MORPHOLOGY AND PATHOMORPHOLOGY

Effect of Esophagoplasty on the Mucosa Structure in the Gastric Transplant

G. A. Lapii, L. M. Nepomnyashchikh, I. E. Sudovykh, and A. V. Kutepov

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Structural modifications of the gastric tube transplant were studied during the delayed period after esophagoplasty carried out for benign diseases of the esophagus. Adaptive and pathological reactions manifesting in atrophic and sclerotic changes in the mucosa formed the basis for transplant reorganization. The leading morphological markers were degeneration and hypersecretion of the foveolar epithelium, focal atrophy of the fundal glands with foci of pyloric metaplasia, hypertrophy and fibrosis of the muscle plate, and stromal sclerosis. Abundant polymorphonuclear infiltration of the mucosa with lymphoid follicular hyperplasia were observed in *H. pylori* contamination of the gastric transplant.

Key Words: *esophagoplasty; gastric transplant; biopsy; pathomorphology*

The technologies of esophagus replacement with plastic material from the stomach are now widely used. Two methods of reconstructive interventions are mainly used: plastic repair with the whole stomach or with a gastric tube [4,8,9,15]. The preference of the stomach is determined by its anatomical proximity to the esophagus, high plastic characteristics, and good blood supply.

With time the transplant can undergo adaptive and pathological changes induced by the reconstructive intervention proper and by disorders in the topography of the digestive organs and antiphysiological conditions of functioning, the totality of which constitutes a large heterogeneous group of diseases of an artificial esophagus [3,6,12]. The incidence of these diseases greatly varies and depends not only on the esophagoplasty method, but largely on the morphology and function of the donor organ [2,5,9,14].

Studies of the structural reorganization of the gastric transplant used for plastic repair of the esophagus are rare and the data presented in them are heterogeneous and reflect a great spectrum of pathological phenomena, including ischemic disorders, fibrosis, atrophy, inflammatory reactions, ulcers, and tumors [1,7,10,11,13]. The biological aspects of these phenomena under conditions of esophagoplasty and the structural mechanisms underlying their formation, in general determining the proper functioning of the transplant, remain not quite clear. All this precludes a conceptual generalization of the available facts and create an integral concept of the morphogenesis of diseases of an artificial esophagus reconstructed from the gastric tube.

We studied the structural modifications of the gastric transplant during delayed periods after esophagoplasty carried out for benign diseases of the esophagus.

Institute of Regional Pathology and Pathomorphology, Siberian Division of the Russian Academy of Medical Sciences, Novosibirsk, Russia. ***Address for correspondence:*** pathol@soramn.ru. G. A. Lapii

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MATERIALS AND METHODS

The study was carried out in 13 men and 15 women aged 27-60 years. Twenty-eight clinical observations of artificial esophagus reconstructed from the gastric tube were analyzed. The indications for reconstructive interventions were as follows: cicatricial stenosis after chemical burns (15 observations), third-fourth degree achalasia cardia (11 cases), and peptic stricture of the esophagus in gastroesophageal reflux disease (2 observations). The morphology and function of the artificial esophagus 1 month to 7 years after esophagoplasty were evaluated by endoscopic monitoring supplemented in 27 cases by spot biopsy. A total of 67 biopsy specimens of the mucosa from the gastric transplant and the esophagogastroanastomosis zone were collected for pathomorphological study.

The specimens for microscopy were fixed in 10% neutral formalin and processed by the standard histological methods. Paraffin sections were stained with hematoxylin and eosin in combination with Perls reaction, after van Gieson with resorcin-fuchsin poststaining of elastic fibers and PAS reaction; staining after Giemsa was used for identification of *H. pylori*. Tissue fragments (1 mm^3) for semithin sections were fixed in 4% paraformaldehyde, postfixed in 1% osmium tetroxide, processed by the standard methods, and embedded in epon and araldite mixture. Semithin sections (1 μ) were stained with 1% azur II and Schiff reagent and examined under a universal Leica DM 4000B microscope. Microphotographs were made using Leica DFC 320 camera and Leica QWin software.

RESULTS

Endoscopic study of the artificial esophagus formed from the gastric tube showed high incidence of esophagogastroanastomosis stenosis (17 cases, 60.7%), often associated with cicatricial changes of the mucosa in this zone. Mosaic erythematous changes in the mucosa were detected in 16 (57.1%) cases, atrophic foci in 6 (21.4%) cases. Bile reflux into the artificial esophagus was detected in 13 (46.4%) cases. Importantly, the gastric tube was virtually not liable to hypotony, dilatation, or deformation during the delayed period after esophagoplasty.

