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FEATURES OF THE GASTRIC AND DUODENAL MUCOSA IN CHILDREN WITH CHRONIC KIDNEY DISEASE

Turdikul Akramovich Bobomuratov, Abduqahhor Abdurakhmonovich Samadov
Tashkent State Medical University, Tashkent, Uzbekistan

Abstract
The study is devoted to the investigation of the clinical, morphofunctional condition of the gastroduodenal region of the digestive system in children with chronic kidney disease using esophagogastroduodenoscopy, endoscopic basal pH-metry, and a stool test to determine the degree of infection with Helicobacter pylori. The obtained results indicate that the frequency and nature of changes in the mucous membrane of the gastroduodenal region depend on the stage of chronic kidney disease, the functional condition of the kidneys, the severity of the underlying disease, the duration of treatment with glucocorticosteroid drugs, and the degree of infection with Helicobacter pylori.
Keywords: chronic kidney disease, esophagogastroduodenoscopy, basal pH-metry, Helicobacter pylori.

Relevance of the Topic: Worldwide, over the last five years, an increase in the incidence of chronic kidney disease (CKD) among children has been observed. According to the World Health Organization (WHO), 11–12 new cases of CKD are diagnosed annually per 100,000 children (incident cases), which indicates the progressive development of the disease and its transition to a chronic form over the years. Children under 10 years of age account for 90% of pediatric patients suffering from chronic kidney disease. According to the literature, against the background of CKD in children, disorders of the gastrointestinal tract are observed in 60–80% of cases, in particular gastritis, gastroduodenitis, duodenitis, and dyspeptic syndromes [1,2,4,7,8,9].

Immunopathological processes in kidney diseases in children, hemostasiological and microcirculatory disorders, as well as long-term treatment with immunodepressants and glucocorticosteroids lead to diffuse damage of the body's membranes, which explains lesions of the digestive system, including damage to the mucous membranes of the stomach and duodenum [1,4,5,6,7,10,12].

Analysis of the morphofunctional characteristics of the digestive and excretory systems makes it possible to conclude that there is a similarity in their histological architectonics, similar transport systems, similar principles of regulation of their functions, and common physiological, microbiological, and immunological processes. In this regard, the structural and functional parallelism of the two systems is also reflected in the similarity of pathological processes [3,9,11,14].

As a result of the identification of changes in the stomach and duodenum in children with chronic kidney disease, the concept of nephrogastrointestinal syndrome has emerged in medical science. In the genesis of this syndrome, vascular and trophic changes in the mucous membrane of the digestive tract, alterations in protein and electrolyte composition, hyperaldosteronism, and imbalance of general and local immune responses are of great importance.

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Based on the above, the determination of the characteristics of clinical and morphofunctional changes in the organs of the gastroduodenal region in children suffering from chronic kidney diseases is undoubtedly of great relevance.

Aim of the Study: To study the morphofunctional features of the gastric and duodenal mucosa in children with chronic kidney disease.

Materials and Methods: Under our observation were 126 children aged 7 to 17 years with different stages of chronic kidney disease. The children were divided into three groups. The distribution of children into groups was based primarily on the stage of chronic kidney disease and the duration of treatment with glucocorticosteroid drugs.

Group 1: Control group – CKD stages 1–2 (GFR > 60 ml/min/1.73 m²), consisting of 34 children with newly diagnosed nephrotic syndrome who had not received prednisolone/methylprednisolone therapy.

Group 2: Main group – CKD stages 1–2 (GFR > 60 ml/min/1.73 m²), consisting of 54 children with the nephrotic form of chronic glomerulonephritis, recurrent 4–5 times, in the active phase and receiving prednisolone/methylprednisolone therapy.

Group 3: CKD stages 3–5 (GFR < 60 ml/min/1.73 m²), with signs of uremia (elevated urea and creatinine levels), consisting of 38 children receiving glucocorticosteroid therapy.

To characterize the morphofunctional condition of the upper gastrointestinal tract, modern and sufficiently informative diagnostic methods were used: esophagogastroduodenoscopy, intragastric pH-metry, and assessment of Helicobacter pylori infection using the urease test.

Results and Discussion

Among the examined patients, a burdened gastroenterological family history was identified in 21 (16.6%) cases. In these children, the early stages of kidney damage were accompanied by lesions of the gastroduodenal zone. However, clinical manifestations indicating damage to the organs of the gastroduodenal zone were not clearly expressed.

Esophagogastroduodenoscopy (EGD) is considered the main instrumental method for assessing changes in the gastric and duodenal mucosa in both adults and children. EGD examination was performed in all children included in the study. The description of the EGD findings began with an assessment of the condition of the esophagus.

In Group 1, CKD stages 1–2 (GFR > 60 ml/min/1.73 m²), n=34 children, changes in the form of esophagitis were detected in 5.9% and reflux esophagitis in 8.8% of cases.

