

Study of the prevalence of gastroesophageal reflux symptoms and the role of each in relation to the GERD Impact Scale, based on a population of patients admitted for laparoscopic surgery compared to a control group

Natalia Dowgiałło-Wnukiewicz^{1,2}, Agata Frask³, Paweł Lech¹, Maciej Michalik¹

¹Department of General and Minimally Invasive Surgery, University of Warmia and Mazury, Olsztyn, Poland

²Department of Anatomy, University of Warmia and Mazury, Olsztyn, Poland

³General and Vascular Surgery Department, Ceynowa Hospital, Wejherowo, Poland

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Abstract

Introduction: Gastroesophageal reflux disease (GERD), demonstrated to impair quality of life (QoL), appears to show significant variation in its prevalence. Estimation of the prevalence is difficult. When defined as at least weekly heartburn and/or acid regurgitation, the prevalence reported in Asia is 2.5–27.6%, in Europe 23.7% and in the US 28.8%.

Aim: The study evaluates the prevalence of GERD symptoms in the assessment of the GERD Impact Scale (GERD-IS) in two age groups of patients.

Material and methods: Evaluation of the prevalence of GERD symptoms with the GERD Impact Scale survey in two groups of patients: younger and older. A total of 2,649 surveys were rated. Statistical analysis was performed using the data analysis software system Statistica version 10.0 and Microsoft Excel.

Results: According to this study the symptoms of GERD included in GERD-IS in northern Poland vary from 0.9–2.4% as daily sensations to 18.9–40.5% occurring sometimes. Individuals with hiatal hernia (HH) were significantly older than those without HH. HH was significantly more frequent in males than females.

Conclusions: Estimation of the prevalence of GERD is difficult, because the medications are widely available and people use them without any consultation. They do not recognize the symptoms as a disease whose treatment can also be surgical. Our analysis shows that the prevalence of symptoms of GERD in northern Poland is as high as 5%. Hence further investigation should be performed and people's awareness should be raised.

Key words: gastroesophageal reflux disease, prevalence of gastroesophageal reflux disease.

Introduction

Gastroesophageal reflux disease (GERD), with symptoms demonstrated to impair quality of life (QoL), appears to show important variation in its prevalence. When defined as at least weekly heartburn and/or acid regurgitation, the prevalence is lowest in East Asia (2.5–9.4%) and higher in Central

(7.6–19.4%) and Western Asia (12.5–27.6%). The highest population-based prevalence is reported in Europe (23.7%) and the US (28.8%) [1, 2].

Estimation of the prevalence of GERD is also difficult, because many people recognize the symptoms of heartburn as “normal” and use drugs anti-acid which are widely available without any con-

Address for correspondence

Natalia Dowgiałło-Wnukiewicz MD, Department of General and Minimally Invasive Surgery, University of Warmia and Mazury, 2 Michała Oczapowskiego St, 10-719 Olsztyn, Poland, phone: +48 604 158 786, e-mail: natalia.dowgiallo@gmail.com

sultation with medical specialists. Moreover, many patients who present typical symptoms of GERD do not have esophagitis. On the other hand, patients with symptoms of esophagitis visible endoscopically do not have any symptoms of GERD.

The first line treatment for GERD is administration of proton pump inhibitors (PPI). Although patients treated with the drugs have reported a noticeable increase in QoL, some studies have shown the superiority of surgery over conservative treatment [3–5]. Laparoscopic Nissen fundoplication (LNF) has become the gold standard of antireflux procedures.

Nevertheless, the role of other laparoscopic fundoplication such as Toupet or mesh repair is debated in parallel [6–8].

The combined treatment of patients with GERD symptoms and the attempt to estimate the prevalence of this disease seems to be wrong. Factors influencing the prevalence of GERD include place of residence, level of civilization and the condition of affluence, dietary habits, body mass index (BMI) and finally the recently raised relationship between the symptoms of GERD and *Helicobacter pylori* infection [9–11].

