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A comparative study of two methods of serological screening of atrophic gastritis

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Abstract
To study the methods of serological screening of atrophic gastritis in order to select the most suitable method of prophylaxis of stomach cancer, 1,072 people at the age of 40 and older were tested for markers of atrophy of the mucous membrane of the antrum section (gastrin-17) and corpus of stomach (pepsinogen-1) and ratio pepsinogen-1/pepsinogen-2. The markers were detected via the test panel for immune-enzyme analysis – "GastroPanel". These markers were identified for a group of patients with severe atrophic gastritis and for a group of patients with atrophic gastritis with no account taken of its severity. Method for the detection of severe atrophic corpus gastritis with the ratio PG-1/PG-2 shows very high level (100%) of NPV compared with the method for the detection with PG-1 with any value of the ratio PG-1/PG-2. The PPV of the method for the detection of severe atrophic corpus gastritis with the ratio PG-1/PG-2, when compared with the method for the detection with PG-1, shows satisfactory indices with the value of the ratio PG-1/PG-2 from 1 to 3. In practice, the ratio PG-1/PG-2 is not applicable to detect antral atrophic gastritis. For the detection of atrophic corpus gastritis, it is enough to apply the method for the identification of the level PG-1. It will be most correct to examine the population with the aid of the markers of atrophic gastritis: gastrin-17 and pepsinogen-1.

Keywords: Screening; atrophic gastritis; ratio pepsinogen-1/pepsinogen-2; gastrin-17; pepsinogen-1.

Introduction

Prevention of gastric cancer has been practiced in many countries in the latest years. In world literature, there is information that 5,229 people in Germany and 2,184 people in China have undergone serological screening in order to detect gastric cancer; in Japan, in the prefecture of Kyoto 1,011 men and 1,848 women have been examined for markers of gastric precancerous changes, 1,000 people have been examined in Sweden, 4,256 people in Finland [1-6]. In Magdeburg, 6,215 people have undergone serological screening [3]. In addition to that, from among those who have undergone serological screening, in the group of patients with gastric precancerous changes with following gastrointestinal endoscopy observation, early gastric cancer was detected among two out of 2,184 Chinese. In Japan early gastric cancer was detected over a period of several years among 33 men out of 1,011 and 28 women out of 1,848 with endoscopic observation of patients with gastric precancerous changes [4,5]. During serological screening, several markers of gastric precancerous changes are used. It is reported that in Germany such serological markers as pepsinogen-1 (PG-1) less than 70 ng/ml and pepsinogen-1/pepsinogen-2 ratio (PG-1/PG-2) less than three have been successfully used in the diagnostics of atrophic gastritis among 5,229 men and women [6]. On the basis of histological and serological comparison, 458 patients in China have been given a high estimation of such serological markers of gastric precancerous changes as gastrin-17 (G-17), PG-1 and PG-2 [7]. British scientists from Glasgow, having examined 255 patients, propose to use the

PG-1/PG-2 ratio to estimate gastric antral atrophy [8]. Italians definitely propose to use G-17 as the criterion of gastric antral atrophy when its level is decreasing [9]. Germaná *et al.* also regard G-17 as the criterion of gastric antral atrophy and pepsinogen as the criterion of gastric corpus atrophy [10].

The studies of different authors, conducted over a period of two decades, have corroborated that gastric corpus atrophy can successfully be detected by means of the detection of serum concentrations PG-1 or of the ratio PG-1/PG-2 [11-16]. Pasechnikov *et al.* have proposed to use postprandial serum G-17 as a highly sensitive and highly specific marker of gastric antral atrophy, and PG-1 as the criterion of gastric corpus atrophy [17-20].

Materials and Methods

Ethics

This work has been carried out in accordance with the Declaration of Helsinki (2000) of the World Medical Association. This study was approved ethically by the Ethical committee of North Caucasian humanitarian-technological academy (Protocol No. 2. Date – 18.03.2014). All patients provided informed written consent.

Materials

As a result of the work on serological screening of atrophic gastritis for markers of mucosal atrophy of the body and antrum of the stomach, as well as the ratio pepsinogen-1/pepsinogen-2, 1,072 people have been examined in the Republic of Karachaevo-Cherkessia. People who applied for any reason to clinics and health centers of Cherkessk and other areas of the Karachaevo-Cherkessia Republic were sent to serological screening in accordance with the following selection criteria: age 40 and older, and the presence of informed consent for clinical research.

