Abstract

**Purpose:** Among 264 children suspected of GERD, acid GER was confirmed in 138 children on the basis of 24-hour pH monitoring.

**Aims of the study:** Comparative analysis of parameters of 24-hour intraesophageal pH monitoring with dual-channel probe (in proximal channel) in children with acid GER: primary and secondary to cow milk allergy and/or other food allergy (CMA/FA) diagnosed; comparison of examined values of pH monitoring parameters with regard to duration of the disease (preliminary study and prospective studies – after 1, 2, 4 and 9 years of clinical observation and/or conservative treatment).

**Material and methods:** 264 children suspected of GERD, aged: 1.5-102 months; x=20.78±17.23 months, were enrolled in a study. In order to differentiate acid primary GER from GER secondary to CMA/FA in 138 (52.3%) children with GERD immunoallergological tests were performed. Positive result of oral food challenge test confirmed the allergy being the cause of GER.

138 children with pathological acid GER were qualified into two groups: 1 and 2.

- Group 1 – 76 patients (55.1%), aged: 4-102 months; x=25.2±27.28 months, with pathological primary GER. Group 2 – 62 patients (44.9%), aged: 4-74 months; x=21.53±17.79 months, with pathological GER secondary to CMA/FA.

**Results:** Significant differentiation of the mean values of these parameters between preliminary study and control studies within groups was shown in the case of: number of episodes of acid GER and duration of the longest episode of acid GER, acid GER index: total and supine (proximal channel). Statistical significance (p<0.05) was higher in group 1, especially during prospective clinical observation and/or conservative treatment. At the same time significant differentiation of the mean values of: number of episodes of acid GER and episodes of acid GER lasting more than 5 minutes and mean values of acid GER index: total and supine was shown between the groups. Statistical significance (p<0.05) was higher in group 2.

**Conclusions:** The preliminary study of examined children confirmed that values of pH monitoring in proximal channel were comparable to those in distal channel and did not contribute to differentiation of GER into primary and secondary. During prospective clinical observation and/or clinical treatment, on the basis of consecutive measurements, especially the number of episodes of acid GER and episodes of acid GER lasting more than 5 minutes, and also supine acid GER index it was stated that GER secondary to CMA/FA was of wider extent (higher) in comparison with primary GER in these patients.

**Key words:** children; GER: primary, secondary; CMA/FA; 24-hour esophageal pH monitoring; oral food challenge test.

Introduction

Among 264 children suspected of gastroesophageal reflux disease (GERD), acid gastroesophageal reflux (GER) was confirmed in 138 (52.3%) children on the basis of 24-hour intraesophageal pH monitoring [1-7].

**Aims of the study**

- comparative analysis of parameters of 24-hour intraesophageal pH-monitoring with dual-channel probe (in proximal channel) in children with acid GER: primary and secondary to CMA/FA diagnosed,
- comparison of examined values of pH monitoring parameters with regard to duration of the disease (preliminary study
Results

Prospective analysis of values of parameters measured during 24-hour intraesophageal pH monitoring with dual-channel probe (proximal channel) was performed in 138 children. Assessment concerned preliminary study and control studies (during clinical observation and/or conservative treatment). 76 children had acid primary GER (group 1) and 62 children GER secondary to CMA/FA (group 2).

pH-monitoring parameters were defined as follows: in 76 children before treatment (preliminary examination) and after 1 year of treatment, in 46 children – after 2 years, and in 12 children after 4 and 9 years of clinical observation and/or conservative treatment. 76 children had acid primary GER (group 1) and 62 children GER secondary to CMA/FA (group 2).

pH-monitoring parameters were defined as follows: in 76 children before treatment (preliminary examination) and after 1 year of treatment, in 46 children – after 2 years, and in 12 children after 4 and 9 years of clinical observation and/or conservative treatment. 76 children had acid primary GER (group 1) and 62 children GER secondary to CMA/FA (group 2).

The analysis is presented in tables (proximal channel; Tab. 1-5).

* according to number of episodes of acid GER (pH<4) (Tab. 1)

In children with primary GER (group 1) mean values of parameter measured before treatment \(x=61.45\pm20.43\) were similar to the values \(x=62.48\pm14.67\) in children with GER and CMA/FA (group 2).

