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Effect of fungal colonization of gastric mucosa on the course of gastric ulcers healing

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SUMMARY

Background: *The aim of the study was to evaluate the effect of fungal colonization on the course of gastric ulcer disease with particular regard to regression of clinical symptoms and reduction in ulcer niche size.*
Material and methods: *The study was performed on the group of 293 patients, aged 20–80, with clinical symptoms of peptic ulcer disease, who attended Gastroenterology Outpatient Department of Collegium Medicum of Kraków Jagiellonian University. Endoscopy of the upper gastrointestinal tract was performed before and following a-4-week period of a standard anti-ulcerous treatment. During the examination aspirate of the stomach contents and surface brushing were collected. Moreover, biopsy specimens from the bottom of the ulcer or inflamed gastric mucosa were taken for mycological and histopathological examinations. According to contemporary recommendations eradication treatment of Helicobacter pylori was introduced in urease-positive patients with endoscopy-proved gastric ulcer.*
Results and conclusions: *The results of our research showed that fungal colonization of gastric ulcers impairs the course of ulcer healing. Moreover, it results in clinical symptoms maintenance as compared with ulcers with non-significant fungal cells count.*

BACKGROUND

Interest in the involvement of infectious factors in the pathogenesis of stomach and duodenum diseases have grossly increased over recent years. Some years ago, acidic environment of stomach was considered as an unfavourable factor for colonization of gastric mucosa by both bacteria and fungi. What is more presence of those organisms was regarded as an indicator of a decreased acidity of gastric contents [1,2]. Fungi of Candida sp. represent a component of normal flora of alimentary tract. They were discovered in oral cavity, jejunum and ileum in 30%, 54% and 55% of healthy people respectively [3,4]. Nevertheless, results of contemporary investigations indicate an increase in the incidence of fungal colonization of gastric mucosa. Fungi are isolated from patients without fungal infection symptoms in 7 up to 33% of cases, according to different authors [5,6,7].

Since 1980 many authors have underlined the fact that fungal infections are on the increase [8]. At present fungi represent one of the etiologic factors of the hospital inborn infections. In the intensive care units they are on the fourth place as regards incidence [9].

Factors predisposing to the development of fungal infections include underlying diseases such as dia-

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betes, neoplasm as well as surgery, injury, burn, antibiotics, steroids, immunosuppressive agents or cytostatic treatment. Moreover, parenteral nutrition, intravascular or bladder catheter applied for long predispose to fungal infection [5,10–12].

Candidiasis is still the most frequent mycosis of alimentary tract and Candida albicans is isolated in about 79% of cases [13]. Recently, a change in the incidence of some species has been observed: a decrease in C. albicans frequency and an increase in the frequency of previously rarely encountered or totally absent species such as C. glabrata, C. lusitaniae, C. krusei, C. zeylanoydes [14]. The frequency of C. tropicalis has remained unchanged [14]. A growth in mixed type infections incidence has also been reported, even in up to 75% of cases, usually with C. albicans or C. tropicalis along with C. krusei and C. glabrata involved [14]. The reason for that is introduction of improved, more sensitive diagnostic methods including DNA analysis as well as immunosuppresive treatment and broad application of wide-spectrum antibiotics [8]. This phenomenon was observed even when antifungals of the imidazole group, e.g. fluconazole, were applied [14]. These drug promoted growth of C. krusei and C. glabrata which were already resistant to fluconazole and cross resistant to other agents of the imidazole group. The resistance to antifungal agent was manifested by the lack of disease regression but and intensification of clinical symptoms during treatment [14].

Fungal colonization of gastric mucosa can be defined as presence of fungus in a symptom-free patient [17]. It can develop into a fungal infection manifested by infection symptoms and the presence of fungal antigen in blood serum [17]. Candidemia i.e. presence of fungi in the blood, is a result of a shift in the equilibrium between the immune mechanisms of host, like non-specific immunisation, cellular and humoral resistance on the one hand and pathogenicity of invading strain and complex interactions between microorganisms on the other [18]. According to Dyess, disturbance in defence mechanisms is the main reason for candidemia. [13].