In Group 2, CKD stages 1–2 (GFR > 60 ml/min/1.73 m²), children with the nephrotic form of chronic glomerulonephritis with 4–5 relapses and receiving prednisolone/methylprednisolone therapy during the active phase, n=54, pathological conditions in the form of esophagitis were detected in 18 cases (33.3%), while reflux esophagitis was identified in 24 patients (44.4%, P<0.001).

In Group 3, CKD stages 3–5 (GFR < 60 ml/min/1.73 m²), with signs of uremia (elevated urea and creatinine levels) and receiving glucocorticosteroid therapy, n=38, pathological conditions in the form of esophagitis were detected in 14 cases (36.8±7.9%, P<0.01), while reflux esophagitis was identified in 21 patients (55.3±8.2%, P<0.001).

In particular, among all 126 children with CKD, esophagitis was diagnosed in 34 patients (27.0±4.0%), gastroesophageal reflux (GER) in 48 patients (38.1±4.3%), and a total of 82 children (65.1±4.3%) were diagnosed with esophagitis and GER.

The pathological conditions observed in the esophagus in the form of esophagitis and GER were mainly recorded in Groups 2 and 3

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Table 1.
Endoscopic Examination Results of the Esophagus in Children with Nephrotic Syndrome (n = 126), %

Groups	Esophagitis		Ger		Total	
	abs	%	abs	%	abs	%
Group n=34	2	5,9±4,1	3	8,8±4,9	5	14,7±6,2
Group n=54	18	33,3±6,5**	24	44,4±6,8***	42	77,8±5,7***
Group n=38	14	36,8±7,9**	21	55,3±8,2***	35	92,1±4,4***^
Total n=126	34	27,0±4,0	48	38,1±4,3	82	65,1±4,3

Note: * – the difference is significant compared with the indicators of Group 1 (P < 0.01; *P < 0.001); ^ – the difference is significant compared with the indicators of Group 2 (^P < 0.05).

When analyzing the results of EGD examination of changes in the stomach and duodenum in children suffering from chronic kidney disease, in Group 1 (n=34), chronic gastritis was detected in 4 cases (11.8±5.6%), and chronic gastroduodenitis in 7 cases (20.6±7.0%). In Group 2 (n=54), chronic gastritis was detected in 4 cases (16.7±5.1%), and chronic gastroduodenitis in 36 cases (66.7±6.5%, P<0.001). Erosive-ulcerative changes of the stomach were observed in 6 cases (11.1±4.3%, P<0.05), and duodenal ulcer disease in 3 cases (5.56%). In Group 3 (n=38), chronic gastritis was detected in 3 cases (7.89%), and chronic gastroduodenitis in 29 cases (5.6±3.2%). Erosive-ulcerative changes of the stomach were observed in 4 cases (10.5±5.0%, P<0.05), and duodenal ulcer disease in 2 cases (5.3±3.7%). In particular, among all 126 patients, chronic gastritis was detected in 16 cases (12.7±3.0%), and chronic gastroduodenitis in 72 cases (57.1±4.4%). Erosive-ulcerative changes of the stomach were observed in 10 cases (7.9±2.4%), while duodenal ulcer disease was observed in 5 cases (4.0±1.8%). The changes in the digestive system depended on the stages and clinical forms of chronic kidney disease and were mainly observed in Groups 2 and 3, who had been receiving prednisolone therapy for more than 6 months (Table 2).

Table 2
Results of endoscopic examination of the stomach and duodenum in children with nephrotic syndrome

Diagnosis	Group 1, n=34		Group 2, n=54		Group 3, n=38		Total, n=126	
	abs.	%	abs.	%	abs.	%	abs.	%
Chronic gastritis	4	11,8±5,6	9	16,7±5,1	3	7,9±4,4	16	12,7±3,0
Chronic gastroduodenitis	7	20,6±7,0	36	66,7±6,5***	29	76,3±7,0***	72	57,1±4,4
Erosive-ulcerative changes of the stomach	0	0	6	11,1±4,3*	4	10,5±5,0*	10	7,9±2,4

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Duodenal ulcer disease	0	0	3	5,6±3,2	2	5,3±3,7	5	4,0±1,8
Total:	11	8,7±2,5	54	42,9±4,4** *	38	30,2±4,1** *	103	81,7±3,5

Note: * – the difference is significant compared with the indicators of Group 1 (*P < 0.05; ***P < 0.001).

The EGD study demonstrated that various pathological manifestations of the gastroduodenal region do not occur separately and, in most cases, are found in combination, i.e., simultaneous damage to different parts of the mucous membrane of the esophagogastroduodenal region is observed. In particular, simultaneous inflammatory lesions of the stomach (CG, CGD) and the esophagus (esophagitis) were recorded in 59 of 126 patients (46.8% ± 4.6%, P < 0.001).