Methods

Markers of mucosal atrophy of the corpus and antrum of the stomach, as well as the ratio pepsinogen-1 (PG-1)/pepsinogen-2 (PG-2), were determined using a test panel for immunoassay – "GastroPanel". The set "Gastropanel" (produced by the Finnish company "Biohit") included: a marker of mucosal atrophy antrum – gastrin-17 (G-17), a marker of mucosal atrophy of the corpus of the stomach – Pepsinogen-1 (PG-1), a marker of mucosal atrophy – the ratio pepsinogen-1/pepsinogen-2 (PG-1/PG-2). As a result of screening to determine the following groups of patients: severe antral mucosa atrophy, moderate antral mucosa atrophy, mild antral mucosa atrophy, severe corpus mucosa atrophy, and other respondents of noninvasive screening of atrophic gastritis, the following criteria were used (Tables 1 and 2).

The pathology of the gastroduodenal area was detected on the basis of a complex of patients' complaints, specific evidence of anamnesis, results of objective and supplementary laboratory examination. The structure of the symptoms of the examined patients is shown in Figure 1.

In order to identify the content of (PG-1) and (PG-2) fasting blood sampling was carried out. The amount of gastrin-17 (G-17) after eating was identified in blood serum samples, which were taken 20 min after ingestion of protein

Figure 1: Prevalence of dyspeptic symptoms among observable patients.

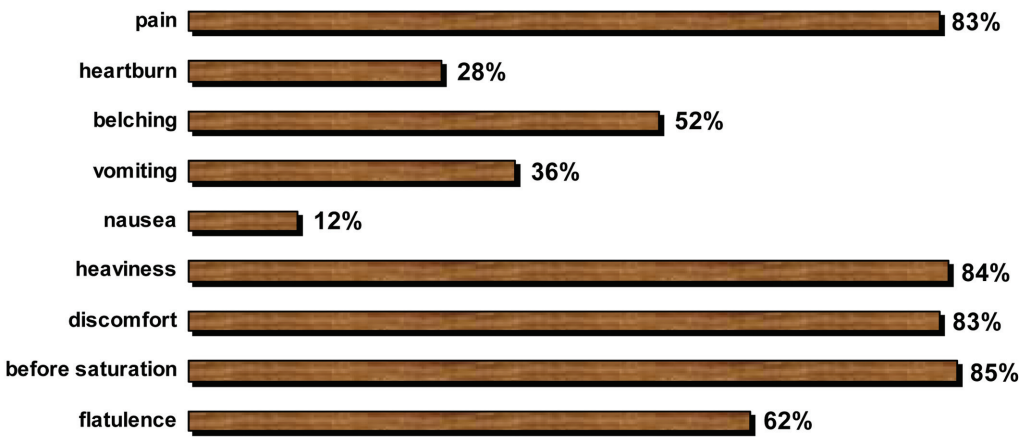


Table 1: Serological criteria of atrophic antral gastritis.

Atrophic antral gastritis	Gastrin-17
Nonatrophic antral gastritis	10 ≤ pmol/l
Mild atrophic antral gastritis	7 ≤ pmol/l < 10
Moderate atrophic antral gastritis	4 ≤ pmol/l < 7
Severe atrophic antral gastritis	0 ≤ pmol/l < 4

Table 2: Serological criteria of atrophic corpus gastritis.

Atrophic corpus gastritis	Pepsinogen-1
Nonatrophic corpus gastritis	25 ≤ μg/l
Mild atrophic corpus gastritis	15 ≤ μg/l < 25
Moderate atrophic corpus gastritis	9 ≤ μg/l < 15
Severe atrophic corpus gastritis	0 ≤ μg/l < 9

dissolved in a beverage (one portion contains 10 g of protein). The samples were subject to centrifugation at 1,500 ×g for 10 min and were thereupon stored at the temperature –20°C until the conduction of analysis.

Immunoenzymatic assay was conducted with the aid of serological analysis with the application of the set of reagents GastroPanel® (Finland Biohit Plc, Helsinki), identifying the values of G-17 and PG-1, as well as PG-2.