Light microscopy of biopsy specimens from the gastric transplant mucosa during the first months after reconstructive interventions revealed degenerative changes in the surface epithelium and glands, which were paralleled by deterioration of cell-cell contacts and increase of glandulocyte desquamation; these cells accumulated in foveolar lumens and glandular secretion ducts (Fig. 1, *a*, *b*). Signs of intensification of cell proliferation with elongation of the cambial zones and increase of the mitotic activity of the epithelium were poorly discernible. Focal disorders in the microcirculation paralleled by lymphoplasmacytic infiltration of the lamina propria were found in some biopsy specimens.

Microscopic examination of biopsy specimens from the artificial esophagus during delayed period after esophagoplasty showed that the most typical of this period were atrophic sclerotic changes of different severity in the mucosa. These changes were found in 76.1% observations. Uneven thinning of the mucosa formed as a result of the glandular layer reduction attracted special attention. By contrast, foveolar structures more often remained deep and in some preparations looked convoluted.

The surface foveal epithelium was characterized by degenerative changes and mainly exhibited high secretion of the mucoid (presumably, a compensatory reaction aimed at increase of the mucosal defense potential in the course of realization of an atypical esophageal function). The epithelial layer was formed by cylindrical mucocytes of the same type. No disorders in cell differentiation with transformation into intestinal metaplasia or dysplasia were detected.

Transition of the gastric cylindrical mucoid epithelium into multilamellar squamous epithelium was seen in the specimens from the esophagogastroanastomosis zone (Fig. 1, *c*); squamous epithelium exhibited a trend to hyperplasia with signs of slight acanthosis. Differentiation into the main cell layers was not impaired; thickening of the intermediate and (less so) of basal layers of epitheliocytes were found. Foci of vacuolar epithelial degeneration, moderate edema, dilatation of the cell-cell spaces, and solitary intraepithelial lymphocytes were seen.

Analysis of the glandular components of the gastric transplant revealed atrophic changes in 66.7% specimens. These changes manifested in reduction of the number and shortening of the terminal compartments of acini together with thickening of the connective tissue lamina separating them; the profiles of some glands were subjected to cystic transformation (Fig. 1, *d*). The epithelial lining of the secretory compartments consisted of degenerative chief, parietal, and accessory glandulocytes. The fundal gland pylorization phenomenon was found in 42.9% specimens. It manifested by foci of the accessory epitheliocyte hyperplasia.

Lymphoplasmacytic infiltration of different intensity was found in the connective tissue compartment of the gastric transplant mucosa; foci of capillary plethora and interstitial edema were more rare (Fig. 2, *a*, *b*). Sclerotic changes predominated in deep sites of the mucosa, around the terminal parts of the glands, and in the submuca, where growth of thick bundles of collagen fibers and signs of perivascular sclerosis were found (Fig. 2, *c*).

