time of appearance of the first portions of barium suspension in the duodenum is on average 20-30 minutes and is of a portioned nature. After 45 minutes, the stomach was unevenly contrasted, and the loops of the small intestine were contrasted.

2-3 hours after giving the contrast mass, the fundic and pyloric sections of the stomach are unevenly filled with a barium suspension. Complete emptying of the stomach occurred somewhat later compared to the control. 6 hours after giving barium, the stomach is not contrasted, the loops of the duodenum, jejunum and ileum are well contrasted.

After 60 days of the experimental study after total resection of the large intestine, on the radiograph taken 15 and 30 minutes after giving barium, the upper and lower parts of the stomach are tightly filled with barium suspension, and the evacuation of barium suspension from the stomach into the duodenum is not yet observed. 45 minutes after the introduction of contrast into the stomach, the cavity and wall of the stomach, as well as the initial part of the duodenum, are well contrasted. The contrast agent begins to flow from the stomach into the duodenum after 45 minutes. After 2 hours, the body and fundus of the stomach are well contrasted. The relief of the gastric mucosa is smoothed, poorly contrasted. The

volume of the stomach is somewhat expanded and its shape is slightly elongated due to the omission of its greater curvature. The evacuation of barium from the stomach is longer than the previous period; even 3-6 hours after giving barium, a small amount of barium suspension is contrasted in the stomach cavity.

A more serious increase in the volume of the stomach is also observed in animals 90 days after total resection of the colon. After 15 minutes, the stomach is unevenly filled with barium suspension: evacuation from the stomach takes a longer time; after 30 minutes, the duodenal loop is not contrasted. After 45 minutes, the stomach is significantly lengthened due to the omission of its greater curvature, the contrast agent evenly fills its upper and lower sections, such hypotension contributes to delayed emptying of the stomach.

In this period, only individual clumps of barium suspension are determined in the proximal part of the duodenum. 2 hours after the introduction of contrast into the stomach, its tight filling is noted, and uneven traces of the remains of the contrast agent in the loop of the jejunum are also visible. The distal ileum contrasts well, as its lumen diameter is several times larger than in control animals. In this period of research, the stomach resembles the shape of a hook, while the contrast agent is unevenly distributed in the stomach, its cavity in the cardiac sections is somewhat expanded, in the fundic and pyloric sections it is somewhat reduced. On a radiograph taken 6 hours after giving barium, clumps of barium suspension are determined in the area of the body and fundus of the stomach, the shape of the stomach resembles the appearance of a hook.

In this period, the movement of the barium suspension through the stomach was very slow, the first portions of the contrast agent appeared in the duodenum after 45 minutes. The time of complete emptying of the barium suspension was significantly slower compared to the control. In some animals, traces of barium suspension in the stomach were noted even after 24 hours, and were directly dependent on its size.

Thus, 30-90 minutes after the total resection of the colon, the evacuation of the contrast suspension from the stomach into the duodenum is sharply slow compared to the previous and control periods. Such a state, in our opinion, is considered as an adaptive reaction aimed at enhancing intragastric digestion. Slowdown motor-evacuation activity of the stomach to 30-90 days after total resection of the colon during gastric digestion indicates an increase in the functionality of the stomach.

120 days after the operation, on the radiograph 15-45 minutes after the introduction of the barium suspension into the stomach, the rate of movement of the contrast mass through the stomach and the appearance of the contrast suspension in the duodenum is almost the same as in the previous periods.

After 2-6 hours, a contrast suspension in the stomach is also noted, the folds of the mucous membrane in all parts of the stomach are almost completely smoothed out, the shape of the stomach resembles the appearance of a hook. 24 hours after the introduction of contrast into the stomach, traces of a contrast agent are noted in it.

Thus, after a total resection of the colon, the motor-evacuation function of the stomach is not completely normalized. The slowdown of gastric motility, the expansion of its gaps with the omission of the greater curvature, as a result, serve as factors for the formation of peculiar adaptive mechanisms aimed at improving digestion.