During clinical observation and/or treatment mean values in group 1 were decreasing and accounted for \(x=34.13\pm16.71\) after 1 year; \(22.17\pm12.40\) after 2 years; \(31.00\pm3.77\) and \(15.00\pm3.02\) after 4 and 9 years, respectively.

In children with GER and CMA/FA (group 2) during clinical observation and/or treatment, a downward tendency of number of episodes of acid GER measured before treatment administration \(x=62.48\pm14.67\) was observed. Its mean values

<table>
<thead>
<tr>
<th>Groups of examined children with specific ailment</th>
<th>pH monitoring parameter – number of episodes of acid GER (pH&lt;4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N= 138</td>
<td>Proximal channel</td>
</tr>
<tr>
<td>Group 1</td>
<td>Primary GER</td>
</tr>
<tr>
<td>(76)</td>
<td>(76)</td>
</tr>
<tr>
<td>Statistical significance within the groups (p)</td>
<td>0 – 1, p=0.0001; 0 – 2, p=0.0001; 0 – 4, p=0.0054; 0 – 9, p=0.0022; 1 – 2, p=0.0001; 1 – 4, p=0.0022; 1 – 9, p=0.0022; 2 – 4, p=0.0022; 2 – 9, p=0.0022; 4 – 9, p=0.0022</td>
</tr>
</tbody>
</table>

| Group 2 | GER+ CMA/FA | 32.00 – 93.00 | 19.00 – 79.00 | 21.00 – 65.00 | 36.00 – 49.00 | 21.00 – 27.00 |
| Statistical significance within the groups (p) | 0 – 1, p=0.0001; 0 – 2, p=0.0001; 0 – 4, p=0.0117; 0 – 9, p=0.0117; 1 – 2, p=0.0001; 1 – 4, p=0.0117; 1 – 9, p=0.0117; 2 – 4, p=0.0117; 2 – 9, p=0.0117; 4 – 9, p=0.0117 |

| Statistical significance between the groups (p) | ns | p=0.0001 | p=0.0001 | p=0.0003 | p=0.0002 |

Assignment of children into study groups

Taking into consideration esophageal pH-monitoring results, complex differential diagnostics, oral food challenge tests and nutrition analysis in 264 children, pathological acid gastroesophageal reflux was confirmed in 138 of them (52.3%). These children were assigned into group 1 and group 2.

Group 1 – 76 patients (55.1%), of both sexes (39 boys – 28.3%, 37 girls – 26.8%), aged 4-102 months (mean age \(x=25.2\pm27.28\) months), with pathological primary GER.

Group 2 – 62 patients (44.9%), of both sexes (33 boys – 28.3%, 29 girls – 21.0%), aged 4-74 months (mean age \(x=21.53\pm17.79\) months), with pathological GER secondary to CMA/FA.

Statistical analysis

The statistical analysis of the results comprised arithmetical mean, standard deviation, minimal and maximal values and median – for measurable features and quantitative percentage distribution for qualitative features.

To compare the groups, features compatible with normal distribution, assessed with Kolomogorov compatibility test, were assessed together with the post hoc Bonferroni one-way analysis of variance. Features non-compatible with the distribution underwent Kruskal-Wallis test followed with Mann-Whitney test. T-Student pair test or Wilcoxon matched pairs test, respectively were used for the comparison between the two tests within each group at time interval. Statistical significance was \(p<0.05\). Calculations were performed with the help of statistical package SPSS’12.0 PL.

and prospective studies – after 1, 2, 4 and 9 years of clinical observation and/or conservative treatment).