Clinical symptoms of fungal colonization of stomach are rather non-specific. Dyspepsia, pain in the epigastrium, weight loss, ulcerous sufferings and vomiting are the most common. Sometimes, bleeding from the upper part of alimentary tract resulting from injury of a vessel by fungal infiltration can occur [2,19].

Minoli et al. distinguished 3 basic types of endoscopic images in patients with fungal colonization of gastric mucosa. The aphthous type, accounting for 42% of all cases, is the easiest to identify as white-grey membranes on a pulpy base. The nodular type, accounting for 27%, is usually found in antrum as a-few-millimetre nodules surrounded by inflammatory mucosa and granulation. This form of candidiasis is often invasive. The ulcerous type was found in 27% of all cases [21,22].

According to Loffeld and Antonioli, endoscopic images of gastric ulcer infected with fungi have the following features: the diameter of ulceration exceeding 2 cm, large crater with irregular infiltration of the margins, hard bottom, tendency to bleed and is localised in the area of the stomach angle [23]. Infiltrations consisting of neutrophiles, granulation with giant cells, microabscesses and fibrin were found in the fungal ulcers [24]. The phenomenon of dimorphism, i.e. concurrent presence of blastospores and mycelium is considered as an indicator of fungi pathogenicity [23,24].

In the late 1970s Robin Warren, histopathologist from the Royal Perth Hospital in Australia, observed spiral bacteria in an active chronic gastritis B. Since that time many research centers have confirmed that spiral bacteria not only colonize gastric mucosa but also cause chronic gastritis and appear to be a substantial etiologic factor in gastric and duodenal ulcer disease [1,26].

H. pylori infection increases the risk of gastric ulcer and chronic gastritis development. The risk of gastric ulcer is 3 to 10-folds higher and of gastric carcinoma twofold higher in patients with H. pylori without symptoms of mucosa atrophy. Atrophy raises that risk twofold [27].

Gastric ulcer often develops from chronic atrophic gastritis, which usually starts in the area of stomach angle and is accompanied by intestinal metaplasia. As a result a decrease in the secretion of hydrochloric acid in the stomach is observed [28,29].

Plasmacytic and lymphocytic infiltrations are typical for chronic gastritis in the course of H. pylori infection and the presence of neutrophiles is an indicator of the level of the process intensity [30].

Both spiral bacteria and fungi have been found in the stomach environment. These microorganisms are able to colonize gastric mucosa. According to some authors, e.g. Lee et al, fungi are regarded as

'innocent bystanders', which under favourable conditions can lead to inflammatory reaction [30,31]. Fungi have been found mostly at the bottom of the ulceration and in its vicinity [30]. Spiral bacteria are present in both antrum and the body of the stomach. Gastritis caused by that bacterium is a progressive process, which starts in antrum and spreads into the body of the stomach. Subsequently this process leads to atrophic changes in mucosa [32,33,34]. Infiltrations consisting of plasmocytes and neutrophiles are indicators of the inflammatory process. The presence of neutrophiles is a measure of its intensity. However, infiltrations of neutrophiles, granulation with giant cells, microabscesses and fibrin are found at the bottom of gastric ulcers colonised by fungi. The importance of fungi occurrence in gastric environment seems to be an open question, which requires a more detailed explanation, regardless the role of spiral bacteria in the pathogenesis of gastric and duodenal disorders.

The objectives of this investigation were as follows:

– to determine the incidence of fungi in the stomach of patients with gastric ulcer and chronic gastritis compared to healthy population;
– to determine the effect of fungal colonization on the course of gastric ulcer disease, with particular regard to regression of clinical symptoms and reduction in ulcerous niche size.

MATERIAL AND METHODS

The study was performed on a group of 293 patients including 142 females and 151 males, aged 20–80, with dyspeptic complaints or clinical symptoms of peptic ulcer disorder, attending Gastroenterology Outpatient Department of Collegium Medicum of Kraków Jagiellonian University. The full characterics is presented in Table 1.

Patients with diabetes and systemic diseases as well as those taking cytostatics, steroids, antibiotics or non-steroid drugs within 6 weeks preceding the study were excluded. Before entering the study all patients gave their written informed consent.