All patients were diagnosed with severe antral mucosa atrophy, moderate antral mucosa atrophy, mild antral mucosa atrophy, severe corpus mucosa atrophy, moderate corpus mucosa atrophy, and mild corpus mucosa atrophy with the technique of Pasechnikov *et al.* [19]. The necessity of the detection of severe antral atrophy gastritis and severe corpus gastritis is attributed to the fact that precisely severe corpus atrophic gastritis and severe corpus atrophic gastritis possess a high risk of the development of stomach cancer.

The techniques for the detection of antral mucosal atrophy and corpus mucosa atrophy with no account taken of its severity, as well as severe antral mucosa atrophy and severe corpus mucosa atrophy, are taken as a standard, as they have been verified by a large number (450 patients) of comparative histological analyses.

The technique for the detection of antral mucosal atrophy and corpus mucosa atrophy of various severities with markers of atrophy is presented in Tables 1 and 2.

The method for the early detection of atrophic gastritis with the ratio PG-1/PG-2 was compared to the method for the early detection of atrophic gastritis with markers of atrophy: G-17 for antrum stomach and PG-1 for corpus stomach (the standard method). The standard method for the early detection of atrophic gastritis with the markers of atrophy: G-17 for antrum stomach and PG-1 for corpus stomach is highly sensitive, Se – 89% and highly specific, Sp – 99% [18]. In addition to that, for the identification of the optimal ratio PG-1/PG-2, which characterizes the detected atrophy mucosa, the ratio PG-1/PG-2 in the range from 1 to 10 was calculated, compared, and analyzed.

Thereby, the exploratory procedures that were applied by us have provided a complex approach to the solving of assigned tasks, which has allowed us to obtain desired results and to formulate valid conclusions.

Statistical analysis was used to calculate the statistical significance of received data: Spearman's correlation coefficient (r), positive predictive value (PPV), and negative predictive value (NPV) of diagnosis by Biohit GastroPanel®.

Results

We compared method of detection of antral atrophic gastritis based on the ratio of PG-1/PG-2 with reference method based on gastrin-17 level which has histological validation. The ratio range PG-1/PG-2 was taken in this case from 1 to 10. In Table 3, data are presented on the number of patients with severe antral atrophic gastritis that was detected with two methods: G-17 and ratio PG-1/PG-2 simultaneously, as well as those with severe antral atrophic gastritis that was not detected with either of the mentioned methods.

Table 3: Identification of severe antral atrophic gastritis with G-17 and with the ratio PG-1/PG-2.

Ratio PG-1/PG-2	G17 < 4 pmol/l PG-1/PG-2 (severe atrophy)	G17 ≥ 4 pmol/l PG-1/PG-2 (no atrophy)	G17 < 4 pmol/l (severe atrophy) PG-1/PG-2 (no atrophy) false −	G17 ≥ 4 pmol/l (no atrophy) PG-1/PG-2 (severe atrophy) false +
<1	1	860	185	26
<2	6	828	180	58
<2.5	10	801	176	85
<3	14	767	172	119
<4	24	685	162	201
<5	44	583	142	303
<6	66	463	120	423
<7	90	361	96	525
<8	114	278	72	608
<9	134	202	52	684
<10	147	156	39	730

Besides, data are presented on the number of patients with severe antral atrophic gastritis that was detected only with the standard method with G-17 and could not be detected with the ratio PG-1/PG-2 (false-negative results). Likewise, data are presented on the number of patients with severe antral atrophic gastritis that could not be detected with the standard method G-17, though it was detected with the ratio PG-1/PG-2 (false-positive results).

The change in sensitivity (Se) and specificity (Sp) of the method for the detection of severe antral atrophic gastritis with the ratio PG-1/PG-2, when compared with the standard method with G-17, depending on the selected value of the ratio PG-1/PG-2 is shown in Figure 2. Multidirectional tendencies attract attention. Evidently, Se and Sp do not allow to put into practice the method for the detection of severe atrophic antral gastritis with the ratio PG-1/PG-2 with any value of the ratio PG-1/PG-2 from 1 to 10. Acceptable values of Se are always combined with very low values of Sp. And vice versa, acceptable values of Sp, with any value of the ratio PG-1/PG-2, are always combined with very low values of Se.

Figure 2: The dynamics of Se, Sp, PPV, and NPV with the change of the ratio PG-1/PG-2 from 1 to 10 (severe atrophic antral gastritis).