CHAPTER 5 . Characteristics of changes in the spectrum of microflora of the contents of the stomach and their correction after total resection of the colon

5.1. Characteristics of the microflora of the stomach during total resection of the colon.

It is known that the morphofunctional state of the stomach largely depends on the state of its microflora, changes in which can contribute to the development of inflammatory and alterative changes in it (I.M. Baibekov et al., 1992; Aruin A.I., 1994, 2004;; K. A. Zufarov, 1996; I. V. Zverkov et al. 1996; Zimmerman Y. S., 2006; Mukhamedov I. M. et al., 2007).

It is known that the contents of the stomach in healthy people contain a small amount of only some types of acid-resistant bacterial flora, such as cavitory or P-flora (M.I. Brusilovsky, 1977; E.M. Baibekova et al., 1979; N.A. Amanov, 1983 ; I.M. Baibekov et al., 1992; L.I. Aruin, 1990, 1997, 2004; K.I. Rasulev, 1990, 1991; Yu.N. Nishanov, 1997; Zimmerman Y.S., 2006 and others; Mukhamedov I.M. et al., 2007).

The question of changes in the microflora of the stomach in various pathologies and surgical interventions on the organs of the gastrointestinal tract is of great interest. It has been established that the microflora in gastroduodenal pathology is represented by *H. pylori*, enterobacteria, staphylococci, enterococci, less often non-fermenting gram-negative rods and anaerobes (L.I. Aruin et al., 1994; 2004 T.A. Lapteva et al., 1994; Zimmerman Ya .S., 2006; Mukhamedov I.M. et al., 2007).

A number of authors believe that the bacteriological status of the stomach is closely related to the functional state of the macroorganism (I.B. Kuvaeva et al., 1991, 1993; K.A. Zufarov, 1996; Mukhamedov I.M. et al., 2007). A number of factors of aggression in the stomach cavity (pepsin and hydrochloric acid) have been noted, which, of course, have bactericidal and bacteriostatic properties (Baibekov I.M., Mavlyan-Khodzhaev R.Sh., 1992; Rasulev K.I., 1990; Zimmerman Ya. S., 2006; Mukhamedov I.M. et al., 2007). It has been shown that a 0.47% solution of hydrochloric acid killed from 30 to 100% of microbes in 30 seconds. At pH<1.0 of gastric juice, infection with *E.coli* was unsuccessful, and at pH>5.1, bacteria continued to grow even after 24 hours of incubation (Shenderov B.A., 1998). In various pathological conditions, especially in chronic anacid and

atrophic gastritis, in chronic gastroduodenal ulcers and enteritis, colitis, enterocolitis, as well as in patients after vagotomy and subtotal removal of the small and large intestine, increased reproduction of various fermentative and putrid luminal (cavitary) or P-flora and mucosal (parietal) or M-flora (Brusilovsky M.I., 1977; Baibekov I.M. et al., 1992; Rasulev K.I., 1990; Aruin L.I. ., 1990, 2004; Nishanov Y. N., K. A. Zufarov, 1995; Nishanov Y. N., 1997; D. E. Makhkamova et al. M. et al., 2007; Boumford K.B., Fan X., Cran S.E. et al., 1998).

The constant contamination of the stomach contents with microflora and the balance of its composition in a certain way affects the general physiological status of macroorganisms and the morphofunctional state of the stomach. A significant increase in the content of opportunistic microorganisms in the contents of the gastrointestinal tract after total resection of the colon indicates the presence of a pronounced intestinal dysbacteriosis and can lead to a number of pathological phenomena in the form of violations of the breakdown and absorption of nutrients (Nishanov Yu.N., 1997).