Clinical examinations

Clinical examinations included full medical history with a special focus on the duration of the disease, drugs ingested, use of stimulants (tobacco, alcohol, coffee) and involvement of other factors promoting development of mycosis [13]. Gastric contents, surface brushing from the bottom of ulcer or from inflamed gastric mucosa and biopsy specimens from the bottom of the ulcer or from inflamed gastric mucosa were sampled from all patients for mycological examinations.

The pH of gastric contents aspirate was measured in all patients.

On endoscopy, biopsy specimens from the vicinity of the ulcer or inflammatory gastric mucosa (inflammation criteria by The World Congress of Gastroenterology in Sydney, 1990) and from prepyloric area [37] were taken for a routine histopathological examination. The presence of spiral bacteria and fungi was also checked.

After every examination, special attention was paid to precise cleaning and disinfection of the endoscop, bioptic forceps and cannulas for gastric contents, according to the guidelines of the European Society of Endoscopy [38].

Blood samples were collected from all patients for blood grouping and to determine the level of fungal antibodies in serum. Moreover, in 51 patients the presence of fungal mannan antigen was determined.

Mycological examination

Mycological examination included evaluation of direct specimens from the aspirated gastric contents and surface brushing collected from the bottom of

Table 1. Profile of investigated groups.

Group	N	Number of women	Number of men	Age* of women	Age* of men
Gastric ulcer with significant fungal cells count	51	26	25	55 33–70	56 36–70
Gastric ulcer with non-significant fungal cells count	43	20	23	48 27–70	50 36–70
Chronic gastritis	107	61	46	50 23–73	48 21–70
Control	92	35	57	43 20–69	48 21–80

N – group size, * – mean, minimum and maximum ages are given in years.

the ulcer or inflamed mucosa. Also, quantitative and qualitative examinations of gastric contents, surface brushing and biopsy specimens sampled from the bottom of ulceration or inflamed mucosa were performed, including identification of cultured strains and antimicograms.

Quantitative mycological examinations and results analyses were performed by modified M(ller method [39]. According to this method, the fungal cells count of 10^3 cells/ml and below was considered as a non-significant. The result of 10^4 cells/ml was considered as ambiguous requiring re-examination. The results of 10^5 and 10^6 cells/ml were regarded as significant count of fungal cells in the examined specimen.

Further identification of Candida and Torulopsis species was performed using biochemical tests API 20C AUX (bioM(rieux, France), according to the procedure recommended by manufecturer.

Susceptibility of fungi, isolated from patients, to antifungal drugs was determined by diffusion-disk method with the use of standard paper disks Whatman 3 mm Chr soaked with antifungal drugs.

The serological examination included the detection of IgG antifungal antibodies in blood serum by indirect immunofluorescence reaction and immunodiffusion in gel [39]

In order to detect fungal mannan antigen in blood serum latex test of Latex Detection System (Immuno-Mycologics Inc, USA) was applied.

Also, in vitro examinations of the growth of 71 C. tropicalis and 24 C. albicans strains, isolated from patients, in Sabouraud medium at pH from 2.0 to 8.0 were carried out. The obtained results represented the basis to determine typical pH for the growth of fungal strains studied.

As a result of endoscopic and mycological examinations, the patients were divided into the groups such as:

a) Patients with gastric ulcer and significant count of fungal cells in the stomach in whom the count of fungal cells was 10^5 cells/ml or higher in at least 2 out of 3 results of mycological examination of: stomach contents, surface brushing from the bottom of the ulcer or gastric mucosa, biopsy specimen sampled from the ulcer or gastric mucosa. For statistic analysis the mean count of fungal cells in specimens taken from a patient was used.
b) Patients with gastric ulcer and non-significant fungal cell count in the stomach in whom at least one examination result was 10^3 cells/ml or lower or no fungi were found.
c) Patients with endoscopic diagnosis of chronic gastritis, confirmed by histology, with significant count of fungal cells; criteria as described above.
d) Patients with chronic gastritis and non-significant fungal cells count.
e) Control group comprising patients with regular endoscopy of gastric mucosa.