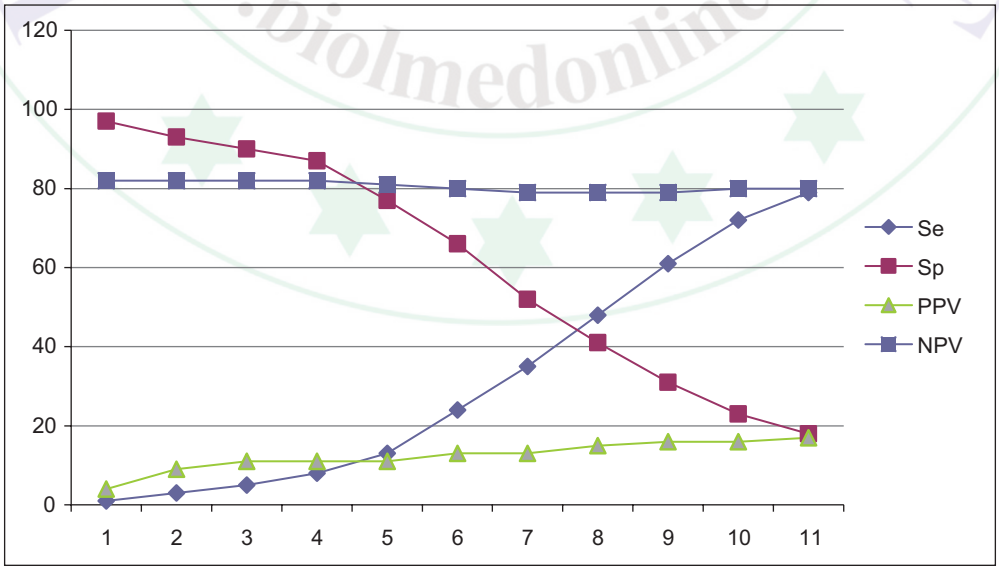


Table 4: Identification of antral atrophic gastritis with no account taken of its severity with G-17 and with the ratio PG-1/PG-2.

Ratio PG-1/PG-2	G17 < 10pmol/l PG-1/PG-2 (atrophy)	G17 ≥ 10pmol/l PG-1/PG-2 (no atrophy)	G17 < 10 pmol/l (atrophy) PG-1/PG-2 (no atrophy) false –	G17 ≥ 10 pmol/l (no atrophy) PG-1/PG-2 (atrophy) false +
<1	3	552	493	24
<2	12	524	484	52
<2.5	31	512	465	64
<3	45	488	451	88
<4	81	432	415	144
<5	132	361	364	215
<6	199	286	297	290
<7	263	224	233	352
<8	315	169	181	407
<9	364	122	132	454
<10	398	97	98	479

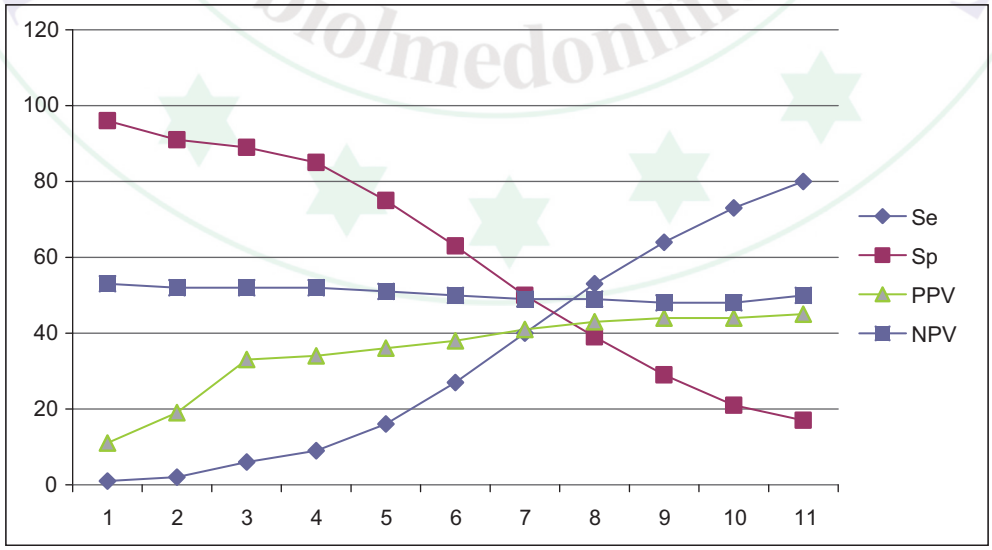
The PPV of the method for the detection of severe atrophic antral gastritis with the ratio PG-1/PG-2, when compared with the PPV of the method for the detection with G-17, has very low indices with any value of the ratio PG-1/PG-2 from 1 to 10.