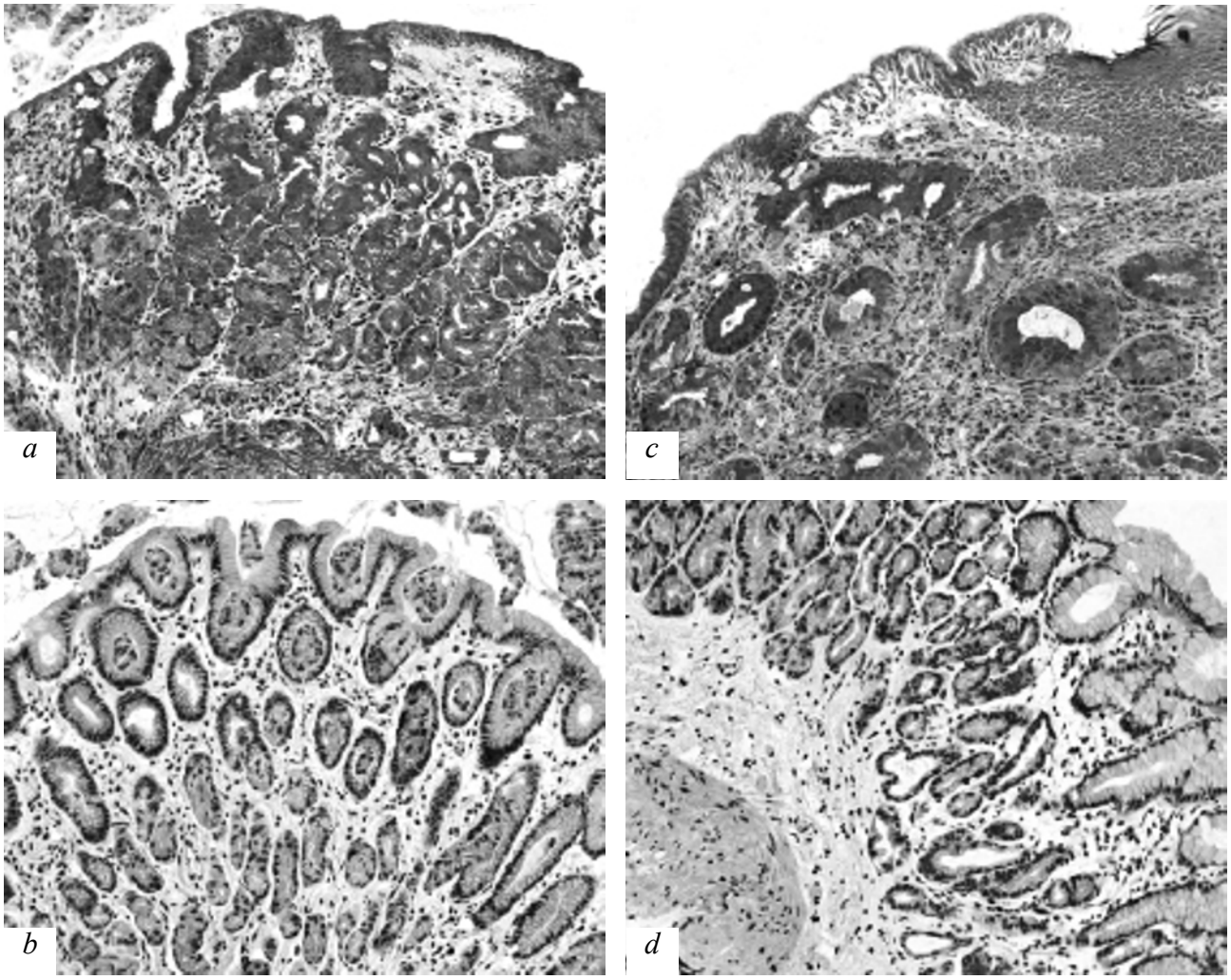

Fig. 1. Structural modifications of epithelial components of gastric transplant mucosa after esophagoplasty. *a*) degeneration of surface foveal and glandular epithelium, slight mononuclear infiltration of stroma; *b*) epithelial degeneration and hypersecretion, desquamated cells in foveal lumens; *c*) degeneration of mucoid epithelium and multilamellar squamous epithelium hyperplasia in esophagogastroanastomosis zone; *d*) hypersecretion of foveal epithelium, atrophy and cystic transformation of glands, stromal sclerosis. *a*, *c*: semithin sections, azur II staining; *b*, *d*: hematoxylin and eosin staining; ×140 (*a*, *b*, *d*), ×280 (*c*).

Hypertrophy and fibrosis of the muscle plate of the mucosa (sometimes significant), thickening of some leiomyocytes in the lamina propria (Fig. 2, *d*), and hyperelastosis were worthy of note. Regeneration and hypertrophy of smooth muscle components of the gastric transplant induced by reconstructive intervention are realized through intricate mechanisms and are closely related to dyscirculatory disorders and functioning of the esophagus. It seems that they play an important role in the formation of delayed complications of esophagoplasty, for example, in those associated with intensification of collagenosis by the formation of anastomosis strictures.

Bacterioscopy of biopsy specimens from artificial anastomosis detected *H. pylori* in 10 of 27 (37%) specimens. Slight and moderate colonization predominated irrespective of the period elapsed after esophagoplasty. The microorganisms were detected in the transplant mucosa and in the esophagogastroanastomosis zone and were located on the mucosa surface and in foveal lumens. Importantly that *H. pylori* contamination of the artificial esophagus was realized in the fundal mucosa, but not pyloric one (as in chronic gastroduodenal disease), which can be responsible for the formation of some structural modifications of the epithelial layer.

Degenerative changes and high secretory activity of foveal epithelium (without cell differentiation disorders) and glandular focal atrophy were found in gastric transplant biopsy specimens contaminated with *H. pylori*. Abundant polymorphonuclear infiltration of the stroma was combined with lymphoid follicular hyperplasia; transepithelial leukodiapedesis was seen in some places. Presumably, long persistence of the