Following a 4-week period of standard antiulcerous treatment the above examinations were repeated. Eradication treatment was introduced in urease-positive patients with endoscopic diagnosis of gastric ulcer, according to contemporary recommendation. If gastric ulcer was not completely cured, examinations were repeated every 2 weeks until the ulcer regressed.

Histological examinations

Biopsy specimens sampled from ulcer vicinity or inflammatory gastric mucosa and prepyloric area were routinely stained with hematoxylin and eosin as well as by the PAS or alcian blue – PAS methods was introduced to assess changes in the tissue and reveal possible presence of fungi.

The specimens were also stained by the Giemza modified method for the presence of spiral bacteria. The histological examinations were carried out in the Institute of Clinical and Experimental Pathomorphology of Collegium Medicum, Jagiellonian University, Kraków.

Statistical analysis

The results of our research are presented as mean values (standard error of the mean ± SEM). The statistical significance of differences between the studied groups was assessed using χ^2 test [40]. The value of $p < 0.05$ was considered to be statistically significant.

The variability of the parameters like gastric ulcer diameter and concentration of fungi in the stomach was analysed by the least squares method and described by equation: $d = Ae^{-bt}$, where exponent *'b'* determines the rate of changes in the above mentioned parameters in subsequent endoscopic examinations [12].

Table 2. Occurrence of significant count of fungal cells in material taken from the stomach with regard to patient groups (the absolute and percentage values)

Studied group	N	Count of fungal cells		
		Significant		Non-significant
			10^6 cells/ml	
I Gastric ulcer	94	51 (54.2%)	13 (13.8%)	43 (45.8%)
II Chronic gastritis	107	11 (10.3%)	2 (1.9%)	96 (89.7%)
III Control	92	4 (4.3%)	0	88 (95.7%)

The statistical significance: I vs.II $p < 0.0001$; I vs.III $p < 0.00001$; II vs.III $p = 0.05$

Table 3. The frequency of clinical symptoms in gastric ulcer patients with significant and non-significant count of fungal cells as found at diagnosis.

Studied group	N	Pain in epigastrium	Weakness	Weight loss	Vomiting	Retrosternal pain	Dysphagia
Gastric ulcer with significant fungal cells count in stomach	38	92 %	76 %	60 %	31 %	18 %	18 %
Gastric ulcer with non-significant fungal cells count in stomach	43	83 %	68 %	43 %	35 %	29 %	11 %
Significance level		< 0.05	NS	< 0.05	NS	NS	NS

NS = statistically non-significant

RESULTS

The presence of fungi in the material sampled on endoscopy, i.e. in stomach contents, surface brushing and biopsy specimen from gastric mucosa in patients with gastric ulcer and chronic gastritis is presented in Table 2.

The quantitative mycological examination revealed significant fungal cells count in 54.2% of the cases and in 13.8% of the cases the fungal cells count was pathologically significant amounting to 10^6 cells/ml in the group of 94 patients with endoscopic diagnosis of gastric ulcer. The significant count of fungal cells was found in 10.3% of the cases compared with 4.3% in the control group in the group of 107 patients with chronic gastritis.

In this research work it is attempted to recognize the differences, or lack of them, between patients with significant and non-significant fungal cells count in the clinical course of gastric ulcer disorder.

In the group of gastric ulcer patients with significant count of fungal cells, the mean duration of the disease was 9.2 years, whereas in gastric ulcer patients with non-significant fungal cells count was 5.7 years.

As it is demonstrated in Figure 1, the cases with duration of the disease exceeding 6 years were more frequent in the group of gastric ulcer patients with significant fungal cells count as compared to the cases of ulcers not colonized by fungi. The cases with shorter duration of symptoms, not exceeding 5 years, were more frequent in gastric ulcer patients with non-significant fungal cells count.

The frequency of clinical symptoms in gastric ulcer patients with significant and non-significant count of fungal cells as found at the moment of diagnosis is presented in Table 3.

Among the clinical symptoms reported by the patients with gastric ulcer such as pain in the epigastrium, weakness, weight loss, vomiting, retrosternal pain, dysphagia – two of them i. e. pain of epigastrium and weight loss were significantly more frequent in the group of high fungal cells count, $p = 0.039$ and $p = 0.019$, respectively.

