Volume 4, Issue 2, February 2026 ISSN (E): 2938-3765

MORPHOLOGICAL CHANGES OF THE SMALL INTESTINE ON THE BACKGROUND OF BIOCORRECTION WITH DANDELION ROOT IN RENAL FAILURE ASSOCIATED WITH CHEMOTHERAPY

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Abstract
Cytostatic drugs used in the course of chemotherapy have a nephrotoxic effect, which leads to the development of renal failure and causes morphological changes in the organs of the digestive system, in particular in the small intestine. The aim of the study was to study the morphological and morphometric parameters of the small intestine in conditions of renal failure associated with chemotherapy, against the background of biocorrection with dandelion root. The study was conducted on an experimental model using histological and morphometric methods. The results showed that under the influence of chemotherapy, there is a decrease in the height of the villi, a decrease in the number of epithelial cells, and the development of inflammatory and degenerative changes. When applying biocorrection with dandelion root, there was a partial restoration of the mucosal structure and an approximation of morphometric parameters to normal values. The data obtained are of great scientific and practical importance for understanding changes in the small intestine during complications of chemotherapy and expand the possibilities of using natural biocorrective agents.

Keywords: Chemotherapy, kidney failure, dandelion root, small intestine, morphology, morphometry.

Introduction

In modern oncology, chemotherapy is considered one of the main methods of treating the disease. At the same time, the use of cytostatic drugs is accompanied by the development of many side effects, including nephrotoxic complications. Renal failure associated with chemotherapy leads to a violation of the metabolic balance in the body, the accumulation of toxic products and secondary morphological changes in various organs and systems. The digestive system is particularly sensitive to these processes, and the mucous membrane of the small intestine is rapidly undergoing structural changes under the influence of toxic and metabolic factors[1,2].

The small intestine plays an important role in nutrient absorption, immune defense, and trophic processes. Endogenous intoxication, microcirculatory disorders and inflammatory reactions developing in conditions of renal failure can disrupt the regeneration processes of the intestinal epithelium and lead to a violation of the architecture of the papillary crypt system. Therefore, the

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study of morphological changes in the small intestine in conditions of renal failure associated with chemotherapy is one of the urgent scientific tasks[3,4].

In recent years, there has been a growing interest in the use of biocorrective agents of natural origin in order to reduce the complications of chemotherapy[5,6]. As one of these remedies, it is believed that dandelion root is rich in biologically active substances, antioxidant and anti-inflammatory components, has the property to activate regeneration processes in tissues and normalize the activity of the immune system. However, its effect on the morphology of the small intestine in conditions of renal failure that developed on the background of chemotherapy has not been sufficiently studied [7.8].

In this regard, the purpose of this study is to study morphological and morphometric changes in the small intestine based on an experimental model against the background of biocorrection with dandelion root in conditions of renal failure associated with chemotherapy.

MATERIALS AND METHODS

The study was conducted under experimental conditions on 6-month-old white mongrel rats. A total of 201 experimental animals were selected, which were kept in standard vivarium conditions (room temperature 20-24 °C, humidity 60%). The animals were provided with a balanced diet and free water. The experiments were conducted in accordance with the rules of biological safety and the ethical requirements of working with laboratory animals.

The experimental animals were divided into 5 groups: I - control group (n=40); II and III groups - groups in which chemotherapy drugs (cisplatin and carboplatin) were used; IV and V groups - groups in which biocorrection was applied against the background of chemotherapy. In order to form an experimental model, a skin tumor model was induced using the carcinogen 7,12-dimethylbenzanthracene (DMBA). During chemotherapy, cisplatin was administered intravenously at a dose of 0.4 mg/kg and carboplatin at a dose of 3 mg/kg. In the control group, 0.7 ml of distilled water was intragastrically administered for 21 days.

For the purpose of biocorrection, dandelion root infusion was administered intragastrically (through a gastric tube) at a therapeutic dose of 0.7 ml for 21 days in the experimental groups. At the end of the experiment, the animals were decapitated using the standard method, and the small intestine tissues were separated for morphological examination.