We have found that in normal control animals, the stomach contents are dominated by the obligate microflora (lactobacilli and bifidobacteria) over the aerobic facultative microflora. These data are consistent with the results of research by a number of authors (N.A. Amanov, 1983; A.Ya. Veselov, 1988; Yu.N. Nishanov, 1997; B.A. Shenderov et al., 1997; B.A. Shenderov, 1998; Mukhamedov I.M. et al., 2007).

After total resection of the colon in operated animals, due to changes in the functional and morphological status of the stomach, colonization of the contents of the stomach with microorganisms unusual for it is observed. At the same time, a direct correlation was found between the time after surgery and the increase in bacterial colonization in the contents of the stomach. Our studies have shown that 7 days after the operation, there is a change in the relationship of the main groups of microorganisms; the quantitative growth of the facultative group of aerobes begins, and the number of the obligate group of microorganisms decreases

significantly or they disappear altogether. There is a significant decrease in the frequency of sowing the main representatives of the obligate microflora - aerobic lactic acid bacilli (lactobacilli) and non-spore anaerobic bacilli (bifidobacteria). The frequency of detection of the facultative group of bacteria was somewhat increased. Of all facultative microorganisms, *Escherichia coli*, *Proteus*, opportunistic staphylococci and enterococci were sown with noticeable constancy, the number of which exceeded their average content in the contents of the stomach of control animals.

Most authors (S.I. Sytnik, 1980; T.A. Lapteva et al., 1994; K.A. Zufarov, 1996; B.Z. Kasymov et al., 2000; Mukhamedov I.M. et al., 2007) believe that the decrease or absence of representatives of the obligate flora (lactobacilli and bifidobacteria) in the contents of the gastrointestinal tract of humans and higher animals is reflected in the morphofunctional state of the gastrointestinal tract. The role of bifidobacteria and lactobacilli is to produce acetic and lactic acids, which create an acidic reaction in the gastrointestinal tract and thereby prevent the reproduction of *Proteus*, *Staphylococcus aureus*, hemolytic *Escherichia coli*, etc. (I.B. Kuvaeva et al., 1993; Yu.N. Nishanov, 1997; A.Yu. Yuldashev et al., 1998; Mukhamedov I.M. et al., 2007).

15 days after the operation, the frequency of detection and the number of bifidobacteria and lactobacilli significantly decreased in the contents of the stomach. Whereas almost 70% of the experimental animals showed growth of yeast fungi of the genus *Candida*, as well as opportunistic staphylococci and enterococci. All this indicates an increase in the number of representatives of opportunistic microflora in the contents of the stomach in dynamics after total resection of the colon (Fig. 1.).

1 month after the operation, the operated animals develop pronounced gastric dysbacteriosis, which manifests itself in a decrease in the frequency of detection and the total number of aerobic lactic acid bacilli and asporogenic anaerobic microflora, as well as in the predominance of facultative opportunistic

microflora (staphylococcus, enterococcus, proteus). Escherichia coli, bacteroids and fungi of the genus Candida much more often and completely populate the contents of the stomach (Fig. 1.).

Thus, dysbacteriosis increases by 30 days after surgery. A number of researchers (N.K. Akhmedov et al., 1994; Yu.N. Nishanov, 1997; I.M. Mukhamedov et al., 2007) argue that dysbacteriosis has a negative effect on the processes of digestion and absorption of food.

2 months after the operation, the phenomenon of dysbacteriosis in the contents of the stomach is reduced to a minimum and the composition of the microflora begins to recover. The content of lactobacilli and bifidobacteria tends to increase. The content of bacteroids throughout the entire period of the study exceeds the control level.

3 months after the operation, the formation of a peculiar microbiocenosis of the contents of the stomach is basically completed, and the restoration of the quantitative and qualitative composition of the obligate microflora is significantly superior. The total number of facultative aerobic microorganisms decreases (Fig. 1.)