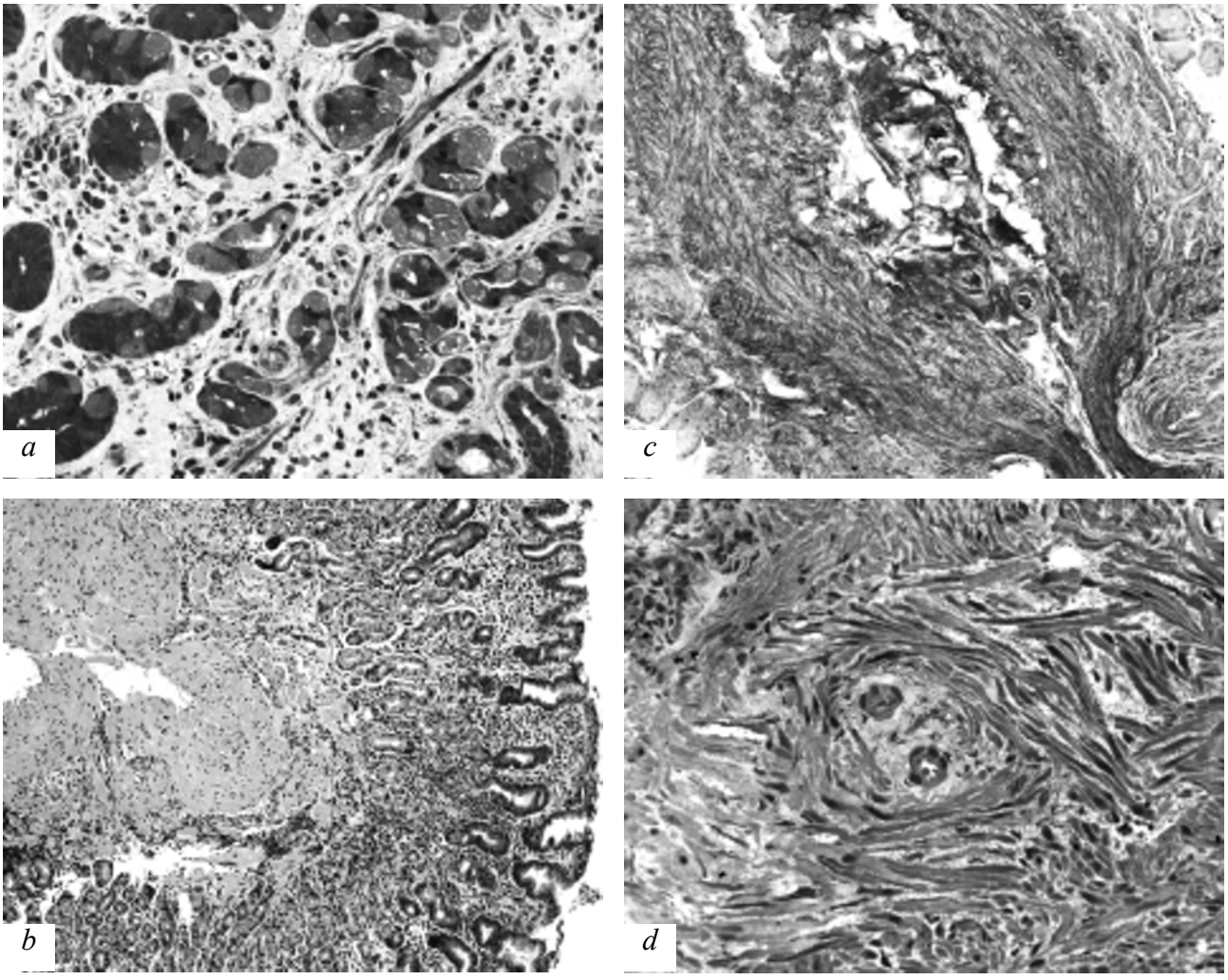

Fig. 2. Structural modifications of connective tissue components of gastric transplant mucosa after esophagoplasty. *a*) thickening of interstitial layers, reduced number of glandular acini; *b*) stromal lymphocytoplasmaytic infiltration, hypertrophic mucosal muscle plate; *c*) muscle plate fibrosis, edema and perivascular sclerosis in the submucosa; *d*) hyperplasia of leiomyocytes, pericapillary sclerosis. *a*, *d*: semithin sections, azur II staining, ×280; *b*) hematoxylin and eosin staining, ×70; *c*) van Gieson staining, ×140.

bacteria in the gastric tube, associated with depression of the mucosal protective mechanisms, can be regarded as a factor augmenting the course of artificial esophagus diseases.

Hence, adaptive and pathological reactions develop in the gastric transplant after esophagoplasty. The association of these reactions is most often realized by the formation of atrophic sclerotic changes in the mucosa. The main morphological marker of these reactions is degeneration and hypersecretion of the foveal epithelium, focal atrophy of fundal gland with foci of pyloric metaplasia, and stromal sclerosis of different severity. Contamination of the mucosa with *H. pylori* is associated with abundant polymorphocellular infiltration concomitant with lymphoid follicular hyperplasia. Inadequate adaptive regeneratory reactions of the gastric transplant, caused by transposition and functioning under antiphysiological conditions, can promote the emergence and negative development of esophageal abnormalities.

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