For histological examination, the tissues were fixed in a 10% solution of neutral formalin, paraffin blocks were prepared and sections with a thickness of 5 microns were obtained. The preparations were stained with hematoxylin-eosin and the Van Gieson method. Morphometric analysis was performed using an ocular micrometer, such indicators as papilla height and thickness, crypt depth and thickness, number of enterocytes and goblet cells, proportion of mucous, submucosa and muscle membranes, percentage of collagen area were evaluated.

An immunohistochemical study was performed using the CD14 marker to assess inflammatory processes and the activity of the monocyte-macrophage system. Statistical processing of the obtained results was carried out using Microsoft Excel and IBM SPSS Statistics programs. The differences were considered statistically significant at the level of $p<0.05$.

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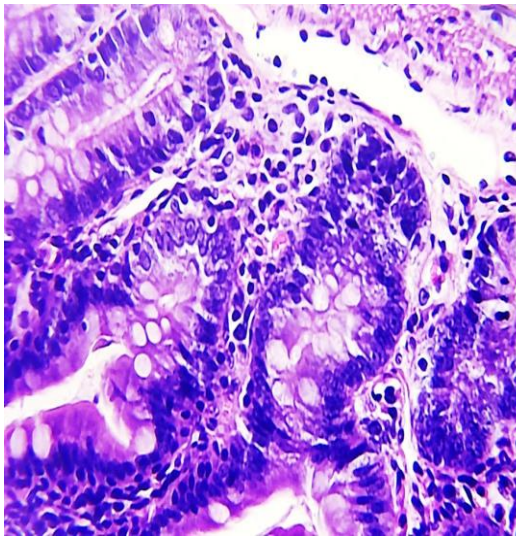
Results

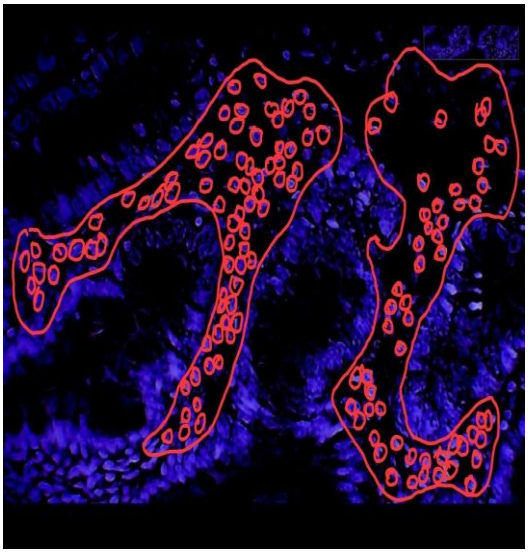
A comparative analysis of the morphological and morphometric parameters of the small intestine with a normal condition after correction with dandelion root as an alternative drug in conditions of renal failure resulting from chemotherapy was performed. The results showed that under the influence of biocorrection, regenerative processes are activated in the mucous membrane of the small intestine and signs of structural recovery are observed. In particular, the architecture of the papillary crypts has relatively normalized, the tips of the papillae have acquired a stable and smooth shape, the continuity of the brush edge in the apical part has been restored, and the preservation of the nuclear layer in the epithelium of the crypts has been revealed. The absence of excessive cellular infiltration in its own plate and the absence of signs of edema or accumulation of water in the submucosal layer indicates a decrease in inflammatory processes in the tissues (Figure 1).

Also, as a result of alcian blue staining, it was found that the mucinous septum had reformed along the arch and papillary margin, indicating that the protective function of the intestine had begun to recover. The continuous and uniform distribution of the mucin layer indicates an improvement in epithelial regeneration and secretory function (Figure 2). In general, the morphological changes observed after correction confirm the partial normalization of the structures of the small intestine and the biocorrectional effectiveness of dandelion root.



A

Figure 1. Ileum of a 9-month-old white mongrel rat of the experimental group (G-E ×200)



B

Figure 2. Digital morphometry of this area: the lymphoid structure is segmented by a polygon (red contour), the reference area is marked with a blue mask. small mphocytes 46.8±2.4%, medium lymphocytes 22.4±1.2%, large lymphocytes 12.0±0.6%, reticular cells 8.9±0.5%, plasmoblasts 2.7±0.3%, destructive cells 4.1±0.6%, macrophages 3.1±0.5%.