Detailed diagnostic procedure is presented in ‘Material and methods’ section, Part I of the study [8-25].
**Table 2. Values of selected parameter of 24-hour esophageal pH monitoring in 138 children with pathological primary GER and GER secondary to CMA/FA before and during treatment and/or clinical observation (prospective study).**

<table>
<thead>
<tr>
<th>Groups of examined children with specific ailment</th>
<th>pH monitoring parameter – number of episodes of acid GER lasting &gt;5mins (pH&lt;4)</th>
<th>Proximal channel</th>
<th>Range of values; mean (X); standard deviation (± SD); statistical significance (p); number of patients (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=138</td>
<td>Before treatment (0)</td>
<td>Treatment and/or clinical observation in progress</td>
<td></td>
</tr>
<tr>
<td></td>
<td>after 1 year</td>
<td>after 2 years</td>
<td>after 4 years</td>
</tr>
<tr>
<td>Group 1</td>
<td>1.00 – 7.00</td>
<td>1.00 – 3.00</td>
<td>1.00 – 2.00</td>
</tr>
<tr>
<td>Primary GER</td>
<td>3.96±1.37</td>
<td>2.08±0.79</td>
<td>1.17±0.39</td>
</tr>
<tr>
<td></td>
<td>(76)</td>
<td>(46)</td>
<td>(12)</td>
</tr>
<tr>
<td></td>
<td>0 – 1, p=0.0001; 0 – 2, p=0.0001; 0 – 4, p=0.0209; 0 – 9, p=0.0033; 1 – 2, p=0.0001; 1 – 4, p=0.0022; 1 – 9, p=0.0022; 2 – 4, p=0.0277; 2 – 9, p=0.0022; 4 – 9, p=0.0117</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 2</td>
<td>1.00 – 15.00</td>
<td>3.00 – 6.00</td>
<td>1.00 – 2.00</td>
</tr>
<tr>
<td>GER + CMA/FA</td>
<td>5.87±3.64</td>
<td>4.38±1.19</td>
<td>1.75±0.46</td>
</tr>
<tr>
<td></td>
<td>(62)</td>
<td>(47)</td>
<td>(8)</td>
</tr>
<tr>
<td></td>
<td>0 – 1, p=0.0001; 0 – 2, p=0.0001; 0 – 4, p=0.0117; 0 – 9, p=0.0117; 1 – 2, p=0.0001; 1 – 4, p=0.0117; 1 – 9, p=0.0117; 2 – 4, p=0.0117; 2 – 9, p=0.0117; 4 – 9, p=0.0117</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statistical significance</td>
<td>ns</td>
<td>p=0.0039</td>
<td>p=0.0046</td>
</tr>
<tr>
<td>within the groups (p)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statistical significance between the groups (p)</td>
<td>ns</td>
<td>p=0.0039</td>
<td>p=0.0046</td>
</tr>
</tbody>
</table>

** made x=45.60±16.70 after 1 year; 30.11±10.58 after 2 years; 41.13±4.29 and 23.50±1.77 after 4 and 9 years, respectively. Mean number of episodes of acid GER, measured in proximal channel in both groups (1 and 2) revealed significant differentiation within the groups, between preliminary study (0) and control studies. Statistical significance was higher in group 1, especially during prospective clinical observation and treatment.

During clinical observation and treatment, differentiation of mean number of episodes of acid GER between study groups (1 and 2) was observed. Statistical significance was higher in group 2, the highest after 4 years and the lowest after 9 years.

** according to the number of episodes of acid GER (pH<4), lasting >5minutes (Tab. 2)**

In children with primary GER (group 1) mean values of measured parameter, before treatment administration, x=3.96±1.37 were lower than the values x=5.87±3.64 in children with GER and CMA/FA (group 2).

During clinical observation and/or treatment in group 1 mean values were decreasing and accounted for x=7.61±4.80 after 1 year; 5.32±3.96 after 2 years; 7.90±1.09 and 3.96±0.73 after 4 and 9 years.

In children with GER and CMA/FA (group 2) downward tendency of mean number of episodes of acid GER lasting >5 minutes, measured before treatment (x=5.87±3.64) was observed. During clinical observation and/or treatment mean values accounted for x=4.24±3.09 after 1 year; 2.40±1.94 after 2 years; 4.38±1.19 and 1.75±0.46 after 4 and 9 years, respectively.

Mean number of episodes of acid GER lasting >5 minutes, measured in proximal channel in both groups (1 and 2) constituted significant differentiation within the groups between preliminary study (0) and control studies. Statistical significance was higher in group 1, especially during prospective clinical observation and treatment.

During clinical observation and treatment there was no dif-
differentiation of mean values of duration of the longest episode of acid GER between study groups (group 1 and 2). Statistical significance was comparable in both groups: 1 and 2, in particular years.