Table I. Demographic and clinical characteristics of groups

Parameter	Olsztyn (n = 1523)	Wejherowo (n = 1126)	All (n = 2649)	P-value Mann-Whitney U/ χ^2
Gender:				
Female	1134 (74.5%)	619 (55.0%)	1753 (66.2%)	$p = 0.0001$ $\chi^2 = 109.80$
Male	388 (25.5%)	506 (45.0%)	894 (33.8%)	
Age:				
Mean (SD)	21.8 (3.4)	51.5 (16.2)	34.4 (18.3)	$p = 0.0001$ $Z = 41.90$
95% CI	21.6–22.0	50.6–52.5	33.8–35.1	
Range (min.–max.)	16.0–53.0	18.0–89.0	16.0–89.0	
Median	21.0	53.0	24.0	
Weight:				
Mean (SD)	65.9 (14.3)	84.2 (23.0)	73.5 (20.5)	$p = 0.0001$ $Z = 24.47$
95% CI	65.1–66.6	82.8–85.6	72.7–74.3	
Range (min.–max.)	40.0–167.0	43.0–260.0	40.0–260.0	
Median	62.0	80.0	69.5	
Height:				
Mean (SD)	171.0 (8.6)	169.8 (9.0)	170.5 (8.8)	$p = 0.0012$ $Z = 3.24$
95% CI	170.6–171.5	169.2–170.3	170.2–170.8	
Range (min.–max.)	150.0–200.0	140.0–205.0	140.0–205.0	
Median	170.0	170.0	170.0	
BMI:				
Mean (SD)	22.4 (4.1)	29.2 (7.5)	25.2 (6.6)	$p = 0.0001$ $Z = 29.23$
95% CI	22.2–22.6	28.8–29.6	25.0–25.5	
Range (min.–max.)	12.9–69.6	14.2–75.6	12.9–75.6	
Median	21.7	27.6	23.5	
HH	43 (2.8%)	362 (32.1%)	405 (15.3%)	$p = 0.0001$, $\chi^2 = 429.57$

Table II. Characteristics of groups according to answers to questions from the survey

Variable	Olsztyn (n = 1523)	Wejherowo (n = 1126)	All (n = 2649)	P-value Mann-Whitney U/ χ^2
How often have you had pain in your chest or behind the breastbone?				
Daily	13 (0.9%)	11 (1.0%)	24 (0.9%)	
Often	96 (6.3%)	26 (2.3%)	122 (4.6%)	$p = 0.0001$
Sometimes	738 (48.6%)	334 (29.7%)	1072 (40.5%)	$Z = -10.23$
Never	673 (44.3%)	754 (67.0%)	1427 (54.0%)	
How often have you had a burning sensation in your chest or behind the breastbone?				
Daily	14 (0.9%)	7 (0.6%)	21 (0.8%)	
Often	63 (4.1%)	17 (1.5%)	80 (3.0%)	$p = 0.0001$
Sometimes	410 (27.0%)	182 (16.2%)	592 (22.4%)	$Z = -6.15$
Never	1033 (68.0%)	919 (81.7%)	1952 (73.8%)	
How often have you had regurgitation or an acid taste in your mouth?				
Daily	14 (0.9%)	20 (1.8%)	34 (1.3%)	
Often	109 (7.2%)	55 (4.9%)	164 (6.2%)	$p = 0.0001$
Sometimes	612 (40.2%)	248 (22.0%)	860 (32.5%)	$Z = -8.22$
Never	786 (51.7%)	803 (71.3%)	1589 (60.0%)	
How often have you had pain or burning in your upper stomach?				
Daily	13 (0.9%)	30 (2.7%)	43 (1.6%)	
Often	128 (8.4%)	64 (5.7%)	192 (7.3%)	$p = 0.0001$
Sometimes	536 (35.2%)	270 (24.0%)	806 (30.4%)	$Z = -4.97$
Never	844 (55.5%)	762 (67.7%)	1606 (60.7%)	
How often have you had a sore throat or hoarseness that is related to your heartburn or acid reflux?				
Daily	17 (1.1%)	24 (2.1%)	41 (1.6%)	
Often	116 (7.6%)	62 (5.5%)	178 (6.7%)	$p = 0.0186$
Sometimes	475 (31.3%)	303 (26.9%)	778 (29.4%)	$Z = -2.35$
Never	911 (60.0%)	737 (65.5%)	1648 (62.3%)	
How often have you had difficulty getting a good night's sleep because of your symptoms?				
Daily	4 (0.3%)	24 (2.1%)	28 (1.1%)	
Often	36 (2.4%)	55 (4.9%)	91 (3.4%)	$p = 0.0001$
Sometimes	248 (16.3%)	294 (26.1%)	542 (20.5%)	$Z = 6.46$
Never	1232 (81.1%)	753 (66.9%)	1985 (75.0%)	
How often have your symptoms prevented you from eating or drinking any of the foods you like?				
Daily	22 (1.4%)	42 (3.7%)	64 (2.4%)	
Often	85 (5.6%)	126 (11.2%)	211 (8.0%)	$p = 0.0001$
Sometimes	238 (15.7%)	266 (23.6%)	504 (19.0%)	$Z = 7.30$
Never	1175 (77.3%)	692 (61.5%)	1867 (70.6%)	
How frequently have your symptoms kept you from being fully productive in your job or daily activities?				
Daily	10 (0.7%)	30 (2.7%)	40 (1.5%)	
Often	71 (4.7%)	83 (7.4%)	154 (5.8%)	$p = 0.0028$
Sometimes	411 (27.0%)	313 (27.8%)	724 (27.4%)	$Z = 2.99$
Never	1029 (67.7%)	700 (62.2%)	1729 (65.3%)	