The study of the frequency of endoscopic changes in the mucous membrane of the stomach and duodenum depending on the activity of CKD showed that, in the active stage of the disease, pathological changes of the gastroduodenal region were observed in 103 (81.7±3.5%) of 126 patients. Of these, 11 (8.7±2.5%) cases were detected in Group 1, 54 (42.9±4.4%) in Group 2, and 38 (30.2±4.1%) in Group 3 (P < 0.001). Comparison of these results with clinical data indicates that gastric and duodenal lesions had a latent course in approximately two-thirds of children with nephrotic syndrome.

Furthermore, in Group 1, CKD stages 1–2 (GFR > 60 ml/min/1.73 m²), n=34 children, the stomach was involved more frequently than the duodenum. This is confirmed, in particular, by the detection of signs of erosive gastritis in the stomach in patients of all examined groups. Erosive-ulcerative changes of the stomach and duodenal ulcer disease were mainly identified in patients of Groups 2 and 3 who had continuously received glucocorticosteroid therapy for six months or longer.

Regarding the fact of ulcerative changes in the duodenal mucosa, in the first case, pronounced hyperchlorhydria, as well as the significance of glucocorticosteroid therapy, should be considered; in the second case, a significant impairment of local regenerative processes in CKD and the addition of Helicobacter pylori infection cannot be excluded.

In all groups, visual examination of the gastric mucosa most often revealed diffuse forms of lesions. Isolated localization of the inflammatory process in the antral region of the stomach was observed only in patients of Group 1 (32.3±3.1%).

In Groups 2 and 3, widespread superficial changes of the gastric mucosa were detected endoscopically (83.3±2.6% and 84.21±2.4%, respectively; P < 0.001), and they represented the predominant form of lesion at the onset of the disease. In these groups, simultaneous damage to different parts of the mucous membrane of the esophagogastroduodenal region predominated (94.4±1.4% and 94.7±1.6%, respectively; P < 0.001).

Analysis of the results of intragastric pH-metry showed that various disturbances of acid-producing function were identified in the majority of patients with CKD and endoscopic changes (51 patients, 65.4%). At the same time, a decrease in acid-producing function from moderate values to markedly reduced levels was observed in 27 patients (34.6%).

Among 78 children with CKD and endoscopically confirmed changes, 64 cases allowed confirmation of the significance of Helicobacter pylori in the genesis of gastric and duodenal lesions. The frequency of Helicobacter pylori detection was directly related to the severity of gastric mucosal damage and was higher in hypertrophic and erosive gastritis, being detected in 46 patients (71.8%), whereas in superficial changes it was detected in 18 patients (28.2%).

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A detailed study of the gastroduodenal region revealed the presence of pathological changes in 110 (87.3%) of the 126 children under our observation. This indicator is 2.5 times higher than the incidence of chronic gastroduodenitis in the general population, which varies from 25% to 30% [12], and 3.5 times higher than that observed in children of the control group (32 children – 29.0%).

In children with the nephrotic form of chronic glomerulonephritis and various variants of nephrotic syndrome, superficial gastritis and gastroduodenitis were the most common findings, being detected in 82 children (65.1%). Deep changes of the mucous membrane of the gastroduodenal region, most often in the form of erosive or hypertrophic granular gastritis, erosive or pronounced duodenitis, were identified in 19 cases (13.6%): 2 cases (1.7%) in the first group, 10 cases (5.88%) in the second group, and 5 cases (3.97%) in the third group. Inflammatory changes of the mucous membranes of the stomach and the cardiac part of the esophagus associated with gastroesophageal reflux were detected in a total of 5 children (3.97%). Duodenogastric reflux in the presence of inflammatory changes of the gastric and duodenal mucosa was recorded in a total of 4 children (3.17%).

The study of the frequency of endoscopic changes in the mucous membrane of the stomach and duodenum depending on the activity of CKD showed that, during the active phase of the disease, pathologies of the gastroduodenal region were detected in 78 cases (71%): in 8 patients (10.3%) of the first group, 40 patients (51.3%) of the second group, and 30 patients (38.4%) of the third group. Deep changes were observed in 28 cases (16.7%). Among these children, 54 continued to receive glucocorticosteroid therapy, while 24 continued cytostatic therapy.

Conclusions

In children with chronic kidney disease, changes in the mucous membrane of the gastroduodenal region are observed in 87.3% of cases. According to the results of esophagogastroduodenoscopy, in CKD stages 3–5 (GFR < 60 ml/min/1.73 m²) accompanied by signs of uremia, as well as in hormone-dependent variants of nephrotic syndrome, erosive and hypertrophic gastritis or gastroduodenitis are detected in every tenth case (13.6%), whereas superficial changes are observed in the remaining cases.

In chronic kidney disease, disturbances of the acid-producing function are observed in 79.8% of children, while impairment of the acid-neutralizing function is observed in 89.9% of children.

In children with chronic kidney disease, the frequency of detection of Helicobacter pylori largely depends on the depth of damage to the gastric and duodenal mucosa. It was detected more frequently in hypertrophic and erosive gastritis—46 patients (71.8%), whereas in superficial changes it was detected in 18 patients (28.2%).

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