With gastric ulcers regression clinical symptoms subsided. Detailed results are presented in Table 4.

On the basis of the above data it was found that on week 4 such symptoms as pain in epigastrium, weakness, weight loss and vomiting were significantly more frequent in gastric ulcer patients with significant count of fungal cells.

The history data concerning stimulants usage, presented in Table 5, did not indicate any remarkable difference between gastric ulcer patients with significant and non-significant fungal cells count.

Table 4. Regression of clinical symptoms in gastric ulcer patients with significant and non-significant count of fungal cells on week 4 following diagnosis.

Studied group	N	Pain in epigastrium	Weakness	Weight loss	Vomiting	Retrosternal pain	Dysphagia
Gastric ulcer with significant fungal cells count in stomach	38	92 %	76 %	60 %	31 %	18 %	18 %
Gastric ulcer with non-significant fungal cells count in stomach	43	83 %	68 %	43 %	35 %	29 %	11 %
Significance level		< 0.05	NS	< 0.05	NS	NS	NS

NS = statistically non-significant

Table 5. Frequency of stimulants uptake by the patients with significant and non-significant count of fungal cells in stomach.

Studied group	N	Smoking > 20/day	Alcohol > 50 g/day	Coffee > 3 cups/day
Gastric ulcer with significant fungal cells count in stomach	38	47 % 55 %	30 % 26 %	40 % 35 %
Gastric ulcer with non-significant fungal cells count in stomach	43	NS	NS	NS
Significance level				

NS = statistically non-significant

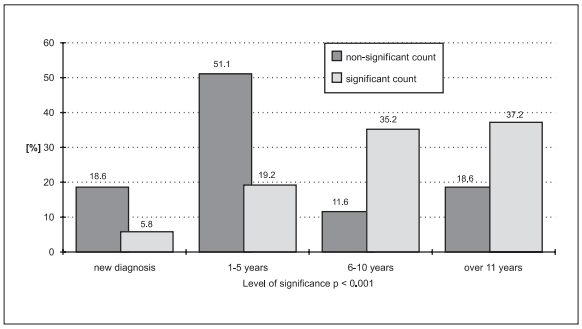

Figure 1. Duration of gastric ulcer in patients with significant and non-significant fungal cells count.

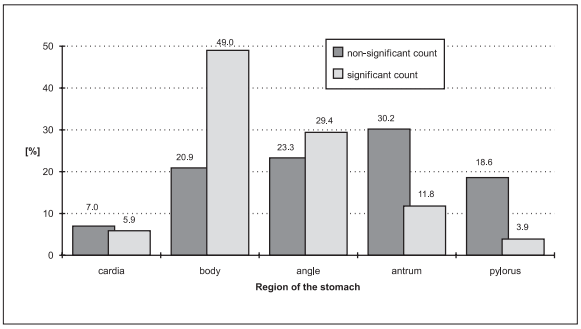

Figure 2. Location of gastric ulcers with significant and non-significant fungal cells count.

The localization of gastric ulcers of significant and non-significant fungal cells count is presented in Figure 2.

Gastric ulcers with significant fungal cells count were significantly more frequent in the stomach body compared with ulcers with non-significant fungal cells count (49% vs 21%, respectively) whereas ulcers with non-significant fungal cells count were significantly more frequent in the prepyloric area in comparison to significant fungal cells count (49% vs 16%, respectively).

On endoscopic detection of gastric ulcers, the diameters of ulcers with high fungal cells count were significantly larger than the diameters of ulcers with low fungal cells count ($p = 0.01$). The mean, minimum and maximum values of ulcers diameters in the above groups are presented in Table 6.

The frequency of ulcers with non-significant fungal cells count was threefold much higher than the frequency of ulcers with significant fungal cells count in the group of gastric ulcers whose diameters ranged from 0 to 10 mm.

Mean value of the ulcer diameter of each studied group was calculated on consecutive endoscopic examinations performed at 4, 6, 8, 10 weeks of observation. Time-related changes in gastric ulcer diameters were approximated with the least square method using an exponential function $d = Ae^{-bt}$

Table 6. The diameters of gastric ulcers with significant and non-significant count of fungal cells.