Only the NPV of the method for the detection of severe atrophic antral gastritis with the ratio PG-1/PG-2, when compared with the NPV of the method for the detection with G-17, is at a good level with any value of the ratio PG-1/PG-2 from 1 to 10.

To sum up, all the examined evaluation criteria of the method for the detection of severe atrophic antral gastritis with the ratio PG-1/PG-2 do not allow to recognize it as suitable for the diagnostics of severe atrophic antral gastritis.

In Table 4, data are presented on the number of patients with antral atrophic gastritis with no account taken of its severity that was detected with the use of two methods with G-17 and with the ratio PG-1/PG-2 simultaneously, as well as on patients with antral atrophic gastritis with no account taken of its severity that cannot

Figure 3: The dynamics of Se, Sp, PPV, and NPV with the change of the ratio PG-1/PG-2 from 1 to 10 (atrophic antral gastritis with no account taken of its severity).



be detected with either of the mentioned methods. Besides, data are presented on the number of patients with antral atrophic gastritis with no account taken of its severity that was detected only with the standard method with G-17 and could not be detected with the ratio PG-1/PG-2 (false-negative results). Likewise, data are presented on the number of patients with antral atrophic gastritis with no account taken of its severity that cannot be detected with the use of the standard method with G-17, though it was detected with the ratio PG-1/PG-2 (false-positive results).

The change in Se and Sp of the method for the detection of antral atrophic gastritis with no account taken of its severity with the ratio PG-1/PG-2, when compared with the standard method with G-17, depending on the selected value of the ratio PG-1/PG-2 is reflected in Figure 3. Likewise, multidirectional tendencies attract attention. Attention is drawn by the fact that Se and Sp do not allow to put into practice the method for the detection of antral atrophic gastritis with no account taken of its severity with the ratio PG-1/PG-2 with any value of the ratio PG-1/PG-2 from 1 to 10. Acceptable values of Se are always combined with very low values of Sp. And vice versa, acceptable values of Sp, with any value of the ratio PG-1/PG-2, are always combined with very low values of Se.

The PPV of the method for the detection of atrophic antral gastritis with no account taken of its severity with the ratio PG-1/PG-2, when compared with the PPV of the method for the detection with G-17, has low indices with any value of the ratio PG-1/PG-2 from 1 to 10.

Likewise, the NPV of the method for the detection of atrophic antral gastritis with no account taken of its severity with the ratio PG-1/PG-2, when compared with the NPV of the method for the detection with G-17, is at a low level with any value of the ratio PG-1/PG-2 from 1 to 10.

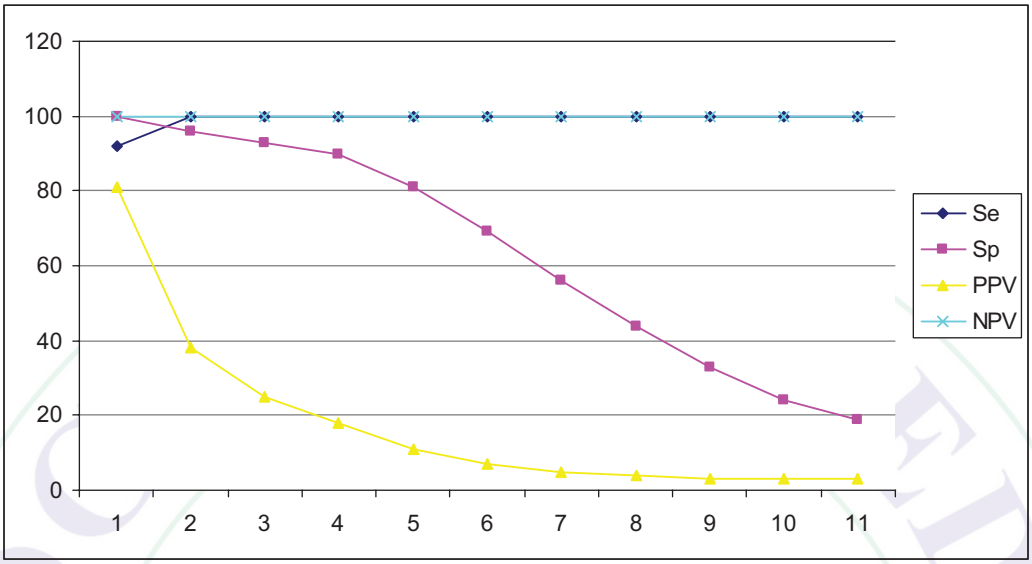
To sum up, all the examined evaluation criteria of the method for the detection of atrophic antral gastritis with no account taken of its severity with the ratio PG-1/PG-2 do not allow to recognize it as suitable for the diagnostics of atrophic antral gastritis with no account taken of its severity.