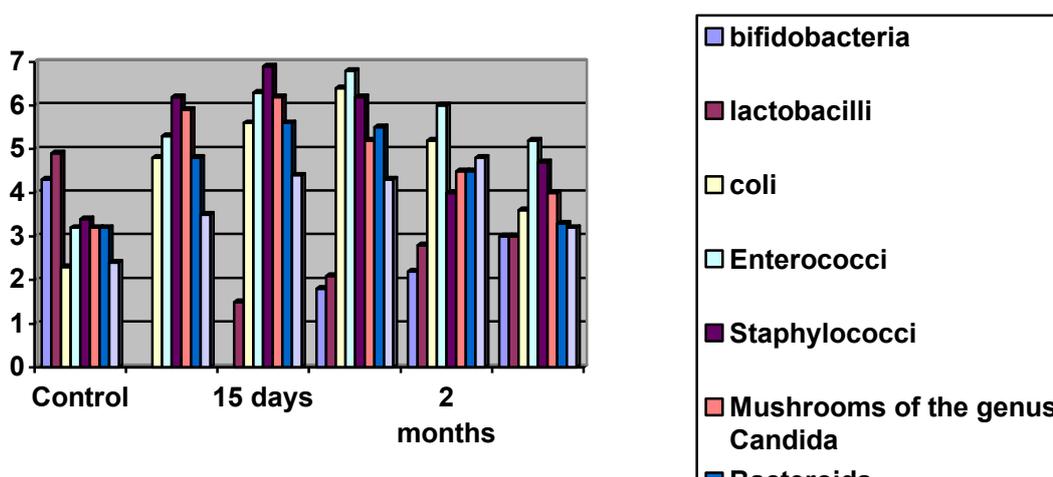


Fig. 1. The quantitative composition of the microflora of the contents of the stomach after total resection of the large intestine (in lg/g).

Thus, the above data allow us to state that in rats in dynamics after total resection of the colon, some types of bacteria that characterize the microbial biocenosis of the colon of a healthy animal were not sown or were present in a smaller amount. In this regard, the question arises: is the fact of colonization of the contents of the stomach by intestinal microorganisms a manifestation of dysbacteriosis or is it the result of a compensatory-adaptive reaction of the body? In our opinion, microbial invasion in the contents of the stomach is a manifestation of one of the adaptive mechanisms in dynamics after total resection of the colon.

Severe dysbacteriosis, which develops mainly in the early stages (up to 30 days) after total resection of the colon in rats, even in the stage of compensation, dictates the need to normalize the composition of the microflora of the stomach contents.

Considering the fact that with dysbacteriosis of the gastrointestinal tract, the content of bifidobacteria and lactobacilli, which are the most important representatives of the normal microflora, is significantly reduced, it seemed to us appropriate to populate the gastrointestinal tract with bifidobacteria and lactobacilli, thereby contributing to the normalization of the quantitative and qualitative composition of the microflora of the contents of the stomach.

Our studies of the formation and development of the structural foundations of compensatory adaptations in the stomach after total resection of the colon made it possible not only to reveal the staging of this process, but to reveal the presence of a certain relationship between the morphological rearrangements of the stomach and the state of its microbiocenosis, as well as its motility.

At the first stage of the reaction of the stomach to colon resection, designated as the stage of early postoperative changes, there is a pronounced acceleration of the evacuation of the contents from the stomach. This is due to significant inflammatory changes in its mucous membrane and edema of all layers of the stomach wall. Enhanced evacuation persists for 15 days after resection. At this stage, there are also significant changes in the composition of the microflora of

the contents of the stomach. The content of *Escherichia coli*, enterococci, staphylococci, and especially fungi of the genus *Candida* increases compared to the control.

1-2 months after resection, there is a slowdown in the evacuation of the contents of the stomach, which, along with enhanced functioning of the main and parietal cells, provides a more complete initial hydrolysis of food masses. During this period, there is a slight decrease in the content of fungi of the genus *Candida*, while maintaining a high level of the number of other microorganisms.