Table II. Cont.

Variable	Olsztyn (n = 1523)	Wejherowo (n = 1126)	All (n = 2649)	P-value Mann-Whitney U/ χ^2
How often do you take additional medication other than what the physician told you to take (such as Maalox, Alusal, Manti)?				
Daily	10 (0.7%)	28 (2.5%)	38 (1.4%)	<i>p</i> = 0.0324 <i>Z</i> = 2.14
Often	42 (2.8%)	34 (3.0%)	76 (2.9%)	
Sometimes	271 (17.8%)	228 (20.2%)	499 (18.9%)	
Never	1198 (78.8%)	836 (74.2%)	2034 (76.8%)	

Table III. Dependence of HH on age

Variable	HH	No HH	P-value Mann-Whitney <i>U</i>
Age (Olsztyn):			
Mean (SD)	21.3 (2.2)	21.8 (3.4)	<i>p</i> = 0.3467 <i>Z</i> = 0.94
95% CI	20.6–22.0	21.7–22.0	
Range (min.–max.)	18.0–28.0	16.0–53.0	
Median	21.0	21.0	
Age (Wejherowo):			
Mean (SD)	52.7 (15.7)	51.0 (16.4)	<i>p</i> = 0.0986 <i>Z</i> = -1.65
95% CI	51.1–54.4	49.8–52.1	
Range (min.–max.)	18.0–87.0	19.0–89.0	
Median	55.0	52.0	
Age (Olsztyn + Wejherowo):			
Mean (SD)	49.4 (17.8)	31.8 (17.0)	<i>p</i> = 0.0100 <i>Z</i> = -17.29
95% CI	47.7–51.1	31.1–32.5	
Range (min.–max.)	18.0–87.0	16.0–89.0	
Median	52.0	23.0	

Table IV. Dependence of HH on gender

Variable	HH	No HH	P-value χ^2
Gender (Olsztyn):			
Female	22 (51.2%)	1112 (75.2%)	<i>p</i> = 0.0004 χ^2 = 12.70
Male	21 (48.8%)	367 (24.8%)	
Gender (Wejherowo):			
Female	122 (33.7%)	497 (65.1%)	<i>p</i> = 0.0001 χ^2 = 98.04
Male	240 (66.3%)	266 (34.9%)	
Gender (Olsztyn + Wejherowo):			
Female	144 (35.6%)	1609 (71.8%)	<i>p</i> = 0.0001 χ^2 = 201.09
Male	261 (64.4%)	633 (28.2%)	

The evaluation of the frequency of GERD symptoms and clinical outcomes such as esophagitis and esophagitis complications should also be clearly distinguished.

Aim

In an effort to provide a consensus definition, a group of experts came together in Montreal in 2006 and concluded that GERD can be best defined as “a condition which develops when the reflux of stomach contents causes troublesome symptoms and/or complications” [12]. In this situation, we decided to evaluate the prevalence of GERD symptoms in the assessment of the GERD Impact Scale in two age groups of patients, young and old, who were questioned, and evaluate the incidence of individual symptoms of GERD without reference to endoscopic, radiological, pH-metric or manometric symptoms.

Material and methods

We evaluated the prevalence of GERD symptoms with the GERD Impact Scale survey (Appendix 1) in two groups of patients: younger – Campus of the University of Warmia and Mazury in Olsztyn; and older – patients hospitalized in the Department of General Surgery Hospital in Wejherowo. A total of 2,649 surveys were rated. In 1523 surveys of the university campus in Olsztyn the average age was 21.8 years and in 1126 from Wejherowo the average age was 51.5 years.