Gastric ulcers	The diameters of gastric ulcers [mm]
with significant count of fungal cells	15±2.3 10–40
with non-significant count of fungal cells	12±1.5 5–20

The mean (SEM, minimum and maximum values are presented.

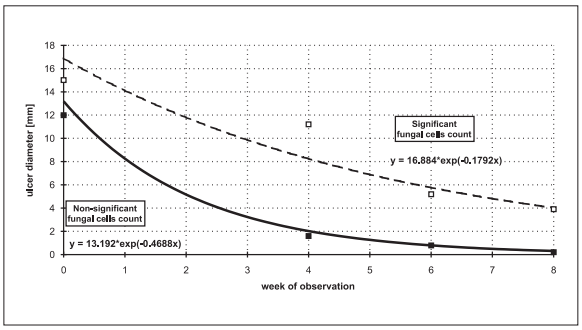

Figure 3. Changes in gastric ulcers diameters in patients with non-significant and significant fungal cells count as measured on consecutive endoscopies.

[38]. This function was chosen as its character is relevant to the real time-dependent variability of ulcers diameters.

In this function "d" represents ulcer diameter, "t" time from the start of observation, coefficient "A" reflects the shape of the function. The rate of ulcer regression is determined by exponent "b". The higher "b" the higher the rate of ulcer diameter reduction. All this data is presented by Figure 3.

The obtained results indicate a significantly higher rate of changes in ulcer diameter in cases with low fungal cells count as compared to cases with high fungal cells count. That can be concluded from the values of exponent "b" in equations of the curves describing the changes in ulcer diameters during consecutive endoscopic examinations: 0.4688 and 0.1792 respectively.

The percentage of regressed gastric ulcers found on consecutive endoscopic follow-up examinations following 4, 6, 8, 10 weeks of observation is presented in Table 7. Based on this data the rate of regressed gastric ulcers found on consecutive endoscopic examinations was significantly higher in the group of ulcers with non-significant fungal cells count.

DISCUSSION

Research works conducted since the late 1970s indicate a substantial role of infectious factor in the pathogenesis of gastric and duodenal ulcer disease. Previous concepts that acidic gastric environment is unfavourable to microbial colonization have not been confirmed yet [25].

The latest data on the incidence of fungal infections in gastric ulcers range from 6.5%, according to di Febo, to 33–36%, according to Katzenstein and Gotlieb-Jensen [41,42,24]. In our research work we found significantly more frequent fungal colonization of gastric ulcers: In 54.2% of patients compared to 10.3% of patients with chronic gastritis and 4.3% in control group. It is noteworthy that in 13.8% of all gastric ulcer cases the count of fungal cells was extremely high and amounted to 10^6 cells/ml. Inconsistency of data reported by different authors seems to be partially due to a set of different criteria employed for detecting fungal colonization, age of patients, concurrent diseases and applied pharmacotherapy.

Wyatt et al. reported that the incidence of spiral bacteria is dependent on the age of patients. In the group of patients below 60 years of age these bacteria were found in 91.1% of patients whereas in the group over 70 years of age – in 65.5% [43]. The incidence of spiral bacteria found in our control group (67%) is similar to that reported by Asake: 40–70% of functional dyspepsia cases and 50% in healthy subjects [44]. Polish authors, including Muszyński et al, report the following frequency of

Table 7. The rate of healed gastric ulcers in consecutive endoscopic examinations in gastric ulcer patients with significant and non-significant fungal cells count.

Gastric ulcers	N	Week of follow-up examination				
		4	6	8	10	12
with significant count of fungal cells	20	62 %	70 %	79 %	84 %	89 %
with non-significant count of fungal cells	43	78 %	92 %	95 %	97 %	98 %
Significance level		< 0.05	< 0.005	< 0.005	< 0.05	< 0.05

NS = statistically non-significant

H. pylori: 62% in functional dyspepsia cases, 65–97% in gastric ulcer patients and 20–38% in healthy persons [45]. In our study the coincidence of significant fungal cells count with the occurrence of spiral bacteria was found in 14% of gastric ulcer cases, in 4% of chronic gastritis cases and in 2% of control group subjects. These data are similar to those reported by Kalogeropuolus et al. Twelve percent for gastric ulcers could indicate a rare co-existence of spiral bacteria with fungi what can result from different environmental conditions required for their colonization and growth [30].