However, it is during this period that there is an increase in parietal microorganisms, in particular fungi, which are not only located on the surface of epitheliocytes, but also penetrate into their cytoplasm without undergoing visible changes. Apparently, the stagnation of the contents in the stomach, along with a slight decrease in the number of parietal and chief cells, with a simultaneous increase in the relative volume fraction of mucus-producing cells, weakens the bactericidal properties of gastric juice, which contributes to an increase in parietal microflora.

In the future, in the period of 2-3 months after resection, delayed evacuation of the contents of the stomach remains, which, along with an increase in the volume of functioning structures, provides a fairly complete compensation for the function of the digestive tract that was disturbed as a result of resection of the colon. At this stage, there is also a pronounced decrease in the amount of luminal and parietal microflora. This is apparently due to an increase in the mass of functioning structures of the main and parietal cells, a decrease in pH and an increase in the digestive power of gastric juice.

Preservation, in subsequent periods of observation (up to 6 months), of the main structural changes formed in previous periods, along with slow evacuation of the contents of the stomach, as well as stabilization of the amount of microflora, made it possible to define this period as a stage of stabilization of the structural foundations of compensatory adaptations.

The conducted studies have shown that the morphological changes underlying the compensatory adaptations in the stomach in response to colon resection fully correlate with functional changes in motility, as well as with shifts in the microbial landscape of this organ.

The microbiocenosis of the stomach is directly dependent on the state of the morphological status of the gastric mucosa, primarily its fundus, where the secretion of the chief and parietal cells has a direct effect on microorganisms, especially parietal ones.

5.2. INFLUENCE OF BIFIDUMBACTERIN, LACTOBACTERIN AND THEIR COMPLEX ON THE MICROFLORA OF THE GASTRIC CONTENTS AFTER TOTAL COLON RESECTION

Live bacteriological preparations (bifidumbacterin and lactobacterin) have antagonistic activity against many pathogenic and opportunistic microorganisms, contribute to the restoration of normal biocenosis of the gastrointestinal tract and clinical recovery. The mechanism of therapeutic efficacy of live bacteriological preparations is multifactorial. They, along with direct effects on the microflora, stimulate reparative processes in the mucous membrane of the gastrointestinal tract, increase immunological reactivity and general nonspecific resistance of the patient's body (V.V. Pospelova et al., 1990, Clinical aspects of the diagnosis and treatment of intestinal dysbacteriosis in general therapeutic practice : Teaching aid, 2003).

We used bifidumbacterin and bifidumbactrin in combination with lactobacterin from the 2nd day after the operation for 15-30 days. On the 15th day, 1 month, 2 months and 3 months of the experiment, in all animals treated with

bifidumbacterin and bifidumbacterin in combination with lactobacterin, a significant acceleration of the processes of normalization of the intestinal microflora was revealed, however, a more pronounced effect was observed with the combined use of bifidumbacterin with lactobacterin. Already on the third day after administration, the animals showed an improvement in their general condition, their appetite improved, they became active, and the feces became more formed.

15 days after the application of bifidumbacterin, the total number of opportunistic microbes isolated from the contents of the stomach decreased by almost 1.5-2 times. At the same time, the reduction of *Proteus* rods attracted attention. Before treatment, its average amount in 1 ml of stomach contents was 4.4 ± 0.1 lg/ml. After treatment, after 30 days, in some rats, yeast and yeast-like fungi of the genus *Candida* and others also decreased. And in other rats, their number significantly decreased -2.4 ± 0.1 lg / ml. The frequency of positive findings of *Escherichia coli* and pathogenic staphylococci became 1.5-2 times less, their number in 1 ml of stomach contents decreased.