Statistical analysis

Statistical analysis was performed using the data analysis software system Statistica version 10.0 (StatSoft Inc.) and Microsoft Excel. Quantitative variables were characterized by the arithmetic mean, standard deviation, median, minimum and maximum values (range) and 95% confidence interval (CI), whereas qualitative variables were presented using frequencies and percentages. To check whether a variable quantitative came from a normally distributed population analysis the Shapiro-Wilk *W* test was used. To test the hypothesis of equal variances the Leven (Brown-Forsythe) test was used. The significance of differences between the two groups (model variables unrelated) was examined by Student's *t*-test (or in case of absence of homogeneity the Welch variance test) or Mann-Whitney *U* test

(in the case of non-compliance with the conditions of applicability of Student's *t*-test or for variables measured on the ordinal scale). The χ^2 test of independence was used for qualitative variables (respectively using Yates' correction for the number of cells below 10, the Cochran Q test, and Fisher's exact test). In order to establish the strength and direction of the association between variables the Pearson and/or Spearman correlation tests were used. In all the calculations the level of significance was set at $p = 0.05$.

Results

A total of 2649 individuals were surveyed according to the GERD-IS. In the Olsztyn group (O) there were 1134 (74.5%) women and 388 (25.5%) men, while in the Wejherowo group (W) there were 619 (55.0%) women and 506 (45.0%) men. In group O there were significantly more women. The W population compared to group O was significantly older, weighed more, was shorter and had higher BMI. Hiatal hernia (HH) was significantly more frequent in group W (Table I).

Group O subjects significantly more often had chest or retrosternal pain and burning sensation, regurgitation or acid taste in the mouth, pain or burning in the upper abdomen, sore throat or hoarseness related to heartburn or acid reflux. Group W subjects significantly more often had sleeping difficulty due to symptoms, had been prevented from eating or drinking food they like because of the symptoms, were kept from being fully productive in their job or daily activities due to symptoms and took additional medication (such as Maalox, Alusal, Manti) (Table II).

Individuals with HH were significantly older than those without HH (Table III). Hiatal hernia was significantly more frequent in males than females (Table IV).

In group O with increasing age there was an increase in burning in the chest or behind the breastbone, pain or burning in the upper abdomen, avoiding eating preferred foods for fear of the onset of the symptoms and taking additional medication, whereas sore throat or hoarseness related to heartburn or reflux was decreased. In group W with increasing age there was an increase in pain in the chest or behind the breastbone, a burning sensation in the chest or behind the breastbone, sleeping difficulties and avoidance of food (Table V).

Table V. Correlation of age, weight, height and BMI with questions of the survey

Variable	Olsztyn		Wejherowo		All	
	<i>R</i>	<i>p</i>	<i>R</i>	<i>p</i>	<i>R</i>	<i>p</i>
1						
Age	0.05	0.0770	-0.07	0.0147	0.19	0.0001
Weight	0.07	0.0064	0.07	0.0256	0.17	0.0001
Height	0.10	0.0001	0.12	0.0001	0.10	0.0001
BMI	0.02	0.3341	0.02	0.5320	0.15	0.0001
2						
Age	-0.12	0.0001	-0.08	0.0093	0.07	0.0006
Weight	-0.06	0.0194	0.03	0.3972	0.05	0.0106
Height	-0.01	0.5697	0.06	0.0477	0.01	0.7958
BMI	-0.06	0.0272	0.01	0.9379	0.06	0.0033
3						
Age	-0.02	0.4637	0.01	0.6767	0.15	0.0001
Weight	0.01	0.7292	0.06	0.0492	0.11	0.0001
Height	0.05	0.0451	0.17	0.0001	0.09	0.0001
BMI	-0.01	0.8291	-0.01	0.6906	0.09	0.0001
4						
Age	-0.10	0.0001	-0.03	0.2465	0.05	0.0071
Weight	0.10	0.0001	0.12	0.0001	0.14	0.0001
Height	0.11	0.0001	0.17	0.0001	0.13	0.0001
BMI	0.07	0.0063	0.05	0.0703	0.11	0.0001
5						
Age	0.07	0.0109	-0.05	0.1078	0.06	0.0035
Weight	-0.05	0.0432	0.02	0.5856	0.00	0.8462
Height	0.01	0.9881	0.11	0.0004	0.04	0.0342
BMI	-0.05	0.0409	-0.04	0.1466	-0.01	0.5453
6						
Age	-0.02	0.4198	-0.14	0.0001	-0.17	0.0001
Weight	0.01	0.5851	0.07	0.0170	-0.05	0.0085
Height	0.04	0.1271	0.14	0.0001	0.10	0.0001
BMI	0.01	0.9660	0.01	0.9173	-0.10	0.0001

Table V. Cont.