Some differences between gastric ulcer patients with significant and non-significant count of fungal cells in the stomach have been observed during the study. The mean duration of gastric ulcer disorder in patients with significant fungal cells count was twice as much as in patients with non-significant fungal cells count: 9.2 and 5.7 years respectively. In the group with high fungal cells count the cases over 6 years were significantly more frequent as compared with the group with non-significant fungal cells count.

Among the clinical symptoms reported by patients with gastric ulcer, like pain of epigastrium, weakness, weight loss, vomiting, retrosternal pain, dysphagia – pain of epigastrium and weight loss were significantly more frequent in patients with high fungal cells count.

Following 4 weeks of observation the symptoms like pain of epigastrium, weakness, weight loss and vomiting remained significantly more frequent in gastric ulcer patients with high fungal cells count.

The medical history data on stimulants use in patients did not reveal any significant differences between gastric ulcer patients with significant and non-significant fungal cells count.

Examination of gastric ulcers position showed that ulcers with significant fungal cells count were more frequently encountered in the body of stomach in comparison with ulcers with non-significant fungal cells count (Fig. 2). Ulcers with low count of fungal cells were significantly more frequently observed in the prepyloric area as compared with ulcers with significant fungal cells count. Loffeld et al. and Oehlert et al. reported similar results [23,46]. This phenomenon can be explained by predisposing conditions to fungal colonization observed in the stomach body such as enhanced mucosal atrophy in this region in the course of gastric ulcer disorder and higher pH compared with the prepyloric area. The diameters of ulcers with high fungal cells count were significantly larger as compared with those of ulcers with low fungal cells count. Other authors, e.g. Loffeld et al. report that gastric ulcers with high fungal cells count are large in size, have infiltrated margins and resemble neoplastic lesions [23].

In our research work it was attempted to evaluate the effect of fungal colonization on the course of ulcer niche regression. On the basis of the obtained results it was found that the rate of gastric ulcer size reduction was significantly higher in patients with low fungal cells count than in patients with high count of fungal cells. That observation is proved by the exponents in the equations of the curves demonstrating changes in gastric ulcers diameters of a given group in consecutive endoscopic examinations.

The rate of regressed ulcers measured on consecutive endoscopic examinations was significantly higher in the group with non-significant fungal cells count.

The fungal colonization of the stomach was found in 54.2% of patients with diagnosis of gastric ulcer confirmed by endoscopy. In these patients significant count of fungal cells without concurrent presence of spiral bacteria accounted for 40%.

The above data are in agreement with those of Katzenstein and Gotlieb-Jensen who reported significantly increased fungal cells count in 33–36% of gastric ulcers cases [42,24]. Fungal colonization of gastric ulcers in patients enrolled in this study was the most likely to be the secondary one, despite reports on primary nature of fungal infection leading to gastric mucosa ulceration development [46]. That assumption could be supported by the lack of a correlation between significant fungal colonization of the stomach and significant titres of antifungal antibodies and fungal antigens in the blood of the patients. Furthermore, only 2 patients with gastric ulcer were found to have fungal infiltrations in biopsy specimens from gastric mucosa.

In gastric ulcer patients with high fungal cells count a longer duration of the clinical symptoms that worsened life quality such as weakness, pain in epigastrium, weight loss and vomiting were observed.

CONCLUSIONS

1. Gastric mucosa and gastric contents are often areas of fungal colonization. Fungi are found in

54.2% of gastric ulcers cases and in 10.3% of chronic gastritis cases.
2. Fungal colonization of gastric ulcers prolongs the healing process. Moreover, it leads to clinical symptoms maintenance longer as compared to ulcers with non-significant fungal cells count.
3. In gastric ulcer patients with high count of fungal cells this count remains significantly high despite ulcer regression. This fact could be in favour of the concept of individual susceptibility of gastric mucosa to fungal colonization.

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