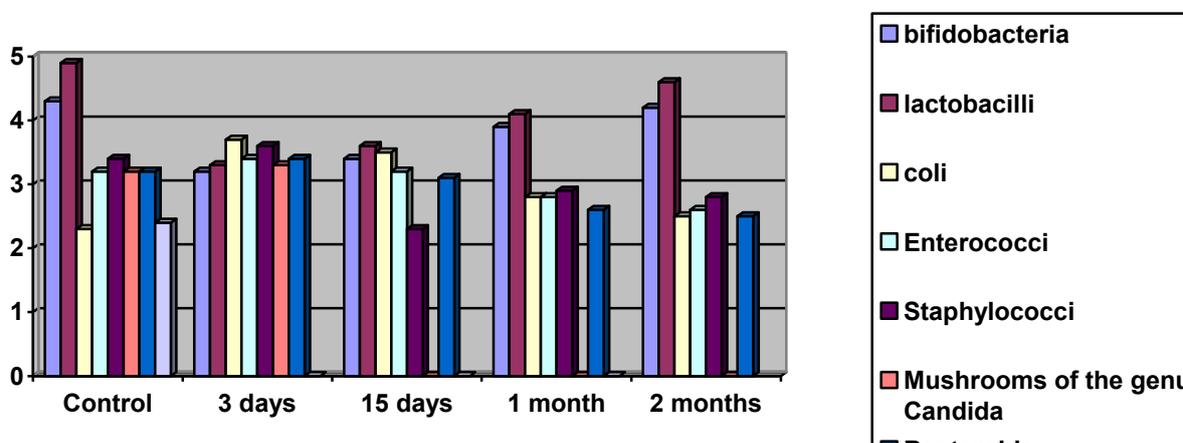


Fig.2. Correction of the microflora of the contents of the stomach with bacterial preparations (bifidobacterin with lactobacterin) in the complex after total resection of the colon (in lg/g).

Our data showed that the use of bifidumbacterin and lactobacterin preparations significantly contributed to a decrease in the frequency of positive findings of the quantitative content of the conditionally pathogenic part of the

microflora of the stomach contents. As for obligate microorganisms, first of all, the appearance of anaerobic non-spore rods in the composition of the microflora was noted. So, after 15 days of treatment with bifidumbacterin with lactobacterin, their average amount in 1 ml of stomach contents was 3.2 ± 0.1 lg/ml. For 1 month, anaerobic nonsporing rods of the stomach contents were found in the amount of 3.4 ± 0.2 lg/ml. The highest clinical effect of the treatment was found 3 months after the operation in rats treated for 30 days. In the following days, positive clinical dynamics remained, however, bifidobacteria and lactobacilli were eliminated from the small intestine.

Under the influence of complex treatment, the shifts in the total number of conditionally pathogenic microorganisms decreased markedly (Fig. 2.). Yeast, yeast-like fungi and *Proteus* bacilli disappeared on the 15-30th day after treatment. There were also clear changes in the obligate part of the flora. From the 15th day after treatment, anaerobic non-spore bacteria and lactobacilli began to be detected in the contents of the stomach. 2 months after the operation, bifidobacteria and lactobacilli were found in the contents of the stomach in the same quantities as in control animals ((Fig. 2). 3 months after the operation, the number of enterococci in treated rats decreased (2.6 ± 0.2 lg/ ml) and staphylococci (2.8 ± 0.2 lg/ml). There was also a decrease in the average content in 1 ml of the contents of the stomach, the number of other types of opportunistic microorganisms (Fig. 2.).

Our data showed that the use of pure bifidumbacterin significantly contributed to a decrease in the frequency of positive findings and the quantitative content of opportunistic microflora. As for obligate microorganisms, the appearance of anaerobic non-spore rods was noted in the composition of the microflora.

A good effect from the ongoing treatment for 60-90 days after surgery. The best results were obtained in rats treated with bifidumbacterin in combination with lactobacterin. The use of these drugs had a more pronounced positive effect on the

increase in the number of bifidobacteria and lactobacilli in untreated animals, respectively (Fig. 1. and 2.).

Thus, our data indicate a rather high efficiency of bifido- and lacto-containing bacterial preparations in complex treatment after total resection of the colon. At the same time, along with the antagonistic effect in relation to pathogenic microorganisms, there is also a “restorative effect provided by the engraftment” of bifidobacteria and lactobacilli as normal main representatives of the microflora of the gastrointestinal tract.