**** according to total acid GER index (%) (Tab. 4)

In children with primary GER (group 1), before administration of treatment, mean values of measured parameter x=11.26±4.18 were lower than the values x=10.47±3.80 in children with GER and CMA/FA (group 2).

During clinical observation and/or treatment in group 1 mean values were decreasing and accounted for x=7.28±3.78 after 1 year; 6.48±4.92 after 2 years; 7.36±0.66 and 4.11±0.55 after 4 and 9 years, respectively.

In children with GER and CMA/FA (group 2) a downward tendency of mean values of total acid reflux index (RI), measured before treatment (x=10.47±3.80) was observed. During clinical observation and/or treatment mean values constituted x=7.99±3.13 after 1 year; 4.84±2.47 after 2 years; 7.48±0.88 and 3.81±0.41 after 4 and 9 years, respectively.

Mean values of total acid RI, measured in proximal channel, in both groups (1 and 2) revealed significant differentiation within the groups, between preliminary examination (0) and control examinations. Statistical significance was higher in

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**Table 3.** Values of selected parameter of 24-hour esophageal pH monitoring in 138 children with pathological primary GER and GER secondary to CMA/FA before and during treatment and/or clinical observation (prospective study)

<table>
<thead>
<tr>
<th>Groups of examined children with specific ailment</th>
<th>pH monitoring parameter – duration of the longest episode of acid GER (mins)</th>
<th>Range of values; mean (X); standard deviation (± SD); statistical significance (p); number of patients (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proximal channel</td>
<td>Before treatment (0)</td>
</tr>
<tr>
<td>Group 1</td>
<td>Primary GER</td>
<td>5.50 – 24.10 (76)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.91±5.14</td>
</tr>
<tr>
<td></td>
<td>Statistical significance within the groups (p)</td>
<td>0 – 1, p=0.0001; 0 – 2, p=0.0001; 0 – 4, p=0.0022; 0 – 9, p=0.0022; 1 – 2, p=0.0001; 1 – 4, p=0.0022; 1 – 9, p=0.0022; 2 – 4, p=0.0022; 2 – 9, p=0.0022; 4 – 9, p=0.0022</td>
</tr>
<tr>
<td>Group 2</td>
<td>GER + CMA/FA</td>
<td>5.60 – 21.50 (62)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.51±3.78</td>
</tr>
<tr>
<td></td>
<td>Statistical significance within the groups (p)</td>
<td>0 – 1, p=0.0001; 0 – 2, p=0.0001; 0 – 4, p=0.0117; 0 – 9, p=0.0117; 1 – 2, p=0.0001; 1 – 4, p=0.0117; 1 – 9, p=0.0117; 2 – 4, p=0.0117; 2 – 9, p=0.0117; 4 – 9, p=0.0117</td>
</tr>
<tr>
<td></td>
<td>Statistical significance between the groups (p)</td>
<td>ns</td>
</tr>
</tbody>
</table>

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**Table 4.** Values of selected parameter of 24-hour esophageal pH monitoring in 138 children with pathological primary GER and GER secondary to CMA/FA before and during treatment and/or clinical observation (prospective study)

<table>
<thead>
<tr>
<th>Groups of examined children with specific ailment</th>
<th>pH monitoring parameter – total acid GER index (%)</th>
<th>Range of values; mean (X); standard deviation (± SD); statistical significance (p); number of patients (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proximal channel</td>
<td>Before treatment (0)</td>
</tr>
<tr>
<td>Group 1</td>
<td>Primary GER</td>
<td>5.20 – 20.20 (76)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.26±4.18</td>
</tr>
<tr>
<td></td>
<td>Statistical significance within the groups (p)</td>
<td>0 – 1, p=0.0001; 0 – 2, p=0.0001; 0 – 4, p=0.0022; 0 – 9, p=0.0022; 1 – 2, p=0.0001; 1 – 4, p=0.0022; 1 – 9, p=0.0022; 2 – 4, p=0.0022; 2 – 9, p=0.0022; 4 – 9, p=0.0022</td>
</tr>
<tr>
<td>Group 2</td>
<td>GER + CMA/FA</td>
<td>5.20 – 19.20 (62)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.47±3.80</td>
</tr>
<tr>
<td></td>
<td>Statistical significance within the groups (p)</td>
<td>0 – 1, p=0.0001; 0 – 2, p=0.0001; 0 – 4, p=0.0117; 0 – 9, p=0.0117; 1 – 2, p=0.0001; 1 – 4, p=0.0117; 1 – 9, p=0.0117; 2 – 4, p=0.0117; 2 – 9, p=0.0117; 4 – 9, p=0.0117</td>
</tr>
<tr>
<td></td>
<td>Statistical significance between the groups (p)</td>
<td>ns</td>
</tr>
</tbody>
</table>
During clinical observation and treatment, differentiation of mean values of total acid RI between study groups (1 and 2) was observed. Statistical significance was comparable in both groups 1 and 2, in particular years.