Histological view of the mucous membrane of the small intestine (hematoxylin-eosin staining). After applying the correction, a partial restoration of the mastoid crypt architecture is observed. A number of epithelial cells are preserved, crypt structures are clearly expressed, and cellular infiltration in the

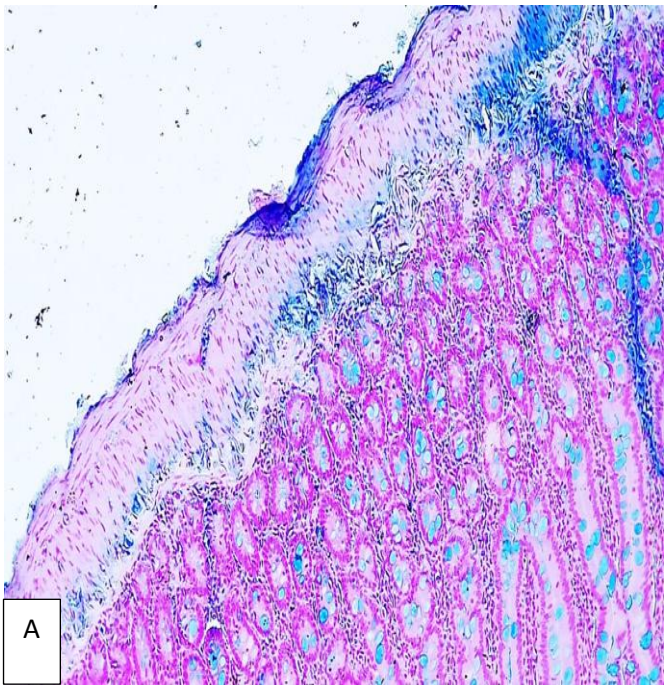
lamina is moderate. There is a decrease in degenerative changes in the mucous membrane and activation of regeneration processes.

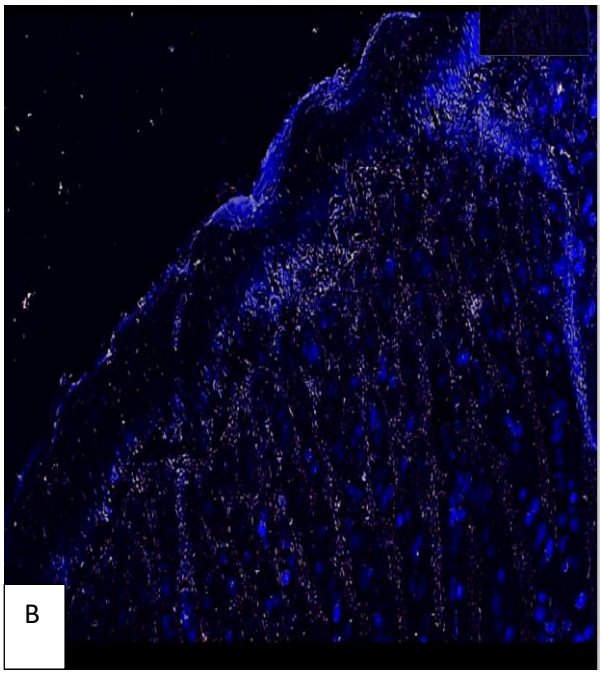
Morphometric view of the papillae of the small intestine. Against the background of correction, the contours of the papillae are stabilized, the apical parts are preserved in integrity. In the areas separated by the red contour, a relatively uniform arrangement of cellular elements is observed, which indicates signs of restoration of the mucosal structure and regeneration of the epithelium.

Digital measurements: papilla height 228.6±7.63 microns, crypt depth 216.8±6.88 microns, 69.2±3.4 mature enterocytes were counted in one papilla. On micro-preparations stained with alcian blue, an increase in the number of cone-shaped cells was observed - 7.60 ± 0.52 pieces (Fig. 3).

The morphological state of the small intestine mucosa after biocorrection with dandelion root in conditions of renal failure associated with chemotherapy was assessed on the basis of additional histological and morphometric analyses. The results of the study showed that after correction, the architectonics of the mucosa relatively recovered, the integrity of the epithelial layer and the structural stabilization of the papillary crypt system were observed. The restoration of the mucin layer on the surface of the mucous membrane and the clear isolation of glandular structures indicate a tendency to restore the protective and secretory functions of the intestine.