Variable	Olsztyn		Wejherowo		All	
	<i>R</i>	<i>p</i>	<i>R</i>	<i>p</i>	<i>R</i>	<i>p</i>
7						
Age	-0.09	0.0005	-0.07	0.0247	-0.19	0.0001
Weight	0.00	0.8671	0.07	0.0246	-0.06	0.0013
Height	0.05	0.0351	0.22	0.0001	0.14	0.0001
BMI	-0.03	0.2831	-0.04	0.2374	-0.13	0.0001
8						
Age	-0.03	0.1932	-0.01	0.7595	-0.07	0.0006
Weight	0.04	0.1682	0.12	0.0001	0.02	0.2151
Height	0.07	0.0085	0.16	0.0001	0.11	0.0001
BMI	0.01	0.6349	0.05	0.1124	-0.02	0.2968
9						
Age	-0.14	0.0001	-0.02	0.4664	-0.10	0.0001
Weight	-0.02	0.4692	-0.07	0.0187	-0.06	0.0018
Height	0.01	0.5633	0.07	0.0219	0.04	0.0274
BMI	-0.03	0.2222	-0.11	0.0005	-0.08	0.0001

In group O with increasing weight gain there was increased burning sensation in the chest or behind the breastbone and sore throat or hoarseness associated with heartburn or reflux, and decreased pain in the chest or behind the breastbone and pain or burning sensation in the upper abdomen. In group W with increasing weight gain there was an increase in taking additional medications, and decrease in pain in the chest or behind the breastbone, regurgitation or acid taste in the mouth, pain or burning sensation in the upper abdomen, sleeping difficulties, avoidance of eating food and disruption of one's work or daily activities (Table V).

In both groups O and W the symptoms decreased with increase in height (Table V).

In group O with increasing body mass index (BMI) there was an increase in burning sensation in the chest or behind the sternum, sore throat or hoarseness related to heartburn or reflux, while there was a decrease in pain or burning in the upper abdomen. In group W with the increase in BMI taking additional medications rose (Table V).

In group O women significantly frequently had pain in the chest or behind the sternum, regurgita-

tion or acid taste in the mouth, pain or burning in the upper abdomen, avoidance of food because of the symptoms and disruption of one's job or daily activities (Table VI).

In group W women significantly frequently had pain in the chest or behind the sternum, regurgitation or acid taste in the mouth, pain or burning in the upper abdomen, sore throat or hoarseness associated with heartburn or reflux, sleeping disorders because of the symptoms, avoidance of food because of the onset of the symptoms, disruption of work or daily activities and taking additional medications (Table VII).

Discussion

According to this study the symptoms of GERD included in the GERD-IS in northern Poland vary from 0.9–2.4% as daily sensations to 18.9–40.5% occurring sometimes.

A review of the literature from 2000 shows that in Europe it varies from 8.8% to 27.5% [1, 2, 10–15]. The largest report, provided by Mungan, included 8143 patients in a population-based cross-sectional

Table VI. Answers to survey questions according to gender in group O

Variable	Female	Male	P-value
How often have you had pain in your chest or behind the breastbone?			
Daily	9 (0.8%)	4 (1.0%)	0.0001
Often	85 (7.5%)	11 (2.8%)	
Sometimes	571 (50.4%)	167 (43.2%)	
Never	468 (41.3%)	205 (53.0%)	
How often have you had a burning sensation in your chest or behind the breastbone?			
Daily	10 (0.9%)	4 (1.0%)	0.5511
Often	47 (4.1%)	16 (4.1%)	
Sometimes	300 (26.5%)	110 (28.4%)	
Never	776 (68.5%)	257 (66.4%)	
How often have you had regurgitation or an acid taste in your mouth?			
Daily	11 (1.0%)	3 (0.8%)	0.1382
Often	88 (7.8%)	21 (5.4%)	
Sometimes	461 (40.7%)	151 (39.0%)	
Never	574 (50.6%)	212 (54.8%)	
How often have you had pain or burning in your upper stomach?			
Daily	12 (1.1%)	1 (0.3%)	0.0001
Often	108 (9.5%)	20 (5.2%)	
Sometimes	423 (37.3%)	113 (29.2%)	
Never	591 (52.1%)	253 (65.4%)	
How often have you had a sore throat or hoarseness that is related to your heartburn or acid reflux?			
Daily	14 (1.2%)	3 (0.8%)	0.8812
Often	87 (7.7%)	29 (7.5%)	
Sometimes	350 (30.9%)	125 (32.4%)	
Never	682 (60.2%)	229 (59.3%)	
How often have you had difficulty getting a good night's sleep because of your symptoms?			
Daily	3 (0.3%)	1 (0.3%)	0.5152
Often	29 (2.6%)	7 (1.8%)	
Sometimes	189 (16.7%)	59 (15.3%)	
Never	913 (80.5%)	319 (82.6%)	
How often have your symptoms prevented you from eating or drinking any of the foods you like?			
Daily	20 (1.8%)	2 (0.5%)	0.0182
Often	72 (6.4%)	13 (3.4%)	
Sometimes	187 (16.5%)	51 (13.2%)	
Never	854 (75.4%)	321 (82.9%)	