**** according to acid RI, supine position (%) (Tab. 5)

In children with primary GER (group 1), before treatment administration mean values of measured parameter x=6.41±2.64 were slightly lower than values x=7.16±2.76 in children with GER and CMA/FA (group 2).

During clinical observation and/or treatment on group 1 mean values decreased and accounted for x=4.07±2.59 after 1 year; 3.03±2.02 after 2 years; 3.93±0.53 after 4 years, and 2.13±0.19 after 9 years.

In children with GER and CMA/FA a downward tendency of mean value of acid RI, in supine position, measured before treatment administration mean values of measured parameter x=6.41±2.64 was observed. Statistical significance of mean values mentioned was higher in group 1, especially during prospective clinical observation and treatment.

The comparative analysis of mean values of pH monitoring parameters recorded in 24-hour intrasophageal pH monitoring in proximal channel of both study groups: children with primary GER and children with GER secondary to CMA/FA was conducted [1-7].

The measurements were done before the treatment and during prospective clinical observation and treatment.

The analysis showed statistically significant differentiation of mean values of episodes of acid GER and episodes of acid GER lasting more than 5 minutes, the longest episode of acid GER duration and acid GER index (total and supine) between preliminary study and control study. Statistical significance of these differences was higher in group 1, especially during prospective, long-term clinical observation.

This is attributable to higher effectiveness of classical antireflux treatment rather than combined treatment (antiallergic and antireflux) in eliminating the results of reflux and the causative and pathogenic role of food allergy in secondary GER [9,10,14,21,26-28].

Statistically significant mean value of episodes of acid GER lasting more than 5 minutes, higher in group 2 in preliminary study and control study after 4 years and in control studies after 2 and 4 years of clinical observation and treatment seems to be an exception.

The higher number of episodes of GER lasting more than 5 minutes constituted a characteristic feature of GER secondary to FA.

During clinical observation differentiation of mean number of episodes of acid GER and episodes of acid GER lasting more than 5 minutes, especially after 4 years was shown. Statistical significance of mean values mentioned was higher in group with GER secondary to CMA/FA.
In the case of acid GER index only supine mean values were differentiated within the groups and had higher statistical significance in group 2, exclusively after the first year of clinical observation and treatment.

The results may suggest that the reduction of the intensity of supine GER, especially during night sleep is due to improvement of mechanism responsible for neutralization and self-purification of esophagus under dietary and pharmacological treatment [5,7,10,14,19,21,22].

The comparative analysis of examined pH monitoring parameters measured in proximal channel showed significantly higher mean values of episodes of acid GER and acid GER lasting more than 5 minutes and supine acid GER index in children with GER secondary to CMA/FA than in children with primary GER during the study.

The results obtained in patients of group 2 are attributable to more clearly expressed dissociation of motor activity of gastroesophageal junction, which could be the result of coexistent allergization of upper gastrointestinal system triggered off by noxious nutrient from the patients’ diet [12,14,21,22,25].

During 24-hour esophageal pH monitoring with dual-channel probe it was assumed that the higher the positioning of the sensor of the electrode the lower number of short-term reflux episodes.

It was also assumed that the total reflux time is shortened, which results from the better efficiency of the mechanism responsible for neutralisation pH gastric content and the ability of esophagus to self-purification [5,7,19,20].