In order to identify the value of the ratio PG-1/PG-2, which most accurately reflects the presence of atrophic corpus gastritis as well as the severity of atrophic corpus gastritis, a comparison has been drawn with the standard that has histological validation, notably with the level of PG-1 for atrophic corpus gastritis. The ratio range PG-1/PG-2 was taken in this case from 1 to 10. In Table 5 data are presented on the number of patients with severe atrophic corpus gastritis that was detected with the use of two methods with PG-1 and with the ratio PG-1/PG-2 simultaneously, as well as those with severe atrophic corpus gastritis that cannot be detected with either of the mentioned methods. Besides, data are presented on the number of patients with severe atrophic corpus gastritis that was detected only with the standard method with PG-1 and could not be detected with the ratio PG-1/PG-2 (false-negative results). Likewise, data are presented on the number of patients with severe atrophic corpus gastritis that could not be detected with

Table 5: Identification of severe atrophic corpus gastritis with PG-1 and with the ratio PG-1/PG-2.

Ratio PG-1/PG-2	PG1 $<$ 9 μg/l PG-1/PG-2 (severe atrophy)	PG1 $\geq$ 9 μg/l PG-1/PG-2 (no atrophy)	PG1 $<$ 9 μg/l (severe atrophy) PG-1/PG-2 (no atrophy) false −	PG17 $\geq$ 9 μg/l (no atrophy) PG-1/PG-2 (severe atrophy) false +
$<$1	24	1,043	2	5
$<$2	24	1,008	0	40
$<$2.5	24	977	0	71
$<$3	24	939	0	109
$<$4	24	847	0	201
$<$5	24	725	0	323
$<$6	24	583	0	465
$<$7	24	457	0	591
$<$8	24	350	0	698
$<$9	24	254	0	794
$<$10	24	195	0	853

Figure 4: The dynamics of Se, Sp, PPV, and NPV with the change of the ratio PG-1/PG-2 from 1 to 10 (severe atrophic corpus gastritis).



the standard method with PG-1, though with the ratio PG-1/PG-2 it was detected – false-positive results (Table 5). Besides, such important evaluation criteria of the method for the detection of severe atrophic corpus gastritis were identified, as Se, Sp, PPV, and NPV (Figure 4).

Attention is attracted by the total absence of false-negative results despite the increase of the value of the ratio PG-1/PG-2 from 1 to 10 when detecting severe atrophic corpus gastritis. The number of false-positive results in this case grows. With the values of the ratio PG-1/PG-2 from 1 to 3 the number of false-positive results does not exceed 10% from the number of examined patients. This indicates a high quality of this method for the detection of severe atrophic corpus gastritis.

The change in Se and Sp of the method for the detection of severe atrophic corpus gastritis with the ratio PG-1/PG-2, when compared with the standard method with PG-1, depending on the selected value of the ratio PG-1/PG-2 is reflected in Figure 4. Se is high at all values of the ratio PG-1/PG-2. With the values of the ratio PG-1/PG-2 from 1 to 3, Sp does not decrease lower than 90%, which characterizes the method for the detection of severe atrophic corpus gastritis with the ratio PG-1/PG-2 as highly sensitive and highly specific. With any value of the ratio PG-1/PG-2, a very high level of NPV of the method for the detection of severe atrophic corpus gastritis with the ratio PG-1/PG-2 is registered (100%) in comparison with the method for the detection with PG-1.