CONCLUSION

1. Total resection of the colon leads to a significant change in the motor-evacuation functions of the stomach:

- in the first stage, there is an accelerated evacuation of the contrast agent through the stomach;

- in the second stage, there is some slowdown in the passage of the contrast agent from the stomach into the duodenum.

In the third and fourth stages, the delayed evacuation is maintained.

Thus, our data show that after a total resection of the large intestine, the motor-evacuation function of the stomach in the early stages (5-15 days) accelerates sharply, and at longer periods (especially after 60-120 days) it slows down, which, apparently, deceleration of gastric motility, expansion of its lumen with the omission of the greater curvature, as a result, serve as factors for the formation of a kind of adaptive mechanism aimed at improving digestion. Along with this, even in the long term after total resection of the colon, the motor-evacuation function of the stomach is not completely normalized, which makes it

relevant to study the motor-evacuation function of the stomach, both for diagnosis and for therapeutic measures after total resection of the colon.

2. Total resection of the colon leads to significant changes in the microbial landscape of the contents of the stomach, the severity of which depends on the period after the operation:

- in the early period - 7-30 days (first stage), the number of representatives of the obligate flora (bifido- and lactobacilli) progressively decreases with an increase in the content of facultative flora (opportunistic staphylococci, enterococci, *Escherichia coli*, bacteroids and *Proteus*), which corresponds to the picture of pronounced dysbacteriosis stomach contents;

- later - 60-90 days after the operation (second stage), the quantitative indicators of obligate microorganisms (bifidus and lactobacilli) are restored, the content of facultative flora (*E. coli*, staphylococci, bacteroids) is significantly reduced, which indicates stabilization of disturbed changes and the inclusion of a more perfect mechanism.

3. Changes in the motility and microbial landscape of the stomach correlate with the stages of formation and development of the structural foundations of compensatory devices in it after resection of the colon.

4. The use of corrective bacterial preparations such as bifidumbacterin and lactobacterin in the early period after colon surgery contributes to the prevention of postoperative dysbacteriosis, significantly reduces the severity of dyspeptic disorders, improves gastrointestinal digestion, has an immunomodulatory effect, positively affects the psychological status of patients and improves the general condition organism. A significant normalization (correction) of the microflora in the contents of the stomach can be recommended for inclusion in the arsenal of generally accepted therapeutic and preventive measures for the postoperative rehabilitation of patients who have undergone surgical interventions on the colon.

PRACTICAL RECOMMENDATIONS:

- The data obtained will contribute to an in-depth understanding of the mechanisms of adaptive changes in the gastric mucosa after the total removal of the colon.

- Our data show that after a total resection of the large intestine, the motor-evacuation function of the stomach in the early stages (5-15 days) accelerates sharply, and at longer periods (especially after 60-120 days) it slows down, which, apparently, is aimed at strengthening intragastric digestion of food. Along with this, even in the long term after total resection of the colon, the motor-evacuation function of the stomach is not completely normalized, which makes it relevant to study the motor-evacuation function of the stomach, both for diagnosis and for therapeutic measures in dynamics after total resection of the colon.

- The effect of bifidumbacterin and lactobacterin on the microbiocenosis of the gastrointestinal tract after total resection of the colon can be recommended for inclusion in the arsenal of generally accepted therapeutic and preventive measures for postoperative rehabilitation of patients who underwent surgical interventions on the colon.

- The data obtained contribute to an in-depth understanding of the pathogenesis of postcolectomy syndrome.

- The paper shows the dynamics of changes in the motor-evacuation function of the stomach after colectomy, which makes it necessary to control this function in the postoperative period in patients.

- The high efficiency of the complex of lacto- and bifidumbacterins for the correction of dysbacteriosis has been shown, which allows us to recommend these drugs for the prevention of postoperative complications in patients with colectomy.

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