Table VI. Cont.

Variable	Female	Male	P-value
How frequently have your symptoms kept you from being fully productive in your job or daily activities?			
Daily	9 (0.8%)	1 (0.3%)	0.0106
Often	58 (5.1%)	13 (3.4%)	
Sometimes	324 (28.6%)	87 (22.5%)	
Never	743 (65.5%)	286 (73.9%)	
How often do you take additional medication other than what the physician told you to take (such as Maalox, Alusal, Manti)?			
Daily	8 (0.7%)	2 (0.5%)	0.7331
Often	32 (2.8%)	10 (2.6%)	
Sometimes	204 (18.0%)	67 (17.3%)	
Never	890 (78.5%)	308 (79.6%)	

study in Turkey. Participants answered the validated GERD questionnaire. In the survey 53.8% of people claimed the presence of reflux symptoms at least once in the last week; however, after adjustment for age and gender the authors reported the prevalence of GERD in 27.5% of the Turkish population [13]. In the same year Lofdahl *et al.* presented an article based on 1483 samples, where the prevalence of GERD is the lowest among the cited papers. Heartburn or regurgitation appears in 8.8% of the Swedish population [14].

These discrepancies of estimated values result from many reasons. There were different characteristics of participants in the studies, such as age or BMI of samples. Moreover, the social status and the behavioral factors have an influence on the occurrence of GERD [2]. Also there are papers which note a correlation between esophagitis severity and *H. pylori* colonization, which is also a common infection in Poland [13]. Cigarette smoking is a globally recognized causative factor for GERD, while other factors lack a consensus [9, 16].

Our study shows a positive correlation between overweight and prevalence of GERD. Similar findings are described in the literature. Hampel *et al.* performed a meta-analysis to compare the risk for GERD with obesity. They found 9 studies from which 6 confirmed the statistically significant relation between higher BMI and GERD, and 3 papers showed no association [10]. Likewise, an association between increasing age and GERD was revealed in our study.

Iwakiri *et al.* developed guidelines for GERD [17]. Proton pump inhibitors (PPI) are recommended as the first-line treatment as well as for the long-term maintenance therapy. Proton pump inhibitors are effective in most GERD patients, even though for some of them it is not necessary to resolve the symptoms. For PPI-resistant patients Iwakiri *et al.* proposed anti-reflux surgery (ARS). In the majority of cases the ARS is successful in reducing heartburn and regurgitation in addition to other complaints. Many studies show the superiority of ARS over PPI treatment [4–6]. Lundell *et al.* presented long-term outcomes after ARS and omeprazole maintenance therapy for reflux esophagitis. Twelve years of follow-up demonstrated that significantly more patients were kept in continuous clinical remission after ARS than PPI [18]. Moreover, studies demonstrated that more than half of the patients had abnormal (> 4%) acid reflux in 24-h pH tests using PPI [19]. According to the literature and own experience, ARS seems to be the best way for long-term treatment of GERD and improving QoL [20].