The PPV of the method for the detection of severe atrophic corpus gastritis with the ratio PG-1/PG-2, when compared with the method for the detection with PG-1, has satisfactory indices with the value of the ratio PG-1/PG-2 from 1 to 3. The NPV of the method for the detection of severe atrophic corpus gastritis with the ratio PG-1/PG-2, when compared with the method for the detection with PG-1, is at a very good level with any value of the ratio PG-1/PG-2. To sum up, all the examined evaluation criteria of the method for the detection of severe atrophic corpus gastritis with the ratio PG-1/PG-2 allow to recognize it as highly sensitive, highly specific and absolutely applicable for the diagnostics of severe atrophic corpus gastritis with the values used in practice (2-2,5-3).

In order to identify the value of the ratio PG-1/PG-2, which most accurately reflects the presence of atrophic corpus gastritis with no account taken of its severity, a comparison has been drawn with the standard that has histological validation, notably with the level of PG-1 for atrophic corpus gastritis. The ratio range PG-1/PG-2 was taken in this case from 1 to 10.

In Table 6, data are presented on the number of patients with atrophic corpus gastritis with no account taken of its severity that was detected with the use of two methods with PG-1 and with the ratio PG-1/PG-2 simultaneously, as well as on patients with atrophic corpus gastritis

with no account taken of its severity that cannot be detected with either of the mentioned methods. Besides, data are presented on the number of patients with atrophic corpus gastritis with no account taken of its severity that was detected only with the standard method with PG-1 and could not be detected with the ratio PG-1/PG-2 (false-negative results). Likewise, data are presented on patients with atrophic corpus gastritis with no account taken of its severity that could not be detected with the use of the standard method with PG-1, though it was detected with the ratio PG-1/PG-2 – false-positive results (Table 6).

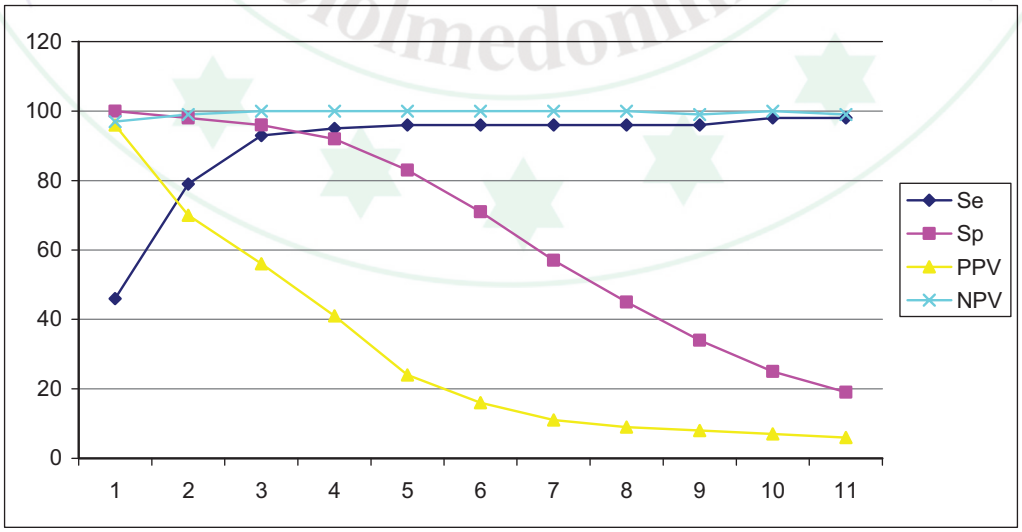
When comparing the two methods for the detection of atrophic corpus gastritis with no account taken of its severity, such evaluation criteria of the method for the detection of atrophic corpus gastritis with no account taken of its severity with the ratio PG-1/PG-2 were identified, as Se, Sp, PPV, and NPV (Figure 5).

A very small number of false-negative results attract attention. With the values of the ratio PG-1/PG-2 from 1 to 3 the number of false-positive results does not exceed 8% from the total number of examined patients. This indicates a high quality of this method for the detection of

Table 6: Identification of atrophic corpus gastritis with no account taken of its severity with PG-1 and with the ratio PG-1/PG-2.