The results of fluorescence and morphometric analysis also showed normalization of the spatial arrangement of epithelial cells and an increase in the density of cellular elements. The revealed distribution of cellular elements confirms the activation of regenerative processes and the positive dynamics of tissue restructuring. These observations indicate the development of structural and regenerative processes in the small intestine against the background of biocorrection.





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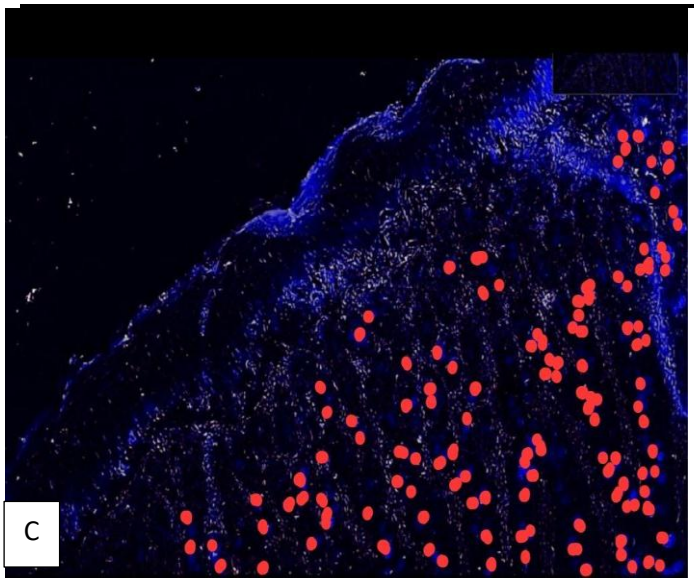

The mucous membrane of the jejunum of a 9-month-old white mongrel rat of the experimental group. A is a micropreparation stained with alcyan blue: mild dystrophic changes in the mucous membrane were observed, a significant decrease in cone-shaped cells and their almost complete disappearance at the tip of some villi; a decrease in the degree of staining indicates a decrease in the content of acidic mucopolysaccharides. V is a digital image of a micro-preparation stained with alcian blue, which was used for clearer visualization of goblet cells (countless variants). This method indicates the presence of mucopolysaccharides in the cytoplasm of the cell in bright blue. S is a segmented digital analysis of the same field in which positive (alcian blue-reactive) cells are marked with red dots. These indicators are used to accurately count the number of goblet cells and estimate the area of their distribution. The number of goblet-shaped cells inside each villi was 6.80±0.47.

In the jejunum, the mucin valve was continuous (Fig. 3. A-B). Papilla height 240.8±7.95 microns, crypt depth 213.6±6.42 microns, number of enterocytes 71.0±3.6 pcs./villi, number of corpus callosum cells 6.80±0.47 pcs./villi. The intensity of staining is the same; there are no signs of detritus. These morphological parameters demonstrated a tendency towards structural restoration of the mucosa after the application of biocorrection in the jejunum. The continuity of the mucin valve indicates the restoration of the protective function of the intestinal epithelium. The approach of papilla height and crypt depth to normal indicators indicates the activation of regenerative processes in the papilla-crypt system. An increase in the number of enterocytes and goblet cells confirms an improvement in the functional state of the epithelial layer and the restoration of secretory activity. The same color intensity and the absence of signs of detritus indicate a decrease in degenerative processes in the mucous membrane, which confirms the stabilization of the morphological state as a result of biocorrection with dandelion root.

Conclusion

1. With renal failure that developed on the background of chemotherapy, morphological changes were observed in the small intestine, papilla height decreased from 267.21 ± 9.91 microns to 198.47 ± 8.32 microns, and the number of enterocytes decreased from 76.5 ± 4.42 to 63.2 ± 3.8, indicating degenerative changes in the mucous membrane.

2.After applying biocorrection with dandelion root, the papilla height increased to 240.8 ± 7.95 microns, the crypt depth was 213.6 ± 6.42 microns, and the restoration of the number of enterocytes to 71.0 ± 3.6 confirmed the activation of regenerative processes in the intestinal mucosa.

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