Two methods of ARS are commonly used worldwide – laparoscopic Nissen fundoplication (LNF) and laparoscopic Toupet fundoplication (LTF). Tan *et al.* conducted a meta-analysis comparing these two methods based on random clinical trials [6]. Comparing the early and later (one to 3 years after surgery) results, no statistically significant difference in occurrence of heartburn was found between LNF and LTF and there was similar patients' satisfaction with both procedures. However, the study revealed a lower incidence of dysphagia and chest pain for patients

Table VII. Answers to survey questions according to gender in group W

Variable	Female	Male	P-value
How often have you had pain in your chest or behind the breastbone?			
Daily	6 (1.0%)	5 (1.0%)	0.0281
Often	23 (3.7%)	3 (0.6%)	
Sometimes	194 (31.4%)	140 (27.7%)	
Never	395 (63.9%)	358 (70.8%)	
How often have you had a burning sensation in your chest or behind the breastbone?			
Daily	4 (0.6%)	3 (0.6%)	0.6529
Often	13 (2.1%)	4 (0.8%)	
Sometimes	100 (16.2%)	82 (16.2%)	
Never	501 (81.1%)	417 (82.4%)	
How often have you had regurgitation or an acid taste in your mouth?			
Daily	15 (2.4%)	5 (1.0%)	0.0001
Often	45 (7.3%)	10 (2.0%)	
Sometimes	160 (25.8%)	88 (17.4%)	
Never	399 (64.5%)	403 (79.6%)	
How often have you had pain or burning in your upper stomach?			
Daily	17 (2.7%)	13 (2.6%)	0.0001
Often	46 (7.4%)	18 (3.6%)	
Sometimes	174 (28.1%)	96 (19.0%)	
Never	382 (61.7%)	379 (74.9%)	
How often have you had a sore throat or hoarseness that is related to your heartburn or acid reflux?			
Daily	15 (2.4%)	9 (1.8%)	0.0118
Often	47 (7.6%)	15 (3.0%)	
Sometimes	173 (27.9%)	130 (25.7%)	
Never	384 (62.0%)	352 (69.6%)	
How often have you had difficulty getting a good night's sleep because of your symptoms?			
Daily	13 (2.1%)	11 (2.2%)	0.0078
Often	33 (5.3%)	22 (4.3%)	
Sometimes	186 (30.0%)	108 (21.3%)	
Never	387 (62.5%)	365 (72.1%)	
How often have your symptoms prevented you from eating or drinking any of the foods you like?			
Daily	31 (5.0%)	11 (2.2%)	0.0001
Often	87 (14.1%)	39 (7.7%)	
Sometimes	173 (27.9%)	93 (18.4%)	
Never	328 (53.0%)	363 (71.7%)	

Table VII. Cont.

Variable	Female	Male	P-value
How frequently have your symptoms kept you from being fully productive in your job or daily activities?			
Daily	14 (2.3%)	16 (3.2%)	0.0002
Often	55 (8.9%)	28 (5.5%)	
Sometimes	203 (32.8%)	110 (21.7%)	
Never	347 (56.1%)	352 (69.6%)	
How often do you take additional medication other than what the physician told you to take (such as Maalox, Alusal, Manti)?			
Daily	22 (3.6%)	6 (1.2%)	0.0124
Often	23 (3.7%)	11 (2.2%)	
Sometimes	137 (22.1%)	91 (18.0%)	
Never	437 (70.6%)	398 (78.7%)	

who had received LTF. Early complications after the surgery were noted less commonly in patients undergoing LNF. Although there are several randomized clinical trials and meta-analyses, the authors did not reach a conclusion as to which of these two methods should be the gold standard. Conceivably, it is connected with differences in patients' characteristics, selection as well as operative techniques.

Conclusions

Estimation of the prevalence of GERD is difficult, because the medications are widely available and people use them without any consultation. They do not recognize the symptoms as a disease whose treatment can also be surgical. Our analysis shows that the prevalence of symptoms of GERD in northern Poland is as high as 40.5%. That demonstrates that further investigation is warranted and people's awareness should be raised.

Conflict of interest

The authors declare no conflict of interest.