The results of our studies do not confirm the stated hypothesis completely because the mean values of analyzed pH monitoring parameters in proximal channel were not lower (not statistically significant) than in distal part of esophagus in children with GER of both study groups with GER. The results are comparable with pH-metric esophageal results obtained by Cucchiara et al. [19] and another authors [5,6,20].

The percentage values of the number of episodes of acid GER registered in preliminary study and after 1 year and 9 years of treatment accounted for 81%, 73% and 57% in proximal channel, respectively (group 1) and 84%, 79% and 87% in distal channel, respectively (group 2).

The number of episodes of acid GER lasting more than 5 minutes recorded in proximal channel accounted for 76% to 74% (group 1) and 66%, 72% and 87% (group 2) in distal channel, in preliminary study and control studies.

Also the duration of the longest episode of acid GER recorded in proximal channel reached 74% and 75% (group 1) and in distal channel 65%, 71% and 74% (group 2), respectively in preliminary study and control studies.

Total acid GER index recorded in proximal channel accounted for 84% and 86% (group 1), whereas in distal channel 61%, 67% and 83% (group 2), in preliminary study and control studies after 1 year and 9 years of treatment, respectively.

Supine acid GER index recorded in proximal channel made 92%, 84% and 89% (group 1) and 93% and 90% (group 2) in distal channel, in preliminary study and control studies.

During prospective studies the gradual tendency of mean values of pH monitoring parameters in both channels to return to normal values. Although the reflux was diminishing in consecutive pH recordings in examined children with primary and secondary GER, mean values of parameters were comparable and did not show significant difference between both channels (distal and proximal).

In both groups the values of pH monitoring parameters obtained in proximal channel constituted more than 50% of the values obtained in distal channel. This may appear due to considerable range of reflux (high reflux), persisting regardless of the normalisation of pathological pH monitoring recording under antireflux or combined treatment (antireflux and antiallergic) [5,7,10,14,19,21,22].

On the basis of the results obtained in preliminary study and control studies in these groups there were no significant quantitative differences in episodes of acid GER reaching both distal and proximal channel, regardless of the age of the children.

The preliminary study in children with primary GER showed that mean values of pH monitoring parameters measured in proximal channel were similar.

However, the control pH monitoring in proximal channel showed that mean values of episodes of acid GER and episodes of acid GER lasting more than 5 minutes during clinical observation and/or treatment, similarly to mean values of supine acid GER index – only after the first year of observation were significantly higher in group with GER secondary to FA than in group with primary GER (p<0.05).

The high GER, reaching proximal esophagus is important in children of both groups, but in children with atypical symptoms, especially of respiratory tract (latent reflux) may suggest microaspiration of gastric content into bronchial tree [5-7,9].

In children below 3 years of age, who had recurrent inflammations of upper respiratory tract reported, latent GER was confirmed with pH esophageal monitoring with single-channel probe in 56% and 57% of other gastroenterological centers in Poland, respectively [29,30].

On the basis of 24-hour esophageal pH monitoring with dual-channel probe in children with symptoms outside the gastrointestinal tract, in the same age group, in our studies, the percentage of high GER in both study groups was reported accounting for 77.4% and 88.3%, respectively.

The results of own studies contribute to intensity of acid GER reaching distal and proximal esophagus, and mean values of pH monitoring parameters in proximal and distal channel show statistical significance between the groups, especially during the prospective clinical observation and administered treatment.

The comparable mean values of duration of the longest episode of acid GER in both channels, supine acid GER index in distal channel and total acid GER index in proximal channel constitute the exception.

This differentiation of examined pH monitoring parameters between the groups could be important in predicting who of the examined children is at risk of primary GER and who is at risk of GER secondary to CMA/FA.

**Conclusions**

In conclusion, the values of all pH monitoring parameters in proximal channel recorded during the preliminary study (before treatment) were comparable (similarly to distal channel) and
did not serve as a source to differentiate GER into primary and secondary to CMA/FA.

During clinical observation and/or treatment of the patients the dynamics of acid GER, especially its range, and its intensity was assessed at control studies, in proximal channel.

The results of control studies, especially the number of episodes of acid GER and episodes of GER lasting more than 5 minutes, and supine acid GER index it showed that the range of GER secondary to CMA/FA was higher than primary GER range in these patients.

Acknowledgement

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References