Ratio PG-1/PG-2	PG17 < 25 μg/l PG-1/PG-2 (atrophy)	PG17 ≥ 25 μg/l PG-1/PG-2 (no atrophy)	PG17 < 25 μg/l (atrophy) PG-1/PG-2 (no atrophy) false –	PG17 ≥ 25 μg/l (no atrophy) PG-1/PG-2 (atrophy) false +
<1	26	1,014	31	1
<2	45	996	12	19
<2.5	53	973	4	42
<3	54	936	3	79
<4	55	845	2	170
<5	55	723	2	292
<6	55	581	2	434
<7	55	455	2	560
<8	55	348	2	667
<9	56	253	1	762
<10	56	194	1	821

Figure 5: The dynamics of Se, Sp, PPV, and NPV with the change of the ratio PG-1/PG-2 from 1 to 10 (atrophic corpus gastritis with no account taken of its severity).



atrophic corpus gastritis with no account taken of its severity.

The change in Se and Sp of the method for the detection of atrophic corpus gastritis with no account taken of its severity with the ratio PG-1/PG-2, when compared with the standard method with PG-1, depending on the selected value of the ratio PG-1/PG-2 is reflected in Figure 5.

With the value of the ratio PG-1/PG-2 from 1 to 3 Sp does not decrease lower than 90%, Se approaches 100%, which characterizes the method for the detection of atrophic corpus gastritis with no account taken of its severity with the ratio PG-1/PG-2 as highly sensitive and highly specific. With any value of the ratio PG-1/PG-2 a very high level of NPV of the method for the detection of atrophic corpus gastritis with no account taken of its severity with the ratio PG-1/PG-2 is registered, when compared with the method for the detection with PG-1.

The PPV of the method for the detection of atrophic corpus gastritis with no account taken of its severity with the ratio PG-1/PG-2, when compared with the PPV of the method for the detection with PG-1, has good indices with the value of the ratio PG-1/PG-2 from 1 to 3. To sum up, all the examined evaluation criteria of the method for the detection of atrophic corpus gastritis with no account taken of its severity with the ratio PG-1/PG-2 allow to recognize it as highly sensitive, highly specific and absolutely applicable for the diagnostics of atrophic corpus gastritis with no account taken of its severity with the values used in practice (2-2,5-3).

Discussion

The method for the early detection of atrophic gastritis with the ratio PG-1/PG-2 does not adequately reflect the condition of atrophic antral gastritis and does not in any way characterize the presence and severity of atrophic antral gastritis. The method is an insensitive and nonspecific method for the diagnostics of atrophic antral gastritis. The method for the early detection of atrophic gastritis with the ratio PG-1/PG-2 does not allow detect severe atrophic antral gastritis, which possesses a high risk of the development of stomach cancer. The ratio PG-1/PG-2, as a method for the diagnostics of atrophic corpus gastritis, has no advantages over the method for the early detection of atrophic corpus gastritis only with PG-1, without the identification of PG-2 and the calculation of their ratio. In the absence of typical specific clinical symptoms of atrophic gastritis, the method for the diagnostics of atrophic gastritis with the aid of the ratio PG-1/PG-2 cannot be considered effective, as it does not allow to diagnose the severity and stage of atrophic gastritis and to prognosticate the risk of the development of stomach cancer. In order to implement the early detection of atrophic gastritis among the population, to identify its severity in every part of the stomach and the stage of the disease, it is recommended to apply the method for the diagnostics by means of identifying G-17 for atrophic antral gastritis and PG-1 for atrophic corpus gastritis. The detection of atrophic gastritis among the population, identification of its severity in every part of the stomach and the stage of the disease by means of identifying the ratio PG-1/PG-2 is less effective. Many authors in different countries have conducted examinations of several thousand patients with the aid of the ratio PG-1/PG-2 [1-6]. As a result, false-negative results were obtained with several hundred patients. Likewise, false-positive results were obtained with several hundred patients. This means that patients with false-negative results will not be sent to endoscopic examination, and stomach cancer will not be timely detected. Later its treatment will be impossible. Patients with false-positive results will be unreasonably undergoing endoscopic examination. If such a screening program will operate across the country, a very large number of people will not be diagnosed with early stomach cancer and will die. A large number of people with false-positive results of the examination will undergo endoscopic examination to no purpose [17-20].

Conclusion

In practice, the ratio PG-1/PG-2 is not applicable to detect antral atrophic gastritis. For the detection of atrophic corpus gastritis it is enough to apply the method for the identification of the level PG-1. It will be most correct to examine the population with the aid of the markers of atrophic gastritis: gastrin-17 and pepsinogen-1.

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