References

- Ronkainen J, Agr us L. Epidemiology of reflux symptoms and GORD. *Best Pract Res Clin Gastroenterol* 2013; 27: 325-37.
- El-Serag HB, Sweet S, Winchester CC, et al. Update on the epidemiology of gastro-oesophageal reflux disease: a systematic review. *Gut* 2014; 63: 871-80.
- Zaninotto G, Parente P, Salvador R, et al. Long-term follow-up of Barrett's epithelium: medical versus antireflux surgical therapy. *J Gastrointest Surg* 2012; 16: 7-14.
- Gillies RS, Stratford JM, Booth MI, et al. Does laparoscopic antireflux surgery improve quality of life in patients whose gastro-oesophageal reflux disease is well controlled with medical therapy? *Eur J Gastroenterol Hepatol* 2008; 20: 430-5.
- Anvari M, Allen C, Marshall J, et al. A randomized controlled trial of laparoscopic Nissen fundoplication versus proton pump inhibitors for the treatment of patients with chronic gastro-oesophageal reflux disease (GERD): 3-year outcomes. *Surg Endosc* 2015; 25: 2547-54.
- Tan G, Yang Z, Wang Z. Meta-analysis of laparoscopic total (Nissen) versus posterior (Toupet) fundoplication for gastro-oesophageal reflux disease based on randomized clinical trials. *ANZ J Surg* 2011; 81: 246-52.
- Du X, Wu JM, Hu ZW, et al. Laparoscopic Nissen (total) versus anterior 180° fundoplication for gastro-oesophageal reflux disease: a meta-analysis and systemic review. *Medicine (Baltimore)* 2017; 96: e8085.
- Wr blewski T, Kobryn K, Nowosad M, et al. Surgical treatment of GERD. Comparative study of WTP vs. Toupet fundoplication – results of 151 consecutive cases. *Videosurgery Miniiniv* 2016; 11: 60-6.
- Terry P, Lagergren J, Wolk A. Reflux-inducing dietary factors and risk of adenocarcinoma of the esophagus and gastric cardia. *Nutr Cancer* 2000; 38: 186-91.
- Hampel H, Abraham NS, El-Serag HB. Meta-analysis: obesity and the risk for gastroesophageal reflux disease and its complications. *Ann Intern Med* 2005; 143: 199-211.
- Richter JE, Rubenstein JH. Presentation and epidemiology of gastroesophageal reflux disease. *Gastroenterology* 2017; S0016-5085: 35977-2.
- Vakil N, van Zanten SV, Kahrilas P, et al. The Montreal definition and classification of gastroesophageal reflux disease: a global evidence-based consensus. *Am J Gastroenterol* 2006; 101: 1900-20.
- Mungan Z. Prevalence and demographic determinants of gastroesophageal reflux disease (GERD) in the Turkish general population: a population-based cross-sectional study. *Turk J Gastroenterol* 2012; 23: 323-32.

14. Lofdahl HE, Lane A, Lu Y, et al. Increased population prevalence of reflux and obesity in the United Kingdom compared with Sweden: a potential explanation for the difference in incidence of esophageal adenocarcinoma. *Eur J Gastroenterol Hepatol* 2011; 23: 128-32.
15. Chu YX, Wang WH, Dai Y, et al. Esophageal *Helicobacter pylori* colonization aggravates esophageal injury caused by reflux. *World J Gastroenterol* 2014; 20: 15715-26.
16. Mohammed I, Cherkas LF, Riley SA, et al. Genetic influences in gastro-oesophageal reflux disease: a twin study. *Gut* 2003; 52: 1085-9.
17. Iwakiri K, Kinoshita Y, Habu Y, et al. Evidence-based clinical practice guidelines for gastroesophageal reflux disease 2015. *J Gastroenterol* 2016; 51: 751-67.
18. Lundell L, Miettinen P, Myrvold HE, et al. Comparison of outcomes twelve years after antireflux surgery or omeprazole maintenance therapy for reflux esophagitis. *Clin Gastroenterol Hepatol* 2009; 7: 1292-8.
19. Gerson LB, Boparai V, Ullah N, et al. Oesophageal and gastric pH profiles in patients with gastro-oesophageal reflux disease and Barrett's oesophagus treated with proton pump inhibitors. *Aliment Pharmacol Ther* 2004; 20: 637-43.
20. Kobiela J, Kaska Ł, Pindel M, et al. Dynamics of quality of life improvement after floppy Nissen fundoplication for gastroesophageal reflux disease. *Videosurgery Miniinv* 2015; 10: 389-97.

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Appendix. GERD-IS questions

1. How often have you had pain in your chest or behind the breastbone?
2. How often have you had a burning sensation in your chest or behind the breastbone?
3. How often have you had regurgitation or an acid taste in your mouth?
4. How often have you had pain or burning in your upper stomach?
5. How often have you had a sore throat or hoarseness that is related to your heartburn or acid reflux?
6. How often have you had difficulty getting a good night's sleep because of your symptoms?
7. How often have your symptoms prevented you from eating or drinking any of the foods you like?
8. How frequently have your symptoms kept you from being fully productive in your job or daily activities?
9. How often do you take additional medication other than what the physician told you to take (such as Maalox, Alusal, Manti)?